AN ABSTRACT OF THE THESIS OF

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This retrospective study investigated the incidence, characteristics, and risk factors of bone fracture among a group of 518 adults with severe mental retardation between 25 and 75 years old. Data were collected from a large state developmental center in the Western United States between April 1, 1991 and March 31, 1996. Ninety-six of 271 males and 133 of 247 females experienced 291 fractures during the study period. Relative risk of fracture for all males was .658 compared to 1.540 for females. Menopausal status did not significantly influence the risk of fractures among females. Risk of fracture by self-feeding ability ranged from 1.675 for individuals who were tube fed to .343 for those requiring no assistance during meals. As a group, individuals with a body mass index (BMI) less than 20 were at the greatest risk of fracture (RR = 2.416). Males with BMI values between 20-25 (RR = .560) and greater than 25 (RR = .373) had a decreased risk of fracture. Ambulatory males and females had a significantly decreased risk of fracture (RR = .356 and .559 respectively). Rib, femur, vertebrae, and radial fractures accounted for nearly 60% of all fractures. The

etiology of the 41% of fractures was of unknown origin. Transfers by developmental training personnel (10.3%), falls to the ground (15.8%), and accidents (32.6%) were also frequently related to fracture cause. Logistic regression analysis revealed the occurrence of any fracture was significantly associated with ambulation, calcium intake, body weight, self-feeding ability, and body mass index.

The Epidemiology of Fractures Among Adults with Severe Mental Retardation Residing in a State Developmental Center

by

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I understand that my thesis will become part of the permanent collection of Oregon State University libraries. My signature below authorizes release of my thesis to any reader upon request.

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Steve B. Downs, Author

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LIST OF ACRONYMS AND ABBREVIATIONS

BM:	Bone Mass
BMC:	Bone Mineral Content
BMD:	Bone Mineral Density
BMI:	Body Mass Index
CI:	Confidence Interval
DS:	Down Syndrome
DXA:	Dual Photon X-ray Absorptiometry
FNBMD:	Femoral Neck Bone Mineral Density
FES:	Functional Electrical Stimulation
g:	grams
IU:	International Units
LBM:	Lean Body Mass
LMM:	Lean Muscle Mass
LSBMD:	Lumbar Spine Bone Mineral Density
MFBMD:	Mid-shaft Femur Bone Mineral Density
mg:	milligrams
MR:	Mental Retardation
OPX:	Oophorectomy
OR:	Odds Ratio
PFBMD:	Proximal Femur Bone Mineral Density
P-Y:	Person-years
RBMD:	Radial Bone Mineral Density
RR:	Relative Risk
SCI:	Spinal Cord Injury
SMR:	Severe Mental Retardation
WBMD:	Whole Body Bone Mineral Density

DEDICATION

This dissertation is dedicated to the memory of a wonderful friend

and colleague who is dearly missed

Steve O. Skaggs, Ph.D.

and to his son

Steven Hunter Skaggs

may you know how truly special your father was

The Epidemiology of Fractures Among Adults with Severe Mental Retardation Residing in a State Developmental Center

Chapter 1

Introduction

It has been nearly sixty years since Albright, Smith, and Richardson (1941) first described the relationship between menopause and osteoporosis in adult women, yet this disease continues to be problematic for modern day researchers. It is currently estimated that one-third of all postmenopausal women, particularly Caucasian women, will experience an osteoporotic fracture within their lifetime (Chrischilles, Shireman, & Wallace, 1994). Moreover, it is anticipated that over 5.2 million hip, spine, and forearm fractures will occur in the next decade (Chrischilles, et al., 1994; Kleerekoper & Avioli, 1993).

Osteoporosis which "represents the most common form of metabolic bone disease" (Genant, 1993, p. 229) is "characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased susceptibility to fractures.." (National Osteoporosis Foundation, 1996, p. 2). The occurrence of these fractures can be attributed to the loss of bone mineral density (BMD) experienced by older adults (Melton, 1993).

Generally, after the third decade of life, BMD slowly declines in the healthy individual (Kleerkoper & Avioli, 1993). For women, this decline is accelerated during the first five years of menopause as levels of estrogen are drastically reduced (Birkenhager-Frenkel, Courpron, & Hupscher, 1988; Snow-Harter &

Marcus, 1991). Because of low estrogen which accompanies menopause, and to a lesser extent aging (Richelson, Wahner, Melton, & Riggs, 1984), women lose approximately 35 percent of cortical and 50 percent of trabecular bone over their lifetime; conversely, men lose approximately two-thirds of these amounts (Aisenbrey & DePaepe, 1992; Richelson, Wahner, Melton, & Riggs, 1984).

Estrogen and age are not the only factors which influence bone remodeling. Mechanical stresses, medications, health status, physiological stress/function, race, gender, body weight and composition, family history, and alcohol and tobacco use also alter BMD. For example, it has been established that the use of glucocorticoid medications increases renal calcium exertion (Nielsen, Thomsen, Eriksen, Charles, Storm, & Mosekilde, 1988). As a result, individuals using these and other selected medications are at greater risk of increasing bone resorption, reducing bone formation, and inducing osteoporosis (Lukert & Raisz, 1990).

In recent years, there has been increased attention on the bone health of pre- and postmenopausal women (Notelovitz, et al., 1991; Pruitt, Jackson, Bartels, & Lehnhard, 1992; Sinaki & Mikkelson, 1984), amenorrheic and eumenorrheic athletes (Risser, Lee, LeBlanc, Poindexter, Risser, & Schneider, 1990; Robinson, Snow-Harter, Taaffe, Gillis, Shaw, & Marcus, 1995; Snow-Harter, 1994), children and adolescents (Bonjour, Theintz, Buchs, Slosman & Rizzoli, 1991; McCulloch, Bailey, Whalen, Houston, Faulkner, & Craven, 1992), and the influence of medications (Weiss, Ure, Ballard, Williams, & Daling, 1980), diet (Aloia, Vaswani, Yeh, Ross, Flaster, & Dilmanian, 1994; Riggs, Wahner, Melton, Richelson, Judd, & O'Fallen, 1988), and physical activity (Cavanaugh & Cann, 1988; Smidt, Lin, O'Dwyer, & Blampied, 1992; Snow-Harter, Bouxsein, Lewis, Carter, & Marcus, 1992). The need for this research is underscored by the fact that the annual cost of treating bone related complications, such as osteoporosis, has reached $20 billion within the United States (Praemer, Furner, & Rice, 1992) and is expected to increase as Americans live longer (Melton, 1993).

One group that has not received adequate attention to their bone health is individuals with mental retardation (MR). This group accounts for nearly three percent of the U.S. population (Eichstaedt & Lavay, 1992), of which over sixty-thousand reside within state developmental centers (Lakin, Prouty, Smith, & Braddock, 1996). Furthermore, Eyman, Grossman, Tarjan, and Miller (1987) suggest with the trend toward deinstitutionalization throughout the United States, large state-operated facilities are caring for fewer individuals with mild MR and more individuals with severe/profound MR than previously. As a result, individuals with a greater degree of disability are admitted to or remain within these facilities. Concurrently, these same individuals may be at increased risk of bone fracture due to disuse osteoporosis and the use of osteodynamic pharmaceuticals (e.g., anticonvulsant medications).

While there is limited information on the bone health of individuals with MR (Felix, 1993), Stamp, Round, Rowe, and Haddad (1972) suggest that the single most costly medical problem in adults residing in state developmental centers may be the treatment of pathologic fractures due to demineralized bone. This may be compounded by the fact there has been a decline in mortality within large developmental centers as well as an increase in the age of the population (O'Brien, Tate, & Zaharia, 1991).

Statement of the Problem

Frequently, individuals with severe mental retardation (SMR) have physical limitations that restrict independent ambulation resulting in a reduction of weightbearing activities. Many are limited to the use of assistive devices such as wheelchairs for transportation and/or rely on the assistance of trained staff or volunteers to assist with movement. That is, staff may "transfer" the individual from the bed to a wheelchair, from wheelchair to shower, and so forth, thereby decreasing the likelihood that the individual will participate in any weightbearing activity throughout each day. If individuals are limited in their participation of weightbearing activities (load) BMD will be compromised (Issekutz, Blizzard, Birkhead, & Rodahl, 1965; Stewart, Alder, Byers, Segre, & Broadus, 1982). This may be particularly evident in individuals with limited motor abilities who reside in continuous care settings, such as board and care homes or state developmental centers, where the severity of mental and/or physical impairment diminish opportunities to participate in weightbearing activities.

In addition to limited data on the bone mass of individuals with MR, little information is currently available on the occurrence of bone fractures among individuals with SMR residing in state developmental centers. The inadequacies of these data may be due to several factors. First, while a central governmental agency (i.e., Health Care Financing Administration) is responsible for compiling a repository of data on all hospital discharges, there is no federal agency responsible for compiling data from state developmental centers. That is, no national reporting requirements exist. As a result, data on fracture injuries for individuals with MR residing in continuous care facilities within the United States are not available. Secondly, there is only a limited number of published studies investigating the bone health of individuals with MR. The few studies which have been done are primarily descriptive in nature. As a result, it was believed essential to conduct a pilot study prior to the onset of this investigation.

The pilot study was designed to answer the question: do ambulatory and non-ambulatory adults with SMR residing in a state developmental center have similar femoral neck, hip, and mid-shaft femur BMD values, and how do these values compare to their non-disabled ambulatory peers? The basic research question was: were individuals with SMR residing in a state developmental center at higher risk of developing an osteoporotic fracture compared with their non-disabled peers?

In the Spring of 1995, sixty-one ambulatory and nonambulatory males and premenopausal females adults with SMR were transported to the Bone

Research Lab at Oregon State University for femoral neck, hip, and mid-shaft femur BMD measurements. Following familiarization, subjects were scanned for BMD using dual energy x-ray absorptiometry (DXA) (Hologic QDR-1000/W). All subjects had been on anticonvulsant therapy longer than 10 years and all were below the age of 45. Results from this preliminary investigation demonstrated that ambulatory adults had significantly higher BMD values at all sites compared with nonambulatory individuals. Furthermore, the results suggested that all individuals had significantly lower BMD values for all sites compared with their non-disabled peers indicating a greater risk of osteoporotic fracture.

As a result of the pilot study, it was determined that subjects were at higher risk of spontaneous fractures due to lower BMD values at all sites compared with their gender- and aged-matched peers without disabilities. Due to these findings, and the lack of empirical data about this population, a retrospective investigation on the epidemiology of fractures among adults with SMR residing in a state developmental center was justified.

Purpose

The purpose of this study was to investigate the five-year incidence, characteristics, and risk factors of bone fractures among adults with SMR residing in a state developmental center. The goal of this investigation was to provide information which may be used to establish procedures to reduce the frequency and severity of such fractures and to minimize these consequences. The specific aims of this study were to: (1) determine the five-year incidence of fractures among adults with SMR residing in a state developmental center, (2) determine the distribution of type of fractures, and (3) identify risk factors (e.g., body mass index) associated with bone fractures among individuals with MR residing in a state developmental center.

This study provides documentation on the magnitude and importance of bone fracture as a significant medical concern in a state developmental center located in the Western United States. Data obtained in this study also provide information useful in: (1) identifying individuals at risk, (2) identifying risk factors for bone fracture, and (3) developing effective preventive programs. In addition, this study may encourage further research investigations into the epidemiology of bone fracture within this group. Lastly, this study utilizes methodology (collection, treatment, and analysis) which could be useful for interpreting fracture data among individuals residing in state developmental centers nationwide.

Research Hypotheses

Specific alternative hypotheses to be tested specific to the SMR population in this investigation include:

(1) Females who reside in a state developmental center will have a significantly greater five-year cumulative incidence rate of bone fractures than males with SMR who reside in a state developmental center.

(2) Postmenopausal females who reside in a state developmental center will have a significantly greater five-year cumulative incidence rate of bone fractures than premenopausal females with SMR who reside in a state developmental center.

(3) Individuals with SMR who reside in a state developmental center and take anticonvulsant medications will have a significantly greater five-year cumulative incidence rate of bone fractures than individuals with SMR who do not take anticonvulsant medications and reside in a state developmental center.

(4) Individuals with SMR who reside in a state developmental center with a BMI value greater than 25 will have a significantly lower five-year cumulative incidence rate of bone fractures compared to those individuals with SMR and a BMI value less than 20 who reside in a state developmental center.

(5) Individuals with SMR who reside in a state developmental center and are not capable of independently ambulating (immobile or immobile/assisted standing group) will have a significantly greater five-year cumulative incidence rate of bone fractures than individuals with SMR who ambulate independently (with or without an assistive device, e.g., cane) and reside in a state developmental center.

(6) Individuals requiring any level of assistance to eat meals will have a significantly greater five-year cumulative incidence rate of bone fractures than those individuals with SMR who require no assistance with feeding and reside in a state developmental center.

Delimitations

This retrospective five-year study includes male and female clients with SMR who resided in a state developmental center located in the Western United States between April 1, 1991 through March 31, 1996. All subjects continuously resided during this five year period in a developmental center or left this cohort due to fracture, deinstitutionalization, or death. Furthermore, every individual included in this study was 20 years old or greater on April 1, 1991.

Limitations

Several factors may limit the extent to which the findings can be generalized. These include:

(1) All participants with SMR are from one training center located in the Western United States.

(2) There was no control on subjects for factors that influence bone health such as: (a) heredity, (b) diet, (c) unmonitored physical activity, and (d) smoking.

(3) The health and physical fitness level of each subject varied greatly.

(4) The type, duration of usage and combination of medications varied greatly between subjects.

(5) The length of time that individuals were ambulatory or nonambulatory varied greatly.

(6) The status of menstrual functioning varied greatly between female subjects.

(7) The medical records obtained from the state development center may not accurately reflect client data.

Chapter 2

Review of Literature

While considerable research has focused on the prevention and treatment of osteoporotic fractures among the elderly, few studies have examined the bone health of individuals with MR. Therefore, this chapter will provide an overview of pertinent topics as they relate to the bone status of this population. Specifically, a review of literature on osteology, and the influences of nutrition, immobilization, and pharmacological agents common to individuals with MR, their collective effects on bone health and the risk of bone fracture among this population.

Osteology: An Overview

The human skeleton consists of 206 bones of various lengths, shapes, and sizes serving very specific functions. These include: (1) providing protection for the vital organs (e.g., brain), (2) support of soft tissue and organs, (3) hemopoiesis functions, (4) locomotion via bones acting as levers and attachment sites for muscles, and (5) mineral storage (Junqueira, Carneiro, & Kelly, 1992). As skeletal bones are structurally and functionally different, so to is their composition. Each skeletal bone is composed of a combination of cortical and trabecular bone. The proportions of the two types of bone vary throughout the different regions of the body. For example, cortical (compact) bone compromises approximately 80 percent of all skeletal bone, forms the shafts of long bones, the outer shell of other bones, and accounts for approximately 75 percent of the femoral neck, 50 percent of the femur, and approximately 30 percent of the vertebral bodies (Riggs, 1982; Wardlaw, 1993). Found to a lesser extent, trabecular (cancellous) bone is porous and found primarily at the end of long bones, throughout the pelvis and vertebrae, and is metabolically more active than cortical bone (Wardlaw, 1993). As a result, trabecular bone is predominantly associated with metabolic functions whereas cortical bone is primarily responsible for mechanical functions. (Baron, 1993).

The internal structure of the bone or matrix is composed of calcium and phosphorous, and to a lesser extent bicarbonate, citrate, potassium, and sodium. Approximately 99% of the body's store of calcium is found within bone in the form of hydroxyapatite as is 90% of phosphorous (Junqueira, Carneira, & Kelley, 1992). In addition to providing rigidity to bone, calcium and phosphorous are needed for other physiological functions including muscle contraction and blood clotting.

As calcium intake and uptake is a vital part of bone formation during childhood growth and the replacement of bone cells during adulthood, it has a critical role in the prevention of osteoporosis (Schaafsma, 1992). As a result, it is instrumental that calcium blood levels be regulated at optimal levels by different hormonal agents. Specifically, the release of parathyroid hormone (PTH), calcitonin, and vitamin D ensure blood calcium levels are adequately maintained, calcium reserves are stored, or calcium excretion is stimulated as needed (Hedge, 1987). For instance, if blood calcium levels are low (e.g., during pregnancy), calcium is absorbed from bones and used to maintain desirable levels. Several factors are suggested to interact with bone maintenance and turnover, including, but not limited to, physical activity (mechanical loading), nutritional practices, pharmacological influences, genetic and lifestyle factors (Wardlaw, 1993).

Selected Factors Influencing Calcium Metabolism

The association between calcium intake and bone health has been well established, however, there are a number of factors which may positively or negatively influence normal calcium metabolism even with a desirable daily intake of calcium. Two factors of primary concern for adults with SMR which can influence calcium metabolism include the influence of diet and different pharmacological agents.

The Role of Protein

To illustrate the prominent role of diet and its relationship to calcium metabolism, numerous investigators have examined the role of a high dietary protein intake and urinary calcium. For example, Heaney and Recker (1982) and others, have suggested that high dietary protein intakes, specifically sulfur-containing amino acids (Wardlaw, 1993), enhance bone resorption as it induces hypercalciuria. More specifically, Hegsted and Linkswiler (1981) investigated the long-term effect (sixty continuous days) of either a 46 g or 123 g/day protein diet on the urinary calcium excretion of six females. Results indicate that urinary calcium held constant on the lower protein diet but doubled when the higher diet was consumed. They concluded that the increase in urinary calcium found with the high protein diet caused a significant negative calcium balance which could have deleterious effects on BMD.

In a similar study, Hegsted, Schuette, Zemel, and Linkswiler (1981) examined the effects of two levels of each dietary protein and phosphorous with eight males for 51 continuous days. They reported that when phosphorous intake was increased during the protein diets, urinary calcium decreased from 156 to 93 mg/day and from 334 to 200 mg/day for the low and high diet, respectively. Simultaneous increases in protein and phosphorous caused a 28% increase in urinary calcium, whereas, protein intake alone caused a 115% increase. They concluded that to maintain bone mineral equilibrium, an increase in dietary protein necessitates a simultaneous increase in dietary phosphorous.

Attempting to identify the exact mechanism involved in the protein-induced hypercalciuria phenomenon, Allen, Oddoye, and Margen (1979) conducted a 95-day metabolic study with six adult males who received either 12 g or 36 g of nitrogen and 1400 mg of calcium per day. Urinary calcium levels were found to increase significantly from a mean of 191 mg/day on 12 g/day nitrogen diet, to 277 mg/day on the 36 g diet. No significant difference in the absorption of calcium consuming the high protein diet were found. They concluded that a decrease in the fractional reabsorption of calcium by the kidney appeared to be the most likely cause of the protein-induce hypercalciuria and that consumption of high calcium diet is unlikely to prevent negative balance.

More recently, Metz, Anderson, and Gallagher (1993), conducted a cross-sectional study of 38 Caucasian women to identify associations between physical activity levels, dietary factors and radial bone mineral density (RBMD). The results of a multiple regression analysis revealed that both protein and phosphorous intake were negatively associated with RBMD ($p < 0.05$), whereas, physical activity level and LBM were positively associated. They suggested that dietary protein and phosphorous intakes greater than suggested RDA values were adverse for BMD.

From a practical standpoint, Schaafsma (1992) has stated that calcium absorption decreases with advancing age and that a limitation on dietary protein and sodium consumption is recommended to prevent a negative calcium balance situation. Current RDA guidelines suggest that adults over the age of 51, consume approximately 0.45 g/kg of body weight. However, this may vary greatly in the elderly. Nevertheless, Tkatch and associates (1992) have suggested that individuals not getting adequate dietary protein may be at greater risk of hip fracture.

Tkatch et al (1992) examined the effects of two different dietary supplements with different protein contents on sixty-two patients who were admitted into a orthopedic ward for a proximal femur fracture. One group (30 females, 5 males; 83.2 ± 1.3 years) received 250 ml/day of an oral protein containing supplement, while a control group (24 females, 5 males; 81.3 ± 1.6 years) received the same supplement but with no protein. They found that the median hospital stay was significantly lower ($p < 0.05$) in the protein supplement group (69 v. 102 days). Seven months following fracture, there were no significant BMD differences between groups, however, the number of patients showing a significant decrease in FBMD was lower in the protein supplemented group ($p < 0.05$). They concluded that elderly adults who had experienced a femoral neck fracture and received an oral protein supplement showed more favorable outcome after fracture.

The findings of Tkatch et al suggest a need for protein supplementation following fracture. Yet, data from Pinchcofsky-Devin and Kaminski (1987) suggest that individuals residing in nursing homes may not be receiving adequate levels of dietary protein. Data were collected from two nursing homes with a total of 225 patients (72.2 ± 21 years). Assessment included biochemical (e.g., serum albumin) and anthropometric measurements (skinfold & circumference). Evaluation of the data indicated a 52% incidence of malnutrition, including 24% hypoalbuminemic nutrition and 76% of individuals were anemic. They concluded that the incidence of malnutrition to be much greater than previously reported for this population.

Most recently, Feskanich, Willett, Stampfer, and Colditz (1996) investigated the association between dietary protein and bone fractures in a cohort of 85,900 women between the ages of 35 and 59 years old. During 931,512 person-years at follow-up, over 200 hip and 1,600 forearm fractures were identified during a twelve year period. They found that while animal protein intake was associated with an increased risk of forearm fracture in women who consumed more than 95 g per day versus women with consumption less than 68 g per day (RR = 1.22, 95% CI 1.04-1.43, p = .01), vegetable protein intake was not associated with bone fracture. Similarly, no association was found between dietary protein (vegetable or animal) and the occurrence of hip fracture.

The Influence of Steroidal Medications

The use glucocorticoid and other steroidal medications has been shown to produce bone loss in healthy young adults (Godschalk & Downs, 1988; Nielsen, et al., 1988), elderly men (Mitchell, Jackson, & Lyles, 1991), and asthmatics (Adinoff & Hollister, 1983). Specifically, these types of drugs alter bone remodeling (Lukert & Raisz, 1990; Mitchell & Lyles, 1990) by decreasing bone formation (Klein, Arnaud, Gallagher, Deluca, & Riggs, 1977), intestinal calcium absorption (Kimberg, Baerg, Gershon, & Graudusius, 1971), increasing renal calcium exertion (Nielsen, et al, 1988), and altering gonadal functioning (Luton, Thieblot, Valcke, Mahoudeau, & Bricaire, 1977).

Traditionally, glucocorticoid medications have been used to treat conditions such as asthma and rheumatic disorders, however, studies which examined the efficacy of glucocorticoids on BMD bone have been with healthy adults. For example, Mitchell and colleagues (1991) investigated the short-term effects of glucocortoid use on seven Caucasian males (68.6 ± 5.3 yrs.) to determine their influence on the serum levels of BGP (a biochemical marker of bone metabolism), calcium, phosphorous, PTH, and alkaline phosphatase. Following baseline serum measurements, subjects were given 40 mg of prednisone orally on five consecutive days. Blood samples were obtained on days 7 through 11, 13, 15, and 17 after the completion of prednisone. Subjects served as their own controls. Mitchell et al. reported that within 24 hours of the first dosage of prednisone, serum BGP levels were diminished. Furthermore, after five continuous days of treatment, BGP levels dropped an average of 78%, which was found to be significantly different than baseline values (p = 0.004). However, within 24 hours of completing the medication routine, serum BGP values were not significantly different than baseline values obtained.

The Influence of Anticonvulsant Medication

Antiepileptics, also known as antiseizure or anticonvulsant medications are widely prescribed for the treatment of seizure disorders such as epilepsy which is commonly found among individuals with SMR. For instance, Tannenbaum, Lipworth, and Baker (1989) report that 80% of individuals with MR residing in an intermediate care facility were using one or more anticonvulsant medications to control seizures. Moreover, Cunningham and Mueller (1987) suggested anticonvulsant drugs to be one of the most frequently prescribed medications for this population. While anticonvulsant medications are often the first choice in the treatment of seizure disorders, only 80% of seizure disorders are controlled by medications which are prescribed based upon the severity of the disorder as well as the possible side effects associated with these drugs (Coulter, 1991). Unfortunately, one such long term side effect of selected anticonvulsant usage includes bone mineral loss (Eadie, 1984).

Anticonvulsant medications have been documented to have a determential effect on BMD and calcium absorption in the gut (Hahn, 1976; Hunter, Maxwell, Stewart, Parsons & Williams, 1971; Iiavainen & Savolainen, 1983; Mosekilde & Melsen, 1976; Tolman, Jubiz, Sannella, & Madsen, 1975). Three such studies examined the bone status of nonambulatory individuals residing in state institutions with MR on anticonvulsant therapy. Specifically, Lee and Lyne (1990), Lee, Lyne, Kleerekoper, Logan, and Belfi (1989), and Fischer, Adkins, Leibl, VanCalcar, and Marlett (1988) report that anticonvulsants are partially responsible for the osteopenia which occurs in children and young adults with multihandicaps. However, therapeutic interventions to help prevent the negative influences of anticonvulsant medications have been encouraging with this population. For instance, using photon absorptiometry, Fischer, Adkins, Liebl, VanCalcar, and Marlett (1988) investigated the effects of vitamin D therapy on the BMC and bone mineral density (BMD) of youngsters with profound MR concurrently taking anticonvulsant medications and residing in a state developmental center. Eleven nonambulant youngsters between 7 and 17 years old (six males, mean age = 14.3 and five females, mean age = 10.6), with profound MR were given vitamin D therapy at a dosage of 4,000 IU/m^2 body surface area/day for 6 continuous months. Seven of the eleven subjects were on at least two anticonvulsant therapies, including two individuals taking four different types. Single photon absorptiometry BMC and BMD measurements were obtained at baseline, three- and six- months of vitamin D therapy. The results of the study indicated a significant increase ($p < 0.01$) in the BMC values for 9 of the 11 clients with one client showing a decrease in BMC. Fischer et al. concluded that supplementation of vitamin D therapy for nonambulant youngsters with profound MR taking anticonvulsant medications can improve BMC values. However, the authors made no mention of a control group and it is uncertain if BMC changes were strictly due to Vitamin D therapy alone or as the result of developmental progression.

Immobilization and BMD

Since the late 1800's it has been known that bone cells, like muscle tissue, are dynamic in nature and ever changing in response to the mechanical forces placed on them (Wolff, 1986 {Translation}). These bone cells (osteoblasts, osteoclasts, & osteocytes) are in a constant flux between dissolution (resorption) and formation (absorption). Collectively, this cycle known as remodeling continues throughout adult life (Frost, 1993).

While the remodeling process is a complex series of physiological events not fully elucidated, it is known that different types of cells take part in the remodeling process. Mainly, osteoclast, the bone-dissolving cells, and osteoblasts, bone rebuilding cells, respond to different stimuli. For example, the presence and utilization of such systemic hormones as thyroxine, estrogen, and insulin; local factors (prostaglandin's), growth factors (insulin-like), mechanical loading (type, duration, intensity of physical activity), lifestyle factors (smoking, diet), and pharmacological therapies all can influence the remodeling process (Toss, 1992; Wardlaw, 1993).

While osteoclast and osteoblast respond to varied stimuli, including physical activity, what is not known is the exact mechanism necessary to positively influence bone absorption within humans (Lanyon, 1992). More specifically, the type, intensity, frequency, or duration of physical activity necessary to stimulate absorption and/or decrease resportion (loss) (Heinonen, Oja, Kannus, Sievanen, Haapasalo, Manttari, & Vuori, 1995).

Empirical investigations have examined the influence of weightlessness, prolonged bed rest, immobilization, and physical activity on the effects of BMD through a variety of qualitative and quantitative judgments (Lanyon, 1987). For example, quantitatively, strain gauges have been attached internally to the limbs (in *vivo*) of turkeys (Lanyon & Rubin, 1984), sheep (Churches, Howlett, Waldron & Ward, 1980; O'Connor, Lanyon, & MacFie, 1984), and roosters (Rubin & Lanyon, 1984) including the only in *vivo* human study (Lanyon, Hampson, Goodship, & Shah, 1975) to determine the extent of mechanical loading on bones during various activities and its influence on bone modeling. Conversely, qualitative investigations have examined the effects of athletic participation, medications, and nutrition on changes in BMC.

It is widely known that mechanical loading through weightbearing activities (LeVeau & Bernhardt, 1984), is positively related to BMD (American College of Sports Medicine, 1995). Yet, investigators continue to explore different interventions and treatment strategies that will prevent and/or reverse the onset of osteoporosis and minimize the occurrence of fracture. Chesnut (1991) suggests that the determinants of osteoporosis include: (1) obtaining optimal peak bone mass, (2) peak bone maintenance, and (3) minimizing the rate of bone mass loss. To illustrate the importance of each of these factors, it is useful to examine data from human exposure to weightlessness where rapid changes in BMD are found.

Residence in the weightless environment of space appears to influence BMD in a manner comparable to that which has been seen in disuse osteoporosis due to immobilization (Lutwak, Whedon, LaChance, Reid, & Lipscomb, 1969; Turner & Szukalski, 1985). Specifically, human bed-rest studies comparing pre- and post-bone biopsy samples (Vico, et al., 1987) and animal immobilization studies using osseous tetracycline staining (Landry & Fleisch, 1964) have shown increased bone resportion to occur during disuse. As a result, during extended duration spaceflights or long periods of immobilization, BMD losses may reach detrimental levels and seriously increase susceptibility to fracture.

Progressive bone loss seen with exposure to weightlessness has been mainly due to the removal of mechanical stresses produced by earth's gravity from the weight-bearing bones of the body (Donaldson, Hulley, Vogel, Hattner, Bayers, & McMillan, 1970; Issekutz, Blizzard, Birkhead, & Rodahl, 1965). Therefore, zero-gravity induced bone loss is of concern for individuals due to long-duration spaceflights or, for the purposes of this study, for individuals who are not capable of weightbearing due to physical and/or mental impairment.

While Turner (1995) reports that inhibition of periosteal bone formation in young rats was not present on a four-day spaceflight, photon absorptiometric measurements taken on Gemini and Apollo crewmembers indicate that bone losses occur on even relatively short spaceflights (Mack, LaChance, Vose, & Vogt, 1967; Mack & Vogt, 1971). However, due to species and skeletal configuration differences in spaceflight experiments, and environmental differences (e.g., mechanical loads) between bed-rest or immobilization and spaceflight, no conclusive statements can be made at this time as to the precise mechanisms of human bone loss during prolonged periods of weightlessness. Yet, there has been a tremendous need to address this issue as demonstrated in the field of rehabilitation medicine.

Prior to the known effects of space travel on bone mineral, the return of thousands of soldiers with disabilities following the end of the Second World War initiated interest on the influence of prolonged periods of immobilization on BMD. Studies such as Howard, Parson, and Bigham (1945), and Dunning and Plum (1957), confirmed, that in fact, extended bed rest/immobilization was detrimental to BMD in humans. As a result, numerous investigators began exploring different therapeutic interventions to minimize and/or reverse these deleterious effects, including the use of ambulation (Abramson, 1948), an oscillating bed (Whedon, Deitrich, & Shorr, 1949; Whedon & Shorr, 1957), standing (Freeman, 1949), heavy resistance exercise (Clark, Watkins, Tonning & Bauer, 1954), and tilt table (Wyse & Pattee, 1954).

Perhaps most noteworthy of these studies is the work of Issekutz, Blizzard, Birkhead, and Rodahl (1965) who investigated the effects of prolonged bed rest and physical activity on the urinary excretion of calcium. Fourteen males between the ages of 18 and 21 years participated in twenty different experimental conditions, including: (a) complete bed rest for 18-42 continuous days with no physical activity, and/or (b) one hour exercise (supine or sitting bicycle ergometer) and 23 hours bed rest daily, (c) complete bed rest for 18 continuous days followed by 2 hours of daily supine exercise for 13 days, (d) sitting for 8 hours followed by bed rest the remaining 16 hours each day, (e) 18 days complete bed rest followed by 24 days with 3 hours of daily standing, (f) 40 days of continuous bed rest followed by a standing program, and (g) complete bed rest for 32 days followed by 15 days of 8 hr/day sitting or 15 days. Baseline urinary calcium excretion levels averaged 218 mg/day for subjects prior to the onset of bed rest. Following 18-42 days of continuous bed rest, urinary calcium excretion increased an average of 157 mg/day for all subjects. After a minimum of 18 continuous days of bed rest, there were no significant decreases in urinary calcium excretion following participation in the one, two, or four hour daily sitting or supine exercise programs. However, calcium output started to decline following the return of normal weightbearing activities. Interestingly, while four hours of daily recumbent cycling did not positively influence calcium excretion during bedrest, a passive standing program did. One of two subjects who stood two hours per day showed a decline in urinary calcium excretion while four of five subjects who stood three hours per day also displayed this same trend. The authors concluded that "the increase in urinary calcium output in prolonged horizontal positions is due to the absence of longitudinal pressure (weightbearing) on the bones rather than the physical inactivity during bed rest " (p. 1013). Unfortunately, statistical analyses were not performed for any of the experimental conditions and the sample size was small.

If weightbearing alone is responsible for declining the urinary calcium output as Issekutz et al. (1965) and others (Donaldson, et al., 1970; Schneider & McDonald, 1984) have suggested, it would therefore seem beneficial for nonambulatory subjects to stand each day to help prevent calcium losses. This may be particularly significant for subjects who are unable to ambulate independently and need supervised therapeutic sessions in order to establish weightbearing positions. Yet, researchers do not agree on the benefits of passive standing for the prevention of osteoporosis. This includes the use of assisted standing programs with individuals who have experienced spinal cord injuries (SCI), older adults with idiopathic osteoporosis, children or adults with other orthopedic and/or mental impairments. However, it has been suggested since 1929 (Cuthberson, 1929), and is now widely accepted, that a lack of physical activity is a contributing factor in the development of osteoporosis (Lindsay, 1993).

