

Risk Factors for Low Bone Mineral Density in Institutionalized Individuals with Developmental Disabilities

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ABSTRACT

Background: Persons with intellectual/developmental disabilities (IDD) are exposed to several factors, which have been determined as risks for osteoporosis. Many of these individuals are non-ambulatory, resulting in lack of weight bearing activity, which is well established as a major contributor to bone loss. The purpose of this study was to investigate risk factors for low bone mineral density (BMD) in persons with IDD residing in residential facilities.

Methods: This cross-sectional study was conducted at an Intermediate Care Facility for individuals with Intellectual and Developmental Disabilities (ICF/IDD). Medical records data were used from 69 individuals, including heel scan T-scores, nutritional, pharmacologic and other risk factors. Chi-Square analysis was used to determine relationships between the variables.

Results: BMD measures were not significantly associated with age, gender, height, weight, or BMI for this population ($P > 0.05$). The association between BMD diagnoses and DSM-IV classification of mental retardation approached significance ($P = 0.063$). A significant association was found with anti-seizure medication ($P = 0.009$).

Conclusion: Follow-up studies should focus on how supplementation and medication changes may or may not alter BMD. Persons with IDD are experiencing longer life expectancies, and therefore, studies ascertaining information on diseases associated with this aging population are warranted.

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Introduction

Intellectual/developmental disability (IDD) is a condition in which there are significant limitations to an individual's ability in intellectual functioning

and in adaptive behavior, which includes daily social and practical skills and have an onset at any point of time prior to when an individual attains

18 years of age.¹ According to the Administration on Intellectual and Developmental Disabilities (AIDD), between 1.2 and 1.65 percent of the total US population live with IDD. Moreover, a recently published epidemiological study revealed that prevalence of any IDD has increased by 17.1% from 1997 - 1999 to 2006 - 2008.²

IDD is usually a lifelong problem with sustained impact on an individual's major life activities including language, mobility, learning, self-care, and capability of independent living.³ The medical care for intellectually/developmentally disabled individuals is complex, therefore, such patients are often taken care of in intermediate care facilities.^{4,6} Individuals with IDD have been shown to be at increased risk of osteoporosis.⁷⁻¹⁰

Osteoporosis, a systemic skeletal disease, is characterized by reduced bone mass or bone mineral density (BMD) and structural deterioration of bone tissue, leading to thin and porous bones with a subsequent increased likelihood of fractures.¹¹ There is also data to suggest that fracture rates are higher in individuals with IDD than in the general US population.^{4,12,13} Moreover, a strong inverse association was documented between BMD and fracture risk, with a 2 to 3 fold rise in fracture risk for one standard deviation (SD) decrease in BMD.¹⁴

Despite a wide range of noninvasive techniques available for determining BMD, the use of quantitative ultrasound instruments has received attention as the method of choice for BMD assessment with regard to intellectually/developmentally disabled population, due to the behavioral and physical limitations of this population group.^{7,8,15,16} Other advantages of this equipment include; portability (weighing approximately 20 pounds), does not involve ionizing radiations, enables easy measurement of BMD, and provides BMD results in less than one minute.^{15,17} Furthermore, considerable amount of studies support the correlation of ultrasound measurements of the heel with hip fracture risk.¹⁸⁻²⁰

In order to establish appropriate protocol for identifying high-risk persons as well as prevention of low BMD in persons with IDDs who reside in a residential facility, it is important to explore risk

factors for low BMD in these groups. The aim of this study was to ascertain if there is a relationship between the dependent variable (BMD) and independent variables [age; gender; height; weight; (DSM-IV, Axis I diagnoses, Axis II diagnosis, and Axis III diagnoses); medications; diseases; diet; history of fractures; ambulation; body mass index; and menstrual cycle (if applicable)].

Materials and Methods

Participants and Procedures

The present study was a cross-sectional study of individuals living in an Intermediate Care Facility for individuals with Intellectual and Developmental Disabilities (ICF/IDD), licensed by the State Department of Mental Health. The inclusion criteria for the clients to participate in the study were being over 21 years of age, having an official BMD report that was completed at the facility and a completed consent form by parents or guardians. The participants were excluded if they did not satisfy the aforementioned eligibility criteria.