Abramson (1948) investigated bone disturbances in ambulatory and nonambulatory adults with SCI several years post-injury. After roentengographical analysis, Abramson found that twenty-five of thirty nonambulators had osteoporosis in varying degree. Conversely, seven of eight ambulators showed no signs of osteoporosis. Unfortunately, Abramson did not report how osteoporosis was determined, the site of the roentengograph, or the duration after injury in which the measurements were obtained. However, as a result of his findings, Abramson concluded that ambulation may prevent urinary calculi which in turn may influence bone status.

Freeman (1949) also suggested that ambulation and standing reduced calcium loss. Similar findings were reported by Whedon and Shorr (1957) while using a rocking bed for immobilized healthy men but not found in individuals with poliomyelitis. Likewise, Wyse and Pattee (1954) did not find rocking or standing beneficial to a group of adults with paraplegia.

In a study to investigate different therapeutic intervention strategies on the intensity and duration of hypercalciuria, Plum and Dunning (1958) studied the effects of rocking, sitting, standing, underwater therapy, and crutch-walking in thirty-seven subjects paralyzed by poliomyelitis. Plum and Dunning further classified individuals by the extent of limb involvement due to paralysis. Seven males and nine females were identified with quadriplegia. From the clinical onset of poliomyelitis, the authors followed subjects throughout the rehabilitation process and at later follow-up. They reported that none of the therapeutic interventions were effective in reducing calcium output in poliomyelitis patients and that hypercalciuria continued for an average of 11 to 12 months after diagnosis of poliomyelitis. Likewise, in a group of twenty patients with paraplegia and "moderate paralysis", there was found to be no reduction in calcium excretion as a result of the intervention. However, the authors reported one patient who could ambulate with canes did show a reduction in calcium output and that other patients who ambulated independently returned to normal calcium excretion levels. Plum and Dunning concluded that the force applied to bone as a result of the muscular capacity to do so and not the ability to ambulate is the most effective means of preventing disuse osteoporosis. Similarly, Abramson and Delagi (1961) suggested that muscle action is the most effective stress upon bone preventing disuse osteoporosis and further suggested that while weightbearing is less effective, it probably has value in preventing osteoporosis.

Yet recent investigations on the BMD of collegiate swimmers do not fully support these conclusions (Taaffe, Snow-Harter, Connolly, Robinson, Brown, & Marcus, 1995). Fehling, Alekel, Clasey, Rector, and Stillman (1995) compared the lumbar spine (LSBMD), proximal femur (PFBMD), and WBMD, including regional analyses for both arms and legs, torso, and pelvis (specific sites were not provided) among Caucasian collegiate female swimmers (n = 7), volleyball players (n = 8), and gymnasts (n = 13). In addition, a non-active control group (n = 17) was also compared using DXA. After controlling for differences in height and weight between subjects and groups, Fehling et al reported that the higher loading groups (volleyballers and gymnasts) had significantly greater WBMD (including legs and pelvis), LSBMD, and FBMD values compared to both the swimming and control groups. Furthermore, Fehling et al reported no significant difference in BMD measurements obtained at any site between the swimming group and the control group, yet the swimmers were reported to have significantly greater ($p < .05$) lean body mass (LBM). They concluded that collegiate females who participated in high impact sports (volleyball and gymnastics) have greater BMD values than those who do not participate in these sports. Furthermore, as participation in a non-loading sport (swimming) yielded similar BMD values compared with a group of non-active woman, these results suggest that the muscular forces generated during swimming do not provide significant forces (loads) to positively influence BMD. These findings are consistent with those of Risser, Lee, LeBlanc, Poindexter, Risser, and Schneider (1990) who compared lumbar spine and calcaneal BMD among 29 Caucasian female collegiate athletes competing at a Division I University in the sports of volleyball (n = 12), basketball (n = 9), and swimming (n = 10). Additionally, a non-active control group of thirteen college-aged females was also compared in the study. After adjusting for height and weight, swimmers were found to have significantly lower LSBMD values compared to all other groups, including the non-active control group. In addition, the swimmers and the non-active group had significantly lower calcaneal BMD values ($p < 0.05$) compared to the volleyball and basketball groups. When comparing the volleyball and basketball groups, no significant BMD differences were found for calcaneous or lumbar spine. Furthermore, volleyball players had significantly greater ($p < 0.05$) LSBMD values than the non-active group. Like the findings of Fehling et al., swimmers were found to have equivalent or lower BMD values when compared to non-active females of similar age, and significantly lower than females participating in high impact sports including volleyball, basketball, and gymnastics.

One such group which has difficulty with weightbearing activities, including an increased risk of demineralization due to disuse are individuals with SCI. Previous researchers have suggested that individuals with paraplegia are at greater risk of spontaneous fractures as a result of disuse osteoporosis (Comarr, Hutchinson, & Bors, 1962; Drennan & Freehafer, 1971; Ohry, Shemesh, Zak, & Herzberg, 1980; Rafii, Firooznia, Golimbu, & Sokolow, 1982; Ragnarsson & Sell, 1981). However, recent investigations have found that while hip BMD values were found to be significantly lower in men and women with SCI, lumbar spine and forearm BMD values were at or near normal values (Biering-Sorensen, Bohr, & Schaadt, 1988, 1990; Eddins, et al.,1995; Leslie & Nance,1993). For instance, using DXA, Biering-Sorensen, Bohr, and Schaadt (1990) investigated the change in lumbar spine, femoral neck and shaft, distal forearm, and proximal tibia bone mineral content (BMC) in six men and two women between the ages of 18 and 49 years. BMC data were obtained an average of 43 days post-injury (range 9-167 days) and subjects were followed up to 53 months after-injury (average 41 months). All individuals with SCI had complete lesions ranging from C7 to L1. The authors reported that while proximal tibia and femoral neck values reached between 40-50% and 60-70% of normal values respectively, lumbar spine and distal forearm BMC were virtually unchanged. Beiring-Sorensen, Bohr, and Schaadt concluded that normal muscle function is necessary to prevent BMC losses and that unchanged lumbar spine BMC may be due to the continuous weightbearing to the trunk required with wheelchair use.

Using Compton gamma ray scattering technique, Gross, Roberts, Foster, Shankardass, and Webber (1987) conducted an investigation of the calcaneal bone density in twenty-six males and twenty-three females with restricted mobility due to such factors as: multiple sclerosis (n = 20), cerebral palsy (n = 4), traumatic brain injury (n = 10), and SCI (n = 8). The investigators reported that mobility had been restricted from 1.5 to 43 years prior to bone density measurement. Using forward stepwise multiple regression analysis, Gross et al examined the influence of disease diagnosis, lower limb muscle tone, gender, and years after condition onset to determine if bone density was related to these variables. They reported that while 57% (n = 28) of subjects tested had bone density values one standard deviation or more below predicted normal density, none of the variables included in the forward stepwise regression analysis were significant predictors on calcaneal bone density. Gross et al concluded that the low calcaneal values obtained were probably a result of restricted weightbearing activity and a reduction in their participation in physical activities.

Kunkel, Scremin, Eisenberg, Garcia, Roberts, and Martinez (1993) investigated the effects of standing on BMD, spasticity, and contactures of six wheelchair dependent (average 19 years in chair) adults, including five individuals with SCI. Following pre-testing and familiarization with the standing apparatus, six men (mean age 49 years) were asked to stand 45 minutes twice per day for five months in a specialized standing frame. Femoral neck and lumbar spine BMD measurements were obtained using DXA. Upon completion of the five month protocol, subjects had averaged standing 144 hours over 135 days. The results of standing did not influence femoral neck or lumbar BMD, contractures, or spasticity values. Kunkel et al (1993) reported that femoral neck values were not significantly different as a result of the standing but were found to be significantly lower than that of healthy men. Like previous researchers (Biering-Sorensen, Bohr, and Schaadt 1988, 1990; Leslie and Nance,1993), Kunkel et al also reported that lumbar spine BMD values, while unchanged due to the standing protocol, were in the normal range compared to healthy men. Lastly, while standing did not improve BMD values, subjects reported improved psychological well-being as a result of being able to stand daily.

While the use of assisted standing remains unfounded in reversing the effects of disuse osteoporosis, researchers have attempted to identify other therapeutic modalities to help minimize or reverse the effects of osteoporosis. For example, in a group of men with quadriplegia, Leeds et al (1990) investigated the influence of a functional electrical stimulation (FES), cycle ergometry training on proximal femur BMD. Six men with quadriplegia between the ages of 18 and 27 years trained three days per week for seven months on a FES cycle ergometer. After initial familiarization and training, subjects trained for 30 minutes each session. Pre- and post-training proximal femur measurements (femoral neck, Ward triangle, and trochanter) were obtained using DXA. Expressed as a percentage of healthy men, Leeds and colleagues reported that BMD data were 65, 52, and 46 percent of normal for the femoral neck, Ward's triangle and trochanter, respectively. Following seven months of training, there was no significant difference in BMD values for any of the three sites. Leeds et al concluded that FES cycle ergometry was not effective in producing positive BMD changes in the proximal femur for men with quadriplegia. However, these findings are not limited to adults with disabilities. For instance, Schneider and McDonald (1984) studied the effects of 5 to 36 weeks of continuous bed rest on 90 healthy men (mean age = 25 years). In an attempt to minimize bone mineral loss, a variety of different interventions were investigated including the use of: (1) calcium supplementation, (2) physical activity, (3) skeletal compression, (4) vitamin D therapy, and (5) hydrostatic pressure to the legs. In spite of the different interventions, urinary calcium was found to increase substantially and monthly calcaneal bone mineral losses of 5% were reported. Like Issekutz et al (1965) and others, the authors concluded that prolonged periods of immobilization and the lack of weightbearing activity causes skeletal loss. Schneider and McDonald concluded that despite the intervention strategies of physical activity, calcium and vitamin D supplementation, the lack of compressive and impactive forces were responsible for calcaneal bone loss.

At this time, there remains a paucity of information on the most effective strategies for minimizing the adverse effects of nonambulation among children and adults. There has been numerous descriptive investigations on the bone health of individuals with SCI, yet little information remains for individuals with other disabilities. While FES has been shown to reverse the effects of muscular atrophy and enhanced quadricep blood flow of individuals with SCI (Taylor, et al., 1993), there has been no proof that this can maintain or improve BMD in nonambulatory children or adults. As a result, modern researchers continue to seek definitive answers on how best to treat disuse osteoporosis among children and adults with and without disabilities.

BMD and Mental Retardation

Until recently, there has been no information available on the BMD of children or adults with MR (Kao, Chen, Wang, & Yeh, 1992). However, three recent investigations have examined this issue among younger adults with mild and SMR.

Using DXA, Sepulveda and colleagues (1995) compared the arm, leg, pelvic, and spinal BMD of a group of males (n = 11) and females (n = 4) with Down syndrome (DS) (28.8 ± 9.71 years) to a group of males (n=12) and females (n =13) without MR (31.24 ± 9.49 years). Unfortunately, specific BMD measurement sites were not provided by the authors (e.g., femoral neck rather than "leg"). Body composition values, including percent body fat, fat mass, and LBM, were also obtained using DXA. Control subjects were selected due to their similarity with individuals with DS on age, height, and weight but not matched one-to-one. No mention was made of ambulatory ability, activity level, dietary differences or status of other factors which may have differentiated the two groups (e.g., tobacco use). Sepulveda et al reported no significant differences between groups among age, weight, LBM, percent body fat, or fat mass, however, a significant difference existed between groups in height. Arm and leg BMD values, while lower in the DS group, were not significantly different from the control group. Pelvic and spine BMD values were both significantly greater (p = .001) in the control group compared to the group with DS. After adjustment for covariates, the percentage difference between the two groups for pelvic and spine BMD values was 11.1% and 13.9%, respectively. The results of this study should be noted with caution, as neither the control or DS group were homogeneous in terms of ethnicity. Specifically, the control group included twelve non-Caucasians, including five African-Americans and no mention was made if subjects were matched on ethnic background. This may be problematic when comparing the results as it is well documented that African-Americans have greater BMD values and fewer fractures compared to Caucasians (Farmer, White, Brody, & Bailey, 1984; Karagas, Lu-Yao, Barrett, Beach, & Baron, 1996).

In another comparative study, Felix (1993) investigated the BMD of premenopausal women with and without mild MR between the ages of 19 and 45 years old. All subjects were able to ambulate independently, were free of any known life-threatening diseases, and did not take any medications which were known to effect bone metabolism other than oral contraceptives. Subjects were matched on age, menopausal status, body mass index (BMI), and oral contraceptive usage. In addition, subjects were evaluated for health and level of physical activity (questionnaire), muscular strength, and body composition. Felix reported no significant differences between groups among age, weight, and BMI. However, like Sepulveda et al, Felix (1993) reported a significant difference between groups in height. Furthermore, he reported that while the average FBMD and WBMD were lower for women with MR, these values were not significantly different than values obtained for their non-retarded peers. Lastly, a stepwise regression analysis revealed that lean muscle mass (LMM) was the best predictor of FBMD and WBMD in women with MR. In women without MR, biceps strength was the best predictor of FBMD while LMM and quadriceps strength were the best predictors of WBMD.

Most recently, Downs, McCubbin, Snow, Baylor, and Whitney (1996) investigated the FBMD and mid-shaft femur BMD (MFBMD) of sixty-one ambulatory and nonambulatory males and premenopausal females with SMR who: (1) were between the ages of 25 and 45 years old, (2) were full-time continuous developmental center residents during the previous five years, (3) were on anticonvulsant therapy continuously for ten or more years, (4) had no history of a fracture in the long bones of one leg, and (5) had no history of metabolic and/or bone disease. Subjects were divided into three groups: (1) Ambulatory (13 males, 8 females; 35.52 ± 5.6 years) nonambulatory weightbearers (tilt table standers) (16 males, 12 females; 35.04 ± 5.6 years), or (3) nonambulatory, nonweightbears (no tilt table standing) (6 males, 6 females; 35.08 ± 5.1 years). Results of the study found that ambulators had significantly greater ($p < .01$) FBMD and MFBMD compared with both nonambulatory groups. Also, MFBMD was higher and there was a trend toward greater BMD in all sites in nonambulatory weightbearers compared with the nonweightbearing-nonambulatory group, suggesting tilt table standing positively influenced bone mass. While the results of this study would suggest the advantages of tilt-table standing for nonambulatory adults, Downs et al reported a number of limitations. First, there was no way to control subjects for factors that influence BMD such as: (a) diet, (b) unmonitored physical activity, (c) heredity, and (d) smoking behavior. Secondly, the health and physical activity level; type, duration of usage and combination of medications; and the length of time that individuals had been nonambulatory varied greatly between subjects. Thirdly, the amount of weightbearing which did occur during tilt table standing was not monitored. It was unknown if 100% of clients body weight was applied to the base of the tilt table during each session or if the straps which held the client onto the table reduce the clients applied body weight to less than 100%. In addition, it is unclear if clients weight was distributed equally on both limbs. Finally, there is no way of knowing whether subjects who were eligible for the tilt table protocol had greater BMD values prior to tilt table standing. As a result, Downs et al suggested that future research be undertaken to examine the influence of assisted standing on nonambulatory adults with SMR who are at greater risk of disuse osteoporosis and spontaneous fracture with the development of a safe and appropriate weightbearing protocol.

Compared with the results of Sepulveda and colleagues (1995) and Downs et al (1996) the results of the Felix (1993) study did not suggest that individuals with MR were at greater risk of osteoporosis. Yet, many individuals with MR have secondary conditions which may directly or indirectly influence bone mineral status. While MR may not cause osteoporosis, common secondary medical conditions, and lack of individual understanding, opportunity, participation or information about healthy lifestyle factors may influence bone health.

One such medical condition which has been investigated is the prevalence of hypothyroidism in individuals with DS. Either congenital or acquired in nature, hypothyroidism is common among individuals with MR, particularly those with DS (Baxter, Larkins, Martin, Heyma, Myles, & Ryan, 1975;

Murdoch, Ratcliffe, McCarty, Rodger, & Ratcliffe, 1977). For instance, cretinism is one such congenital endocrine disorder characterized by a deficiency of thyroid hormone causing MR (Luckasson, et al., 1992). Hypothyroidism, particularly in children, may result in abnormal skeletal growth (Perry, 1989). While hypothyroidism has actually been shown to increase calcium absorption within the gut, the calcium is not deposited within the bones; rather than storing the excessive calcium, a hypercalciuria state resulting in negative calcium balance is achieved (Krane, Brownell, Stanburg, & Corrigan, 1956; Lekkerkerker & Doorenbos, 1973).

In an attempt to determine the presence of hypothyroidism in a group of adults with DS, Mani (1988) examined fifty-five individuals residing in a state developmental center for the presence of thyroid dysfunction as determined by both clinical (e.g., lethargy, reflexes), and biochemical features (e.g., elevated TSH, low T_4). Of the thirty-two males and twenty-three females with DS examined, twenty-eight exhibited clinical signs suggestive of hypothyroidism. Upon further examination via biochemical analyses, twelve were found to have hypothyroidism. Mani concluded that while 50% of individuals with DS exhibited clinical signs of hypothyroidism, approximately 20% (n = 12) of those individuals with DS examined had biochemical results indicative of hypothyroidism compared to a reported population average of approximately 1.1%.

Frequently, hypothyroidism is treated with thyroxin, a form of thyroid hormone. Jancar (1990) examined the presence of osteoporosis in institutionalized adults with SMR on thyroxine treatment for hypothyroidism. Nineteen subjects, including fourteen females (mean age = 63.3 years) and five males (mean age = 54 years) were examined. Females had been on thyroxine treatment an average of 11.4 years, males 11.2. The results of the investigation found that nine of the fourteen females (64%) and one of the five males (20%) showed signs of either osteoporosis or had a related bone fracture. Unfortunately, Jancar did not report on the menopausal status of the females, the ambulatory/activity levels of either groups, or how signs of osteoporosis were determined, thus it is difficult to suggest that thyroxine treatment is implicated in causing bone fragility in this study. While Jancar concluded the need for further study of the effects of thyroxine therapy for individuals with MR being treated for hypothyroidism, previous investigators suggested individuals undergoing such treatment are at risk for developing osteoporosis (Cooper, 1988; Paul, Kerrigan, Kelly, Braverman, & Baran, 1988).

Menopause & Hormone Replacement Therapies

Produced mainly by the ovaries, estrogen is circulated via the blood to many of the tissues and organs of the body. At the onset of menopause, decreased ovarian function results in a loss of estrogen (Nordin, Aaron, Speed, & Crilly, 1981). There are several physiological mechanisms whereby estrogen exerts an effect on BMD (Marks & Popoff, 1988). First, estrogen deficiency indirectly leads to greater osteoclastic activity by diminishing osteoblastic activity within the bones. Secondly, estrogen promotes the synthesis of calcitonin which inhibits bone resorption. Lastly, estrogen enhances the active metabolite of Vitamin D, 1, 25-dihyroxyvitamin D3, which increases absorption of calcium at the intestine. As a result of decreased estrogen production at menopause, BMD declines rapidly, particularly during the first five years of menopause (Snow-Harter & Marcus, 1991).

The importance of estrogen function can be demonstrated when a young women has had the surgical removal of her ovaries. Following oophorectomy, a rapid phase of bone loss occurs attributed to the loss of estrogen (Fogelman, Poser, Smith, Hart, & Bevan, 1984). Similarly, this pattern of bone loss occurs during menopause which parallels the age-related, gradual decrease in bone loss after peak bone mass attained during the third decade of life (Sinaki, 1989).

The accelerated bone loss seen in women in the first five years of menopause can be prevented by hormone replacement therapy (HRT) (Horsman, Gallagher, Simpson, & Nordin, 1977; Lindsay, et al., 1976). Perhaps due to the wide variation in methodologies and populations studied, neither physical activity nor calcium supplementation alone or in combination have repeatedly shown positive effects on BMD in postmenopausal women (ACSM, 1995).

While Aloia and colleagues (1994) reported that calcium augmentation (1700 mg/day) alone significantly reduced bone loss in 118 postmenopausal Caucasian women followed over a three year period, it was significantly less effective than estrogen-progesterone-calcium supplementation given to a similar group of women. Unfortunately, there was no estrogen-progesterone only group in this design.

The efficacy of HRT in preventing postmenopausal bone loss has been widely documented in both retrospective and prospective studies and at a number of skeletal sites, including the femoral neck and spine (Christiansen & Riis, 1990; Cititelli et al., 1988; Stevenson, et al., 1990). In addition, some of these studies have demonstrated an increase in bone mass in response to estrogen replacement therapy (ERT) or HRT. Stevenson and colleagues (1990) have shown in a prospective study that transdermal estradiol increased BMD in the spine and proximal femur in postmenopausal women and cross-sectional data suggest similar results (Savvas, et al., 1988).

A number of studies have shown that ERT/HRT use is associated with a reduction in fracture risk in the hip, spine, and radius (Ettinger, Genant, & Cann, 1985, 1988; Kiel, Felson, Anderson, Wilson & Moskowitz, 1987; Naessen, Person, Adami, Bergstrom, Bergkvist, 1990). More recently, Tuppurainen et al (1995) reported HRT use had a protective effect (odds ratio 0.70, 95% CI 0.50 - 0.96) against fractures in a cohort of 3,140 women (53.4 years ± 2.8 years) followed for an average of 2.4 years. The protective effect against hip fractures is considerable, most studies indicating an overall risk reduction of 50-75% in ERT/HRT users. Felson, Zhang, Hannan, Kiel, Wilson, and Anderson (1993), investigated the influence of ERT on the femoral, vertebral, mid-shaft and distal radius BMD in a cohort of 670 Caucasian women (mean age 76 years). From the entire cohort, 212 women (approximately 32%) had continuously taken ERT. After adjusting for age, weight, height, smoking behavior, age at menopause, and physical activity level, the researchers concluded that women below the age of 75 years who had taken ERT for seven or more years had on average, 11.2 percent greater BMD (all sites) than women who had never taken ERT. Similarly, women 75 years or older had 3.2 percent greater BMD values at all sites compared to their same-age peers who did not take ERT. Felson and colleagues reported that women who had taken ERT a minimum of seven years since menopause had significantly greater ($p < 0.05$) femoral and spinal BMD values and those on ERT for 10 or more years had significantly greater ($p <0.05$) BMD values at all sites except the spine. The authors concluded that women should take ERT at least seven years after menopause for the preservation of BMD.

While the minimum duration of ERT use required for protection against fractures has not been firmly established, two studies report a period of five or more years is required (Paganini-Hill, et al., 1981; Weiss, Ure, Ballard, Williams, & Dahling, 1980). These findings would support those of Nguyen, Jones, Sambrook, White, Kelly, and Eisman (1995). In a cohort of 1091 women (70 ± 7.2 years old), they reported that ERT users of more than five years had significantly greater ($p < 0.001$) lumbar spine and femoral neck BMD values compared with a similar group of women who had used ERT less than five years or not at all.

In light of the perceived benefits of HRT administration for peri- and postmenopausal women, their usage is based on consideration of risks versus benefits. While there are considerable protective effects against fracture with HRT use, there is also widespread evidence of a significantly greater RR for endometrial (Ettinger, Goldtich, & Friedman, 1988), uterine (Rubin, Peterson, Lee, Maes, Wingo, & Becker, 1990; Shapiro, Kelly, & Rosenberg, 1985), and breast cancers (Bergkvist, Adami, Persson, Hoover, & Schairer, 1989; Colditz et al., 1991). As Langer and Barrett-Connor (1994) have suggested, women and their medical practitioners thus need to be clear about their main reasons for use of HRT: whether for short term relief of symptoms or for longer term prophylaxis since the potential risk-benefit balance associated with different modes of administration, formulations, and duration of use differ.

Summary

The human skeleton, composed of 206 bones of various lengths, shapes, and sizes is constantly undergoing transformation. Composed of both cortical and trabecular bone in different proportions each skeletal bone has a very specific function. One such role is the storage of calcium. There are a number of factors which influence calcium metabolism including, but not limited to: diet, medications, ambulatory and menopausal status, gender, and age.

Diet plays a critical role in calcium metabolism and thus bone health. For example, excessive dietary animal protein intake has been identified as potential risk factor for forearm fractures among females who consume more than 95 g per day (Feskanich et al, 1996) and yet a necessary oral supplement following femoral fracture (Tkatch et al, 1992). Calcium, phosphorous, and vitamin D supplementation have yielded mixed results in regards to positively influencing bone health.

Medications, including steroidals and glucorticoids have consistently demonstarted a deleterious effect on bone remodeling (Lukert & Raisz, 1990; Mitchell & Lyles, 1990). Similarly, anticonvulsant medications, which are widely prescribed for individuals with SMR, negatively influence BMD and calcium absorption (Cunningham & Mueller, 1987; Iiavainen & Savolainen, 1980).

With the exception of genetics, the greatest single factor which may influence BMD is ambulatory status. That is, are individuals capable of participating in weightbearing activities which stimulate osteoblastic responses. Numerous bedrest, spaceflight, and studies with nonambulatory (e.g., spinal cord injured) children and adults have consistently shown the positive influence of mechanical loading through weightbearing activities (Lindsay, 1993). Unfortunately, many adults with SMR are not capable of participating in weightbearing activities which stimulate bone absorption.

Due to population differences, no definitive statements can be made about the risk of osteoporosis associated with having MR. Data, while limited, suggest that nonambulatory children and adults with MR are at greater risk of fracture (Downs et al, 1996; Lee & Lyne, 1990; Sepulveda et al, 1995) but females with

DS may not (Felix, 1993). More studies are needed with this population of children and adults before conclusive statements can be established.

Menopausal status is widely known to influence bone health (Sinaki, 1989). The older an individual, the greater risk of fracture, particularly among postmenopausal females. However, the use of HRT/ERT has been successfully used to maintain and/or increase BMD values among postmenopausal females (Christiansen & Riis, 1990; Felson et al., 1993; Stevenson et al., 1990). Unfortunately, usage of these pharameticutical therapies are not without risk, including a higher incidence of some forms of cancer (Ettinger et al., 1988; Rubin et al., 1990).

Chapter 3

Methodology and Procedures

The methodology and procedures used within this study are described within this section. This includes a description of the cohort, the methodology employed to gain client data, and those statistical methods used in data analysis.

Cohort Definition

The primary purpose of this five-year retrospective study was to examine the incidence, causes, and the risk factors of bone fracture in a population of individuals with severe mental retardation who resided in a state developmental center located in the Western United States between April 1, 1991 through March 31, 1996. It was estimated that over 500 individuals were eligible for study participation. For each individual, study years began when the following criteria were met: residence in the state developmental center on April 1, 1991 and diagnosed with severe mental retardation[1].

Risk of fracture ended on the first of the following dates: first fracture of that type, residence outside of the developmental center longer than 14 continuous days, death, or the end of the study period (March 31, 1996).

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[1] Classification based on 1992 AAMR Definition from *Mental Retardation: Definition, classification, and systems of support* (9th ed.), by R. Luckasson, D. Coulter, E. Polloway, S.Deiss, R. Schalock, M. Snell, D. Spitalnik,& J. Stark, 1992, Washington, DC: American Association on Mental Retardation.

Methodology

Permission to conduct this study was obtained from the Institutional Review Boards at the state developmental center located in the Western United States (Appendix A), Oregon State University (Appendix B) and the parents/legal guardians of subjects (Appendix C & D). Each individual meeting the study criteria was eligible for inclusion within this study as identified by the medical director of the state developmental center.

After individuals were identified, a manual review of radiographical records including the original roentgenogram was undertaken to identify those individuals who have experienced a fracture for the period between April 1, 1991 and March 31, 1996. The date of the radiographical procedure which positively determined the presence of a fracture served as the reference date for the incident unless otherwise noted within the client medical records. Once clients had been identified as having experienced a fracture, the primary investigator with the assistance of developmental center nursing personnel, filled-out a medical questionnaire (Appendix E) for each client based on the following information from their medical and nursing records: identification number (assigned by developmental center), age, gender, race, cottage of residence, medication(s) and dosage(s), body height and weight, ambulatory status, smoking status, calcium and vitamin D supplementation, years residing in a state developmental center, amount of assistance needed to eat meals (e.g., total assistance, independent), fracture site, type, date, and etiology.

A separate questionnaire for those clients who were identified as eligible for inclusion within the study but did not experience any fracture during the study period was completed by the investigator and a team of nursing staff from the state developmental center. The questionnaire included except fracture data information.

All subjects and families/guardians were assured of confidentiality as each individual was identified by their developmental center issued identification number rather than name.

Treatment of the Data

Upon the completion of the medical questionnaire, information was entered manually into a Alpha IV database system to ensure the accuracy of data input. Data were then downloaded to an Microsoft Excel 5.0 for Windows (Microsoft, 1993) file by the principal investigator. Analysis was conducted on Epi Info 6.0 (Centers for Disease Control and Prevention, 1995) and SPSS Advanced Statistics 6.1 for Windows (Norusis, 1994).

The outcome variable was the occurrence or non-occurrence of bone fracture. Fracture occurrence measured by cumulative incidence (CI) as calculated by dividing the number of fractures by total cases with stratification by age, gender, ambulatory ability, medication usage, and calcium and vitamin D supplementation. Relative risk of fractures including construction of confidence intervals (95% CI) for all estimates was undertaken (Hennekens & Buring, 1987) for: age, gender, BMI, ambulatory ability, supplemental calcium and vitamin D, smoking, menopausal status, and medication usage (Tables 38 - 125).

Chi-square (χ^2) contingency table analysis was employed for unadjusted tests for detecting significant associations between fracture occurrence and characteristics of clients (Page, Cole, & Timmreck, 1995). Mantel-Haenszel methods were used for variables with multi-levels of classifications (e.g., medication dosage) and for stratified data. To assess the degree of association between a risk factor of interest and an outcome event (fracture), relative risk ratios (RR) were obtained. Confidence intervals for those effect estimates were also computed. For variables with more than two categories, logistic regression methods were used to identify possible trends in fracture risk by such variables. The significance of a trend was tested by the Wald test (Hosmer & Lemeshow, 1989). A p-value of ≤ 0.05 was considered statistically significant.

Variables found to be important (at $\propto = 0.25$ level) and logically plausible in previous univariate analysis were then considered for multivariate analysis. Logistic regression was used to perform multivariate analysis on the relationship between fracture and the important risk factors in order to examine significant fracture predictors or variables that might be important in explaining fracture occurrence. Stepwise procedures were employed for inclusion or exclusion of variables. The multivariate model was fit after verifying the importance of each variable in the model based on the likelihood ratio test and Wald statistics (Hosmer & Lemeshow, 1989). The regression coefficients were used to estimate odds ratios (Hosmer and Lemeshow, 1989). The goodness of fit of the model was assessed by evaluating Pearson residuals and deviance residuals.

Chapter 4

Results

Data presented within this chapter are the result of a retrospective epidemiological study on the occurrence of bone fracture among a cohort of adults with severe mental retardation. Medical records were reviewed for 518 adults residing in a state developmental center on April 1, 1991 and followed through March 31, 1996.

As expected from a group of individuals who reside in a state developmental center, there was considerable variability between and within age and gender groups on the variables of interest. Therefore, for the purposes of simplification, data will be organized into four categories. First, the general characteristics of the study population will be presented. This includes gender, age group, height, weight, BMI, anticonvulsant and different medication usage, ambulatory and self-feeding ability, and other descriptive data. Secondly, the results of epidemiological data analyses, including cumulative incidence and relative risk ratios (RR) across strata will be provided. Third, as the primary question of interest is the occurrence or non-occurrence of bone fracture, the outcome of six alternative hypotheses will be presented which focus on those factors associated with fracture outcome. The last section, logistic regression analysis, will provide evidence of those factors which best predict the occurrence or non-occurrence of bone fracture and assist in the identification of individuals at greatest risk of future bone fracture.

General Characteristics

Age and Gender

Table 1 describes the age and gender specific distribution of all clients in this investigation. More than half of the entire cohort of adults were males (n = 271, 52.3%) who ranged in age from 23 to 65 years old (± 11.08 years). With the exception of the 60-and-over age category, there were more males than females within each of the five 10-year age groups (e.g., 30 - 39 years old). While females accounted for less than half of the entire cohort (n = 247, 47.7%), they comprised 66% (n = 39) of those individuals over the age of sixty and ranged in age from 23 to 72 years old (± 12.62 years).

As a group, the 30 to 39 year olds accounted for the largest proportion of adults (n = 175, 33.8%) and conversely those 60 years and older (n = 59, 11.3%) comprised the smallest group. Due to the recent trend of deinstitutionalization which has occurred within this and other state developmental centers throughout the country, fewer children have been placed within these facilities in recent years (Lakin, Braddock, & Smith, 1995). As a result, there were no individuals under the age of 23 in residence at the state developmental center and the 20 to 29 year old age group represented only 15.1% (n = 78) of the entire population. The lack of younger individuals residing within the state developmental center is further demonstrated by the fact that on the last day of data collection the youngest subject was 28 years old and had been residing at the state developmental center for 15 years.

Table 1.

Age and Gender of Adults Residing in a State Developmental Center.