In January of 2011, family members and legal guardians ($n = 201$) of those living in the facility were mailed a consent form along with a cover letter briefly explaining the purpose of the study. Contact information of the primary researcher was provided for those family members/guardians wanting further information about the study. A self-addressed, stamped envelope was provided for returning the consent form.

All clients living in this ICF/IDD must have a Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) diagnosis of Mental Retardation to reside in the facility. The clinical terms for the DSM-IV for Axis II category are Borderline Mental Retardation, Mild Mental Retardation, Moderate Mental Retardation, Severe Mental Retardation, and Profound Mental Retardation. Although clients in the facility do not require any Axis I or Axis III diagnosis to reside at the ICF/IDD, many clients have multiple diagnoses in both. All these diagnoses (if applicable) are listed in the clients' medical file as well as the Axis II diagnoses.

Two primary researchers were granted access to medical files within the facility for the sole pur-

pose of this study. The nursing staff of the facility briefly identified and explained the portions of the files needing to be explored. The graduate researchers independently examined all individual medical files and documented the information onto separate data sheets. They then cross-referenced their data sheets for correctness. If a discrepancy was found, the file would be re-examined by the graduate researchers together and incorrect information on data sheets would be replaced with correct information.

Measures

Most residents at this ICF/IDD are scanned annually using a heel scan test with the results recorded in their respective medical files. In this study, the most recent scan (usually within the past year) was used for analysis. Independent variables analyzed separately were: age, gender, height, weight, Axis I (mental illness), Axis II (Mental Retardation), and Axis III (medical) diagnoses, medications, diseases, diet (including supplementation), history of fractures, ambulation, body mass index (BMI), and menstrual cycles (if applicable). The dependent variable was BMD.

Medication changes were noted as they occur in each client's medical files by the Medical/Nursing department. All prescribed medications within the past year were logged for this study, yet only those listed on the data sheet were later used in assessing the relationship between medications and BMD levels. Those medications included medicines related to specific illnesses and diseases. These illnesses and diseases included endocrine, hematologic, rheumatologic, pulmonary, gastrointestinal, renal, bone, sarcoidosis, porphyria, hypophosphatemia, and seizures.

Statistical Analysis

SPSS Version 20 statistical software was used to analyze the data. Chi-Square analysis was used to determine relationships between the variables. Alpha was set at 0.05. A power analysis was performed using G*Power. Power was set at 0.80, and the alpha was set at 0.05. Results of the analysis showed that a sample size of 143 was needed to detect a medium effect (0.3).

Statistical analyses for descriptive statistics and tests presented in the results section (such as chi squared tests) should be added.

Ethical Considerations

The Research Committee of the ICF/IDD and the Institutional Review Board (IRB) of the University provided approval for this study.

Results

There were 81 consent forms returned to the researcher (39% response rate). Of the consent forms being returned, 11 (14%) were excluded due to being incomplete or illegible, and one (<1%) was excluded due to the individual being under 21 years of age. There were a total of sixty-nine participants accepted for this study. The age range of the participants was 23 to 67 years of age ($M = 41.27$ years, $SD = 11.55$). There were 39 males (57%) and 30 females (43%). Ninety-six percent ($n = 66$) of the participants were ambulatory.

Descriptive statistics of participants' information is presented in table 1. T-scores ranged from -3.4 to 2.0 for the 69 participants. The overall, mean T-score was -1.31, $SD = 1.40$. The mean T-scores varied between the Axis II diagnoses: borderline mental retardation ($n = 5$, $M = -1.20$, $SD = 1.30$), mild mental retardation ($n = 8$, $M = -1.00$, $SD = 1.51$), moderate mental retardation ($n = 7$, $M = -1.57$, $SD = 1.51$), severe mental retardation ($n = 14$, $M = -0.71$, $SD = 1.44$), and profound mental retardation ($n = 35$, $M = -1.26$, $SD = 1.38$).