Age Group	Males (%)	Females (%)	Total (%)
20 to 29	41 (7.9)	37 (7.1)	78 (15.1)
30 to 39	94 (18.1)	81 (15.6)	175 (33.8)
40 to 49	69 (13.3)	57 (11.0)	126 (24.3)
50 to 59	47 (9.1)	33 (6.4)	80 (15.5)
60 & Above	20 (3.9)	39 (7.5)	59 (11.3)
Total	271 (52.3)	247 (47.7)	518 (100.0)

Height, Weight, and Body Mass Index

The specific group and gender related anthropometric characteristics of this cohort are found in Table 2. This includes mean and standard deviation values by gender and age group for the cohort by height (cm), weight (kg), and BMI (weight in kg/height in meters^2). Subjects weight ranged from a low of 31 kg and 33 kg for females and males respectively to a high of 70 kg for females and 116 kg for males. As a group, males averaged 57.68 kg (± 12.86 kg), well over 9 kg more than the female cohort (48.18 ± 9.31 kg). Males were also on average 11 cm taller than females. Males ranged from a low of 137 cm to a high of 185 cm (± 11.43 cm) in height. Conversely, females ranged from 112 cm to 175 cm (± 11.39 cm). As the formula for BMI is a function of height and weight, as expected, male BMI values were slightly greater than females (22.39 ± 4.73 v. 21.60 ± 3.52).

Table 2.

Characteristics of Adults by Age Groups for Height, Weight and Body Mass Index (BMI). (Means and Standard Deviations)

Age Group (Yrs.)	Frequency	Height (cm)	Weight (kg)	BMI
Group				
20 to 29	78	154.90 (11.32)	53.49 (14.11)	22.15 (4.46)
30 to 39	175	155.36 (12.68)	53.85 (13.06)	22.22 (4.23)
40 to 49	126	157.04 (12.05)	52.81 (11.29)	21.40 (3.88)
50 to 59	80	156.88 (14.31)	54.77 (11.50)	22.38 (4.50)
≥ 60	59	149.81 (12.63)	49.17 (9.28)	22.03 (4.06)
Males				
20 to 29	41	159.58 (10.33)	59.81 (14.96)	23.43 (4.74)
30 to 39	94	161.03 (11.41)	59.70 (13.43)	23.08 (4.98)
40 to 49	69	161.04 (11.25)	54.63 (12.20)	21.08 (4.37)
50 to 59	47	162.98 (11.84)	58.64 (11.00)	22.27 (4.69)
≥ 60	20	154.98 (10.51)	52.11 (8.53)	21.82 (3.98)
Females				
20 to 29	37	149.70 (8.88)	46.50 (9.01)	20.74 (3.71)
30 to 39	81	148.78 (10.79)	47.07 (8.65)	21.22 (2.87)
40 to 49	57	152.19 (11.28)	50.62 (9.74)	21.78 (3.18)
50 to 59	33	148.19 (13.09)	49.25 (9.96)	22.52 (4.28)
≥ 60	39	147.16 (13.01)	47.66 (9.39)	22.14 (4.15)

Race

An overwhelming majority of clients were Caucasian (n = 444, 86.7%) compared with the race of the remaining sixty-nine clients. Of the non-

Caucasians, Native Americans comprised the second largest group (n = 25, 4.8%) (Table 3). Hispanic American (n = 19, 3.7%), African American (n = 15, 2.9%), and Asian American (n = 10, 1.9%) comprised the balance of adults residing in the developmental center.

Table 3.

Racial Background of Adults Residing in a State Developmental Center.

Racial Background	Frequency	Percentage
Caucasian	449	86.7
Native American	25	4.8
Hispanic American	19	3.7
African American	15	2.9
Asian American	10	1.9
Total	518	100.0

Residency at Developmental Center

Upon the onset of the study, individuals had been residing within state developmental centers an average of 38.6 years (± 12.56 years) with the longest resident having been within developmental centers for 71 years. The client with the shortest residence at developmental centers had been there 8 years. From the onset of the study (April 1, 1991) until the study endpoint (March 31, 1996), 144 (27.8%) of the 518 individuals were no longer residing at the developmental center. Most adults had been placed in other full-time care residences, with families and siblings, or were deceased. Individual follow-up upon leaving the developmental center was not conducted.

Ambulation Ability

Of particular interest to the outcome variable on the occurrence of bone fractures was the ambulatory ability of clients. As it is well documented that non-weightbearing activity contributes to diminished bone health, the ambulatory status of all individuals was documented.

Working with developmental center personnel, ambulatory status was identified on a four-point Likert scale. With a range from immobile (incapable of performing assisted standing) to independent ambulation, it was felt a four-point Likert scale would account for the ambulatory ability of all developmental center clients.

For the purposes of this study, the final ambulatory characteristics of the subjects noted in Table 4 are reflective of their ambulatory status at the time of fracture if any, upon the last day of the study if subjects did not fracture, or upon subjects last day at the developmental center (other than last day of the study). Those identified as immobile were separated into one of two groups: (a) those who could participate in assisted standing (immobile/assisted standing), and (b) those who could not physically stand on a tilt table/prone stander (immobile). The greatest number of clients were identified to be in the immobile/assisted standing group (n = 190, 36.7%) followed by those individuals (n = 161, 31.1%) who could ambulate with an assistive device (e.g., walker, crutch, cane). Those individuals who could ambulate independently, even with orthothic devises (e.g., ankle-foot orthotics/AFO's) but without the use of any other devise were identified as ambulatory (n = 89, 17.2%). The group with the least number of adults were those identified as immobile and incapable of participating in an assisted standing protocol (n = 78, 15.1%).

Table 4.

Ambulatory Ability of Adults Residing in a State Developmental Center.

Ambulatory Ability	Frequency	Percentage
Immobile / Assisted Standing[1]	190	36.7
Use Assistive Devise[2]	161	31.1
Ambulatory	89	17.2
Immobile[3]	78	15.1
Total	518	100.0

[1] Includes individuals who can use tilt table or other assistive devise to maintain stationary standing position.

[2] Includes such devises as walkers, crutches, braces, and canes

[3] Individuals are physically unable to participate in assisted standing

Feeding Ability

The ability to feed oneself was recorded on a five point Likert Scale reflecting the amount of personal care assistance necessary to consume meals.

Approximately 83% (n = 430) of subjects needed some level of assistance during meals. This included 28 individuals who were fed by either an oral or abdominal tube. Table 5 depicts the range of feeding abilities from the lowest level (Tube Fed) to highest level of self-feeding (No Assistance).

Table 5.

Self-Feeding Ability of Adults Residing in a State Developmental Center.

Self-Feeding Ability	Frequency	Percentage
Total Assistance	164	31.7
Mostly Assistance	120	23.2
Minimal Assistance	118	22.8
No Assistance	88	17.0
Tube Fed	28	5.4
Total	518	100.0

One hundred and sixty-four adults (31.7%) required total assistance during meals. Conversely, only 88 (17.0%) were capable of independently eating without any assistance. Collectively, the minimal assistance (n = 118, 22.8%) and mostly assistance (n = 120, 23.2%) groups accounted for 46% of the cohort. In addition to feeding ability, it was possible to document the prescribed supplemental calcium and Vitamin D provided to individuals in addition to medications of interest. Recognizing the need for supplemental calcium, 473 (91%) clients received 500 - 600 mg of calcium daily. Similarly, every client on anticonvulsant therapy (n = 438, 84.6%) received 600 - 800 iu of supplemental vitamin D daily.

Reproductive Status

The reproductive status of females is provided in Table 6. This includes classification of females as either pre- or postmenopausal and their history of hysterectomy or oophorectomy.

Women who had bilateral oophorectomies (n = 17, 6.9%) were included in the postmenopausal group. Conversely, women with hysterectomies (n = 39, 15.8%) and were not known to be postmenopausal were included in the premenopausal group. Due to the difficulty of establishing, the developmental center did not systematically record peri-menopausal status, and this group of women was included in the postmenopausal group. Almost equally distributed, of the 247 females in the cohort slightly over half (n = 128, 51.8%) were postmenopausal an average of 8.29 years (± 5.24 years). The remainder of women (n = 119, 48.2%) were identified as premenopausal.

Table 6.

Reproductive Status of Females Residing in a State Developmental Center.

Reproductive Status	Frequency	Percentage[1]
Pre-Menopausal	119	48.2
Post-Menopausal	128	51.8
Hysterectomy	39	15.8
Oophorectomy	17	6.9

[1] Based on 247 Female Adults

Medications

Anticonvulsant, oral contraceptive, glucocorticoid, and hypothyrodial medication usage among adults is summarized in Table 7. Of those medications of interest, anticonvulsants were prescribed most frequently (n = 438, 84.6%).

Specifically, there were six different anticonvulsants which were widely prescribed to individuals (Table 8). These included Phenytoin (n = 353, 80.6%), Phenobarbital (n = 234, 53.4%), Valproic Acid (n = 166, 37.9%), Carbamazpine (n = 101, 23.1%), Primidone (n = 61, 13.9%), and Ethosuximide (n = 35, 8.0%).

Table 7.

Medication Usage Among Adults Residing in a State Developmental Center.

Medication Type	Frequency	Percentage[1]
Anticonvulsants	438	84.6
Oral Contraceptives	34	6.6
Glucocorticoids	21	4.1
Hypothyrodial	9	1.7

[1] Based upon 518 Adults

Table 8.

Anticonvulsant Medication Usage Among Adults Residing in a State Developmental Center

Medication Type	Frequency	Percentage[2]
Phenytoin	353	80.6
Phenobarbital	234	53.4
Valproic Acid	166	37.9
Carbamazepine	101	23.1
Primidone	61	13.9
Ethosuximide	35	8.0

[2] Based on 438 adults taking one or more anticonvulsant medications

Of the 518 individuals within the cohort, 84.6% (n = 438) were on one or more anticonvulsant medications including nearly 75% (n = 380) who were taking two or more types of anticonvulsants (Table 9). Frequencies of other medications of interest were as follows: oral contraceptives for females (n = 34, 13.8% of women), glucocorticoids (n = 21, 4.1%), and hypothyrodial medications (n = 9, 1.7%). No hormone or estrogen replacement therapies were prescribed for females.

Table 9.

Number of Anticonvulsant Medications Taken Concurrently Among Adults Residing in a State Developmental Center.

Number of Anticonvulsants Concurrently Taking	Frequency	Percentage
0	80	15.4
1	58	11.2
2	259	50.0
3	112	21.6
4	9	1.7
Total	518	100.0

Fractures

Based on the case definitions of this study, 229 individuals (44.2%) experienced 291 fractures during this five year retrospective period (Table 10).

Of those who experienced a fracture, 168 (73.3%) had one fracture, 43 (18.8%) had two, 15 (6.6%) fractured three times, and only 3 (1.3%) had four fractures. There were no individuals who had more than four fractures to areas of the body defined in this study (e.g., mid-shaft femur).

Table10.

Five-Year Cumulative Incidence of Fractures Among Adults Residing in a State Developmental Center

Type	Fractures or Fractured	People at Risk	Cumulative Incidence
Incidence[1]	291	518	.560
Incidence[2]	229	518	.440

[1] Based on the number of incident fractures occurring on/between April 1, 1991 and March 31, 1996

[2] Based on the number of individuals experiencing a fracture on/between April 1, 1991 and March 31, 1996

Of these 291 fractures, 120 (41.2%) were idiopathic in nature. That is, according to the medical records, developmental center personnel were uncertain of the cause of the fracture. The cause of ninety-five fractures (32.6%) were classified as Other, which usually included minimal trauma due to accidents other than falls (e.g., subject being struck by another subject) or more commonly, were documented to occur during a seizure (e.g., striking object during the course of the seizure). Fracture causation which occurred with less frequency were due to falls (n = 46, 15.8%) and transfers (n = 30, 10.3%). Unfortunately, there are a number of limitations when examining causation. Individual fractures were often not discovered until hours or days after the event seemed to occur, thus the etiology was recorded as unknown. Secondly, the reported causes are assumed to be honest and accurate. Therefore, medical personnel bias or uncertainty may prevent accurate recording of the cumulative incidence of causation (Table 11).

Table 11.

Documented Causes of Fractures Among Adults Residing in a State Developmental Center.

Cause of Fracture	Frequency	Percentage
Unknown	120	41.2
Other[1]	95	32.6
Falls	46	15.8
Transfers	30	10.3
Total	291	100.0

[1] Includes such items as accidents and seizure related incidents

In regards to site of fracture (Table 12), three areas, ribs (n = 49, 16.8%), femur (n = 46, 15.8%), and radius (n = 41, 14.1%), accounted for 46.7% of all fractures sites. Other locations with ten or more fractures included the thoracic vertebrae (n = 38, 13.1%), humerus (n = 26, 8.9%), clavicle (n = 22, 7.6%), fibula (n = 18, 6.2%), hip (n = 15, 5.2%), and ulna (n = 13, 4.5%). Five additional locations accounted for 23 (7.9%) fractures.

Table 12.

Site of Fracture Among Adults Residing in a State Developmental Center (April 1, 1991 to March 31, 1996)

Site of Fracture	Frequency	Percentage
Ribs	49	16.8
Femur	46	15.8
Radius	41	14.1
Thoracic Vertebrae	38	13.1
Humerus	26	8.9
Clavicle	22	7.6
Fibula	18	6.2
Hip (Proximal Femur)	15	5.2
Ulna	13	4.5
Pelvis	8	2.7
Lumbar Vertebrae	5	1.7
Cervical Vertebrae	5	1.7
Tibia	3	1.0
Skull	2	< 1.0
Sacrum	0	0.0
Total	291	100.0

Cumulative Incidence of Fractures

Age and Gender Data

The cumulative incidence of fractures among males was 35.4% with a relative risk of .658 (95% CI = .342 - .669, $p < .001$). Conversely, females had a cumulative incidence of 53.8% with a relative risk of 1.540 ($p = <.001$, 95% CI for RR = 1.521 - 4.213) (Table 13). Even though many of the relative risk estimates were not found to be statistically significant, two groups of males (Table 14) and two groups of females (Table 15) were found to be at greater risk of fracture. The 40 - 49 year old male group was found to be at 21% greater risk of fracture ($p = .298$, 95% CI for RR = .843 - 2.362) and 50 to 59 year olds had a 42% greater risk among males ($p = .073$, 95% CI for RR = 1.059 - 3.374). Likewise, 40 - 49 year old females also were at increased risk (6%) ($p = .689$, 95% CI for RR = .675 - 2.047) as were 20 - 29 year old females ($p = .704$, 95% CI for RR = .693 - 2.324). The lowest relative risk for males was found in 20 - 29 year olds (RR = .652, $p = .107$, 95% CI for RR = .332 - 1.157) and the 60 - 69 year old female group (RR = .944, $p = .726$, 95% CI for RR = .509 - 1.756).

As a group (Table 16) there was an increase in RR with increasing age from a low RR of .883 ($p = .390$, 95% CI for RR = .559 - 1.317) for the 20 - 29 year olds to a peak RR of 1.124 ($p = .373$, 95% CI for RR = .847 - 2.002) for the 50 - 59 year olds. Curiously, the exception of this trend was the 60 years and older group with a RR of 1.040 ($p = .803$, 95% CI for RR = .710 - 1.851). When gender specific age groups were combined (Table 17), males ≥ 50 years old had a RR of 1.318 (p = .121, 95% CI for RR = .969 - 2.746) while females < 40 years had a RR of 1.014 (p = .849, 95% CI for RR = .645 - 1.701). The only statistically significant RR found among the males, females, or the entire cohort by gender was a protective effect for men younger than 40 years old with a RR of .689 (p = .029, 95% CI for RR = .362 - .933).

Table 13.
Relationship Between Gender and Cumulative Incidence of Fractures

Gender	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Males	96	175	.354	.658	.342 - .669	<.001
Females	133	114	.538	1.540	1.521 - 4.213	<.001
Total	229	289				

Table 14.

Relationship Between Age and Cumulative Incidence of Fractures for Males

Age (Males)	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
20 to 29	10	31	.244	.652	.332 - 1.157	.107
30 to 39	29	65	.309	.815	.473 - 1.248	.250
40 to 49	28	41	.401	1.205	.843 - 2.362	.298
50 to 59	22	25	.468	1.417	1.059 - 3.374	.073
60 & above	7	13	.350	.987	.520 - 2.547	.682
Total	96	175				

Table 15.

Relationship Between Age and Cumulative Incidence of Fractures for Females

Age (Females)	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
20 to 29	21	16	.568	1.064	.693 - 2.324	.704
30 to 39	43	38	.531	.979	.596 - 1.628	.865
40 to 49	32	25	.561	1.056	.675 - 2.047	.689
50 to 59	17	16	.515	.950	.500 - 1.871	.772
60 & above	20	19	.513	.944	.509 - 1.756	.726
Total	133	114				

Table 16.
Relationship Between Age and Cumulative Incidence of Fractures

Age Group	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
20 to 29	31	47	.397	.883	.559 - 1.317	.390
30 to 39	72	103	.411	.899	.604 - 1.197	.317
40 to 49	60	66	.476	1.105	.854 - 1.795	.379
50 to 59	39	41	.488	1.124	.847 - 2.002	.373
60 & above	27	32	.458	1.040	.710 - 1.851	.803
Total	229	289				

Table 17.

Relationship Between Age and Cumulative Incidence of Fractures for Males and Females

Age Group	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Males						
< 40 yrs old	39	96	.289	.689	.362 - .933	.029
≥ 50 yrs old	29	38	.433	1.318	.969 - 2.746	.121
Females						
< 40 yrs old	64	54	.542	1.014	.645 - 1.701	.849
≥ 50 yrs old	37	35	.514	.937	.540 - 1.508	.617

Body Mass Index Data

Unlike age and gender data, BMI data yielded numerous statistically significant relative risks (Table 18). Specifically, when male and female data were combined, those with BMI values less than 20 were found to be at 242% greater risk (RR = 2.416) of fracture ($p < .001$, 95% CI for RR = 1.906 - 4.978). Conversely, individuals with BMI values between 20 and 25 only had a RR of .771 ($p = .013$, 95% CI for RR = .465 - .908) and those with a BMI greater than 25 had the lowest RR value (RR = .505, $p < .001$, 95% CI for RR = .247 - .536). With the exception of the female 20 - 25 BMI group, this trend was consistent across gender. Interestingly, the male BMI group less than 20 was at the greatest risk of fracture among all groups (RR = 3.633, $p < .001$, 95% CI for RR = 3.021 - 10.641). Males with a BMI greater than 25 were at the least risk of all groups (RR = .373, $p < .001$, 95% CI for RR = .166 - .501).

Table 18.

Relationship Between Body Mass Index (BMI) and Cumulative Incidence of Fractures

Body Mass Index	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Group						
< 20	123	73	.628	2.416	1.906 - 4.978	<.001
20 to 25	76	127	.374	.771	.465 - .908	.013
> 25	30	89	.252	.505	.247 - .536	<.001
Males						
< 20	62	40	.608	3.633	3.021 -10.641	<.001
20 to 25	22	72	.234	.560	.277 - .747	.003
> 25	12	63	.160	.373	.166 - .501	<.001
Females						
< 20	61	33	.649	1.379	1.266 - 3.532	.007
20 to 25	54	55	.545	.865	.462 - 1.215	.215
> 25	18	26	.409	.722	.320 - 1.027	.057

Race Data

As the cohort was predominately Caucasian, the RR estimates required that all non-Caucasian adults be grouped for analysis (Table 19). While neither the Caucasian or non-Caucasian group had a statistically significant RR value, non-Caucasians were found to be at a 6% greater risk of fracture (RR = 1.057, p = .697, 95% CI for RR = .746 - 1.840).

Ambulation Ability Data

Group analyses of RR by ambulatory ability yielded several significant findings (Table 20). For example, the assisted standing group was at the greatest risk of fracture (RR = 1.386, p < .001, 95% CI for RR = 1.317 - 2.634) compared with the other three groups, including the immobile group (RR = .950, p = .711, 95% CI for RR = .630 - 1.486). The only group which was statistically protected from fracture included the Ambulatory group who had a RR of .461 (p < .001, 95% CI for RR = .220 - .520). When immobile groups were combined, overall they had a 34% greater chance of fracture (p = .004, 95% CI for RR = 1.207 - 2.392) compared with the assistive device and ambulatory group (RR = .746, p = .004, 95% CI for RR = .433 - .843). When gender specific ambulatory groups were examined (Table 21), ambulatory males (RR = .356, p < .001, 95% CI for RR = .159 - .580) were at the lowest risk of fracture overall but ambulatory females also had a decreased chance of fracture (RR = .559, p = .003, 95% CI for RR = .211 - .709). Women in the assistive device group were at greatest risk of fracture among females (RR = 1.348, p = .016, 95% CI for RR = 1.195 - 3.684) as were assisted standing men for their respective gender (RR = 1.687, p < .001, 95% CI for RR = 1.454 - 3.968).

Table 19.

Relationship Between Race and Cumulative Incidence of Fractures

Race	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Caucasian	197	252	.439	.919	.512 - 1.431	.549
Non-Caucasian	32	46	.410	1.057	.746 - 1.840	.697
Total	229	298				

Table 20.

Relationship Between Ambulatory Ability and Cumulative Incidence of Fractures

Ambulatory Ability	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Group						
Immobile	33	45	.423	.950	.630 - 1.486	.711
Assisted Standing	102	88	.537	1.386	1.317 - 2.634	<.001
Assistive Device	74	87	.460	1.059	.802 - 1.612	.589
Ambulatory	20	69	.225	.461	.220 - .520	<.001
Combined Groups						
Immobile & Assisted Standing	135	133	.504	1.340	1.207 - 2.392	.004
Assistive Device & Ambulatory	94	156	.376	.746	.433 - .843	.004

Table 21.
Relationship Between Ambulatory Ability, Gender and Cumulative Incidence of Fractures

Ambulatory Ability	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Males						
Immobile	16	23	.410	1.190	.778 - 2.645	.430
Assisted Standing	43	45	.489	1.687	1.454 - 3.968	<.001
Assistive Device	30	65	.842	.842	.496 - 1.307	.330
Ambulatory	7	42	.143	.356	.159 - .580	<.001
Females						
Immobile	17	22	.436	.782	.361 - 1.222	.162
Assisted Standing	59	43	.578	1.126	.809 - 2.163	.298
Assistive Device	44	22	.666	1.348	1.195 - 3.684	.016
Ambulatory	13	27	.325	.559	.211 - .709	.003
Total	229	289				

Self-Feeding Ability

There was a progressive decrease in risk of fracture as self-feeding ability increased (Table 22). Tube Fed individuals had a 68% greater risk of fracture (p = .003, 95% CI for RR = 1.623 - 7.784) followed by those who required total assistance (RR = 1.347, p = .003, 95% CI for RR = 1.250 - 2.542). Also at increased fracture risk, but not statistically significant, was the mostly assisted group (RR = 1.102, p = .095, 95% CI for RR = .999 - 1.204). Like the mostly assisted group, findings from the minimal assist group were not statistically significant but nevertheless, indicated a decreased risk of fracture (RR = .829, p = .131, 95% CI for RR = .521 - 1.102). The independent self-feeding group (No Assistance) was found to have a significant lower risk of fracture (RR = .343, p < .001, .150 - .373). When groups were combined, those which required tube, total, and mostly assistance were at 99% greater risk of fracture (p < .001, 95% CI for RR = 1.860 - 4.181) while those who were capable of feeding with minimal or no assistance demonstrated a significant lower risk of fracture (RR = .506, p < .001, 95% CI for RR = .256 - .538).

Table 22.
Relationship Between Self-Feeding Ability and Cumulative Incidence of Fractures

Self-Feeding Ability	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Group						
Tube Fed	20	8	.714	1.675	1.623 - 7.784	.003
Total Assistance	88	76	.537	1.347	1.250 - 2.542	.003
Mostly Assist	61	59	.508	1.204	.999 - 2.132	.095
Minimal Assistance	45	73	.381	.829	.521 - 1.102	.131
No Assistance	15	73	.170	.343	.150 - .373	<.001
Combined Groups						
Tube/Total/Mostly Assistance	169	143	.542	1.994	1.860 - 4.181	<.001
Minimal & No Assistance	60	146	.291	.506	.256 - .538	<.001

Reproductive Status

There were no reproductive factors which yielded a statistically greater or lesser risk of fracture (Table 23). Postmenopausal women had a slightly higher (7%) risk of fracture (p = .582, 95% CI for RR = .712 - 1.954) than premenopausal women (RR = .935, p = .582, 95% CI for RR = .521 - 1.456). While the cumulative incidence of fracture was slightly greater among women 10 or more years postmenopausal (.576) versus women less than 10 years postmenopausal (.554), they had slightly reduced risk of fracture (RR = .961, p = .818, 95% CI for RR = .394 - 2.179) than women less than 10 years postmenopausal (RR = 1.040, p = .818, 95% CI for RR = .495 - 2.610).

The surgical procedures which may influence the outcome of fracture risk of pre- and postmenopausal women included hysterectomies and oophorectomies. While there was a limited number of women who had bilateral oophorectomies (n = 17), they were found to be at 10% greater risk of fracture (p = .667, RR = 1.100, 95% CI for RR = .556 - 3.380). Women who had experienced a hysterectomy had a lower risk of fracture, but it was not found to be significant (RR = .782, p = .165, 95% CI for RR = .361 - 1.222).

Table 23.

Relationship Between Reproductive Status and Cumulative Incidence of Fractures in Females

Reproductive Status	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Pre-Menopausal[1]	83	75	.525	.935	.521 - 1.456	.582
Post-Menopausal[2]	50	39	.562	1.069	.712 - 1.954	.582
Hysterectomy	17	22	.436	.782	.361 - 1.222	.165
Oophorectomy	10	7	.588	1.100	.556 - 3.380	.667

[1] Pre-menopausal group includes women with hysterectomies

[2] Post-menopausal group includes women with bilateral oophorectomies

Medications

Medications identified for analysis of this cohort were chosen based on their probability of negatively influencing bone health. These included oral contraceptives, hypothydrodial, glucocorticoid, and anticonvulsant medications. With the exception of oral contraceptive usage, there was a greater risk of fracture for usage associated with the other medications (Table 24). In descending order by fracture risk, these included anticonvulsants, (RR = 1.167, p = .285, 95% CI for RR = .803 - 2.124), glucocorticoids (RR = 1.081, p = .749, 95% CI for RR = .614 - 2.768), and thyroxine (RR = 1.005, p = .889, 95% CI for RR = .409 - 3.807). While none of the medications achieved significance for fracture risk, oral contraceptive usage, which was limited to certain ambulatory women at the developmental center (n = 34), was approaching significance as a decreased risk of fracture (RR = .821, p = .059, 95% CI for RR = .366 - 1.393).

Examination of each of the six different anticonvulsant medications commonly prescribed to adults yielded only one agent which approached a significant lower risk effect (valproic acid); the remaining five medications all yielded a greater risk of fracture (Table 25). For example, the greatest risk (17%) was found among individuals taking primidone (p = .246, 95% CI for RR = .885 - 2.309) whereas carbamazepine yielded a 3.8% greater risk (p = .757, 95% CI for RR = .752 - 1.656). As 73.4% of the entire cohort was taking two or more anticonvulsants, analysis was undertaken to investigate the presence of any combination or dosage effects with the different medications.

Only one combination of medications was found to reach significance. Phenytoin (Dilantin) and valporic acid (Depakane) yielded a significant decreased risk of fracture among the 94 individuals on this pharmaceutical combination (RR = .759, p = .050, 95% CI for RR = .447 - 1.002). As no other combination of medications was found to produce either a increased or decreased risk among subjects, analysis was conducted strictly by the number of anticonvulsant medications concurrently taken (Table 26).

Regardless of medication type, there were no significant values found for any number of anticonvulsant medications taken at the same time. The greatest risk of fracture (24%) was found among subjects taking four anticonvulsants (p = .529, 95% CI for RR = .557 - 5.775) followed by individuals taking two medications (RR = 1.019, p = .857, CI for RR = .719 - 1.519). When the number of medications were combined, neither the two or less anticonvulsant group, nor the three or more anticonvulsant group yielded any significant risk of fracture.

Table 24.
Relationship Between Different Medications and Cumulative Incidence of Fractures

Medication	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Oral Contraceptives	16	18	.471	.821	.366 - 1.393	.059
Thyroxine	4	5	.444	1.005	.409 - 3.807	.889
Glucocorticoids	10	11	.476	1.081	.614 - 2.768	.749
Anticonvulsants	198	240	.452	1.167	.803 - 2.124	.285
Total	228	274				

Table 25.

Relationship Between Anticonvulsant Medications and Cumulative Incidence of Fractures

Anticonvulsant Medication	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
Medication						
Phenytoin	160	192	.455	1.094	.814 - 1.702	.407
Valproic Acid	65	101	.392	.840	.539 - 1.074	.114
Carbamazepine	46	55	.455	1.038	.752 - 1.656	.757
Phenobarbital	112	122	.498	1.162	.949 - 1.858	.131
Primidone	31	30	.501	1.173	.885 - 2.309	.246
Ethosuximide	17	18	.486	1.107	.723 - 2.400	.596
Combined Medications[1]						
Phenytoin & Valporic Acid	33	61	.351	.759	.447 - 1.002	.050

[1] Only combination of medications found to be significant at 0.05 level

Table 26.

Relationship Between the Number of Anticonvulsant Medications Taken and Cumulative Incidence of Fractures

Number of Anticonvulsants	Cases	Controls	Cumulative Incidence	Relative Risk (RR)	95% CI For RR	p-value
None	31	49	.388	.857	.534 - 1.249	.285
One	25	33	.431	.947	.595 - 1.584	.726
Two	118	141	.456	1.019	.719 - 1.519	.857
Three	50	62	.446	.983	.677 - 1.494	.889
Four	5	4	.555	1.235	.557 - 5.775	.529
One or Two	143	174	.451	.992	.653 - 1.502	.952
Three or more	55	66	.455	1.008	.710 - 1.545	.952

Hypotheses Testing

The results of six alternative hypothesis are presented in order as they appear in Chapter 1. Chi square (χ^2) contingency tables were constructed to test each of the six working hypothesis with an alpha set at .05 level for acceptance.

The first hypothesis suggested that females would have a significantly greater five-year cumulative incidence of fractures than males. With an incidence rate of .442 for the entire cohort, 120 males were expected to experience at least one fracture as were 109 females (Table 27). Contrary to the expected results based on the incidence rate, 96 males and 133 females experienced one or more fractures. With analysis, these data revealed that females had a significantly greater ($\chi^2 = 17.51$, $p < .001$) cumulative incidence of fractures than did males and the alternative hypothesis was not rejected.

As females were expected to have significantly more fractures than males, the second hypothesis was established to test if postmenopausal women had a fracture cumulative incidence which was significantly greater than premenopausal women. With a cohort fracture incidence rate of .538 for females, and with consideration given for the distribution of the cohort by menopausal status, it was expected that premenopausal women would have 85 fractures compared with 48 for postmenopausal women. The results of data analysis revealed that premenopausal women had 83 fractures while postmenopausal women experienced 50 fractures (Table 28). As a result of contingency table analysis, postmenopausal women did not have a significantly greater cumulative incidence of fractures compared to premenopausal women ($\chi^2 = .230$, $p > .10$), and the working hypothesis was rejected.

Table 27.

Chi Square Contingency Table Analysis of Fracture Incidence Between Males and Females

Fracture Status	Males	Females	Total
Fracture			
Observed	96	133	
Expected	120	109	229
No Fracture			
Observed	175	114	
Expected	151	138	289
Total	271	247	518

Cumulative Incidence for cohort = (229/518) = .442

χ Statistic = 17.51

df = 1

p - value = < .001

Table 28.

Chi Square Contingency Table Analysis of Fracture Incidence Between Pre - and Post-Menopausal Females

Fracture Status	Pre-Menopausal	Post-Menopausal	Total
Fracture			
Observed	83	50	
Expected	85	48	133
No Fracture			
Observed	75	39	
Expected	73	41	114
Total	158	89	247

Cumulative Incidence for cohort = (133/247) = .538

χ Statistic = .230

df = 1

p - value = > .10

As anticonvulsant usage among adults residing in the State developmental center approached 85%, and it is documented that these medications may negatively influence bone health, it was hypothesized that individuals taking anticonvulsant medications would have a significantly greater five year cumulative incidence of fractures than adults who did not take anticonvulsant medications. The fracture incidence rate for the use or non-use of anticonvulsant medications was calculated to be .442 as a result of 229 individuals fracturing among 518 adults. Contingency table analysis expected 194 adults on anticonvulsant medication to have experienced a fracture versus 35 individuals not on these medications. Data analysis (Table 29) found no significant difference in the cumulative incidence of fracture as a result of anticonvulsant usage ($\chi^2 = 1.11$, $p > .10$) and the working hypothesis was rejected. Furthermore, no significant difference in the cumulative incidence of fracture was found due to the number of anticonvulsant medications (Table 30) concurrently taken ($\chi^2 = .004$, $p > .10$).

Table 29.

Chi Square Contingency Table Analysis of Fracture Incidence Between Anticonvulsant Usage or Non-Usage

Fracture Status	Anticonvulsants Yes	No	Total
Fracture			
Observed	198	31	
Expected	194	35	229
No Fracture			
Observed	240	49	
Expected	244	45	289
Total	438	80	518

Cumulative Incidence for cohort = (229/518) = .442

χ Statistic = 1.11

df = 1

p - value = > .10

Table 30.

Chi Square Contingency Table Analysis of Fracture Incidence Between Number of Anticonvulsant Medications Used

Fracture Status	Anticonvulsants 1 or 2	 3 or 4	Total
Fracture			
Observed	143	55	
Expected	143	55	198
No Fracture			
Observed	174	66	
Expected	174	66	240
Total	317	121	438

Cumulative Incidence for cohort = (198/438) = .442

χ Statistic = .004

df = 1

p - value = > .10

The influence of BMI was identified as a plausible factor which contributes to, or helps prevent the occurrence of fracture. Therefore, it was hypothesized that individuals with a BMI less than 20 would have a significantly greater cumulative incidence of fracture compared with adults with a BMI greater than 25. The fracture incidence rate for these two groups was calculated to be .477, which would have resulted in 94 fractures in the BMI < 20 group and 54 fractures in the BMI > 25 group. Results of contingency table analysis (Table 31) supported the hypothesis that individuals with a BMI value below 20 would have a significantly greater cumulative incidence of fractures compared to those with BMI values greater than 25 ($\chi^2 = 47.55$, $p < .001$).

Table 31.

Chi square Contingency Table Analysis of Fracture Incidence Between Body Mass Index Values

Fracture Status	Body Mass Index		
	< 20	> 25	Total
Fracture			
Observed	123	25	
Expected	94	54	148
No Fracture			
Observed	73	89	
Expected	102	60	162
Total	196	114	310

Cumulative Incidence for cohort = (148/310) = .477

χ Statistic = 47.55

df = 1

p - value = < .001

The fifth working hypothesis suggested that individuals capable of ambulating, either with an assitive device (e.g., walker) or independently, would have a significantly lower cumulative incidence of fractures compared to those individuals who could not ambulate (immobile and immobile/assisted standing group). Contingency table analysis (Table 32) suggested that the combined ambulatory groups would have 111 fractures compared with 118 in the immobile groups. Results of the χ^2 test supported the hypothesis that ambulators had a significantly lower cumulative incidence of fractures compared to the immobile groups ($\chi^2 = 9.13$, $p < .005$). Further analysis of the combined ambulation groups found that independent ambulators had a significantly lower cumulative incidence (Table 33) of fracture compared to those individuals who ambulated with the use of an assistive device ($\chi^2 = 13.46$, $p < .001$).

Table 32.
Chi Square Contingency Table Analysis of Fracture Incidence Between Ambulatory Ability

Fracture Status	Immobile[1]	Ambulatory[2]	Total
Fracture			
Observed	135	94	
Expected	118	111	229
No Fracture			
Observed	133	156	
Expected	150	139	289
Total	268	250	518

Cumulative Incidence for cohort = (229/518) = .442

χ Statistic = 9.13

df = 1

p - value = < .005

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[1] Immobile group includes: (a) immobile, and (b) immobile/assisted standing groups
[2] Ambulatory group includes: (a) assistive device, and (b) ambulatory groups

Table 33.

Chi Square Contingency Table Analysis of Fracture Incidence Between Assistive Device and Ambulation Groups

Fracture Status	Group		
	Assistive	Ambulatory	Total
Fracture			
Observed	74	20	
Expected	61	33	94
No Fracture			
Observed	87	69	
Expected	100	56	156
Total	161	89	250

Cumulative Incidence for cohort = (94/250) = .376

χ Statistic = 13.46

df = 1

p - value = < .001

The last hypothesis examined the impact of self-feeding ability on the cumulative incidence of fractures (Table 34). Specifically, do individuals requiring any level of assistance to eat meals have a significantly greater cumulative incidence of fractures than do individuals who need no assistance with meals. Theoretically, it was felt that if individuals could eat independently, they would have more opportunities to purchase (e.g., vending machines) and/or consume food than would individuals who rely on some level of assistance to eat meals. As a result, individuals who were capable of eating independently might weigh more resulting in greater BMI values which would suggest a protective effect against fracture. Results of hypothesis testing did accept the hypothesis that independent self-feeders were at a significantly lower risk of fracture compared with individuals who could not eat meals independently ($\chi^2 = 31.71$, $p < .001$).

Table 34.

Chi Square Contingency Table Analysis of Fracture Incidence Between Self-Feeding Ability

Fracture Status	Self-Feeding Assistance Yes[1]	No[2]	Total
Fracture			
Observed	214	15	
Expected	190	39	229
No Fracture			
Observed	216	73	
Expected	240	49	289
Total	430	88	518

Cumulative Incidence for cohort = (229/518) = .442

χ Statistic = 31.71

df = 1

p - value = < .001

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[1] Includes all groups which required feeding assistance: (a) tube, (b) total, (c) mostly, and (d) minimal.

[2] Includes only those individuals who are independently self-feeding

Logistic Regression Analysis

Multivariate logistic regression analysis was employed to examine the relationship between bone fracture and a regression model which adequately identify variables or "predictors" of fracture outcome. Univariate logistic regression was employed to assess which variable(s) were appropriate for entry into the model. Variables yielding an alpha of at least .25, verified as important with use of the Wald statistic to determine the significance of the likelihood ratio test, and biologically plausible in univariate analysis were then considered for multivariate analysis (Hosmer & Lemeshow, 1989). As a result of this preliminary analysis, 13 variables were identified for entry into the multivariate model (Table 35).

The saturated or full model was constructed using a forced entry technique where the rank order for variables was established using the degrees of freedom from the univariate statistic (variables which met entry $\alpha < 0.25$). With establishment of the saturated model, a reduced model was constructed using stepwise techniques with the criteria parameters set at $\propto = .25$ and the backward elimination parameters set at $\propto = .30$ (Hosmer & Lemeshow, 1989). Using the stepwise procedures the following variables were identified for inclusion within the reduced model (Table 36): (1) ambulation ability, (2) use of calcium, (3) body weight (kg), (4) self-feeding ability, and (4) body mass index.

Verification of the model was then employed using the Likelihood ratio test (Hosmer & Lemeshow, 1989). This test examines the model likelihood with and without variables to test overall significance. The calculated log of the likelihood in the full model (546.492) was tested against the calculated log of the likelihood in the reduced model (552.072) to determine if they were significantly different. The likelihood ratio test resulted in a non-significant difference ($p > .05$) between the full and reduced model.

Finally, to assist with data interpretation, all risk factors found to reach significance can be found in Table 37. This includes male, female, and group data.

Table 35.

Variables Identified from Univariate Logistic Regression for Entry into the Multivariate Model (Listed Alphabetically with Corresponding p-value).

Variable	p-value[1]
Age	.2268
Ambulation	.0000
Body Mass Index	.0000
Calcium	.0111
Gender	.0000
Height	.0000
Menopause Status	.0001
Oophorectomy	.2191
Phenobarbital	.1285
Primidone	.2390
Self-Feeding	.0000
Smoking	.0149
Valporic Acid	.1109
Vitamin D	.2829
Weight	.0000

[1] p-value obtained from Chi square distribution for the Likelihood Ratio Test

Table 36.

Variables Identified for Inclusion into the Reduced Model

Variable	Parameter Estimate	Odds Ratio	Wald (χ^2) test p-value
Ambulation			
Immobile			
Assisted Standing	1.1008	3.0067	.0001
Assistive Device	. 0217	1.0220	.9281
Ambulatory	-.9594	.3831	.0000
Self-Feeding			
Tube Fed			
Total Assistance	-.2857	.7515	.0000
Mostly Assist	-.5592	.5717	.0292
Minimal Assist	-.3037	.7380	.1590
No Assistance	.4428	1.5571	.1313
Body Mass Index			
< 20			
20 - 25	.0509	1.0522	.7756
> 25	.2465	1.2795	.0967
Body Weight	.1126	1.1192	.0000
Calcium			
Yes			
No	-.3346	.7156	.1045

Table 37.
Summary of Significant Relative Risk Factors

Variable	Relative Risk	Risk	p-value
Gender			
Males (M)	.658	Decreased	<.001
Females (F)	1.540	Increased	<.001
Males < 40 years	.689	Decreased	.029
Ambulation Status/Group			
Assisted Standing	1.386	Increased	.007
Ambulatory	.461	Decreased	<.001
Ambulation Status/Gender			
Assisted Standing (M)	1.687	Increased	<.001
Ambulatory (M)	.356	Decreased	<.001
Ambulatory (F)	.559	Decreased	.003
Assistive Device (F)	1.348	Increased	.016
BMI/Group			
< 20	2.416	Increased	<.001
20-25	.771	Decreased	.013
> 25	.505	Decreased	<.001
BMI/Gender			
< 20 (M)	3.633	Increased	<.001
< 20 (F)	1.379	Increased	.007
20-25 (M)	.560	Decreased	.003
> 25 (M)	.373	Decreased	<.001
Feeding Ability			
Tube	1.675	Increased	.003
Total Assistance	1.347	Increased	.003
No Assistance	.343	Decreased	<.001
Medications			
Phenytoin & Valporic Acid	.759	Decreased	.050

Chapter 5

Discussion & Recommendations

Adults with SMR who reside within state developmental centers may be at greater risk of bone fracture due to individual characteristics as well as developmental center practices. As fracture data regarding this population is limited, this five-year retrospective study enhances the understanding of the type, frequency, and site of bone fractures as well as specific risk factors associated with fracture outcome.

In order to facilitate understanding of the current investigation findings, this chapter will (1) focus the findings of this research on the results presented in Chapter 4 and the interpretation with the current body of knowledge, (2) identify the strengths and limitations in conducting retrospective research within a large state developmental facility, (3) provide recommendations for similar investigations, and (4) summarize the findings of this study.

Discussion of the Results

Age, Gender & BMI Data

The relationship between age, gender, and the cumulative incidence of fractures was explored for both males (Table 15) and females (Table 16). As a group, males were found to have a significant protective effect against bone fracture (Table 13). By age stratification, both the 40-49 and 50-59 year old male groups revealed an increased relative risk of fractures. Interestingly, males

60 years of age or older were found to have a slight protective effect against fracture (Table 15). While none of the five age categories among males revealed a statistically protective or increased relative risk of fracture, these findings are not consistent with the current research base. For example, Rudman et al (1989), Gullberg et al (1993), and others have reported a significant yearly increase in the cumulative incidence of fractures among males after the age of 50 years. More specifically, Melton et al (1992) suggested that males older than 50 years have a 13% lifetime risk of hip, spine, or distal forearm fracture.

Perhaps one explanation for the protective relative risk found in those males 60 years of age and older was due to the small sample size within this age group. While data for 271 males was collected within this study, males 60 years and older accounted for less than eight percent (7.3%, n = 20) of the cohort. Of these twenty individuals, only seven experienced any fracture. Therefore, as a result of the findings for this age group and the small sample size, all males 50 years and older were pooled for further analysis and the relationship between age, gender, and relative risk of fracture was re-evaluated (Table 17).

Pooling data for all males over 50 years yielded an increased relative risk of fractures (RR = 1.318, 95% CI for RR = .969 - 2.746), however, it was not found to be statistically significant (p = .121). With the exception of not reaching significance, the pooled data for men 50 years and older are consistent with the findings of Rudman et al (1989), Gullberg et al (1993) and others. That is, these data suggest that males over the age of 50 years old with or without SMR appear to have an increased risk of bone fracture. Contrary to these findings, males 40 years and younger had a significantly lower risk of fracture ($p = .029$).

Unlike the male cohort, females as a group were found to have a significantly greater risk of fracture ($p < .001$) and experienced a significantly greater number of fractures than did the male group ($p < .001$). However, the 60 years and older female group, like the same age male group, were also found to have a protective effect against the risk of fracture (Table 16). Furthermore, a similar trend was found among the 50-59 year old females. While neither of these age groups reached significance, these findings conflict with most, if not all, available information on the development of fractures among older females. To investigate these results in greater detail, women 50 years and older were pooled for further analysis (Table 17). Unlike their male counterparts, females 50 years and older continued to have a protective, but non-significant, effect (RR = .937, 95% CI for RR = .540 - 1.508) against the risk of fracture. These findings are particularly interesting, especially with further analysis by age stratification. Surprisingly, the greatest risk of fracture among women was found among the 20-29 year olds. While none of the female age groups yielded a significant protective or increased relative risk of fracture, both the 20-29 and 40-49 year olds were at greater risk of fracture. These findings are disturbing in light of our current understanding on the progression of osteoporosis and the lifetime risk of fractures among females.

It is well established that females have less age-specific bone mass and a greater number of fractures than males (Karagas, Lu-Yao, Barrett, Beach, & Baron, 1996; Mazess, 1982; Melton, Chrischilles, Cooper, Lane, & Riggs, 1992). Is there an explanation for younger women with SMR to have a greater risk of fracture than those women with SMR over the age of 50 years old? In addition, is this trend consistent among all age groups when male and female age-specific data are combined?

To explore these questions, both the male and female age-specific groups were combined. Results (Table 14) suggest that with the exception of the 60 years and older group, there was a progressive increase in the relative risk of fracture by age group as expected in this population of adults. Specifically, the 50-59 year olds had the greatest relative risk of fracture while the 20-29 year old group had the least risk. It would appear from combining gender data that the protective effect found among 20-29 year old males positively influenced the age-specific data. Yet, this does explain the difference between the cumulative incidence of fractures for 20-29 year old males (.244) compared with the same age female group (.568). Perhaps 20-29 year old females had a greater level of disability than their same-age male peers. Furthermore, how does one interpret the findings that females less than 40 years old had a greater cumulative incidence of fractures (.542) compared to females 50 years or older (.514)? Why were women older than 50 and men less than 40 years old at a lower risk of fracture? Are there characteristics that these two groups share which yield a protective effect against fracture?

Based on the current information available, regardless of gender, the older an individual, the greater the risk of fracture. Could it be that women with SMR who are living into their 50's and beyond are healthier with fewer secondary risk factors than their younger female peers? Are healthier younger females being deinstitutionalized as Eyman et al (1987) suggested? Perhaps women who remain within the state developmental centers are more apt to fracture or younger females are more active and therefore at greater risk of fracturing.

One plausible explanation is the influence of body weight and the relationship to BMD. In an investigation of 300 healthy Caucasian premenopausal females between 20 and 29 years old, Mazess and Barden (1991) examined the effects of calcium intake, participation in physical activity, smoking behavior, and oral contraceptive usage on spinal, femoral, and distal radius BMD. Mazess and Barden reported that while smokers had significantly lower SBMD ($p < .05$), there was no significant influence of calcium intake, physical activity participation, or oral contraceptive usage on BMD at any site. However, the authors reported that the best predictor of BMD among premenopausal women was body weight. Specifically, the greater the body weight the greater the BMD values obtained at the spine, femur, and radius. Similarly, among 550 male and female adults, Elliot and colleagues (1993) found lower spinal and femoral BMD values associated with decreased body weight.

Likewise, Salamone et al (1996), Nagraj et al (1990), Dawson-Hughes, Shipp, Sadowski, and Dallal (1987), and Ribot, Tremollieres, Pouilles, Bonneu, Germain, and Louvet (1988) have reported high correlations between body weight and BMD.

Other investigators have examined body weight and height individually and collectively as BMI (weight in kg/height in meters^2) on the relative risk of fractures. For instance, among 52,313 middle-aged Norwegian males and females between 35 and 49 years old, Meyer, Tverdal, and Falch (1993) reported that age-adjusted relative risks of hip fractures increased with height in both men (RR = 2.92, 95% CI for RR = 0.94 - 9.05) and women (RR = 3.62, 95% CI for RR = 1.46 - 8.97). In addition, they reported BMI to be inversely related to the incidence of hip fractures. Likewise, Greenspan, Meyers, Maitland, Resnick, and Hayes (1991) reported that a decrease in BMI of one standard deviation increased the odds ratio for the risk of hip fracture by 2.2 (95% CI for RR = 1.2 - 3.8, $p < 0.01$) among ambulatory male and female older adults who experienced a fracture due to falling.

With BMI as a plausible explanation for the greater relative risk among younger females, one would then expect the BMI of the 20-29 year old females, who are at greater fracture risk, to be significantly different than those women in the 60 and over age group who had a lower risk of fracture. However, these data do not support this hypothesis. Specifically, while the 20-29 year old females had an average BMI value of 20.74 (± 3.71), the 60 and older group, while slightly greater (22.14 ± 4.15), was not significantly different (Table 2). Further descriptive analysis revealed that of the 37 females between the ages of 20-29, 17 had a BMI value less than 20. Of these, 15 experienced a fracture for a cumulative incidence of 0.882. Conversely, of the 39 women over the age of 60, 15 had BMI values less than 20 and only 7 experienced a fracture for a cumulative incidence of 0.466. Somehow the younger females with BMI values less than 20 were fracturing at nearly twice the rate as those women over the age of 60 with equivalent BMI values. Did these older women once have BMI values greater than 20 with concurrent values in BMD and now, in their later years, be obtaining BMI values less than 20? Alternatively, could the younger women with BMI values less than 20 have never developed optimal BMD values at or above the fracture threshold as Chesnut (1991) suggests? If so, are there optimal BMI values which could be obtained and maintained for individuals with SMR without undue risk to individual health (e.g., obesity)? To further investigate, analysis of those women with greater BMI values was undertaken. While the sample size is limited, descriptive data revealed of the fifteen females with BMI values between 20 and 25, six or approximately 40% experienced one (or more) fracture(s) during the study period. Furthermore, five females had BMI values greater than 25 and none experienced any fracture. While it is obvious there are a number of factors which influence optimal bone health, it would seem appropriate to further investigate the interaction between BMI and fracture risk among young female adults with SMR. This is particularly important information as both males and females with BMI values less than 20 were at a significant risk of fracture.

Of all the risk factors investigated throughout this study, none yielded a greater risk factor for males than having a BMI less than 20 (RR = 3.633, 95% CI for RR = 3.021 - 10.641, p < .001). Furthermore, males with BMI values greater than 20 had a significant protective effect against fracture as demonstrated in both the BMI 20-25 group (RR = .560, 95% CI for RR = .277 - .747, p = .003), and those with BMI values greater than 25 (RR = .373, 95% CI for RR = .166 - .501, p < .001). These protective effects were not limited to males. While the magnitude of the relative risk was not found to be significant for either group, females with BMI values between 20 and 25 (RR = .865, 95% CI for RR = .462 - 1.215, p = .215) and those with BMI greater than 25 (RR = .722, 95% CI for RR = .320 - 1.027, p = .057), both were found to have a protective effect.

Overall, the gender specific age-groups with the lowest BMI values were the 20 - 29 year old females (20.74 ± 3.71) and the 40 - 49 year old males (21.08 ± 4.37). The greatest BMI values obtained for males were found within the 20-29 year olds (23.43 ± 4.74) and the 50 - 59 year old females (22.52 ± 4.28).

Race

It was felt that race might have a significant effect on the findings of this study, however, due to the limited number of individuals who were non-Caucasian, generalizability to a larger group of individuals with SMR is not possible. Throughout the literature, numerous researchers have reported higher incidence and risk of fracture for Caucasian women compared with Caucasian and African-American men (Farmer, White, Brody, & Bailey, 1984; Karagas, Lu-Yao, Barrett, Beach, & Baron, 1996; Mangaroo, Glasser, Roht, & Kapadia, 1985). With few exceptions (e.g., 95-99 year olds experiencing femoral neck fractures), Caucasian women have a greater incidence rate of fractures than African-American women (Karagas, Lu-Yao, Barrett, Beach, & Baron, 1996).

Due to the diversity of ethnicity's among the 78 non-Caucasians within this study (15% of sample), and the non-significant relative risk estimates found for both non-Caucasians (RR = 1.057, 95% CI for RR = .746 - 1.840, p = .697) and Caucasians (RR = .919, 95% CI for RR = .512 - 1.431, p = .549), inference on the relationship between ethnicity and the cumulative incidence of fractures is not possible. However, what is clear is the unexpected protective effect found among Caucasians (RR = .919) and the 6% greater risk of fracture for non-Caucasians. These findings are inconsistent with information currently available, but the lack of an adequate non-Caucasian sample would seem to restrict conclusions. Therefore, a meaningful assessment by ethnicity is not feasible.

Self-Feeding Ability

Those groups which were found to require assistance during feeding (tube, total, and mostly assistance groups) were found to be at greatest risk of fracture when compared to those who required no assistance (independent group). One possible explanation is the magnitude of the accompanying physical disability of each individual. Those requiring total assistance during feeding tended to be nonambulatory and had lower BMI values whereas individuals who required no assistance tended to be ambulators with greater BMI values. Dietary practices also must be considered with regard to nutritional status. It is unclear to what extent the diets were similar among individuals of different ambulatory abilities.

Developmental center practices monitor the caloric intake of individuals each day with an isocaloric state often the goal. Specifically, equating caloric input to match caloric output as demonstrated by changes in body weight, fecal, and urinary excretion. Understandably, there are limitations to simply establishing a given caloric input each day. That is, will the individual ingest all, part, or none of the food and if so, how are these nutrients utilized within and by the body. For example, in a 5-year retrospective study of one hundred and fifty-three (48-96 years old) full-time male residents of a Veterans Administration Nursing Home, Rudman et al (1989) identified thirteen attributes associated with the occurrence of fracture within this population. After correcting for age, blood levels of 25-OH-D, 1,25-$(OH)_2$-D and somatomedin C were significantly associated with fracture occurrence. While there were a number of limitations within the study design, Rudman et al suggested that the impaired renal function of 1,25-$(OH)_2$-D (vitamin D metabolite) contributed to the occurrence of fracture. Furthermore, while Rudman et al investigated the functional abilities of each male, including years of residence at the nursing home, they did not find individuals requiring total assistance (with activities of daily living) to be at greater risk of fracture than those with greater functional abilities (e.g., able to self-dress). Rudman and colleagues went as far as determining dentition (number of teeth) and found no correlation to the occurrence of bone fractures. To date, no research studies have investigated the relationship of self-feeding ability and the prevalence of osteoporosis or incidence of bone fractures among individuals with MR.

Eyman and Call (1991) investigated mortality rates among individuals with (DS) residing within the state of California. Eyman and Call reported that inadequate mobility or self-feeding skills were better predictors of mortality than the presence of congenital heart difficulties frequently associated with DS. They reported that these same individuals also had life-expectancies less than their same-aged peers with DS who were capable of self-feeding and independent mobility.

Perhaps directly related to the ability to self-feed is the ability to adequately care for ones' teeth. If individuals with MR, including DS, are not capable of self-feeding, functionally they probably are not able to brush their own teeth. The result might be a greater incidence of problems associated with poor oral hygiene. Whyman, Treasure, Brown, and MacFadyen (1995) examined the oral health of nearly 200 individuals with MR residing in a state developmental center. This group was found to have more teeth missing and decayed than the national average of their non-institutionalized peers. Over eighty percent of individuals required extensive scaling and cleaning while nearly twenty percent of those required complex periodontal treatment (Whyman et al, 1995).

While dietary analysis was not conducted during the present study, the cumulative incidence of fractures found for the various self-feeding groups may be somewhat related to the findings of Whyman et al (1995). If individuals are not capable of self-feeding and perhaps performing minimal oral hygiene skills, it may be that these individuals are uncomfortable eating with assistance due to discomfort associated with dental disease. This may further translate to less consumption of foodstuff and perhaps influence bone health. Encouraging findings from McCubbin and Jansma (1987) suggest that individuals with SMR are capable of increasing their personal hygiene skills with training. Collectively, the findings of this study, and those of McCubbin and Jansma (1987), suggest investigating the role of personal hygiene skills and the implications toward the development of ideal body weight.

Reproductive Factors

Throughout history individuals with MR have been denied rights to education, employment, and recreational pursuits (Dunn, 1997). Perhaps one of the most controversial of these rights which individuals with MR have been denied, and continue to be so in many states, is the right to reproduce or bear children (Brantlinger, 1995). Traditionally, in order to insure individuals with MR were not capable of bearing children, their parents and/or legal guardians authorize surgical procedures performed (hysterectomies and bilateral oophorectomies) on their female children. Today, while not as commonly practiced, these procedures are still performed (Brantlinger, 1995). Unfortunately, one of the consequences of performing these procedures is the increased risk of bone fractures due to osteoporosis later in life (Tuppurainen et al, 1995a).

Within the present study, seventeen females had bilateral oophorectomies (OPX) and thirty-nine had hysterectomies. Unlike the recent findings of Torgerson, Campbell, Thomas, and Reid (1996), individuals in our study did not have an increased risk of fracture following hysterectomy. Of the seventeen females who experienced OPX, ten experienced at least one fracture. The relative risk associated with this surgery was 1.10 but not found to be a significant risk. Seventeen of the thirty-nine females with hysterectomy experienced a fracture, but unlike women with OPX, these women actually were found to have a protective, but non-significant, relative risk against fracture.

One explanation would be that these women were on some form of ERT or HRT. The protective benefits to women who begin ERT/HRT after such procedures is well documented (Ettinger et al, 1988; Naessen et al, 1990; Tuppurainen et al, 1995a), however, no females residing at the state developmental center were on ERT or HRT. While HRT has documented benefits in regards to the overall reduction of bone fractures, it is not without deleterious side effects, mainly cancers (Ettinger et al, 1988; Rubin et al, 1990).

As a result of the consideration of risks versus benefits, developmental center personnel do not prescribe HRT following hysterectomy or OPX.

Ohta and colleagues (1992) explored which was more osteoporosis-inducing, the natural menopause or OPX. Their findings suggested that the natural menopause influences vertebral BMD in much the same way as OPX and recommended both be clinically treated in the same way. Tuppurainen, Kroger, Saarikoski, Honkanen, and Alhaua (1995b) investigated the gynecological history and BMD among 1605 perimenopausal females and reported that gynecological variables accounted for 18.4 to 26.8% of the variance in BMD. They further suggested that age, body weight and history of hysterectomy were found to be the most significant factors of BMD, and that it is unlikely that BMD status can be predicted from gynecological characteristics. However, Ulrich, Georgiou, Snow-Harter, and Gillis (1996) suggest that women can enhance bone mass through behavior and hormonal control, including postmenopausal ERT.

Medications

Clearly, with close to 85% of subjects within this study taking one or more anticonvulsant medications, examination of the prolonged usage of these medications on the relative risk of fractures was justified. Lee et al (1989, 1990), and Fischer et al (1988) all have reported that anticonvulsant usage to be partially responsible for osteopenia found in children and young adults with disabilities. Contrary to the findings of these studies, results from this investigation revealed no significant risk of fracture associated with anticonvulsant usage in this adult population.

Six commonly prescribed anticonvulsant medications were each individually and collectively analyzed for the corresponding relative risk of fracture, none were found to separately result in a significant fracture risk. As two or more anticonvulsant medications are frequently taken concurrently, further analysis revealed only one combination of these medications to achieve significance, Phenytoin with Valporic Acid. This combination was actually found to decrease rather than increase the risk of fracture with usage. Nonsignificant relative risk were also found for usage of three or four anticonvulsant medication. Furthermore, when the cumulative incidence of fractures was compared between anticonvulsant users and non-users, hypothesis testing revealed no significant difference between groups.

One possible explanation is the supplementary vitamin D and calcium provided to all clients on anticonvulsant therapy. This supplementation is indicated as anticonvulsant medications have been documented to interfere with normal vitamin D metabolism at the liver (Hahn, 1976), to improve bone quality biochemically (MacLaren & Lifshitz, 1973), and concurrently it has been suggested that there is a high prevalence of vitamin D deficiency among children with severe disabilities (Lee et al, 1989, 1990).

The findings of anticonvulsant medication usage and BMD, while not determined in the present study, might parallel those of Henderson and colleagues (1995). That is, they reported that anticonvulsant usage did not correlate with LBMD and FNBMD in children and adolescents with spastic cerebral palsy, but that ambulatory status was the best predictor of BMD at these sites.

While anticonvulsant medication usage was extensive among clients in this study, hypogondial, oral contraceptive, glucocorticoid, and thyroxin usage were minimal. With the exception of oral contraceptive usage, none of these agents were approaching significance as either a protective or causative risk for fracture. Oral contraceptives, while not found to be, were approaching significance as a protective agent. These results are not surprising as this medication was used exclusively among ambulatory premenopausal females who were found to have a significant protective effect against fracture.

Fractures and Ambulatory Status

Injuries related to seizures are not uncommon among individuals with multihandicaps. Nakken and Lossius (1993) reported during a 13-month retrospective study that 62 adults residing in two developmental centers experienced nearly 7,000 seizures which resulted in 2,696 falls. As a result of these falls, mandibular, femoral, cervical and skull fractures were reported. Nakken and Lossius reported the overall risk of serious injury related to the occurrence of a seizure to be approximately 1.2%. Unlike Nakken and Lossius, this project did not record the number of known seizures during the five-year study period. Data from medical records indicated that 90 fractures were directly attributable to the occurrence of a seizure, including fractures to the ribs, femur, and humerus.

As the occurrence of fractures is reported to be greater in children with severe disabilities compared with their same-age healthy peers (Inamo, Ayusawa, Yamashita, Sasaki, Takeuchi, & Okuni, 1989), findings of this study suggest more fractures as these same individuals grow older, particularly if these individuals have difficulty with independent ambulation. Like the findings of Nakken and Lossius (1993), falls to the ground were associated with fractures in the present study.

Numerous investigators have examined predictors of falling among adults, the consequences of these falls, and explored preventative strategies to reduce the occurrence of these falls. Bone mineral density (Nevitt & Cummings, 1993; Nguyen et al, 1991), quadricep strength (Nguyen et al, 1991), hypotension (Graafmans et al, 1996), selected medications (Torgerson, Garton, & Reid, 1993), and visual impairment (Nevitt, Cummings, Kidd, & Black, 1989; Tinetti, Williams, & Mayewski, 1986) frequently have been cited as factors related to falls to the ground among the elderly. Nevitt and Cummings (1993) suggest that the factors which attenuate the force of impact upon falling will determine the occurrence of a fracture whereas the type of fracture is reported to be dependent upon how the individual falls (e.g., backward onto hands).

Perhaps the fracture site which receives the greatest attention worldwide are fractures of the hip. It is estimated that one-third of all older adults who experience a hip fracture will never return to their own home (Armstrong & Wallace, 1993) and that these fractures result in the greatest socioeconomic consequence among the elderly (Kanis, 1993). While the incidence of hip fractures continues to rise throughout the world (Zohman & Lieberman, 1995), Meunier (1993) reports that a 50-year old Caucasian female has a 17% lifetime risk of experiencing a hip fracture. Meunier (1993) suggested that current prevention strategies which address the prevention of falls, using hip protectors, and strategies which minimize bone fragility are necessary for older adults at risk of falling.

Fall prevention programs have become commonly practiced among institutions which provide long-term care for the elderly. For example, Wagner et al (1994) randomly assigned 1559 ambulatory adults residing in nursing homes to one of three groups to examine the effectiveness of a one-time fall prevention program. The group receiving the one-time prevention curriculum had significantly fewer falls one year after following the class than did the other two groups which did not receive the same specialized instruction. While similar results of a one-time fall prevention program are unrealistic for adults with SMR, the findings of this study suggest a problem may exist as 46 individuals experienced a fracture due to falling in the present study. The use of hip protectors might minimize the occurrence of such fractures among these same ambulatory adults residing in this state developmental center. While fall prevention programs take different forms, most require extensive and prolonged training programs which may not be feasible to implement with limited personnel and financial resources in state developmental centers. However, hip protectors might afford an economic alternative which may decrease the occurrence or provide the necessary prevention of hip fracture. Even so, among this group of individuals, the occurrence of hip fractures accounted for only 5.2% of the fractures and were the eighth most frequent site of fracture. More common were fractures of the ribs, vertebrae, and proximal and mid-shaft femur which collectively accounted for 60% of all fractures. Perhaps most perplexing about these fractures is the majority were idiopathic in nature.

Understandably, it is difficult to continuously monitor each client within the developmental center. Many individuals are independent ambulators capable of moving freely among selected cottages. Issues such as adequate lighting, floor surface, slipping on wet floors, or not using handrails may have contributed to accidents and perhaps falls among this group. Most frequently the nature surrounding the fracture was unknown and this study did not attempt to identify specific cottages, time of day, or even personnel which might have been related to the occurrence of fractures.

While ambulators had the lowest cumulative incidence (.225), they were also found to have a significantly reduced risk against any fracture. More challenging is identifying those idiopathic fractures among the assisted standing group which experienced the greatest cumulative incidence of fractures.

A number of investigations have been conducted on ambulatory and nonambulatory children and adults residing in long-term residential settings with regards to bone health and fracture outcome. Sturm, Alman, and Christie (1992) retrospectively examined the occurrence of femoral fractures following hip spica immobilization among 77 children residing in a state developmental center. They reported that 29% of nonambulatory children and youth experienced a femoral fracture within three months after the discontinuation of the spica casts. Conversely, they reported no fractures occurring in ambulatory subjects. Nagraj, Gergans, Mattson, Rudman, and Rudman (1990) reported that 50% of males between 57 and 85 years old who resided in a nursing home had BMD values less than 70% of their age-matched healthy peers at one or more measurement sites. Nagraj et al (1990) and Salamone et al (1996) have both reported that body weight is significantly correlated with and a determinant of BMD, respectively. Orwoll, Bauer, Vogt, and Fox (1996) concluded that body weight is strongly associated with BMD in 7963 ambulatory Caucasian women 65 years or older, more so than estrogen exposure and calcium intake. Similarly, Rudman et al (1994) have reported that the strongest predictors of osteopenia among males 58 to 95 years old residing in a nursing home was immobility and being under-weight.

These findings appear to support the data found in this study. Interestingly, in older subjects residing in nursing homes, Visentin et al (1995) suggested that reduced BMD values are not as important as a risk factor for fracture as is age and the occurrence of falls among this group. While subjects in the Visentin et al investigation averaged 81.5 years of age, none of the subjects in the present study were older than 72 years.

Recent data from Gambian women suggest that significantly lower BMD and BMC values do not necessarily translate to osteoporotic fractures (Aspray, Prentice, Cole, Sawo, Reeve, & Francis, 1996). Similar findings have been reported with Asian males and females (Russell-Aulet, Wang, Thorton, Colt, & Pierson, 1991, 1993). As individuals with SMR may not achieve BMD values similar to age-matched healthy subjects (Downs et al, 1996), developmental center practices play a significant role in the outcome of fracture. Administration of supplemental vitamin D and calcium, achievement of weight-bearing positions, preventative strategies to reduce the impact of falls, and staff familiarization with the risk of fracture and prevention strategies may positively influence the bone health of adults residing in state developmental centers.

Strengths and Limitations

As any retrospective investigation has inherent strengths and limitations, this was especially obvious during data collection. First, locating subject files for the time period in question was often troublesome. As the starting date of the study began on April 1, 1991 and concluded on March 31, 1996, there were a number of complications including: (a) locating files with the April 1st starting date, (b) finding subsequent files for the time between the starting and ending date, or as was often the case, (c) finding files for individuals who had left the state developmental center or had died, and (d) frequently after the files were located, there often were pages poorly xeroxed, missing, or difficult to read. Alternatively, as data collection was conducted so close to the study end point, for the majority of subjects, most of the personal data was unavailable in current files.

Secondly, while the principal investigator had complete access to individual data, the amount of paperwork within files made it difficult to access subject information. Thankfully, the nursing staff was invaluable in locating information which often appeared to be missing or excluded.

Thirdly, the database while large was manageable but presented logistical concerns for the principal investigator. Namely, the accuracy of the data collected by the nursing staff over the years and their ability to reliably re-record the information onto data sheets. While the nursing staff was entirely cooperative and understanding to the challenge of obtaining subject data, it is difficult to know the reliability of the data recorded. Time constraints do not allow one person to obtain, collect, and record all data requiring the assistance of trained nursing personnel. The nurses were familiar with subject file formats, location of subject cottage (ward), location and access to information once within cottages, and obtaining data in a timely and accurate manner from subject files. In order to minimize inaccuracies during data collection, the principal investigator was extensively involved in data recording and conducted weekly random checks of data information accuracy as they were completed by the nursing staff.

During data entry of subject information from the completed data sheet into the computer database, an Alpha IV program was used which required each data point to be entered twice consecutively. If the two data points did not match, the computer program would not record subject data and the information had to be re-entered.

Fourth, compared with interview or recall investigations, one strength of this retrospective study is the validation of bone fractures. This was accomplished by obtaining fracture data and other important subject information directly from individual medical records. However, one of the shortcomings of this research is based on identification of fractures. There is no way to know the extent of individuals who were asymptomatic or were not identified as having experienced a bone fracture within one of the skeletal sites of interest for this study.

Fifth, while there is documentation and validation of bone fracture(s) within individual medical files, there are assumptions associated with retrospective studies. It is assumed that over the course of the study period there was a close relationship between past and current exposures. Furthermore, it is assumed that there are no changes in the exposures of interest throughout the study period. For example, individual ambulatory data were recorded at the time of fracture. Therefore, it is assumed that individuals who were non-ambulatory at the time of fracture were also non-ambulatory from day one of the study. As a result, inference drawn from the results of this investigation are limited.

Lastly, specific risk estimates are somewhat lower than reported since certain individuals sustained multiple fractures and only the number of fractured, not fractures, were widely used throughout data analysis. This study does, however, provide guidance for future investigations.

Recommendations for Future Study

It may be feasible to improve this research by:

(1) Conducting a prospective study on this group of individuals with SMR. While retrospective studies have obvious advantages (e.g., not having to wait for long periods of time before analysis), a prospective study would be able to : (a) ask specific contrast hypothesis *a priori* thus minimizing any chance of observer bias and potential inaccuracies in data recording, and (b) account for changes in personal welfare (e.g., ambulatory ability, medication usage, or other significant changes in individual status) over time.

(2) Examining the consequences of fracture morbidity for this group of individuals. Determination of how long individuals were excluded from other activities (e.g., specialized training) following a bone fracture would be beneficial.

(3) Comparing age and gender specific fracture rates within the state developmental center to the healthy-normal population within the same community. Specifically, asking if fracture rates were excessive or consistent with the local community.

(4) Comparing nationwide fracture rates between state developmental centers who serve adults with SMR. Specifically, how do these fracture rates and risk compare to other developmental centers of similar size.

(5) Investigating the effectiveness (e.g., reducing fracture incidence rate) of different intervention strategies which might help minimize and/or reverse the risk of fractures among adults with SMR. For example, incorporating hip protectors among ambulatory adults who may be at risk of falling.

(6) Examining the related cost-benefits ratio to developing training programs for medical personnel who work with adults with SMR. That is, can effective training protocols be established which (a) yield significant benefits to the client with SMR, (b) reduce the cost of treating fractures for the state developmental center.

Summary & Conclusions

The results of this study provide estimates for risk of fracture among adults with severe mental retardation residing in a state developmental center. The five-year cumulative incidence of fractures was 44% based on the number of individuals fractured and 56% based upon the number of fractures.

The most frequently fractured sites were ribs, femur, thoracic vertebrae, and radius. The mechanism of injury for the majority of fractures was idiopathic in nature followed by accidents (e.g., during seizure), falls, and as a result of transfers by developmental training center personnel.

Males were found to have a significant protective effect against the risk of fractures while females were at a significant risk. Combined gender groups found individuals over the age of 40 years to be at greater risk. Contrary to all available research data, gender specific results suggest that females over 50 years old and males over 60 had protective risk of fracture, although this was not found to be significant for either group.

Perhaps the most significant finding of this investigation was that individuals with body mass index values less than 20 were at significant risk of fracture. Conversely, fracture risk among males with body mass index values greater than 20 and females with values greater than 25 had a significant protective effect. The magnitude of this effect warrants further investigation.

Relative risk estimates by ethnicity for fracture risk were not found to be significant for either Caucasian or non-Caucasian individuals. As the cohort was predominately Caucasian, detailed analysis for other specific groups was not possible.

The analysis of ambulatory ability yielded several significant findings. Specifically, the group with the greatest risk of fracture was the assisted standing group. Relative risk data for individuals who were capable of ambulating independently yielded a significant protective effect against fracture. By gender, ambulatory males and females had the lowest risk of fracture. Alternatively, assisted standing males and assistive device females were at greatest risk.

The progressive decrease in the ability to feed oneself was an increase relative risk of fracture. Individuals being tube fed were at the greatest risk followed by those who required total assistance. Independent self-eaters were found to have a significant protective effect.

Postmenopausal women, while at slightly greater risk of fracture, were not significantly different than premenopausal females. Women who were postmenopausal 10 or less years had a slightly reduced risk compared with females greater than 10 years postmenopausal. Women experiencing bilateral oophorectomies were found to have a moderate risk of fracture while women who had hysterectomies and were not postmenopausal had a slight protective effect.

Medications, including hypothyrodial, gulcocorticoids, and the majority of anticonvulsants were each found to yield a non-significant increase in fracture risk. Oral contraceptive usage among females was found to have a non-significant protective effect perhaps since ambulatory females were the primary recipients of these medications. The anticonvulsant primidone and individuals concurrently taking four or more anticonvulsant medications had an increased risk of fracture.

Logistic regression analysis revealed that the combination of ambulatory ability, use of calcium supplementation, body weight, BMI, and self-feeding ability to best predict fracture outcome. Having established the risk of fracture in this population due to ambulatory ability, pharmacological considerations, gender, age, BMI and other factors, future researchers should address how to alleviate and/or minimize the risk of fracture for individuals with SMR either residing within state developmental centers or smaller group homes. For example, adults with SMR should be encouraged and guided in safe and appropriate weightbearing activities which may help prevent premature osteoporotic fractures. Additionally, large developmental centers should insure that personnel are trained to identify individuals at risk and minimize any situations which may increase individual fracture risk unnecessarily.

Due to the fact that the study population was limited to adults with SMR, generalizability of the results is uncertain. However, there is no reason to suspect that this institution's practices or the individuals residing within state developmental centers elsewhere are vastly different than the population examined in this study. Further investigations would need to determine whether: (1) other adults with SMR differ from the population investigated within this study with respect to fracture outcome, and (2) the training developmental center personnel receive with respect to handling of clients differ from other state developmental centers.

Lastly, further investigation on the role of BMI with relationship to this population is justified, particularly as the risk of fractures for both males and females was significantly greater among those individuals with BMI values less than 20.

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Appendices

Appendix A

Developmental Training Center Institutional Review Board Approval Form

NOTICE OF DECISION
INSTITUTIONAL RESEARCH BOARD

TO: XXXXXXXXXXXXXXXXXXXXXX
Steven Downs, Doctoral Candidate, Researcher, OSU

RE: Application For Approval Research on "The Epidemiology of Fractures Among Adults with Severe Mental Retardation Residing in a State Developmental Center"

The Committee met on Wednesday, March 6 (1996), to review a request by Steven Downs to conduct research on the epidemiology of bone fractures among adults residing at XXXXXXXXXXXXXXXX and were residing here on January 1, 1991 to be followed through December 31, 1995. Additional requirements are as follows:

- Client identification number
- Client age, gender, height, weight, ethnicity, & cottage
- Client ability to ambulate and eat independently
- Client history of fracture, including date, site, mechanism
- Client history of medications
- Client smoking behavior

The study will involve examing client medical files for all clients who were residing at XXXXXXXXXXXXX on January 1, 1991. Clients eligible for inclusion into the study will be identified by XXXXXXXXXXXXX. The researcher will work with a representative from the Department of Rehabilitation Medicine to secure client data. **A copy of the research proposal, which outlines the study in more detail, is attached.**

The purpose of the research is said to be:

1) To investigate the magnitude, characteristics, and potential risk factors of bone fractures among adults with severe mental retardation residing in a state developmental center.

RECOMMENDATION: **APPROVAL**

There were seven members present. The vote was 5 to 1 in favor of approving the experiment, with one member abstaining due to a potential conflict of interest. The member voting not to approve the study felt that there was insufficient benefit to clients to justify moving forward. Also, this member felt that the impact of the study would generate negative attention to this and other state training centers.
There was also discussion by other members (voting favorably) about the possible consequences such a study could have for XXXXXXXXXXXX. These items were

addressed by XXXXXXXXXX and the researcher. They discussed that the name of the training center nor individuals associated with the training center would be identified within any documents published, including, presentations made and the doctoral thesis. Mr. Downs agreed to this and asked that a second copy of the approval form be forwarded to him for use within his study which does not identify the training center or personnel by name (attached).

There was discussion about the title of the experiment (why the word "profound" was not included). The educational community has only two categories; mild and severe retardation, whereas the medical community/training center recognizes four (mild, moderate, sever, profound). Approval to conduct this experiment is still to be obtained at Oregon State University. Collection of all information can begin as soon as the researcher and XXXXX XXXXXX have all the necessary approvals, forms, and accessibility to medical data. Mr. Downs will work out of an office located in the Department of Rehabilitation Medicine and does not have permission to travel to cottages without supervision. All necessary documents will be transported to this office. Procedures for obtaining documents is to be arranged by XXXXXXX.

This test is expected to cost approximately $8,000. Mr. Downs will not be paid for the research, nor is he expected to reimburse the training center for associated costs.

cc: XXXXXXXXXXXX
Committee Members

XXXXXXXXXXXX

Appendix B

Oregon State University
Institutional Review Board Approval Form

INSTITUTIONAL REVIEW BOARD FOR THE PROTECTION OF HUMAN SUBJECTS

OREGON STATE UNIVERSITY

Report of Review

TITLE: Epidemiology of fracture in adults with severe mental retardation residing in a state developmental center.

PRINCIPAL INVESTIGATOR: Jeffrey McCubbin

DEPARTMENT: ExSS

STUDENT: Steve Downs

COMMITTEE DECISION: Approved

COMMENTS:

1. The informed consent form obtained from each subject should be retained in program/project's files for three years beyond the end date of the project.
2. Any proposed change to the protocol or informed consent form that is not included in the approved application must be submitted to the IRB for review and must be approved by the committee before it can be implemented.

Warren N. Suzuki, Chair
Committee for the Protection of Human Subjects
(Education, 7-6393, suzukiw@ccmail.orst.edu)

Date: April 19, 1996

Appendix C

Description of Study

Description of the Study

Title: The Epidemiology of Fractures Among Adults with Severe Mental Retardation Residing in a State Developmental Center

Investigators:

Steve Downs	(Student investigator)
Dr. Jeff McCubbin	(Prinicipal investigator)

Purpose:

To investigate the magnitude, characteristics, and potential risk factors of bone fractures among adults with severe mental retardation residing in a state developmental center.

Why is this Study Important?

Many adults with severe mental retardation cannot stand or participate in weightbearing activities and therefore, are at higher risk of developing osteoporosis, a degenerative bone disease. This may be particularly evident in individuals who reside in continuous care settings, such as board and care homes or state developmental centers, where the severity of mental and/or physical impairment diminish the opportunities to participate in weightbearing activities.

What the Subject Needs to do:

There is no need for the investigators or any other individual associated with this study to make contact with the subjects residing in the state developmental center. The student investigator will examine the medical records of the client and record data from these records into a database. Data to be obtained (Appendix B) include: identification number (assigned by the developmental center), age, gender, race, cottage of residence (within the developmental center), anticonvulsant medication(s) and dosage(s), body height and weight, ambulatory ability (e.g., independent ambulator), smoker / nonsmoker status, calcium supplementation, years residing in medical center, level of assistance needed to eat meals (e.g., total assistance, independent), and lastly, the site, type, and etiology of bone fracture. The subject's name will not be included within this database and will be identified by a state developmental center assigned number.

Possible Risks to Subject:

There is no risk due to this investigation.

Benefits to the Subject:

Data obtained in this study will provide information and direction useful in: (1) identifying potential risk factors for bone fracture within this population of adults with severe mental retardation, and (2) identifying individuals at risk. As a result, it is hoped that this information may be useful in stimulating the development of effective preventive programs at this and other similar developmental centers.

Subject Characteristics

This cohort of subjects will include all males and females with severe mental retardation who have resided in a state developmental center since January 1, 1989. All subjects with severe mental retardation who were residing within the developmental center on this date will be included in this study regardless of gender, age, or any other criteria. It is estimated that over 450 individuals will be eligible for study participation. All subjects are over the age of 21 and are dependent upon continuous care to meet their long term needs.

Informed Consent

Permission to conduct this study has been obtained from the XXXXXXXXXXX Center (Appendix A). It was determined by the Institutional Review Board of XXXXXXXXXXXXXX that it was not necessary to receive subject's informed consent. Futhermore, the student investigator does not have permission to travel freely within the training center without supervision, therefore, minimizing any contact with subjects in this study.

Confidentiality:

The information obtained during this study will be treated as privileged and confidential. As the student investigator will be working from an office within the Department of Rehabilitation Medicine, all subject files will be brought to this office by medical personnel and are not to be removed from this area or copied. The data obtained from the medical records will be used for statistical analysis and scientific purposes with the clients right to privacy retained. The subject will be assigned an identification number by the developmental center on all data collection sheets (Appendix B), reports and publication of this data. Access to this data will only be available to the student researcher in this study. Upon the completion of this study, the code list to numerical references will be destroyed.

Questions/Concerns?

Contact Steve Downs (541/737-3402) or Dr. Jeff McCubbin (541/737-5921) at Oregon State University.

Appendix D

Informed Consent

Statement of Informed Consent

Title: The Epidemiology of Fractures Among Adults with Severe Mental Retardation Residing in a State Developmental Center

Purpose:

The purpose of this study is threefold. First, to examine the number of bone fractures which occur to clients at the XXXXXXXXXXXXXXXXX. Secondly, what common characteristics do clients have who fracture a bone. That is, age, gender, medications, etc. Lastly, to identify the potential risk factors which the client may have which put them at higher risk of experiencing more fractures than those who can walk without assistance.

Significance/Benefits:

At this time the fracture risk factors for adults with severe mental retardation have not been identified. While similar information is known about men, women, and children without a disability, no information is currently available to help understand why fractures may occur and who may be at the greatest risk in a group of adults with severe mental retardation. To date, no investigations have examined this question. The results of this study, are far reaching to a large group of adults with mental retardation (perhaps adults without mental retardation). Not only will this information help XXXXXXXXXXXXXXXXXXXXXX staff in the therapeutic programming of clients, but will help determine those clients at greatest risk and help develop approaches for future training. In addition, all subjects, guardians, and hospital personnel can receive a free copy of the results of this study. Participation in this study will not require any contact with the client. Conversely, only the client's medical records need to be made available to the researcher to determine who has experienced a bone fracture and investigate why the client might have had the bone fracture.

Location of the Study:

All data will be collected at the Training Center. The student investigator will travel to the Training Center to collect information from each client medical file. The student investigator will not remove the clients record, xerox any part of the file, nor even to know the client name, only their identification number.

Risks to the Subject:

There is no risk to the client due to this investigation.

Confidentiality
The information obtained during this study will be treated as privileged and confidential. As the student investigator will be working from an office within the Department of Rehabilitation Medicine, all subject files will be brought to this office by medical personnel and are not to be removed from this area or copied. The data obtained from the medical records will be used for statistical analysis and scientific purposes with the clients right to privacy retained. Subjects identity will not be known by the researchers. Upon completion of this study, the code list of numerical references will be destroyed.

Freedom of Consent
I have been thoroughly informed and understand the nature and purpose of this investigation. The researchers have made it clear that they will answer all questions or concerns that I may have. Participation in this study is completely voluntary. I am free to deny consent at any time without prejudice or loss of benefits guaranteed by participation. Questions concerning rights as a subject can be directed to the Institutional Review Board for the Protection of Human Subjects at the Research Office of Oregon State University and the XXXXXXXXXXX XXXXXX. I understand that Oregon State University does not provide a research subject with compensation or medical treatment in the event the subject is injured as a result of participation in a research project. Questions concerning the study may be directed to Steve Downs at 541/737-3402, Dr. Jeff McCubbin (737-5921).

Informed Consent

Title: The epidemiology of fractures among adults with severe mental retardation residing in a state developmental center.

Acting Parent/Guardian: I have thoroughly read this statement of informed consent and agree to
allow____
to participate in this study.

____________________________________ ____________
Guardians Signature **Date**

____
Guardians Name (Please Print)

Appendix E

Medical Questionnaire

Medical Questionnaire
Sheet A
Questions? Call Steve Downs (541) 737-3402

Client ID#	_______			
Gender	1 MALE	2 FEMALE		
Cottage	_____________			
Date of Birth	_____________	Age _____________		
Date of Admission to Instit.	_____________			
Yrs Institutionalized	_____________			
Weight (kg)	_____________			
Height (cm)	_____________	BMI _____________		

Medications

Anticonvulsant(s)	1	YES	9	NO
Corticosteroids	1	YES	9	NO
Oral Contraceptives	1	YES	9	NO
Thyroid Medication	1	YES	9	NO

(Use sheet C to report type, dosage, and date started medications)

Behaviors

Does the client smoke	1 YES	9 NO	How long? ______
Calcium supplements	1 YES	9 NO	Dose _______
Vitamin D supplements	1 YES	9 NO	Dose _______

Menopausal Status

Pre-menopausal	1	
Post-menopausal	5	How long? _______ Date _______

Ambulatory Ability

4	Walk independently without assistance
3	Walk with the aid of a supportive device (cane, walker, etc.)
2	Restricted to use of wheelchair only for transportation
1	Restricted to prone/supine lier

Self-Feeding

5	Feed independently without assistance
4	Feed with minimal assistance
3	Feed mostly with assistance
2	Feed with total assistance
1	Tube fed

Ethnic Background

Which best describes the clients ethnic identity?

5	African American
4	American Indian/Alaskan Native
3	Asian American
2	Caucasian
1	Hispanic American
0	Other (please specify) ______________________________

Client ID# _______

PREVIOUS FRACTURE(S) *(Use sheet B to list type of fracture, if any)*

1 YES
9 NO

Site	**Date(s)**	**Reported Cause**
1 Skull	________	____
2 Cervical vertebrae	________	____
3 Thoracic vertebrae	________	____
4 Lumbar vertebrae	________	____
5 Sacrum	________	____
6 Ribs	________	____
7 Clavicle	________	____
8 Pelvis	________	____
9 Hip	________	____
10 Femur	________	____
11 Tibia	________	____
12 Fibula	________	____
13 Ulna	________	____
14 Radius	________	____
15 Humerus	________	____

1 = Falls
2 = Transfer
3 = Unknown
4 = Other
  a. seizure
  b. accident
  c. struck

Sheet B

Client #________

Fracture Summary

	Location	Cause	Date
1.			
2.			
3.			
4.			
5.			
6.			

Sheet C

Client #__________

Medication Summary

Medication	Dosage	Start Date

Appendix F

Analysis Tables

Table 38.
Two-by-Two Table of Fractures and Age (All Subjects 20 - 29 Years)

Fractures

		YES	NO	TOTAL
Age (All Subjects) (20 - 29 years)	**YES**	31	47	78
	NO	198	242	440
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.883***
95% RR CI= ***.559 - 1.317***
p-value= ***0.390***

Table 39.
Two-by-Two Table of Fractures and Age (All Subjects 30 - 39 Years)

Fractures

		YES	NO	TOTAL
Age (All Subjects) (30 - 39 years)	**YES**	72	103	175
	NO	157	186	343
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.899***
95% RR CI= ***.604 - 1.197***
p-value= ***0.317***

Table 40.
Two-by-Two Table of Fractures and Age (All Subjects 40 - 49 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Age (All Subjects) (40 - 49 years)	**YES**	60	66	126
	NO	169	223	392
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.105***
95% RR CI= ***.854 - 1.795***
p-value= ***0.379***

Table 41.
Two-by-Two Table of Fractures and Age (All Subjects 50 - 59 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Age (All Subjects) (50 - 59 years)	**YES**	39	41	80
	NO	190	248	438
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.124***
95% RR CI= ***.847 - 2.002***
p-value= ***0.373***

Table 42.
Two-by-Two Table of Fractures and Age (All Subjects ≥ 60 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Age (All Subjects) (≥ 60 years)	**YES**	27	32	59
	NO	202	257	459
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.040***
95% RR CI= ***.710 - 1.851***
p-value= ***0.803***

Table 43.
Two-by-Two Table of Age (All Males)

Fractures

Males (All Ages)		YES	NO	TOTAL
	YES	96	175	271
	NO	133	114	247
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.658***
95% RR CI= ***.342 - .669***
p-value= ***>.001***

Table 44.
Two-by-Two Table of Age (All Females)

Fractures

Females (All Ages)		YES	NO	TOTAL
	YES	133	114	247
	NO	96	175	271
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.54***
95% RR CI= ***1.521 - 3.027***
p-value= ***>.001***

Table 45.
Two-by-Two Table of Males (20 - 29 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Males (20 - 29 yrs)	**YES**	10	31	41
	NO	86	144	230
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.652***
95% RR CI= ***.332 - 1.157***
p-value= ***0.107***

Table 46.
Two-by-Two Table of Females (20 - 29 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Females (20 - 29 Years)	**YES**	21	16	37
	NO	112	98	210
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.064***
95% RR CI= ***.639 - 2.324***
p-value= ***0.704***

Table 47.
Two-by-Two Table of Males (30 - 39 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Males (30 - 39 years)	**YES**	29	65	94
	NO	67	110	177
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.815***
95% RR CI= ***.473 - 1.248***
p-value= ***0.25***

Table 48.
Two-by-Two Table of Females (30 - 39 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Females (30 - 39 Years)	**YES**	43	38	81
	NO	90	76	166
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.979***
95% RR CI= ***.596 - 1.628***
p-value= ***0.865***

Table 49.
Two-by-Two Table of Males (40 - 49 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Males (40 - 49 Years)	**YES**	28	41	69
	NO	68	134	202
	TOTAL	**96**	**175**	**271**

Relative Risk= ***1.205***
95% RR CI= ***.843 - 2.362***
p-value= ***0.298***

Table 50.
Two-by-Two Table of Females (40 - 49 Years)

		Fractures		
		YES	**NO**	**TOTAL**
Females (40 - 49 Years)	**YES**	32	25	57
	NO	101	89	190
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.056***
95% RR CI= ***.675 - 2.047***
p-value= ***0.689***

Table 51.
Two-by-Two Table of Males (50 - 59 Years)

Fractures

Males (50 - 59 Years)		YES	NO	TOTAL
	YES	22	25	47
	NO	74	150	224
	TOTAL	**96**	**175**	**271**

Relative Risk= ***1.417***
95% RR CI= ***1.059 - 3.374***
p-value= ***0.073***

Table 52.
Two-by-Two Table of Females (50 - 59 Years)

Fractures

Females (50 - 59 Years)		YES	NO	TOTAL
	YES	17	16	33
	NO	116	98	214
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.95***
95% RR CI= ***.500 - 1.871***
p-value= ***0.772***

Table 53.
Two-by-Two Table of Males (60 Years & Above)

Males (60 & Above)		Fractures YES	Fractures NO	TOTAL
	YES	7	13	20
	NO	89	162	251
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.987***
95% RR CI= ***.520 - 2.547***
p-value= ***0.682***

Table 54.
Two-by-Two Table of Females (60 Years & Above)

Females (60 & Above)		Fractures YES	Fractures NO	TOTAL
	YES	20	19	39
	NO	113	95	208
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.944***
95% RR CI= ***.509 - 1.756***
p-value= ***0.726***

Table 55.

Two-by-Two Table of Males (< 40 Years Old)

		Fractures		
		YES	**NO**	**TOTAL**
Males (< 40 Years Old)	**YES**	39	96	135
	NO	57	79	136
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.689***
95% RR CI= ***.362 - .933***
p-value= ***0.029***

Table 56.

Two-by-Two Table of Females (< 40 Years Old)

		Fractures		
		YES	**NO**	**TOTAL**
Females (< 40 Years Old)	**YES**	64	54	118
	NO	69	60	129
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.014***
95% RR CI= ***.645 - 1.701***
p-value= ***0.849***

Table 57.
Two-by-Two Table of Males (≥ 50 Years Old)

Fractures

Males (≥ 50)		YES	NO	TOTAL
	YES	29	38	67
	NO	67	137	204
	TOTAL	**96**	**175**	**271**

Relative Risk= ***1.318***
95% RR CI= ***.969 - 2.746***
p-value= ***0.121***

Table 58.
Two-by-Two Table of Females (≥ 50 Years Old)

Fractures

Females (≥50)		YES	NO	TOTAL
	YES	37	35	72
	NO	96	79	175
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.937***
95% RR CI= ***.540 - 1.508***
p-value= ***0.617***

Table 59.
Two-by-Two Table of Race (Caucasian)

Fractures

		YES	NO	TOTAL
Race (Caucasian)	**YES**	197	252	449
	NO	32	37	69
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.919***
95% RR CI= ***.512 - 1.431***
p-value= ***0.549***

Table 60.
Two-by-Two Table of Race (Non-Caucasian)

Fractures

		YES	NO	TOTAL
Race (Non-Caucasian)	**YES**	32	37	69
	NO	197	252	449
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.057***
95% RR CI= ***.746 - 1.840***
p-value= ***0.697***

Table 61.
Two-by-Two Table of Body Mass Index (< 20)

		Fractures		
		YES	**NO**	**TOTAL**
Body Mass Index (< 20)	**YES**	123	73	196
	NO	106	216	322
	TOTAL	**229**	**289**	**518**

Relative Risk= ***2.416***
95% RR CI= ***1.906 - 4.978***
p-value= ***>.001***

Table 62.
Two-by-Two Table of Body Mass Index (20 - 25)

		Fractures		
		YES	**NO**	**TOTAL**
Body Mass Index (20 - 25)	**YES**	76	127	203
	NO	153	162	315
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.771***
95% RR CI= ***.465 - .908***
p-value= ***0.013***

Table 63.
Two-by-Two Table of Body Mass Index (> 25)

		Fractures		
		YES	**NO**	**TOTAL**
Body Mass Index (> 25)	**YES**	30	89	119
	NO	199	200	399
	TOTAL	**229**	**289**	**518**

Relative Risk=	***0.505***
95% RR CI=	***.247 - .536***
p-value=	***>.001***

Table 64.
Two-by-Two Table of Males (BMI < 20)

Fractures

Males (BMI < 20)		YES	NO	TOTAL
	YES	62	40	102
	NO	34	135	169
	TOTAL	**96**	**175**	**271**

Relative Risk= ***3.633***
95% RR CI= ***3.021 - 10.641***
p-value= ***> .001***

Table 65.
Two-by-Two Table of Females (BMI < 20)

Fractures

Females (BMI < 20)		YES	NO	TOTAL
	YES	61	33	94
	NO	72	81	153
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.379***
95% RR CI= ***1.266 - 3.532***
p-value= ***0.007***

Table 66.

Two-by-Two Table of Males (BMI 20 - 25)

Fractures

Males (BMI 20 - 25)		YES	NO	TOTAL
	YES	22	72	94
	NO	74	103	177
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.56***
95% RR CI= ***.277 - .747***
p-value= ***0.003***

Table 67.

Two-by-Two Table of Females (BMI 20 - 25)

Fractures

Females (BMI 20 - 25)		YES	NO	TOTAL
	YES	54	55	109
	NO	79	59	138
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.865***
95% RR CI= ***.462 - 1.215***
p-value= ***0.215***

Table 68.
Two-by-Two Table of Males (BMI > 25)

Fractures

		YES	NO	TOTAL
Males (BMI > 25)	**YES**	12	63	75
	NO	84	112	196
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.373***
95% RR CI= ***.166 - .501***
p-value= ***>.001***

Table 69.
Two-by-Two Table of Females (BMI > 25)

Fractures

		YES	NO	TOTAL
Females (BMI > 25)	**YES**	18	26	44
	NO	115	88	203
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.722***
95% RR CI= ***.320 - 1.027***
p-value= ***0.057***

Table 70.
Two-by-Two Table of Immobile Ambulation (All Subjects)

Fractures

Immobile Ambulation (All Subjects)		YES	NO	TOTAL
	YES	33	45	78
	NO	196	244	440
	TOTAL	**229**	**289**	**518**

Relative Risk= *.950*
95% RR CI= *.630 - 1.486*
p-value= *.711*

Table 71.
Two-by-Two Table of Immobile Ambulation (Males)

Immobile Ambulation (Male)	Fractures: YES	NO	TOTAL
YES	16	23	39
NO	80	152	232
TOTAL	**96**	**175**	**271**

Relative Risk= ***1.19***
95% RR CI= ***.778 - 2.645***
p-value= ***0.43***

Table 72.
Two-by-Two Table of Immobile Ambulation (Females)

Immobile Ambulation (Females)	Fractures: YES	NO	TOTAL
YES	17	22	39
NO	116	92	208
TOTAL	**133**	**114**	**247**

Relative Risk= ***0.782***
95% RR CI= ***.361 - 1.222***
p-value= ***0.162***

Table 73.

Two-by-Two Table of Assisted Standing Ambulation (All Subjects)

		Fractures		
		YES	**NO**	**TOTAL**
Assisted Standing Ambulation (All Subjects)	**YES**	102	88	190
	NO	127	201	328
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.386***
95% RR CI= ***1.317 - 2.634***
p-value= ***>.001***

Table 74.
Two-by-Two Table of Assisted Standing Ambulation (Males)

		Fractures		
		YES	**NO**	**TOTAL**
Assisted Standing Ambulation (Male)	**YES**	43	45	88
	NO	53	130	183
	TOTAL	**96**	**175**	**271**

Relative Risk= ***1.687***
95% RR CI= ***1.454 - 3.968***
p-value= ***> .001***

Table 75.
Two-by-Two Table of Assisted Standing Ambulation (Females)

		Fractures		
		YES	**NO**	**TOTAL**
Assited Standing Ambulation (Females)	**YES**	59	43	102
	NO	75	71	146
	TOTAL	**134**	**114**	**248**

Relative Risk= ***1.126***
95% RR CI= ***.809 - 2.163***
p-value= ***0.298***

Table 76.
Two-by-Two Table of Assistive Device Ambulation (All Subjects)

		Fractures		
		YES	**NO**	**TOTAL**
Assistive Device Ambulation (All Subjects)	**YES**	74	87	161
	NO	155	202	357
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.059***
95% RR CI= ***.802 - 1.612***
p-value= ***0.589***

Table 77.
Two-by-Two Table of Assistive Device Ambulation (Males)

Assistive Device Ambulation (Male)		Fractures YES	Fractures NO	TOTAL
	YES	30	65	95
	NO	66	110	176
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.842***
95% RR CI= ***.496 - 1.307***
p-value= ***0.33***

Table 78.
Two-by-Two Table of Assistive Device Ambulation (Females)

Assistive Device Ambulation (Female)		Fractures YES	Fractures NO	TOTAL
	YES	44	22	66
	NO	90	92	182
	TOTAL	**134**	**114**	**248**

Relative Risk= ***1.348***
95% RR CI= ***1.195 - 3.684***
p-value= ***0.016***

Table 79.
Two-by-Two Table of Independent Ambulation (All Subjects)

Fractures

Independent Ambulation (All Subjects)		YES	NO	TOTAL
	YES	20	69	89
	NO	209	220	429
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.461***
95% RR CI= ***.220 - .520***
p-value= ***>.001***

Table 80.
Two-by-Two Table of Independent Ambulation (Males)

Fractures

		YES	NO	TOTAL
Independent Ambulation (Males)	**YES**	7	42	49
	NO	89	133	222
	TOTAL	**96**	**175**	**271**

Relative Risk= ***0.356***
95% RR CI= ***.159 - .580***
p-value= ***> .001***

Table 81.
Two-by-Two Table of Independent Ambulation (Females)

Fractures

		YES	NO	TOTAL
Independent Ambulation (Females)	**YES**	13	27	40
	NO	121	87	208
	TOTAL	**134**	**114**	**248**

Relative Risk= ***0.559***
95% RR CI= ***.211 - .709***
p-value= ***0.003***

Table 82.
Two-by-Two Table of Immobile & Assisted Standing (All Subjects)

		Fractures		
		YES	**NO**	**TOTAL**
Immobile & Assisted Standing (All Subjects)	**YES**	135	133	268
	NO	94	156	250
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.34***
95% RR CI= ***1.207 - 2.392***
p-value= ***0.004***

Table 83.
Two-by-Two Table of Assistive & Independent Ambulation (All Subjects)

		Fractures		
		YES	**NO**	**TOTAL**
Assistive & Independent Ambulation (All Subjects)	**YES**	94	156	250
	NO	135	133	268
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.746***
95% RR CI= ***.433 - .843***
p-value= ***0.004***

Table 84.
Two-by-Two Table of Smoking (All Subjects)

Fractures

		YES	**NO**	**TOTAL**
Smoking	**YES**	2	12	14
	NO	227	277	504
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.317***
95% RR CI= ***.111 - .919***
p-value= ***0.023***

Table 85.
Two-by-Two Table of Self-Feeding (Tube Fed)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Tube)	**YES**	20	8	28
	NO	209	281	490
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.675***
95% RR CI= ***1.623 -7.784***
p-value= ***0.003***

Table 86.
Two-by-Two Table of Self-Feeding (Assisted)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Assisted)	**YES**	88	76	164
	NO	141	213	354
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.347***
95% RR CI= ***1.250 - 2.542***
p-value= ***0.003***

Table 87.

Two-by-Two Table of Self-Feeding (Mostly Assist)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Mostly Assist)	**YES**	61	59	120
	NO	168	230	398
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.204***
95% RR CI= ***.999 - 2.132***
p-value= ***0.095***

Table 88.

Two-by-Two Table of Self-Feeding (Some Assist)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Some Assist)	**YES**	45	73	118
	NO	184	216	400
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.829***
95% RR CI= ***.521 - 1.102***
p-value= ***0.131***

Table 89.
Two-by-Two Table of Self-Feeding (Independent)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Independent)	**YES**	15	73	88
	NO	214	216	430
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.343***
95% RR CI= ***.150 -.373***
p-value= ***>.001***

Table 90.
Two-by-Two Table of Self-Feeding (Tube, Total & Mostly Assisted)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Tube - Mostly Assisted)	**YES**	169	143	312
	NO	60	146	206
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.994***
95% RR CI= ***1.860 - 4.181***
p-value= ***>.001***

Table 91.
Two-by-Two Table of Self-Feeding (Some Assist & Independent)

		Fractures		
		YES	**NO**	**TOTAL**
Self-Feeding (Some Assist & Independent)	**YES**	60	146	206
	NO	169	143	312
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.506***
95% RR CI= ***.256 - .538***
p-value= ***>.001***

Table 92.
Two-by-Two Table of Anticonvulsant Medication Usage

		Fractures		
		YES	**NO**	**TOTAL**
Anticonvulsant Medications (All Subjects)	**YES**	198	240	438
	NO	31	49	80
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.167***
95% RR CI= ***.803 - 2.124***
p-value= ***0.285***

Table 93.
Two-by-Two Table of No Anticonvulsant Medication Usage

		Fractures		
		YES	**NO**	**TOTAL**
No Anticonvulsant Medications (All Subjects)	**YES**	31	49	80
	NO	198	240	438
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.857***
95% RR CI= ***.534 - 1.249***
p-value= ***0.285***

Table 94.
Two-by-Two Table of Usage of One Anticonvulsant Medication

		Fractures		
		YES	**NO**	**TOTAL**
One (1) Anticonvulsant Medication	**YES**	25	33	58
	NO	173	207	380
	TOTAL	**198**	**240**	**438**

Relative Risk= ***0.947***
95% RR CI= ***.595 - 1.584***
p-value= ***0.726***

Table 95.
Two-by-Two Table of Usage of Two Anticonvulsant Medications

		Fractures		
		YES	**NO**	**TOTAL**
Two (2) Anticonvulsant Medications	**YES**	118	141	259
	NO	80	99	179
	TOTAL	**198**	**240**	**438**

Relative Risk= ***1.019***
95% RR CI= ***.719 - 1.519***
p-value= ***0.857***

Table 96.
Two-by-Two Table of Usage of Three Anticonvulsant Medications

		Fractures		
		YES	NO	TOTAL
Three (3) Anticonvulsant Medications	**YES**	50	62	112
	NO	148	178	326
	TOTAL	**198**	**240**	**438**

Relative Risk= ***0.983***
95% RR CI= ***.677 - 1.494***
p-value= ***0.889***

Table 97.
Two-by-Two Table of Usage of Four Anticonvulsant Medications

		Fractures		
		YES	NO	TOTAL
Four (4) Anticonvulsant Medications	**YES**	5	4	9
	NO	193	236	429
	TOTAL	**198**	**240**	**438**

Relative Risk= ***1.235***
95% RR CI= ***.557 - 5.775***
p-value= ***0.529***

Table 98.
Two-by-Two Table of Usage of Two or less Anticonvulsant Medications

Fractures

		YES	NO	TOTAL
2 or less Anticonvulsant Medications (All Subjects)	**YES**	143	174	317
	NO	55	66	121
	TOTAL	**198**	**240**	**438**

Relative Risk= ***0.992***
95% RR CI= ***.653 - 1.502***
p-value= ***0.952***

Table 99.
Two-by-Two Table of Usage of Three or more Anticonvulsant Medications

Fractures

		YES	NO	TOTAL
3 or more Anticonvulsant Medications (All Subjects)	**YES**	55	66	121
	NO	143	174	317
	TOTAL	**198**	**240**	**438**

Relative Risk= ***1.008***
95% RR CI= ***.710 - 1.545***
p-value= ***0.952***

Table 100.
Two-by-Two Table of Usage of Phenytoin & Valproic Acid

Medications Phenytoin & Valproic Acid		Fractures YES	Fractures NO	TOTAL
	YES	33	61	94
	NO	196	228	424
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.759***
95% RR CI= ***.447 - 1.002***
p-value= ***0.05***

Table 101.
Two-by-Two Table of Usage of Phenytoin & Carbamazepine

Medications Phenytoin & Carbamazepine		Fractures YES	Fractures NO	TOTAL
	YES	46	55	101
	NO	183	234	417
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.038***
95% RR CI= ***.752 - 1.656***
p-value= ***0.757***

Table 102.
Two-by-Two Table of Usage of Phenytoin & Phenobarbital

Fractures

Medications Phenytoin & Phenobarbital		YES	NO	TOTAL
	YES	90	94	184
	NO	139	195	334
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.175***
95% RR CI= ***.971 - 1.929***
p-value= ***0.110***

Table 103.
Two-by-Two Table of Usage of Phenytoin & Primidone

Fractures

Medications Phenytoin & Primidone		YES	NO	TOTAL
	YES	24	25	49
	NO	205	264	469
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.121***
95% RR CI= ***.787 - 2.229***
p-value= ***0.447***

Table 104.
Two-by-Two Table of Usage of Phenytoin & Ethosuximide

		Fractures		
		YES	**NO**	**TOTAL**
Medication Phenytoin & Ethosuximide	**YES**	14	14	28
	NO	215	275	490
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.14***
95% RR CI= ***.724 - 2.742***
p-value= ***0.529***

Table 105.
Two-by-Two Table of Usage of Valproic Acid & Phenobarbital

		Fractures		
		YES	**NO**	**TOTAL**
Medication Valporic Acid & Phenobarbital	**YES**	35	51	86
	NO	194	238	432
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.906***
95% RR CI= ***.589 - 1.348***
p-value= ***0.472***

Table 106.
Two-by-Two Table of Usage of Valproic Acid & Primidone

Fractures

		YES	NO	TOTAL
Medication Valporic Acid & Primidone	**YES**	12	12	24
	NO	217	277	494
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.138***
95% RR CI= ***.695 - 2.899***
p-value= ***0.562***

Table 107.
Two-by-Two Table of Usage of Carbamazepine & Primidone

Fractures

		YES	NO	TOTAL
Medication Carbamazepine & Primidone	**YES**	4	8	12
	NO	225	281	506
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.75***
95% RR CI= ***.302 - 2.102***
p-value= ***0.441***

Table 108.
Two-by-Two Table of Usage of Valproic Acid & Ethosuximide

Fractures

Medication Valporic Acid & Ethosuximide		YES	NO	TOTAL
	YES	5	8	13
	NO	224	281	505
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.867***
95% RR CI= ***.379 - 2.431***
p-value= ***0.674***

Table 109.
Two-by-Two Table of Usage of Carbamazepine & Ethosuximide

Fractures

Medication Carbamazepine & Ethosuximide		YES	NO	TOTAL
	YES	7	3	10
	NO	222	286	508
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.602***
95% RR CI= ***.949 - 11.767***
p-value= ***0.097***

Table 110.

Two-by-Two Table of Usage of Phenobarbital & Ethosuximide

		Fractures		
		YES	**NO**	**TOTAL**
Medication Phenobarbital & Ethosuximide	**YES**	5	7	12
	NO	224	281	505
	TOTAL	**229**	**288**	**517**

Relative Risk= ***0.939***
95% RR CI= ***.414 - 2.863***
p-value= ***0.849***

Table 111.
Two-by-Two Table of Usage of Phenytoin

		Fractures		
		YES	**NO**	**TOTAL**
Phenytoin	**YES**	160	192	352
	NO	69	97	166
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.094***
95% RR CI= ***.814 - 1.702***
p-value= ***0.407***

Table 112.
Two-by-Two Table of Usage of Valporic Acid

		Fractures		
		YES	**NO**	**TOTAL**
Valporic Acid	**YES**	65	101	166
	NO	164	188	352
	TOTAL	**229**	**289**	**518**

Relative Risk= ***0.84***
95% RR CI= ***.539 - 1.074***
p-value= ***0.114***

Table 113.
Two-by-Two Table of Usage of Carbamazepine

Fractures

		YES	NO	TOTAL
Carbamazepine	**YES**	46	55	101
	NO	183	234	417
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.038***
95% RR CI= ***.752 - 1.656***
p-value= ***0.757***

Table 114.
Two-by-Two Table of Usage of Phenobarbital

Fractures

		YES	NO	TOTAL
Phenobarbital	**YES**	112	122	234
	NO	117	167	284
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.162***
95% RR CI= ***.949 - 1.858***
p-value= ***0.131***

Table 115.
Two-by-Two Table of Usage of Primidone

Primidone		Fractures YES	Fractures NO	TOTAL
	YES	31	30	61
	NO	198	259	457
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.173***
95% RR CI= ***.885 - 2.309***
p-value= ***0.246***

Table 116.
Two-by-Two Table of Usage of Ethosuximide

Ethosuximide		Fractures YES	Fractures NO	TOTAL
	YES	17	18	35
	NO	212	271	483
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.107***
95% RR CI= ***.723 - 2.400***
p-value= ***0.596***

Table 117.
Two-by-Two Table of Pre-Menopausal Females

		Fractures		
		YES	**NO**	**TOTAL**
Pre-Menopausal Females	**YES**	83	75	158
	NO	50	39	89
	TOTAL	**133**	**114**	**247**

Relative Risk= ***.935***
95% RR CI= ***.521 - 1.456***
p-value= ***0.528***

Table 118.
Two-by-Two Table of Post-Menopausal Females

		Fractures		
		YES	**NO**	**TOTAL**
Post-Menopause (Females)	**YES**	50	39	89
	NO	83	75	158
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.069***
95% RR CI= ***.712- 1.954***
p-value= ***0.582***

Table 119.
Two-by-Two Table of Post-Menopausal Females < 10 years

Fractures

		YES	NO	TOTAL
Post-Menopause < 10 years (Females)	**YES**	19	14	33
	NO	31	25	56
	TOTAL	**50**	**39**	**89**

Relative Risk= ***1.040***
95% RR CI= ***.495 - 2.610***
p-value= ***0.818***

Table 120.
Two-by-Two Table of Post-Menopausal Females ≥ 10 years

		YES	TOTAL
Post-Menopause ≥ 10 years (Females)	**YES**	31	56
	NO	19	33
	TOTAL	**50**	**89**

Relative Risk=
95% RR CI=
p-value=

Table 121.
Two-by-Two Table of Females with Oophorectomy

		Fractures		
		YES	**NO**	**TOTAL**
Oophorectomy	**YES**	10	7	17
	NO	123	107	230
	TOTAL	**133**	**114**	**247**

Relative Risk= ***1.10***
95% RR CI= ***.556 - 3.380***
p-value= ***0.667***

Table 122.
Two-by-Two Table of Females with Hysterectomy

		Fractures		
		YES	**NO**	**TOTAL**
Hysterectomy	**YES**	17	22	39
	NO	116	92	208
	TOTAL	**133**	**114**	**247**

Relative Risk= ***0.782***
95% RR CI= ***.361 - 1.222***
p-value= ***0.165***

Table 123.
Two-by-Two Table of Usage of Glucocorticoids

		Fractures		
		YES	**NO**	**TOTAL**
Glucocorticoids	**YES**	10	11	21
	NO	219	278	497
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.081***
95% RR CI= ***.614 - 2.768***
p-value= ***0.749***

Table 124.
Two-by-Two Table of Usage of Thyroxine

		Fractures		
		YES	**NO**	**TOTAL**
Thyroxine	**YES**	4	5	9
	NO	225	284	509
	TOTAL	**229**	**289**	**518**

Relative Risk= ***1.005***
95% RR CI= ***.409 - 3.807***
p-value= ***0.889***

Table 125.
Two-by-Two Table of Usage of Oral Contraceptives

		Fractures		
		YES	**NO**	**TOTAL**
Oral Contraceptives	**YES**	16	18	34
	NO	90	67	157
	TOTAL	**106**	**85**	**191**

Relative Risk= ***0.821***
95% RR CI= ***.366 - 1.393***
p-value= ***0.059***

Appendix G

Data Collected from State Developmental Center

KEY TO RAW DATA SHEETS

Column		
1.	Subjects Age	
2.	Gender	(1= Male 2= Female)
3.	Ethnicity	(1= Hispanic 2= Caucasian 3= Asian 4= American Indian 5= African American 6= Other)
4.	Years Institutionalized	
5.	Height (cm)	
6.	Weight (kg)	
7.	Body Mass Index	(Ht squared in meters/weight (kg))
8.	Ambulation Ability	(1= Immobile 2= Immobile/Assisted Standing 3= Assistive Device 4= Ambulatory)
9.	Self Feeding Ability	(1= Tube 2= Total Assistance 3= Mostly Assist 4= Minimal Assistance 5= No Assistance)
10.	Menopausal Status	(1 = Pre 5= Post)
11.	Years Post Menopause	
12.	Hysterectomy	(1 = Yes 9 = No)
13.	Years Post Hysterectomy	
14.	Oophorectomy	(1 = Yes 9 = No)
15.	Years Post Oophorectomy	
16.	Oral Contraceptives	(1 = Yes 9 = No)
17.	Smoking	(1 = Yes 9 = No)
18.	Anticonvulsant Usage	(1 = Yes 9 = No)
19.	Phenytoin (mg)	
20.	Valporic Acid (mg)	
21.	Carbamazepine (mg)	
22.	Phenobarbital (mg)	
23.	Primidone (mg)	
24.	Ethosuximide (mg)	
25.	Number of Anticonvulsant Medications Concurrently Taken	
26.	Glucocorticoids	(1 = Yes 9 = No)
27.	Thyroxine	(1 = Yes 9 = No)
28.	Calcium Supplement	(1 = Yes 9 = No)
29.	Vitamin D Supplement	(1 = Yes 9 = No)
30.	Term of Study (e.g., date of first fracture, deinstitutionalization)	
31.	Person-Years for Term of Study	
32.	Fracture History	(1 = Yes 9 = No)
33.	Fracture 1 Date	
34.	Fracture 1 Site	
35.	Fracture 1 Cause	
36.	Fracture 1 Person-Years	

Raw Date Key (continued)

37. Fracture 2 Date
38. Fracture 2 Site
39. Fracture 2 Cause
40. Fracture 2 Person-Years
41. Fracture 3 Date
42. Fracture 3 Site
43. Fracture 3 Cause
44. Fracture 3 Person-Years
45. Fracture 4 Date
46. Fracture 4 Site
47. Fracture 4 Cause
48. Fracture 4 Person-Years
49. Total Number of Fractures

Code 99 = Not Appropriate

1	2	3	4	5	6	7	8	9	10	11	12
38	1	2	37	163	114	43.00	4	5	99	99	99
26	1	2	26	163	97	36.59	4	5	99	99	99
36	1	2	36	157	90	36.51	4	5	99	99	99
59	1	2	35	142	70	34.72	4	4	99	99	99
26	1	2	26	183	116	34.66	4	5	99	99	99
53	2	2	50	135	61	33.58	2	3	5	1	9
52	1	2	50	160	84	32.81	4	4	99	99	99
31	1	5	25	163	87	32.74	4	5	99	99	99
57	2	4	55	127	53	32.66	2	2	5	8	9
30	1	2	29	150	73	32.44	2	3	99	99	99
41	1	3	39	150	73	32.44	4	5	99	99	99
63	2	2	63	119	46	32.18	2	2	5	4	9
60	1	2	59	140	63	32.14	2	2	99	99	99
25	1	4	25	145	67	31.87	3	4	99	99	99
25	2	2	19	137	59	31.22	4	4	1	99	9
27	1	2	21	150	70	31.11	3	5	99	99	99
37	1	2	35	142	62	30.75	3	4	99	99	99
37	1	5	29	152	71	30.73	2	3	99	99	99
33	1	2	24	147	66	30.54	4	5	99	99	99
55	1	3	49	160	78	30.47	4	5	99	99	99
41	1	2	25	152	70	30.30	3	5	99	99	99
38	1	2	36	140	59	30.10	2	3	99	99	99
63	2	2	61	132	52	29.93	1	2	5	10	9
58	1	2	29	152	69	29.86	4	4	99	99	99
55	1	2	54	165	81	29.75	4	5	99	99	99
41	1	2	29	163	78	29.55	4	5	99	99	99
39	1	2	38	152	68	29.43	4	4	99	99	99
41	2	2	41	140	57	29.32	2	3	5	99	1
29	1	2	29	157	72	29.21	4	5	99	99	99
46	1	2	43	157	72	29.21	4	5	99	99	99
46	1	2	45	142	59	29.05	1	3	99	99	99
29	2	2	20	145	61	29.01	4	5	1	99	9
43	1	2	40	145	61	29.01	3	4	99	99	99
27	1	2	27	152	67	29.00	4	4	99	99	99
34	1	1	25	152	67	29.00	2	3	99	99	99
34	1	2	28	152	67	29.00	3	4	99	99	99
36	1	2	31	152	67	29.00	4	5	99	99	99
31	2	2	28	152	67	28.72	4	4	1	99	9
42	1	4	42	165	78	28.65	4	5	99	99	99
26	2	4	20	145	60	28.54	4	5	1	99	9

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	530	9	1000	9	9
99	99	99	99	1	1	9	9	9	200	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	9	1500	9	9	9
99	99	99	99	9	1	9	9	9	240	9
9	9	99	9	9	1	300	9	600	9	9
99	99	99	99	9	1	430	9	9	165	9
99	99	99	99	9	9	99	99	99	99	99
9	9	99	9	9	1	260	9	600	9	9
99	99	99	99	9	1	400	1500	9	140	9
99	99	99	99	9	1	360	9	800	9	9
9	9	99	9	9	1	230	9	400	9	9
99	99	99	99	9	1	330	9	600	9	9
99	99	99	99	9	1	360	1500	9	132	1000
9	9	99	1	9	1	300	9	9	116	9
99	99	99	99	9	1	360	1500	9	140	9
99	99	99	99	9	1	310	1250	9	132	9
99	99	99	99	9	1	360	9	9	140	9
99	99	99	99	9	1	330	9	9	132	9
99	99	99	99	9	1	390	9	800	9	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	300	9	9	100	9
9	9	99	9	9	1	260	9	9	100	9
99	99	99	99	9	1	360	1500	9	132	9
99	99	99	99	9	1	400	1625	9	165	9
99	99	99	99	1	1	390	9	9	165	9
99	99	99	99	9	1	360	9	9	132	9
16	99	99	99	9	1	300	9	600	9	9
99	99	99	99	9	1	360	1250	9	148	9
99	99	99	99	1	1	360	1500	9	9	9
99	99	99	99	9	1	300	9	9	116	9
9	9	99	1	9	9	99	99	99	99	99
99	99	99	99	9	1	300	9	600	9	1000
99	99	99	99	9	1	9	1500	9	132	9
99	99	99	99	9	1	360	1500	9	9	9
99	99	99	99	9	1	360	9	9	132	500
99	99	99	99	9	1	360	1500	9	132	9
9	9	99	1	9	1	360	1500	9	9	9
99	99	99	99	9	1	390	9	800	9	9
9	9	99	1	9	1	330	1250	9	120	9

24	25	26	27	28	29	30	31	32
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	9	9	11/27/93	2.66301	9
9	1	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	2/27/96	4.91507	1
9	2	9	9	500	800	6/17/93	2.21644	9
99	0	9	9	9	9	6/20/94	3.22466	9
1250	3	9	9	600	800	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	700	11/13/91	.62192	1
9	2	9	9	500	800	1/12/96	4.78904	1
9	4	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	800	10/17/94	3.55068	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	9	9	9/7/92	1.44110	9
9	2	9	9	500	800	10/11/94	3.53425	1
9	2	9	9	600	800	7/27/95	4.32603	1
9	3	9	9	500	800	12/2/95	4.67671	1
9	3	9	9	500	800	5/27/93	2.15890	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	2/1/92	.84110	1
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	4/20/91	.05479	9
9	2	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	10/13/91	.53699	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	800	2/2/95	3.84658	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	9/6/91	.43562	9
9	2	1	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	800	8/11/92	1.36712	9

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
2/27/96	6	2	4.91507	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/13/91	13	2	.62192	4/17/92	10	2	1.04932
1/12/96	10	2	4.78904	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
10/11/94	6	3	3.53425	99	99	99	99
7/27/95	6	2	4.32603	99	99	99	99
12/2/95	7	4	4.67671	99	99	99	99
5/27/93	9	1	2.15890	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
2/1/92	6	3	.84110	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
8/22/94	10	4	3.39726	99	99	99	99	3
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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32	1	2	30	163	75	28.53	4	5	99	99	99
45	2	2	40	142	57	28.27	4	5	5	99	1
37	1	2	37	178	89	28.15	4	5	99	99	99
49	1	2	46	152	65	28.13	4	4	99	99	99
39	1	2	35	173	84	28.07	4	5	99	99	99
50	2	2	36	142	57	28.05	2	3	3	99	9
43	1	2	43	170	81	28.03	4	5	99	99	99
40	2	2	29	157	70	28.02	2	3	1	99	9
38	1	2	38	150	63	28.00	2	3	99	99	99
52	1	2	41	157	69	27.99	4	5	99	99	99
57	2	2	47	122	41	27.80	2	3	5	5	9
50	2	2	43	147	60	27.77	4	5	3	99	9
46	2	2	42	145	58	27.73	2	2	3	99	9
39	1	2	32	152	64	27.70	3	4	99	99	99
63	1	2	59	152	64	27.70	4	4	99	99	99
66	2	2	66	142	56	27.60	3	2	5	13	9
37	1	2	37	157	68	27.59	2	2	99	99	99
30	2	2	30	145	58	27.59	3	4	1	99	9
60	2	2	24	122	41	27.50	2	2	5	4	9
35	1	2	33	163	73	27.48	3	5	99	99	99
34	1	2	30	163	72	27.32	2	2	99	99	99
43	2	2	42	147	59	27.30	3	5	1	99	9
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67	2	2	66	137	51	27.27	2	3	5	18	9
53	2	2	53	155	65	27.24	2	2	5	99	1
59	1	2	46	137	51	27.17	2	3	99	99	99
25	1	2	24	152	63	27.17	4	4	99	99	99
39	2	2	36	114	35	27.11	1	2	5	99	99
36	2	2	35	150	61	27.11	3	5	1	99	9
47	1	2	47	170	78	26.99	4	5	99	99	99
37	1	2	19	168	76	26.97	2	2	99	99	99
26	1	2	23	142	54	26.83	1	2	99	99	99
32	1	2	30	145	56	26.78	1	2	99	99	99
63	2	2	62	142	54	26.78	3	4	5	6	9
25	1	1	22	163	71	26.72	3	4	99	99	99
64	2	2	62	150	60	26.69	2	2	5	99	1
59	1	1	57	155	64	26.64	4	4	99	99	99
39	2	2	34	147	58	26.54	4	4	1	99	9
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13	14	15	16	17	18	19	20	21	22	23
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23	99	99	99	9	1	290	1250	9	100	9
99	99	99	99	9	1	445	9	9	165	9
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99	99	99	99	1	9	99	99	99	99	99
99	99	99	99	9	1	300	9	9	100	9

24	25	26	27	28	29	30	31	32
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9	3	9	9	600	800	3/31/96	5.00548	9
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9	2	9	9	500	800	4/29/94	3.08219	9
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99	0	9	9	9	9	3/31/96	5.00548	9
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1000	3	9	9	600	800	3/31/96	5.00548	9
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9	3	9	9	600	800	3/31/96	5.00548	9
9	1	1	9	600	600	11/29/91	.66575	1
99	0	9	9	9	9	9/15/93	2.46301	9
9	1	9	9	500	800	8/26/92	1.40822	9
99	0	9	9	600	9	3/31/96	5.00548	9
9	2	9	9	500	800	5/4/93	2.09589	1
9	2	9	9	600	800	3/31/96	5.00548	9
1500	3	9	9	600	800	10/13/93	2.53973	1
9	3	9	9	500	800	4/20/93	2.05753	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	600	9/11/92	1.45205	1
99	0	9	9	600	9	11/16/92	1.63288	1
99	0	9	9	9	9	3/31/96	5.00548	9
99	0	9	9	9	9	10/5/94	3.51781	9
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	500	800	1/26/96	4.82740	9
9	2	9	9	600	800	7/1/92	1.25479	9
99	0	9	9	9	9	8/21/93	2.39452	9
9	2	9	9	600	800	6/19/92	1.22192	1
99	0	9	9	9	9	8/14/91	.37260	1
9	2	9	9	600	800	9/8/94	3.44384	9
99	0	9	9	9	9	6/19/91	.21918	9
9	2	9	9	500	800	3/31/96	5.00548	9

33	34	35	36	37	38	39	40
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99	99	99	99	99	99	99	99
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99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
3/16/93	9	3	1.96164	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/29/91	12	3	.66575	3/15/93	11	3	1.95890
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/4/93	14	1	2.09589	99	99	99	99
99	99	99	99	99	99	99	99
10/13/93	6	4	2.53973	99	99	99	99
4/20/93	9	1	2.05753	99	99	99	99
99	99	99	99	99	99	99	99
9/11/92	14	3	1.45205	6/7/93	14	3	2.18904
11/16/92	15	1	1.63288	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
6/19/92	6	4	1.22192	99	99	99	99
8/14/91	6	3	.37260	1/28/96	15	4	4.83288
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
5/27/95	12	3	4.15890	99	99	99	99	3
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
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39	1	2	37	165	72	26.45	3	4	99	99	99
25	1	2	25	152	61	26.40	2	3	99	99	99
32	1	2	31	180	86	26.38	4	5	99	99	99
34	1	2	30	157	65	26.37	3	3	99	99	99
55	1	2	54	157	65	26.37	3	4	99	99	99
29	1	2	23	170	76	26.30	4	5	99	99	99
51	1	2	49	160	67	26.17	3	4	99	99	99
54	2	2	53	160	67	26.17	3	5	3	99	9
43	2	2	40	152	60	26.00	2	3	5	99	99
45	1	2	41	152	60	25.97	3	5	99	99	99
42	1	2	40	144	54	25.84	1	2	99	99	99
61	2	2	60	135	47	25.81	1	2	5	6	9
63	1	2	61	150	58	25.78	4	4	99	99	99
24	2	2	20	160	66	25.77	4	4	1	99	9
25	1	2	21	185	88	25.71	4	5	99	99	99
32	1	2	32	165	70	25.71	2	3	99	99	99
60	1	2	59	145	54	25.68	2	2	99	99	99
44	2	2	41	117	35	25.62	1	2	3	99	9
53	2	2	47	163	68	25.60	2	2	5	99	99
38	2	2	36	142	52	25.59	1	3	1	99	9
29	2	2	27	140	50	25.57	1	2	1	99	9
63	2	2	60	157	63	25.56	3	5	5	5	9
62	2	2	62	162	67	25.53	3	5	5	99	1
51	1	2	49	168	72	25.51	3	3	99	99	99
30	2	2	26	112	32	25.48	1	2	1	99	9
56	2	2	51	147	55	25.45	3	4	5	4	9
72	2	2	71	112	32	25.45	1	1	5	19	9
40	1	2	33	160	65	25.39	3	4	99	99	99
55	2	2	54	155	61	25.39	3	5	3	99	9
33	2	2	33	142	51	25.36	2	2	1	99	9
45	1	2	44	165	69	25.34	4	4	99	99	99
23	1	2	23	150	57	25.25	3	4	99	99	99
36	2	2	36	157	63	25.24	2	3	5	99	1
66	2	2	65	149	56	25.22	4	4	5	99	1
28	1	2	24	163	67	25.22	2	3	99	99	99
33	1	2	30	175	77	25.21	2	3	99	99	99
31	1	2	29	157	62	25.15	3	5	99	99	99
40	2	2	34	157	62	25.08	2	3	1	99	9
54	1	2	54	173	75	25.06	4	5	99	99	99
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13	14	15	16	17	18	19	20	21	22	23
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99	99	99	99	9	1	430	1625	9	9	1000
99	99	99	99	9	9	99	99	99	99	99
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9	9	99	9	9	9	99	99	99	99	99
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99	99	99	99	9	9	99	99	99	99	99
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99	1	18	99	9	1	9	1500	9	132	500
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34	99	99	99	9	1	360	1500	9	9	9
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99	99	99	99	9	1	330	1500	9	120	1000
9	9	99	9	9	1	300	9	9	132	9
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99	99	99	99	1	9	99	99	99	99	99
16	99	99	99	9	1	9	1500	9	116	1000

24	25	26	27	28	29	30	31	32
9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	9	9	5/21/95	4.14247	9
9	2	9	9	500	800	3/19/92	.96986	1
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99	0	9	9	600	9	3/31/96	5.00548	9
9	1	9	9	600	800	7/5/91	.26301	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	500	800	11/30/93	2.67123	1
99	0	9	9	600	9	3/31/96	5.00548	9
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9	2	9	9	600	800	12/29/92	1.75068	9
9	1	9	9	600	800	1/19/94	2.80822	1
9	2	9	9	600	800	3/10/96	4.94795	1
9	2	9	9	500	800	8/25/91	.40274	9
9	3	1	9	600	600	4/27/94	3.07671	1
9	2	9	9	600	800	11/10/91	.61370	1
9	2	9	9	600	600	6/12/94	3.20274	1
9	4	9	9	500	800	6/29/92	1.24932	1
9	2	9	9	600	800	12/4/93	2.68219	1
9	2	9	9	600	800	12/26/95	4.74247	1
9	2	9	9	500	800	1/14/95	3.79452	9
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9	2	9	9	600	800	3/31/96	5.00548	9
9	3	9	9	600	800	11/4/93	2.60000	9
9	3	9	9	500	800	3/31/96	5.00548	9
1500	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	2/11/93	1.87123	9
99	0	9	9	9	9	10/27/95	4.57808	9
9	2	9	9	600	800	6/23/91	.23014	9

33	34	35	36	37	38	39	40
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99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
3/19/92	9	1	.96986	9/17/93	14	1	2.46849
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
7/5/91	6	2	.26301	99	99	99	99
99	99	99	99	99	99	99	99
11/30/93	10	2	2.67123	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
12/22/92	9	3	1.73151	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/19/94	9	1	2.80822	99	99	99	99
3/10/96	3	3	4.94795	99	99	99	99
99	99	99	99	99	99	99	99
4/27/94	10	2	3.07671	99	99	99	99
11/10/91	10	3	.61370	5/4/93	3	3	2.09589
6/12/94	15	4	3.20274	99	99	99	99
6/29/92	15	3	1.24932	6/2/94	6	4	3.17534
12/4/93	7	1	2.68219	99	99	99	99
12/26/95	13	2	4.74247	99	99	99	99
99	99	99	99	99	99	99	99
5/14/95	6	1	4.12329	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
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99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	0
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24	1	2	19	165	68	24.98	2	3	99	99	99
33	2	2	31	165	68	24.98	3	5	5	99	1
28	1	2	27	155	60	24.97	3	5	99	99	99
33	1	2	32	152	58	24.96	1	2	99	99	99
30	1	2	26	142	50	24.80	2	2	99	99	99
44	2	2	43	163	65	24.74	2	2	3	99	9
41	2	2	36	157	61	24.67	4	5	5	99	1
42	2	2	42	137	46	24.62	1	3	3	99	9
47	1	2	43	165	67	24.61	3	5	99	99	99
43	1	2	42	170	71	24.57	3	5	99	99	99
39	1	2	37	155	59	24.56	3	5	99	99	99
38	1	2	36	163	65	24.46	2	2	99	99	99
38	1	3	33	168	69	24.45	3	4	99	99	99
36	2	2	30	157	60	24.34	3	5	1	99	9
43	2	2	36	157	60	24.34	3	5	5	99	1
60	1	2	58	157	60	24.34	3	4	99	99	99
65	1	2	63	157	60	24.34	3	4	99	99	99
35	2	2	28	124	38	24.33	1	2	1	99	9
35	1	2	30	152	56	24.24	2	2	99	99	99
39	2	2	39	152	56	24.24	3	4	1	99	9
33	2	2	32	163	64	24.09	4	5	1	99	9
47	2	2	40	152	56	24.05	2	2	3	99	9
50	2	2	47	124	37	24.04	2	1	3	99	9
37	1	2	26	180	78	23.98	3	5	99	99	99
67	2	1	65	140	47	23.98	3	4	5	99	1
55	1	2	55	170	69	23.88	3	4	99	99	99
24	1	2	24	147	52	23.82	3	4	99	99	99
43	2	2	42	152	55	23.81	3	5	3	99	9
50	1	2	42	152	55	23.81	2	2	99	99	99
27	2	1	25	157	59	23.79	1	2	1	99	9
43	2	2	43	142	48	23.79	1	2	3	99	9
29	1	5	25	168	67	23.74	3	5	99	99	99
27	2	2	26	135	43	23.71	4	4	1	99	9
38	1	2	33	178	75	23.67	3	5	99	99	99
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49	2	4	48	168	66	23.59	2	3	3	99	9
67	2	5	64	142	48	23.57	2	2	5	99	99
37	2	4	36	150	53	23.56	4	5	1	99	9
48	1	2	45	150	53	23.56	3	4	99	99	99
47	1	2	38	175	72	23.51	4	5	99	99	99

13	14	15	16	17	18	19	20	21	22	23
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99	99	99	99	9	1	260	9	400	9	1250
9	9	99	9	9	1	9	1500	9	132	9
18	99	99	99	1	1	300	9	9	132	9
9	9	99	9	9	9	99	99	99	99	99
99	99	99	99	9	1	9	1500	9	9	9
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24	25	26	27	28	29	30	31	32
9	3	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	800	1/25/93	1.82466	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	800	6/11/91	.19726	1
9	3	9	9	500	800	7/1/91	.25205	1
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1250	3	9	9	500	800	1/13/92	.78904	9
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9	2	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	800	2/18/94	2.89041	9
9	2	9	9	500	800	5/11/93	2.11507	1
9	3	9	9	600	600	11/27/91	.66027	1
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9	2	9	9	600	800	10/19/94	3.55619	9
99	0	9	9	600	9	3/31/96	5.00548	9
1250	3	9	9	600	800	8/19/94	3.38904	1
9	2	9	9	600	600	9/17/91	.46575	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	1	9	600	800	9/25/92	1.49041	1
99	0	9	9	9	9	7/14/93	2.29041	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	600	800	6/26/92	1.24110	1
9	3	9	9	500	800	12/16/91	.71233	1
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9	2	9	1	600	800	8/31/93	2.42192	1
1250	3	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	10/10/94	3.53151	1
9	1	1	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	700	1/27/96	4.83014	9
1500	3	9	9	600	800	3/31/96	5.00548	9
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9	2	9	9	500	800	3/31/96	5.00548	9

33	34	35	36	37	38	39	40
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99	99	99	99	99	99	99	99
6/11/91	14	4	.19726	99	99	99	99
7/1/91	14	4	.25205	99	99	99	99
12/1/93	13	3	2.67397	99	99	99	99
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99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/11/93	14	1	2.11507	99	99	99	99
11/27/91	15	3	.66027	2/25/92	10	4	.90685
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/19/94	6	4	3.38904	99	99	99	99
9/17/91	10	2	.46575	8/14/95	15	4	4.37534
99	99	99	99	99	99	99	99
9/25/92	6	1	1.49041	12/6/93	15	3	2.68767
7/14/93	6	1	2.29041	99	99	99	99
99	99	99	99	99	99	99	99
6/26/92	6	1	1.24110	99	99	99	99
12/16/91	3	2	.71233	99	99	99	99
99	99	99	99	99	99	99	99
8/31/93	6	3	2.42192	99	99	99	99
99	99	99	99	99	99	99	99
10/10/94	15	4	3.53151	99	99	99	99
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99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/22/93	2	3	1.81644	99	99	99	99
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41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	1
7/17/95	10	3	4.29863	99	99	99	99	3
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
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44	1	2	40	165	64	23.51	3	3	99	99	99
34	2	2	32	150	53	23.47	3	4	1	99	9
51	1	2	51	173	70	23.39	3	5	99	99	99
36	1	4	30	152	54	23.37	3	4	99	99	99
33	2	2	33	163	62	23.34	3	5	1	99	9
27	1	2	25	145	49	23.32	2	3	99	99	99
33	2	2	32	155	56	23.31	3	5	1	99	9
46	2	2	44	167	65	23.31	3	5	3	99	9
32	1	2	29	145	49	23.31	3	3	99	99	99
46	2	4	41	162	61	23.24	4	5	3	99	9
30	1	2	24	170	67	23.18	2	3	99	99	99
36	1	2	30	170	67	23.18	3	4	99	99	99
38	2	2	37	145	49	23.18	2	2	1	99	9
42	2	2	39	145	49	23.18	2	3	3	99	9
64	2	2	62	137	44	23.17	2	2	5	99	1
62	2	2	62	165	63	23.16	2	3	5	8	9
31	2	2	29	157	57	23.12	4	5	1	99	9
34	1	2	33	145	49	23.11	2	3	99	99	99
38	1	1	30	173	69	23.05	3	4	99	99	99
48	1	2	46	178	73	23.04	4	5	99	99	99
39	2	2	38	140	45	23.04	2	2	5	99	1
62	2	4	59	173	69	22.98	2	2	5	99	1
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42	2	2	42	163	60	22.68	1	2	5	99	1
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29	1	2	26	168	64	22.68	3	5	99	99	99
37	1	2	30	168	64	22.68	3	4	99	99	99
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47	2	1	46	132	40	22.65	2	3	3	99	9
44	2	2	41	147	49	22.60	1	2	3	99	9
23	2	2	19	167	63	22.59	3	5	1	99	9
65	2	2	65	155	54	22.53	1	3	5	99	1
35	1	2	32	175	69	22.53	3	4	99	99	99
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41	1	2	41	152	52	22.51	2	2	99	99	99

13	14	15	16	17	18	19	20	21	22	23
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9	9	99	9	9	1	9	1125	9	9	1250
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9	9	99	9	9	1	310	9	600	9	9
99	99	99	99	9	1	260	9	9	9	9
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99	99	99	99	9	1	260	9	400	9	9
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32	99	99	99	9	1	230	9	9	9	9
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9	9	99	1	9	1	290	1250	9	100	9
99	99	99	99	9	1	9	9	9	100	9
99	99	99	99	9	1	360	9	9	132	1000
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14	99	99	99	9	1	9	1000	9	90	750
27	99	99	99	9	1	360	9	9	132	1000
99	99	99	99	9	1	290	9	9	108	9
99	99	99	99	9	1	230	9	400	9	9
29	99	99	99	9	1	290	9	9	9	9
9	9	99	1	9	1	260	9	9	9	9
9	9	99	9	9	1	260	9	9	100	9
19	99	99	99	9	1	300	9	9	120	1000
9	9	99	9	9	1	260	1125	9	9	9
99	99	99	99	9	1	330	9	9	132	9
99	99	99	99	9	1	9	1500	9	132	750
99	99	99	99	9	1	260	1000	9	100	9
99	99	99	99	9	1	290	9	600	9	9
9	9	99	9	9	1	200	9	9	80	500
9	9	99	9	9	1	260	9	9	100	9
9	9	99	1	9	1	330	9	600	9	9
30	99	99	99	9	1	9	1125	9	9	9
99	99	99	99	9	1	360	9	9	132	9
9	9	99	9	9	9	99	99	99	99	99
99	99	99	99	9	1	260	9	9	100	1250

24	25	26	27	28	29	30	31	32
9	2	9	9	500	800	8/2/95	4.34247	9
9	2	9	9	600	800	7/15/92	1.29315	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
1250	3	9	9	600	800	12/2/91	.67397	1
9	1	9	9	500	800	2/15/96	4.88219	9
99	0	9	9	600	9	3/31/96	5.00548	9
9	2	9	9	600	800	10/17/95	4.55068	1
9	2	9	9	500	800	2/7/95	3.86027	1
9	1	9	9	600	800	12/20/95	4.72603	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	1/23/94	2.81918	1
9	2	9	9	600	800	8/2/92	1.34247	1
1250	2	9	9	600	700	3/31/96	5.00548	9
9	1	9	9	600	800	3/31/96	5.00548	9
9	3	9	9	600	800	3/31/96	5.00548	9
9	1	9	9	500	800	11/2/93	2.59452	1
9	3	9	9	500	800	5/14/92	1.12329	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	3	9	9	600	700	3/31/96	5.00548	9
9	3	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/95	4.00274	9
9	2	9	9	500	700	5/20/92	1.13973	9
9	1	9	9	600	800	10/12/91	.53425	1
9	1	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	600	700	3/31/96	5.00548	9
9	3	9	9	600	800	3/31/96	5.00548	9
1500	3	9	9	600	800	12/27/93	2.74521	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	500	700	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	600	3/8/93	1.93973	1
9	2	9	9	600	800	7/21/94	3.30959	1
9	2	9	9	600	800	3/31/96	5.00548	9
9	1	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	5/2/94	3.09041	1
9	3	9	9	500	800	4/24/94	3.06849	9

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
7/15/92	10	2	1.29315	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
12/2/91	3	2	.67397	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
10/17/95	10	3	4.55068	99	99	99	99
2/7/95	14	1	3.86027	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/23/94	13	3	2.81918	7/3/95	3	3	4.26027
8/2/92	7	4	1.34247	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/2/93	10	4	2.59452	99	99	99	99
5/14/92	7	1	1.12329	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
10/12/91	6	4	.53425	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
3/8/93	12	4	1.93973	99	99	99	99
7/21/94	12	3	3.30959	1/25/96	7	3	4.82466
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/2/94	6	2	3.09041	99	99	99	99
99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0

1	2	3	4	5	6	7	8	9	10	11	12
56	2	2	54	155	54	22.51	2	2	5	8	9
30	2	2	26	155	54	22.48	3	5	1	99	9
36	2	2	31	137	42	22.45	1	2	1	99	9
59	2	2	55	150	50	22.44	2	2	5	99	1
45	1	2	40	178	71	22.41	3	5	99	99	99
59	1	2	58	173	67	22.39	3	3	99	99	99
39	2	2	37	137	42	22.38	4	3	1	99	9
64	1	2	63	145	47	22.35	3	3	99	99	99
43	2	2	28	160	57	22.35	2	2	1	99	9
40	2	2	39	140	44	22.34	2	2	1	99	9
55	1	2	55	140	44	22.34	2	3	99	99	99
40	1	1	40	168	63	22.32	3	5	99	99	99
27	2	2	24	157	55	22.31	3	5	1	99	9
28	1	2	26	137	42	22.26	1	1	99	99	99
48	1	2	47	147	48	22.21	3	4	99	99	99
32	1	4	32	163	59	22.21	2	2	99	99	99
40	2	2	40	163	59	22.17	2	2	5	99	1
38	2	2	37	160	57	22.17	2	2	1	99	9
25	2	2	24	157	55	22.16	2	3	5	99	1
28	2	2	26	132	39	22.13	1	2	1	99	9
51	2	2	49	170	64	22.11	2	2	5	99	99
55	2	5	49	152	51	22.07	4	4	5	99	99
35	2	2	33	142	45	21.99	2	2	1	99	9
63	2	2	63	160	56	21.99	2	2	5	7	9
44	2	2	42	170	64	21.95	2	2	5	99	1
24	1	5	23	157	54	21.92	1	3	99	99	99
38	2	1	36	157	54	21.91	3	4	1	99	9
35	2	2	29	145	46	21.88	3	4	1	99	9
42	2	2	39	145	46	21.88	3	4	1	99	9
49	2	2	40	145	46	21.88	2	2	5	3	9
42	1	1	41	160	56	21.88	3	4	99	99	99
42	2	2	38	167	61	21.87	3	4	1	99	9
24	2	2	19	163	58	21.83	4	5	1	99	9
62	1	2	62	170	63	21.80	2	2	99	99	99
35	1	2	32	142	44	21.79	1	2	99	99	99
27	1	2	22	150	49	21.78	2	2	99	99	99
29	2	2	20	150	49	21.78	4	4	1	99	9
61	2	2	61	150	49	21.78	3	3	5	99	99
46	1	2	41	178	69	21.78	3	4	99	99	99
59	1	2	58	155	52	21.75	1	3	99	99	99

13	14	15	16	17	18	19	20	21	22	23
9	9	99	9	9	1	290	9	600	9	9
9	9	99	1	9	1	290	9	9	9	9
9	9	99	9	9	1	230	9	9	90	9
29	99	99	99	9	1	9	1125	9	100	9
99	99	99	99	9	1	9	9	9	132	9
99	99	99	99	9	1	330	9	600	9	9
9	9	99	1	9	1	230	9	9	90	1000
99	99	99	99	9	1	230	9	400	9	9
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9	9	99	9	9	1	230	9	9	90	500
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99	99	99	99	9	1	230	9	9	80	9
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15	99	99	99	9	1	300	9	600	9	9
9	9	99	9	9	1	290	1250	9	9	9
5	99	99	99	9	1	290	1125	9	108	9
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99	1	28	99	9	1	260	9	600	9	9
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24	99	99	99	9	1	300	1500	9	9	9
99	99	99	99	9	1	290	1125	9	108	1250
9	9	99	1	9	9	99	99	99	99	99
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9	9	99	9	9	1	9	1000	9	9	9
9	9	99	9	9	9	99	99	99	99	99
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9	9	99	1	9	1	260	9	400	9	9
99	1	29	99	9	1	9	1000	9	9	9
99	99	99	99	9	1	9	1500	9	9	9
99	99	99	99	9	1	260	9	600	9	9

24	25	26	27	28	29	30	31	32
9	2	9	9	600	800	3/31/96	5.00548	9
9	1	9	9	600	800	3/31/96	5.00548	9
1000	3	9	9	600	700	12/12/92	1.70411	1
9	2	9	9	600	800	3/31/96	5.00548	9
1250	2	1	9	500	800	5/5/92	1.09863	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	700	6/17/93	2.21644	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	600	800	12/20/93	2.72603	1
9	3	9	9	600	700	5/29/93	2.16438	1
9	2	9	9	500	700	8/12/92	1.36986	1
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	700	5/18/92	1.13425	1
9	1	1	9	500	800	11/2/91	.59178	1
9	2	9	9	500	800	5/31/95	4.16986	1
9	2	9	9	600	800	10/11/94	3.53425	9
9	2	9	9	600	800	5/11/93	2.11507	9
9	3	9	9	600	800	8/25/94	3.40548	9
9	3	9	9	600	600	9/6/91	.43562	1
9	2	9	9	600	800	8/10/91	.36164	9
9	2	9	9	600	800	3/31/96	5.00548	9
99	0	9	9	600	9	4/29/95	4.08219	1
9	2	9	9	600	800	3/9/95	3.94247	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	4	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	5/4/95	4.09589	1
9	2	9	9	600	700	9/24/93	2.48767	1
9	1	9	9	600	700	7/15/92	1.29315	1
99	0	9	1	600	9	7/16/91	.29315	9
99	0	9	9	9	9	3/31/96	5.00548	9
9	1	9	9	600	800	5/27/94	3.15890	1
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9	1	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	700	11/2/93	2.59452	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	1	9	9	600	700	3/6/93	1.93425	1
9	1	9	9	500	800	4/14/94	3.04110	9
9	2	9	9	500	800	2/21/93	1.89863	1

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
12/12/92	7	3	1.70411	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
6/17/93	6	1	2.21644	99	99	99	99
99	99	99	99	99	99	99	99
12/20/93	15	4	2.72603	99	99	99	99
5/29/93	14	2	2.16438	99	99	99	99
8/12/92	15	4	1.36986	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/18/92	10	3	1.13425	99	99	99	99
11/2/91	14	1	.59178	99	99	99	99
5/31/95	15	4	4.16986	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
9/6/91	10	3	.43562	12/14/95	7	4	4.70959
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/29/95	7	3	4.08219	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/4/95	8	1	4.09589	99	99	99	99
9/24/93	10	3	2.48767	99	99	99	99
7/15/92	10	3	1.29315	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/27/94	9	1	3.15890	99	99	99	99
99	99	99	99	99	99	99	99
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11/2/93	10	2	2.59452	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
3/6/93	14	3	1.93425	99	99	99	99
99	99	99	99	99	99	99	99
2/21/93	15	2	1.89863	99	99	99	99

41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	0
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37	1	2	27	157	54	21.74	1	2	99	99	99
30	2	2	23	155	52	21.64	4	5	1	99	9
32	1	2	30	155	52	21.64	3	4	99	99	99
31	2	2	30	152	50	21.64	3	5	1	99	9
36	2	2	30	152	50	21.64	3	4	1	99	9
36	2	2	33	160	55	21.64	2	2	1	99	9
36	1	2	36	168	61	21.63	4	4	99	99	99
68	2	2	66	155	52	21.57	3	3	5	13	9
34	1	2	34	155	52	21.55	1	2	99	99	99
33	1	2	27	178	68	21.54	4	4	99	99	99
49	2	2	38	167	60	21.51	3	4	5	99	1
37	2	2	25	152	50	21.51	2	2	1	99	9
59	1	2	58	165	59	21.49	1	2	99	99	99
35	2	2	25	137	40	21.48	2	2	1	99	9
42	2	2	40	163	57	21.45	3	5	1	99	9
45	1	1	45	163	57	21.45	2	2	99	99	99
28	1	2	22	173	64	21.38	2	3	99	99	99
38	2	2	37	142	43	21.33	3	3	5	99	1
31	1	2	25	170	62	21.30	4	4	99	99	99
46	2	2	35	157	53	21.24	1	2	3	99	9
36	2	1	29	155	51	21.23	4	5	1	99	9
36	2	2	35	155	51	21.23	3	5	1	99	9
54	1	2	53	152	49	21.21	3	4	99	99	99
31	2	2	29	140	41	21.19	4	3	5	99	1
39	2	3	34	155	51	21.19	2	3	1	99	9
36	1	2	33	155	51	21.16	3	3	99	99	99
29	2	2	27	147	46	21.15	3	4	1	99	9
32	1	2	26	178	67	21.15	2	3	99	99	99
37	1	2	34	157	52	21.10	3	4	99	99	99
57	1	2	46	160	54	21.09	3	3	99	99	99
33	1	4	26	163	56	21.08	3	4	99	99	99
30	2	2	27	150	47	21.03	2	2	1	99	9
56	2	2	54	137	40	21.00	2	2	5	99	1
26	1	2	24	165	57	20.98	2	3	99	99	99
48	2	2	35	163	55	20.96	2	2	3	99	9
33	2	5	30	140	41	20.94	2	2	1	99	9
60	2	2	59	145	44	20.93	3	3	5	7	9
33	1	2	33	168	59	20.90	3	4	99	99	99
55	2	2	55	142	42	20.87	2	2	5	3	9
58	2	4	56	145	44	20.80	1	2	5	99	1

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	290	9	9	108	9
9	9	99	1	9	1	260	9	9	100	9
99	99	99	99	9	1	260	9	9	100	9
9	9	99	9	9	1	9	9	9	100	1500
9	9	99	1	9	1	260	9	400	9	9
9	9	99	9	9	9	99	99	99	99	99
99	99	99	99	9	1	300	9	9	132	9
9	9	99	9	9	1	260	1125	9	9	9
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99	99	99	99	9	1	360	9	9	132	9
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99	99	99	99	9	1	9	1250	9	116	9
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99	99	99	99	9	1	330	1500	9	9	750
12	99	99	99	9	1	9	1000	9	90	9
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9	9	99	9	9	1	260	9	9	100	9
9	9	99	1	1	1	260	9	600	9	9
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99	99	99	99	9	1	260	9	600	9	9
99	99	99	99	9	1	260	9	9	9	9
99	99	99	99	9	1	290	9	600	9	1250
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99	99	99	99	9	1	9	1250	9	9	9
9	9	99	9	9	1	290	9	9	116	9
9	9	99	1	9	9	99	99	99	99	99
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99	99	99	99	9	9	99	99	99	99	99
9	9	99	9	9	1	9	1000	9	9	9
35	99	99	99	9	1	230	9	400	9	9

24	25	26	27	28	29	30	31	32
1250	3	9	9	500	800	12/15/92	1.71233	9
9	2	9	9	600	800	5/1/93	2.08767	9
9	2	9	9	500	800	8/23/95	4.40000	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	600	800	4/20/92	1.05753	1
99	0	9	9	600	9	3/31/96	5.00548	9
9	2	9	9	500	800	9/10/94	3.44932	9
9	2	9	1	600	800	6/22/91	.22740	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	3/31/96	5.00548	9
99	0	9	9	600	9	11/6/94	3.60548	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	600	3/27/94	2.99178	1
99	0	9	9	600	9	9/4/93	2.43288	1
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9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	700	2/13/96	4.87671	1
99	0	9	9	9	9	3/31/96	5.00548	9
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9	2	9	9	600	800	3/31/96	5.00548	9
9	3	9	9	600	800	1/17/96	4.80274	1
9	3	9	9	500	800	7/27/95	4.32603	9
9	2	9	9	600	700	4/20/92	1.05753	1
9	2	1	9	600	800	6/28/95	4.24658	1
99	0	9	9	9	9	3/31/96	5.00548	9
99	0	9	1	600	9	8/24/91	.40000	1
9	2	9	9	500	800	2/28/92	.91507	9
9	2	9	9	500	800	7/17/95	4.29863	1
9	1	9	9	500	800	8/17/92	1.38356	9
9	3	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	6/5/95	4.18356	1
9	1	9	9	600	600	3/13/92	.95342	1
9	1	9	9	500	800	6/21/93	2.22740	9
9	2	9	9	600	800	5/19/92	1.13699	1
99	0	9	9	600	9	3/31/96	5.00548	9
750	3	9	9	600	700	8/31/94	3.42192	1
99	0	9	9	9	9	3/31/96	5.00548	9
1000	2	9	9	600	700	4/26/92	1.07397	1
9	2	9	9	600	700	6/10/93	2.19726	1

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/20/92	6	1	1.05753	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/6/94	6	4	3.60548	99	99	99	99
99	99	99	99	99	99	99	99
3/27/94	14	3	2.99178	99	99	99	99
9/4/93	3	4	2.43288	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
2/13/96	9	1	4.87671	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/17/96	10	1	4.80274	99	99	99	99
99	99	99	99	99	99	99	99
4/20/92	7	1	1.05753	99	99	99	99
6/28/95	3	4	4.24658	99	99	99	99
99	99	99	99	99	99	99	99
8/24/91	3	3	.40000	99	99	99	99
99	99	99	99	99	99	99	99
7/17/95	3	1	4.29863	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
6/5/95	12	3	4.18356	99	99	99	99
3/13/92	14	3	.95342	99	99	99	99
99	99	99	99	99	99	99	99
5/19/92	14	4	1.13699	99	99	99	99
99	99	99	99	99	99	99	99
8/31/94	14	4	3.42192	6/12/95	10	4	4.20274
99	99	99	99	99	99	99	99
4/26/92	10	3	1.07397	7/29/92	4	3	1.33151
6/10/93	6	3	2.19726	99	99	99	99

41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
4/27/94	3	3	3.07671	99	99	99	99	3
99	99	99	99	99	99	99	99	1

1	2	3	4	5	6	7	8	9	10	11	12
24	1	2	16	152	48	20.78	3	4	99	99	99
47	2	2	45	152	48	20.78	3	4	3	99	9
41	1	2	40	170	60	20.76	2	3	99	99	99
23	2	2	20	160	53	20.75	1	2	1	99	9
64	1	2	58	147	45	20.72	2	2	99	99	99
42	1	2	39	163	55	20.70	4	4	99	99	99
43	2	2	41	163	55	20.70	4	5	1	99	9
28	2	4	27	157	51	20.69	2	3	1	99	9
62	1	2	60	165	56	20.57	2	2	99	99	99
64	1	2	61	165	56	20.57	3	4	99	99	99
34	2	2	28	132	36	20.56	2	2	1	99	9
33	1	1	33	168	58	20.55	2	2	99	99	99
34	1	2	29	168	58	20.55	2	2	99	99	99
61	1	2	62	168	58	20.55	4	3	99	99	99
56	2	2	51	152	48	20.53	1	2	5	7	9
50	1	2	49	178	65	20.52	4	4	99	99	99
25	2	2	22	140	40	20.48	2	2	1	99	9
39	1	2	36	170	59	20.42	3	5	99	99	99
41	2	2	40	170	59	20.42	4	4	5	99	99
32	2	2	27	155	49	20.40	3	4	1	99	9
49	1	2	46	173	61	20.38	3	5	99	99	99
31	1	2	30	160	52	20.31	3	4	99	99	99
46	2	2	46	160	52	20.31	3	5	3	99	9
40	2	2	37	137	38	20.29	2	3	5	99	99
61	2	2	58	147	44	20.29	1	3	5	3	9
26	1	2	20	157	50	20.28	2	2	99	99	99
43	1	4	41	157	50	20.28	3	3	99	99	99
65	1	2	64	137	38	20.27	1	1	99	99	99
30	1	2	15	175	62	20.24	2	2	99	99	99
53	1	2	52	175	62	20.24	3	4	99	99	99
26	2	2	21	140	40	20.24	2	2	1	99	9
53	2	2	51	140	40	20.24	1	2	3	99	9
26	2	2	23	155	49	20.24	2	3	1	99	9
57	2	2	43	160	52	20.22	2	2	5	99	99
30	1	4	29	165	55	20.20	3	4	99	99	99
29	2	2	18	142	41	20.20	2	2	1	99	9
35	1	2	35	168	57	20.20	2	3	99	99	99
30	1	2	30	163	54	20.17	2	2	99	99	99
34	2	2	33	165	55	20.16	2	3	1	99	9
46	1	2	42	166	55	20.13	1	2	99	99	99

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	260	9	400	9	9
9	9	99	1	9	1	260	9	9	100	9
99	99	99	99	9	1	9	1250	9	120	9
9	9	99	9	9	1	290	1125	9	108	1250
99	99	99	99	9	1	230	9	9	9	9
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24	25	26	27	28	29	30	31	32
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	3/4/93	1.92877	1
9	2	9	9	500	800	10/26/91	.57260	1
9	4	9	9	600	800	11/23/93	2.65205	9
9	1	9	9	500	700	1/31/96	4.84110	1
99	0	9	9	9	9	7/13/95	4.28767	9
99	0	9	9	600	9	3/27/92	.99178	1
9	2	9	9	600	800	4/5/94	3.01644	9
9	1	9	9	500	800	1/17/95	3.80274	9
9	2	9	9	500	800	1/21/95	3.81370	9
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9	2	9	9	500	800	11/2/93	2.59452	9
99	0	9	9	9	9	5/22/91	.14247	1
9	2	9	9	600	700	3/31/96	5.00548	9
9	1	9	9	500	800	10/17/91	.54795	9
9	2	9	9	600	600	4/6/91	.00164	1
9	1	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	8/6/94	3.35342	9
9	3	9	9	600	800	8/6/92	1.35342	1
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9	2	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	800	4/9/91	.02466	1
9	3	9	9	600	600	9/27/91	.49315	1
9	2	9	9	600	700	11/26/94	3.66027	1
9	3	9	9	500	800	10/16/91	.54521	1
9	2	9	9	500	800	6/7/91	.18630	1
9	2	9	9	500	600	3/31/96	5.00548	9
9	1	1	9	500	800	3/31/96	5.00548	9
99	0	9	9	9	9	1/2/92	.75890	1
750	3	9	9	600	600	6/3/94	3.17808	1
9	2	9	9	600	600	3/31/96	5.00548	9
99	0	9	9	600	9	3/31/96	5.00548	9
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99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	600	600	8/12/91	.36712	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	800	1/6/96	4.77260	9
99	0	9	9	9	9	3/31/96	5.00548	9

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
3/4/93	9	1	1.92877	99	99	99	99
10/26/91	3	4	.57260	4/18/92	14	3	1.05205
99	99	99	99	99	99	99	99
1/31/96	10	3	4.84110	99	99	99	99
99	99	99	99	99	99	99	99
3/27/92	3	3	.99178	10/14/94	6	3	3.54247
99	99	99	99	99	99	99	99
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99	99	99	99	99	99	99	99
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99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
5/22/91	1	1	.14247	6/27/92	7	3	1.24384
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/6/91	15	3	.00164	2/15/93	6	4	1.88219
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/6/92	10	1	1.35342	9/17/93	14	1	2.46849
6/3/91	8	1	.17534	99	99	99	99
99	99	99	99	99	99	99	99
4/9/91	14	4	.02466	99	99	99	99
9/27/91	13	3	.49315	99	99	99	99
11/26/94	15	4	3.66027	99	99	99	99
10/16/91	6	3	.54521	99	99	99	99
6/7/91	14	4	.18630	6/7/91	9	4	.18630
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/2/92	6	4	.75890	99	99	99	99
6/3/94	6	3	3.17808	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/12/91	14	3	.36712	12/6/92	12	4	1.68767
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
12/1/95	3	3	4.67397	99	99	99	99	3
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
1/9/93	10	4	1.78082	5/14/95	6	4	4.12603	4
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
3/21/93	14	3	1.97534	11/29/94	14	3	3.66848	4
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0

1	2	3	4	5	6	7	8	9	10	11	12
33	1	2	29	180	65	20.11	4	4	99	99	99
54	2	2	53	147	44	20.08	2	2	3	99	9
23	2	5	18	155	48	19.98	4	4	1	99	9
33	1	2	26	157	50	19.96	3	3	99	99	99
28	2	2	28	145	42	19.95	4	4	1	99	9
56	1	2	53	163	53	19.95	2	2	99	99	99
33	2	2	30	145	42	19.93	2	3	1	99	9
54	1	2	53	145	42	19.93	1	2	99	99	99
51	2	2	48	152	46	19.91	3	4	5	99	1
37	2	2	35	147	43	19.90	3	4	1	99	9
42	1	2	39	147	43	19.90	2	3	99	99	99
40	2	2	30	140	39	19.90	4	4	1	99	9
50	1	2	43	157	49	19.88	1	2	99	99	99
26	2	2	26	147	43	19.88	2	2	1	99	9
25	1	2	24	155	48	19.85	2	2	99	99	99
24	1	2	21	168	56	19.84	3	3	99	99	99
40	1	2	39	137	37	19.84	2	1	99	99	99
27	1	4	19	142	40	19.84	2	2	99	99	99
46	1	2	44	142	40	19.84	2	2	99	99	99
38	2	2	35	137	37	19.79	1	2	1	99	9
45	2	2	44	137	37	19.79	2	1	3	99	9
38	2	4	32	137	37	19.71	3	3	5	99	99
59	2	2	58	137	37	19.71	3	3	5	4	9
41	1	2	37	173	59	19.71	3	4	99	99	99
53	1	2	39	173	59	19.71	3	5	99	99	99
34	2	2	31	160	50	19.68	2	3	5	99	1
35	2	2	35	160	50	19.68	1	2	1	99	9
57	1	2	50	175	60	19.59	3	3	99	99	99
51	1	2	47	163	52	19.59	1	2	99	99	99
45	1	2	42	163	52	19.57	4	5	99	99	99
37	2	2	37	155	47	19.56	3	4	1	99	9
38	2	5	38	155	47	19.56	3	4	1	99	9
43	1	2	41	150	44	19.56	2	2	99	99	99
48	2	2	28	150	44	19.56	1	4	5	2	9
28	1	2	22	152	45	19.55	3	4	99	99	99
44	2	2	38	140	38	19.54	1	3	5	99	1
57	2	2	51	175	60	19.51	2	3	5	99	1
47	1	5	44	168	55	19.49	3	5	99	99	99
66	2	2	60	155	47	19.48	2	2	5	99	99
61	2	2	60	152	45	19.48	4	5	5	8	9

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	330	1500	9	9	9
9	9	99	9	9	1	9	9	9	90	9
9	9	99	1	9	9	99	99	99	99	99
99	99	99	99	9	1	260	1000	9	100	1500
9	9	99	1	9	1	230	9	9	90	9
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99	99	99	99	9	1	200	9	9	90	9
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99	99	99	99	9	1	260	9	9	9	750
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99	99	99	99	9	1	260	9	9	100	9
99	99	99	99	9	1	290	1125	9	116	9
99	99	99	99	9	9	99	99	99	99	99
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99	1	7	99	9	1	185	9	400	9	1000
9	9	99	9	9	1	190	9	9	9	500
99	99	99	99	9	1	9	1250	9	9	9
99	99	99	99	9	1	300	1250	9	100	9
11	99	99	99	9	1	260	9	600	9	9
9	9	99	9	9	1	260	1125	9	9	9
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99	99	99	99	9	9	99	99	99	99	99
99	1	34	99	9	1	230	9	9	9	9
9	9	99	9	9	1	230	9	400	9	9

24	25	26	27	28	29	30	31	32
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	600	700	12/4/94	3.68219	1
99	0	9	9	600	9	2/20/94	2.89589	1
9	4	9	9	500	800	10/12/95	4.53699	1
9	2	9	9	600	700	10/13/95	4.53973	1
9	2	1	9	500	800	12/28/94	3.74795	9
9	2	9	9	600	700	4/3/93	2.01096	9
9	2	9	9	500	700	8/26/91	.40548	1
9	2	9	9	600	700	3/31/96	5.00548	9
9	2	9	9	600	700	3/31/96	5.00548	9
9	3	9	9	500	700	6/9/91	.19178	1
9	2	9	9	600	600	8/16/92	1.38082	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	600	700	1/28/94	2.83288	1
9	2	9	9	500	700	7/30/91	.33151	1
9	3	9	9	500	800	10/15/94	3.54521	9
99	0	9	9	9	9	3/31/96	5.00548	9
99	0	9	9	9	9	4/1/95	4.00548	1
99	0	9	9	9	9	7/24/92	1.31781	1
9	2	9	9	600	600	3/31/96	5.00548	9
9	3	9	9	600	600	6/13/92	1.20548	1
9	3	9	9	600	600	11/6/92	1.60548	1
9	2	9	9	600	600	4/11/93	2.03288	1
9	1	9	9	500	800	3/31/96	5.00548	9
9	3	1	9	500	800	11/21/91	.64384	1
9	2	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	800	11/29/94	3.66849	1
9	2	1	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	1	9	600	700	11/5/92	1.60274	1
9	1	9	9	600	700	3/31/96	5.00548	9
9	2	9	9	500	700	4/29/92	1.08219	1
9	2	9	9	600	700	7/9/92	1.27672	9
9	3	1	9	500	700	8/2/95	4.34247	1
9	3	9	9	600	600	11/14/95	4.62740	1
9	3	9	9	600	800	3/31/96	5.00548	9
99	0	9	9	9	9	10/24/93	2.56986	9
9	1	9	9	600	800	12/31/92	1.75616	9
9	2	9	9	600	700	6/6/93	2.18630	9

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
12/4/94	2	3	3.68219	99	99	99	99
2/20/94	8	1	2.89589	99	99	99	99
10/12/95	12	1	4.53699	99	99	99	99
10/13/95	12	3	4.53973	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/26/91	3	2	.40548	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
6/9/91	9	3	.19178	11/9/92	10	3	1.61370
8/16/92	14	4	1.38082	3/2/95	15	3	3.92329
99	99	99	99	99	99	99	99
1/28/94	7	3	2.83288	1/28/94	14	3	2.83288
7/30/91	7	4	.33151	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/1/95	10	4	4.00548	99	99	99	99
7/24/92	2	3	1.31781	99	99	99	99
99	99	99	99	99	99	99	99
6/13/92	15	4	1.20548	99	99	99	99
11/6/92	10	3	1.60548	99	99	99	99
4/11/93	4	3	2.03288	99	99	99	99
99	99	99	99	99	99	99	99
11/21/91	13	4	.64384	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/29/94	7	1	3.66849	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
11/5/92	7	3	1.60274	6/3/93	6	3	2.17808
99	99	99	99	99	99	99	99
4/29/92	6	4	1.08219	7/14/93	6	3	2.29041
99	99	99	99	99	99	99	99
8/2/95	3	4	4.34247	99	99	99	99
11/14/95	14	3	4.62740	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
2/17/95	15	3	3.88767	99	99	99	99	3
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
5/3/95	14	3	4.09315	99	99	99	99	3
99	99	99	99	99	99	99	99	0
9/17/95	3	4	4.46849	99	99	99	99	3
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
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66	1	2	65	152	45	19.48	3	3	99	99	99
34	1	2	33	140	38	19.39	2	2	99	99	99
54	1	2	52	173	58	19.38	2	2	99	99	99
30	1	2	17	170	56	19.38	3	5	99	99	99
41	1	2	33	150	44	19.37	1	2	99	99	99
35	2	5	34	155	46	19.29	2	2	1	99	9
47	1	2	46	168	54	19.23	3	3	99	99	99
40	1	2	40	145	40	19.22	1	2	99	99	99
38	2	2	30	130	32	19.21	1	1	1	99	9
30	1	2	19	157	47	19.16	1	2	99	99	99
48	2	2	39	155	46	19.15	4	4	5	99	99
52	1	2	52	160	49	19.14	2	3	99	99	99
29	1	2	29	160	49	19.14	3	3	99	99	99
56	1	2	55	180	62	19.14	2	2	99	99	99
41	1	2	40	168	54	19.13	2	3	99	99	99
53	1	2	42	168	54	19.13	3	3	99	99	99
34	2	2	33	150	43	19.11	3	3	1	99	9
35	2	2	31	150	43	19.11	4	4	1	99	9
45	2	5	41	150	43	19.11	3	4	5	1	9
46	1	2	45	150	43	19.11	3	4	99	99	99
64	2	5	63	150	43	19.11	4	4	5	16	9
35	1	4	34	155	46	19.09	2	2	99	99	99
60	2	2	58	157	47	19.07	4	5	5	9	9
58	1	2	56	152	44	19.04	2	2	99	99	99
37	2	2	34	147	41	19.04	2	2	5	99	1
62	2	2	61	145	40	19.02	4	4	5	9	9
34	1	2	19	150	43	19.02	4	3	99	99	99
61	2	3	31	167	53	19.00	3	4	5	99	1
44	1	2	44	147	41	18.97	1	3	99	99	99
31	2	4	30	155	45	18.92	1	2	1	99	9
40	2	2	36	155	45	18.92	1	1	1	99	9
47	2	2	46	140	37	18.85	1	2	5	99	1
35	2	2	32	142	38	18.85	3	4	1	99	9
36	2	2	26	142	38	18.85	4	3	1	99	9
42	2	2	34	165	51	18.82	2	2	1	99	9
31	2	2	31	160	48	18.80	2	2	1	99	9
62	1	2	63	160	48	18.80	3	2	99	99	99
23	2	2	23	152	44	18.77	2	3	1	99	9
28	1	2	24	165	51	18.73	2	3	99	99	99
50	2	2	47	165	51	18.73	3	4	3	99	9

13	14	15	16	17	18	19	20	21	22	23
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99	99	99	99	9	1	190	9	9	80	9
99	99	99	99	9	1	300	9	9	65	9
99	99	99	99	9	1	290	9	9	116	9
99	99	99	99	9	1	230	1000	9	9	9
9	9	99	9	9	1	9	1000	9	90	9
99	99	99	99	9	1	260	9	600	9	9
99	99	99	99	9	1	200	9	400	9	9
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99	99	99	99	9	1	290	9	9	108	1250
99	99	99	99	9	1	290	1125	9	9	9
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9	9	99	9	9	1	230	9	400	9	9
9	9	99	9	9	1	230	9	400	9	9
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99	99	99	99	9	1	230	9	400	9	9
12	99	99	99	9	1	230	9	400	9	9
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99	99	99	99	9	1	230	1000	9	90	9
35	99	99	99	9	1	290	9	9	9	9
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9	9	99	9	9	1	230	1000	9	9	9
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99	99	99	99	9	1	230	9	400	9	9
9	9	99	9	9	1	230	1000	9	90	1000
99	99	99	99	9	1	260	1125	9	100	9
9	9	99	9	9	9	99	99	99	99	99

24	25	26	27	28	29	30	31	32
9	2	9	9	500	700	3/31/96	5.00548	9
9	2	9	9	500	600	2/14/94	2.87945	1
9	2	9	9	500	800	11/19/93	2.64110	1
1250	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	700	7/29/94	3.33151	1
9	2	9	9	600	700	3/31/96	5.00548	9
9	2	9	9	500	800	10/29/91	.58082	1
750	3	9	9	500	600	3/31/96	5.00548	9
9	2	9	9	600	600	3/31/96	5.00548	9
9	1	9	9	500	700	2/9/93	1.86575	1
9	2	9	9	600	700	2/27/93	1.91507	1
9	3	9	9	500	800	10/3/92	1.51233	1
9	2	9	9	500	800	1/16/92	.79726	1
1250	3	1	9	500	800	7/25/91	.31781	1
9	3	9	9	500	800	11/6/93	2.60548	1
9	2	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	11/8/91	.60822	1
9	2	9	9	600	700	3/6/92	.93425	1
1250	3	9	9	600	700	4/9/93	2.02740	1
9	2	9	9	500	700	5/15/91	.12329	1
9	2	9	9	600	700	12/20/91	.72329	9
9	2	9	9	500	700	2/10/92	.86575	1
9	2	9	9	600	700	3/31/96	5.00548	9
9	2	9	1	500	700	3/31/96	5.00548	9
9	2	9	9	600	700	9/1/92	1.42466	1
99	0	9	9	600	9	2/27/92	.91233	1
9	3	9	9	500	700	5/20/92	1.13973	1
9	1	9	9	600	800	4/14/91	.03836	1
9	2	9	9	500	700	3/31/96	5.00548	9
9	2	9	9	600	700	2/9/95	3.86575	1
9	1	9	9	600	700	3/31/96	5.00548	9
9	2	9	9	600	600	3/31/96	5.00548	9
1000	3	9	9	600	600	3/31/96	5.00548	9
9	2	9	9	600	600	2/20/93	1.89589	1
9	2	9	9	600	800	5/1/95	4.08767	1
1000	3	9	9	600	800	3/31/96	5.00548	9
9	2	9	9	500	700	4/24/91	.06575	1
9	4	9	9	600	700	4/15/92	1.04384	1
1000	4	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	2/9/96	4.86575	1

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
2/14/94	6	4	2.87945	99	99	99	99
11/19/93	10	4	2.64110	99	99	99	99
99	99	99	99	99	99	99	99
7/29/94	6	4	3.33151	99	99	99	99
99	99	99	99	99	99	99	99
10/29/91	7	3	.58082	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
2/9/93	12	3	1.86575	99	99	99	99
2/27/93	9	3	1.91507	99	99	99	99
10/3/92	15	3	1.51233	99	99	99	99
1/16/92	13	3	.79726	99	99	99	99
7/25/91	3	3	.31781	99	99	99	99
11/6/93	15	4	2.60548	99	99	99	99
99	99	99	99	99	99	99	99
11/8/91	4	3	.60822	99	99	99	99
3/6/92	6	3	.93425	4/17/93	3	4	2.04932
4/9/93	12	4	2.02740	99	99	99	99
5/15/91	6	3	.12329	99	99	99	99
99	99	99	99	99	99	99	99
2/10/92	7	3	.86575	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
9/1/92	3	2	1.42466	99	99	99	99
2/27/92	8	1	.91233	99	99	99	99
5/20/92	10	3	1.13973	99	99	99	99
4/14/91	10	4	.03836	7/12/93	14	4	2.28493
99	99	99	99	99	99	99	99
2/9/95	13	4	3.86575	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
2/20/93	3	4	1.89589	99	99	99	99
5/1/95	14	4	4.08767	99	99	99	99
99	99	99	99	99	99	99	99
4/24/91	14	4	.06575	11/12/91	6	3	.61918
4/15/92	6	2	1.04384	99	99	99	99
99	99	99	99	99	99	99	99
2/9/96	14	4	4.86575	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
2/16/94	3	4	2.88493	99	99	99	99	3
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
3/4/93	3	3	1.92877	8/12/94	3	3	3.36986	4
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1

1	2	3	4	5	6	7	8	9	10	11	12
40	1	5	36	155	45	18.73	2	2	99	99	99
46	1	2	46	155	45	18.73	1	4	99	99	99
47	1	2	41	155	45	18.73	3	4	99	99	99
45	1	2	45	185	64	18.70	2	3	99	99	99
51	2	2	46	150	42	18.67	3	3	5	5	9
65	2	2	65	137	35	18.65	4	4	5	10	9
36	2	2	34	145	39	18.63	2	2	1	99	9
65	2	2	64	140	36	18.62	2	2	5	16	9
56	1	2	54	175	57	18.61	2	2	99	99	99
23	2	2	15	150	42	18.60	2	2	1	99	9
48	2	3	47	145	39	18.55	3	3	3	99	9
52	2	2	52	145	39	18.55	3	3	5	6	9
69	2	2	67	135	34	18.54	2	2	5	15	9
50	1	2	50	180	60	18.52	2	3	99	99	99
40	1	2	39	152	43	18.47	1	2	99	99	99
24	1	4	24	160	47	18.45	1	2	99	99	99
43	1	2	41	163	49	18.44	3	3	99	99	99
61	1	2	59	163	49	18.44	3	3	99	99	99
25	2	2	16	145	39	18.43	2	2	1	99	9
36	2	2	33	145	39	18.43	2	1	1	99	9
56	1	1	56	168	52	18.42	4	4	99	99	99
32	2	4	30	147	40	18.41	2	2	1	99	9
32	2	4	28	140	36	18.38	2	1	1	99	9
45	1	2	37	173	55	18.38	2	3	99	99	99
35	2	2	35	140	36	18.37	3	4	5	99	1
26	2	2	25	160	47	18.36	3	4	1	99	9
49	1	2	49	157	45	18.31	2	2	99	99	99
37	2	2	28	165	50	18.31	2	3	1	99	9
23	1	2	20	178	58	18.31	3	4	99	99	99
52	2	2	48	135	33	18.29	2	1	3	99	9
49	1	2	38	180	59	18.21	1	4	99	99	99
57	1	2	55	180	59	18.21	3	4	99	99	99
38	1	2	38	163	48	18.20	3	2	99	99	99
38	2	2	36	150	41	18.20	2	3	1	99	9
31	1	3	30	150	41	18.16	1	2	99	99	99
38	2	2	38	140	35	18.15	2	1	1	99	9
23	1	2	22	178	57	18.09	2	2	99	99	99
35	1	2	35	180	59	18.09	3	4	99	99	99
36	1	2	36	160	46	18.08	1	3	99	99	99
37	1	2	37	147	39	18.07	2	1	99	99	99

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	9	1000	9	9	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	230	9	9	100	500
99	99	99	99	9	1	330	9	9	132	9
9	9	99	9	9	1	230	9	9	90	9
9	9	99	9	9	1	190	9	9	9	9
9	9	99	9	9	1	200	9	9	9	9
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99	99	99	99	9	9	99	99	99	99	99
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99	99	99	99	9	1	9	1125	9	100	750
9	9	99	9	9	1	200	9	9	80	9
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99	99	99	99	9	1	290	1125	9	65	9
12	99	99	99	9	1	200	9	9	80	9
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99	99	99	99	9	1	260	1000	9	100	1250
9	9	99	9	9	1	9	1000	9	80	9
99	99	99	99	9	9	99	99	99	99	99
9	9	99	9	9	1	190	9	400	9	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	300	9	600	9	1000
99	99	99	99	9	1	9	1000	9	9	9
99	99	99	99	9	1	9	9	9	80	9

24	25	26	27	28	29	30	31	32
9	1	9	1	500	700	12/7/95	4.69041	1
99	0	9	9	9	9	3/31/96	5.00548	9
9	3	9	9	500	700	5/8/92	1.10685	1
9	2	9	9	500	800	8/21/93	2.39452	1
9	2	9	9	600	700	4/12/94	3.03562	1
1000	2	9	9	600	700	4/11/95	4.03288	9
9	1	9	9	600	600	4/19/93	2.05479	1
9	2	9	9	600	600	3/31/96	5.00548	9
99	0	9	9	9	9	3/31/96	5.00548	9
750	3	9	9	600	700	8/4/91	.34521	1
9	2	9	9	600	600	12/19/91	.72055	1
9	2	9	9	600	600	7/12/91	.28219	1
9	2	9	9	600	600	3/24/92	.98356	1
9	2	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	500	700	10/9/91	.52603	1
9	1	9	9	500	700	8/20/91	.38904	1
9	1	9	9	500	800	6/19/94	3.22192	9
9	2	9	9	500	700	3/2/95	3.92329	1
9	2	1	9	600	600	10/21/94	3.56164	1
9	2	9	9	600	600	3/12/95	3.95068	1
9	3	9	9	500	800	8/5/93	2.35068	1
9	2	9	9	600	600	7/19/94	3.30411	1
9	3	9	9	600	600	10/14/92	1.54247	1
9	3	9	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	600	1/14/93	1.79452	1
9	3	9	9	600	700	6/24/92	1.23562	1
9	2	9	9	500	700	10/7/92	1.52329	1
9	2	9	9	600	800	5/4/91	.09315	1
9	2	1	9	500	800	3/31/96	5.00548	9
9	2	9	9	600	600	8/16/93	2.38082	1
9	1	9	9	500	800	11/21/93	2.64658	9
9	2	9	9	500	800	2/19/93	1.89315	1
9	4	9	9	500	800	11/8/92	1.61096	1
9	2	9	9	600	600	12/7/91	.68767	1
99	0	9	9	9	9	12/14/94	3.70959	1
9	2	9	9	600	600	12/17/91	.71507	1
99	0	9	9	9	9	5/27/91	.15616	9
9	3	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	500	700	4/10/95	4.03014	1
9	1	9	9	500	600	12/1/94	3.67397	1

33	34	35	36	37	38	39	40
12/7/95	7	3	4.69041	99	99	99	99
99	99	99	99	99	99	99	99
5/8/92	6	3	1.10685	99	99	99	99
8/21/93	3	3	2.39452	99	99	99	99
4/12/94	6	1	3.03562	99	99	99	99
99	99	99	99	99	99	99	99
4/19/93	15	3	2.05479	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/4/91	7	1	.34521	12/16/94	12	3	3.71507
12/19/91	12	3	.72055	99	99	99	99
7/12/91	6	4	.28219	5/1/95	10	3	4.08767
3/24/92	6	3	.98356	99	99	99	99
99	99	99	99	99	99	99	99
10/9/91	6	2	.52603	99	99	99	99
8/20/91	10	3	.38904	99	99	99	99
99	99	99	99	99	99	99	99
3/2/95	7	1	3.92329	99	99	99	99
10/21/94	4	3	3.56164	99	99	99	99
3/12/95	14	4	3.95068	99	99	99	99
8/5/93	14	3	2.35068	99	99	99	99
7/19/94	12	1	3.30411	99	99	99	99
10/14/92	10	3	1.54247	99	99	99	99
99	99	99	99	99	99	99	99
1/14/93	10	4	1.79452	99	99	99	99
6/24/92	9	1	1.23562	7/11/94	15	4	3.28219
10/7/92	12	4	1.52329	99	99	99	99
5/4/91	13	3	.09315	99	99	99	99
99	99	99	99	99	99	99	99
8/16/93	11	3	2.38082	99	99	99	99
99	99	99	99	99	99	99	99
2/19/93	2	3	1.89315	99	99	99	99
11/8/92	3	3	1.61096	99	99	99	99
12/7/91	3	4	.68767	99	99	99	99
12/14/94	6	4	3.70959	3/18/95	3	3	3.96712
12/17/91	7	3	.71507	7/9/93	15	4	2.27671
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/10/95	15	4	4.03014	99	99	99	99
12/1/94	15	3	3.67397	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	2
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99	99	99	99	99	99	99	99	1
1/12/96	14	4	4.78904	99	99	99	99	3
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
6/14/94	14	4	3.20822	99	99	99	99	3
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1

1	2	3	4	5	6	7	8	9	10	11	12
27	1	3	27	168	51	18.07	3	4	99	99	99
41	2	2	38	147	39	18.05	3	3	5	99	1
34	2	2	34	135	33	18.04	1	1	5	99	99
28	1	2	21	165	49	18.00	3	3	99	99	99
44	1	2	40	178	57	17.99	1	4	99	99	99
28	2	2	28	160	46	17.91	2	2	5	99	1
41	2	2	38	167	50	17.89	4	5	1	99	9
29	2	2	19	137	34	17.86	2	2	1	99	9
29	2	2	29	147	39	17.80	2	2	5	99	99
36	2	2	35	152	41	17.79	2	2	1	99	9
26	2	2	17	145	37	17.78	2	2	1	99	9
32	2	2	29	150	40	17.78	3	4	1	99	9
62	1	2	28	152	41	17.75	1	1	99	99	99
27	1	2	26	173	53	17.71	3	4	99	99	99
51	1	2	50	173	53	17.71	2	2	99	99	99
30	1	2	23	165	48	17.63	2	2	99	99	99
31	2	2	30	145	37	17.60	3	4	1	99	9
26	2	2	23	152	41	17.60	1	3	1	99	9
68	2	2	67	145	37	17.55	2	1	5	13	9
53	2	2	51	162	46	17.53	4	4	3	99	9
39	1	2	39	180	57	17.50	2	2	99	99	99
31	1	2	31	155	42	17.48	2	1	99	99	99
23	1	2	22	152	40	17.42	1	2	99	99	99
36	2	2	36	170	50	17.40	2	3	5	99	99
32	2	2	29	150	39	17.39	1	3	1	99	9
39	1	1	37	173	52	17.37	2	3	99	99	99
44	1	2	43	168	49	17.36	2	2	99	99	99
42	1	2	40	150	39	17.33	2	2	99	99	99
24	2	2	23	145	36	17.33	2	2	1	99	9
41	2	2	39	163	46	17.31	3	5	1	99	9
61	1	2	60	175	53	17.31	3	3	99	99	99
41	1	2	39	170	50	17.27	3	3	99	99	99
68	2	2	68	152	40	17.21	1	3	5	16	9
39	1	2	36	165	47	17.18	3	2	99	99	99
31	1	2	31	147	37	17.12	2	2	99	99	99
40	2	3	35	145	36	17.12	3	4	1	99	9
50	1	2	39	173	51	17.04	3	3	99	99	99
39	1	2	37	173	51	17.04	2	3	99	99	99
43	1	2	40	173	51	17.04	2	2	99	99	99
39	1	2	39	165	46	16.90	2	2	99	99	99

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	260	1125	9	9	1250
20	99	99	99	9	1	9	1000	9	90	9
99	1	10	99	9	1	190	9	9	65	9
99	99	99	99	9	1	260	1000	9	100	1000
99	99	99	99	9	1	290	1250	9	100	9
7	99	99	99	9	9	99	99	99	99	99
9	9	99	1	9	9	99	99	99	99	99
9	9	99	9	9	1	190	750	9	9	9
99	1	9	99	9	1	190	9	9	80	9
9	9	99	9	9	9	99	99	99	99	99
9	9	99	9	9	9	99	99	99	99	99
9	9	99	9	9	1	200	9	400	9	1250
99	99	99	99	9	1	200	9	9	9	9
99	99	99	99	9	1	290	1125	9	108	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	260	9	9	100	9
9	9	99	1	9	1	190	9	400	9	9
9	9	99	9	9	1	230	9	9	80	1000
9	9	99	9	9	1	190	9	9	65	9
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99	99	99	99	9	1	9	1250	9	100	9
99	99	99	99	9	1	230	9	9	90	9
99	99	99	99	9	1	230	9	400	9	9
99	1	9	99	9	1	9	1125	9	100	9
9	9	99	9	9	1	200	1000	9	9	9
99	99	99	99	9	1	260	9	600	9	9
99	99	99	99	9	1	260	9	400	9	9
99	99	99	99	9	1	190	9	400	9	9
9	9	99	9	9	9	99	99	99	99	99
9	9	99	9	9	9	99	99	99	99	99
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	260	9	9	100	9
9	9	99	9	9	1	9	9	9	80	9
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	190	9	400	9	9
9	9	99	9	9	1	190	9	9	90	9
99	99	99	99	9	1	260	9	600	9	9
99	99	99	99	9	1	260	9	600	9	9
99	99	99	99	9	1	9	1125	9	100	1250
99	99	99	99	9	1	230	9	9	100	1000

24	25	26	27	28	29	30	31	32
9	3	9	9	500	800	3/2/92	.92329	9
9	2	9	9	600	600	3/2/96	4.92603	1
9	2	9	9	600	600	8/19/95	4.38904	1
9	4	9	9	500	800	7/25/92	1.32055	1
9	3	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	600	9	3/31/96	5.00548	9
99	0	9	9	600	9	3/31/96	5.00548	9
9	2	9	9	600	600	7/9/94	3.27761	1
9	2	9	9	600	600	5/12/95	4.11781	1
99	0	9	9	600	9	12/29/91	.74795	1
99	0	9	9	600	9	11/23/95	4.65205	1
9	3	9	9	600	600	5/24/93	2.15068	1
9	1	9	9	500	700	3/31/96	5.00548	9
9	3	9	9	500	800	3/31/96	5.00548	9
99	0	9	9	9	9	3/31/96	5.00548	9
9	2	9	9	500	800	1/21/95	3.81370	1
9	2	9	9	600	600	10/6/91	.51781	1
9	3	9	9	600	600	1/13/96	4.79178	9
9	2	9	9	600	600	2/1/93	1.84384	1
99	0	9	9	600	9	3/31/96	5.00548	9
1500	3	9	9	500	800	8/2/94	3.34247	1
9	2	9	9	500	700	1/16/92	.79726	1
9	2	9	9	500	600	12/11/93	2.70137	1
9	2	9	9	600	800	3/27/95	3.99178	9
9	2	9	9	600	600	3/26/93	1.98904	1
9	2	9	9	500	800	11/9/95	4.61370	9
9	2	9	1	500	800	3/31/96	5.00548	9
9	2	9	9	500	600	4/12/92	1.03562	1
99	0	9	1	600	9	1/25/94	2.82466	1
99	0	9	9	600	9	8/10/92	1.36438	9
99	0	9	9	9	9	3/31/96	5.00548	9
1250	3	9	9	500	800	3/31/96	5.00548	9
9	1	9	9	600	600	3/31/96	5.00548	9
99	0	9	9	9	9	1/3/95	3.76438	1
9	2	9	9	500	600	3/11/93	1.94795	1
9	2	9	9	600	600	1/8/96	4.77808	1
9	2	9	9	500	800	4/3/94	3.01096	1
9	2	9	9	500	800	9/16/94	3.46575	1
9	3	9	9	500	800	11/13/93	2.32466	1
9	3	9	9	500	700	8/8/94	3.35890	1

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
3/2/96	13	1	4.92603	99	99	99	99
8/19/95	3	3	4.38904	99	99	99	99
7/25/92	1	1	1.32055	12/26/95	6	3	4.74247
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
7/9/94	15	3	3.27761	99	99	99	99
5/12/95	3	3	4.11781	99	99	99	99
12/29/91	10	4	.74795	6/5/92	12	4	1.18356
11/23/95	6	4	4.65205	99	99	99	99
5/24/93	9	3	2.15068	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/21/95	11	3	3.81370	99	99	99	99
10/6/91	10	4	.51781	4/3/95	14	4	4.01096
99	99	99	99	99	99	99	99
2/1/93	10	2	1.84384	99	99	99	99
99	99	99	99	99	99	99	99
8/2/94	14	4	3.34247	99	99	99	99
1/16/92	15	2	.79726	99	99	99	99
12/11/93	14	4	2.70137	99	99	99	99
99	99	99	99	99	99	99	99
3/26/93	3	3	1.98904	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
4/12/92	8	3	1.03562	99	99	99	99
1/25/94	8	3	2.82466	5/30/95	3	4	4.16712
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
1/3/95	12	3	3.76438	99	99	99	99
3/11/93	3	4	1.94795	99	99	99	99
1/8/96	14	4	4.77808	99	99	99	99
4/3/94	14	4	3.01096	99	99	99	99
9/16/94	10	2	3.46575	99	99	99	99
11/13/93	14	3	2.32466	99	99	99	99
8/8/94	6	4	3.35890	12/13/95	10	3	4.70685

41	42	43	44	45	46	47	48	49
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
1/19/94	10	3	2.80822	99	99	99	99	3
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2

1	2	3	4	5	6	7	8	9	10	11	12
31	1	2	23	160	43	16.85	1	2	99	99	99
31	1	2	27	155	40	16.85	1	3	99	99	99
53	1	4	50	155	40	16.83	1	1	99	99	99
51	2	2	50	160	43	16.80	4	5	5	99	1
44	2	2	44	163	44	16.67	2	3	5	2	9
48	1	2	46	145	35	16.65	2	1	99	99	99
41	2	4	40	155	40	16.65	2	2	1	99	9
58	1	2	58	170	48	16.61	1	4	99	99	99
31	2	2	31	165	45	16.49	2	2	1	99	9
37	2	1	37	165	45	16.49	2	2	1	99	9
59	2	2	57	155	40	16.46	1	2	5	2	9
24	2	2	18	152	38	16.45	3	4	1	99	9
66	2	2	65	154	39	16.44	1	5	5	15	9
37	1	2	32	142	33	16.44	1	1	99	99	99
45	2	2	45	144	34	16.40	3	3	3	99	9
44	1	2	36	180	53	16.36	3	3	99	99	99
67	2	2	66	163	43	16.32	2	2	5	16	9
25	2	2	23	165	44	16.16	3	4	1	99	9
40	2	2	38	140	31	16.07	1	2	1	99	9
66	2	2	61	145	34	16.03	1	2	5	19	9
36	1	2	35	175	49	16.00	2	2	99	99	99
56	1	2	56	170	46	15.83	1	3	99	99	99
40	1	2	39	157	39	15.82	2	2	99	99	99
43	1	2	43	155	38	15.82	2	3	99	99	99
43	1	2	29	165	43	15.79	2	1	99	99	99
37	1	2	28	185	54	15.78	4	3	99	99	99
41	1	2	40	160	40	15.43	2	1	99	99	99
44	1	3	42	157	38	15.42	2	1	99	99	99
26	2	2	19	145	32	15.40	2	1	1	99	9
35	2	2	32	152	35	15.25	3	2	1	99	9
63	1	2	61	152	35	15.15	1	1	99	99	99
29	2	1	21	150	34	15.11	4	3	5	99	99
65	2	2	64	160	38	14.72	2	1	5	99	1
49	1	2	41	163	39	14.68	2	3	99	99	99
49	1	1	45	165	39	14.33	1	1	99	99	99
33	1	2	27	180	45	13.89	2	3	99	99	99
42	1	2	41	178	44	13.89	3	3	99	99	99
51	1	1	51	178	42	13.26	2	2	99	99	99

13	14	15	16	17	18	19	20	21	22	23
99	99	99	99	9	1	230	9	400	9	1000
99	99	99	99	9	1	230	9	9	80	9
99	99	99	99	9	1	200	9	400	9	9
30	99	99	99	1	1	230	9	400	9	9
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99	99	99	99	9	1	9	750	9	9	9
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9	9	99	9	9	1	200	9	400	9	9
99	99	99	99	9	1	190	9	9	65	9
9	9	99	1	9	1	9	750	9	65	750
99	99	99	99	9	9	99	99	99	99	99
9	9	99	9	9	1	230	9	9	9	9
9	9	99	9	9	1	230	9	400	9	9
9	9	99	9	9	1	160	9	9	65	9
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99	1	6	99	9	1	190	9	9	65	9
36	99	99	99	9	1	9	750	9	9	9
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99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	9	99	99	99	99	99
99	99	99	99	9	1	230	9	9	90	9
99	99	99	99	9	1	9	1000	9	9	9

24	25	26	27	28	29	30	31	32
9	3	9	9	500	700	3/31/96	5.00548	9
750	3	9	9	500	600	9/14/92	1.46027	1
9	2	9	9	500	600	10/4/94	3.51507	1
9	2	9	9	600	700	9/25/95	4.49041	1
1250	2	9	9	600	700	5/11/94	3.11507	9
9	1	9	9	500	600	3/31/96	5.00548	9
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9	1	9	9	500	800	3/31/96	5.00548	9
9	3	9	9	600	700	4/10/94	3.03014	9
9	3	9	9	600	700	3/31/96	5.00548	9
9	2	1	9	600	600	1/14/95	3.79492	9
99	0	9	9	600	9	9/8/94	3.44384	1
9	2	9	9	600	600	3/31/96	5.00548	9
9	2	9	1	500	600	3/31/96	5.00548	9
9	3	9	9	600	600	7/1/93	2.25479	1
99	0	9	9	9	9	10/2/93	2.50959	1
9	1	9	9	600	700	7/24/91	.31507	1
750	3	9	9	600	700	8/29/95	4.41644	1
9	2	9	9	600	600	1/6/94	2.77260	1
750	3	9	9	600	600	4/22/93	2.06301	1
9	3	9	9	500	800	11/7/94	3.60822	1
9	2	9	9	500	700	2/8/96	4.86301	9
99	0	9	9	9	9	8/30/91	.41644	9
9	2	9	9	500	600	8/10/93	2.36438	1
1250	3	9	9	500	700	5/18/91	.13151	1
9	2	9	9	500	800	7/8/93	2.27397	1
9	2	9	9	500	600	8/30/91	.41644	1
99	0	9	9	9	9	6/14/92	1.20822	1
9	2	9	9	600	600	9/28/93	2.49863	1
9	2	9	9	600	600	2/1/96	4.84384	1
9	1	9	9	500	600	3/31/96	5.00548	9
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9	1	9	9	600	700	8/8/91	.35616	1
9	2	9	9	500	600	9/18/93	2.47123	1
99	0	9	9	9	9	3/21/96	4.97808	1
99	0	9	9	9	9	5/18/94	3.13425	1
9	2	9	9	500	700	6/29/92	1.24932	1
1250	2	9	9	500	700	10/3/91	.50959	1

33	34	35	36	37	38	39	40
99	99	99	99	99	99	99	99
9/14/92	10	2	1.46027	3/30/94	6	4	3.00000
10/4/94	13	3	3.51507	3/17/95	12	4	3.96438
9/25/95	10	1	4.49041	99	99	99	99
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
7/28/93	10	4	2.32877	99	99	99	99
99	99	99	99	99	99	99	99
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99	99	99	99	99	99	99	99
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9/8/94	3	3	3.44384	99	99	99	99
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99	99	99	99	99	99	99	99
7/1/93	8	3	2.25479	99	99	99	99
10/2/93	14	3	2.50959	99	99	99	99
7/24/91	3	2	.31507	99	99	99	99
8/29/95	9	1	4.41644	99	99	99	99
1/6/94	6	3	2.77260	99	99	99	99
4/22/93	8	3	2.06301	99	99	99	99
11/7/94	7	4	3.60822	2/17/96	7	3	4.88767
99	99	99	99	99	99	99	99
99	99	99	99	99	99	99	99
8/10/93	10	4	2.36438	99	99	99	99
5/18/91	3	4	.13151	99	99	99	99
7/8/93	10	1	2.27379	99	99	99	99
8/30/91	4	3	.41644	99	99	99	99
6/14/92	3	2	1.20822	99	99	99	99
9/28/93	10	2	2.49863	99	99	99	99
2/1/96	13	1	4.84384	99	99	99	99
99	99	99	99	99	99	99	99
11/16/93	6	4	2.63288	99	99	99	99
8/8/91	3	4	.35616	99	99	99	99
9/18/93	12	3	2.47123	99	99	99	99
3/21/96	10	2	4.97808	99	99	99	99
5/18/94	6	2	3.13425	99	99	99	99
6/29/92	2	3	1.24932	99	99	99	99
10/3/91	13	4	.50959	99	99	99	99

41	42	43	44	45	46	47	48	49
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
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99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	2
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	0
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1
99	99	99	99	99	99	99	99	1