Over 52% ($n = 36$) of the participants in this study had healthy BMD, while nearly 32% ($n = 22$) were classified as osteopenic, and 16% ($n = 11$) osteoporotic. No associations were found between BMD and age, gender, height, weight, or BMI ($P > 0.05$). Seizure medications had a significant relationship with BMD categories of healthy, osteopenic, or osteoporotic BMD ($\chi^2 = 23.62$, $P = 0.009$).

Although Axis II diagnosis did not prove to have a significant relationship with BMD, it did

approach significance ($\chi^2 = 14.83, P = 0.063$). There were no other relationships that met or approached any form of significance in this population. Of interest however, is that although the *P*-value for Axis II diagnosis was not significant,

several participants having borderline mental retardation had some of the lowest BMD levels. It was discovered that five of these individuals had an Axis III (medical) diagnosis of Prader-Willi Syndrome (PWS).

Table1: Descriptive Statistics of Participants' Information (*n* = 69)

Axis II diagnosis	Percentage	Mean Age (yrs) Mean (SD)	T score Mean (SD)	BMI (Mean) Mean (SD)
Borderline	7.2%	38.60 (5.45)	-1.20 (1.30)	28.0 (2.11)
Mild	11.6%	44.75 (13.50)	-1.00 (1.51)	27.2 (5.73)
Moderate	10.1%	39.43 (13.91)	-1.57 (1.51)	27.6 (5.87)
Severe	20.3%	42.86 (10.14)	-0.71 (1.44)	24.1 (3.52)
Profound	50.7%	43.17 (11.64)	-1.26 (1.38)	24.4 (4.73)

Discussion

Previous research identified risk factors for low BMD in the healthy, normal population.²¹⁻²³ Studies of individuals with IDD reported the same risk factors.^{5,7,8,10} Data collected in the present study suggests that individuals living in this particular residential facility do not share the same risk factors as previous studies of IDD.^{5,7,8,10} Participants in the present study live in a residential facility; have varying degrees of intellectual/developmental disabilities, mental health and medical issues; are provided 24-hour a day health care services; and have access to up-to-date medicines and nutritional supplements.

This study identified a significant association between BMD and anti-seizure medications. These results were similar to Schmidt, et al. (2004) who conducted a cross-sectional study investigating BMD risk factors in an ICF/IDD program.⁵ Although there appears to be a strong relationship existing between these two variables, one must consider if the relationship warrants altering any anti-seizure medication to lower BMD. Additional studies should be conducted to address issues related to the use of anti-seizure medications and its relationship with low BMD.

Results concerning age and its impact on BMD are mixed. Zystra et al. found a relationship between age and BMD in a study involving an outpa-

tient, medical, residential, and day habilitation program for individuals with IDD.¹⁰ On the contrary, the results of the present study revealed that age did not have a significant effect on BMD. When considering this population's increase in life expectancy, fractures will also increase due to osteoporosis.⁹ Moreover, with the change in philosophy for the needs of individuals to live independently; one must consider the importance of research of health needs of this population in the near future. Policy-shifts of deinstitutionalization of this population began in the late 1960's and continue today.^{24,25} In fact, between 1990 and 2002, the number of individuals residing in public institutions for 16 or more residents declined from 84,818 to 44,252 persons (48%). Private institutions of the same type declined 30%, while the number of nursing facility residents declined by 31%. Funding for public facilities decreased by 15%, while taking into account inflation.²⁶ As institutions decrease, so do the opportunities to study a large number of individuals under controlled environments. Besides, lost will be individuals who have unique medical familiarity and knowledge of these individuals by working with them over several years.

The results of the present study are subject to limitations. This study included only one interme-

diate care facility in a small region of the US; therefore, the results reported are not truly generalizable to the population with developmental disabilities. Caution must be applied while interpreting the cause and effect relationship because of the cross-sectional design and no adjustments were made for the effects of potential confounding variables. It is noteworthy that due to lack of participants, we did not have adequate statistical power to detect the relationships between the targeted variables. Clearly, future studies with larger sample sizes from multiple facilities are warranted.

Conclusion

Follow-up studies should focus on how supplementation and medication changes may or may not alter BMD. The majority of the individuals in this study have co-morbid health concerns, requiring a multitude of medications. Longitudinal research identifying baseline data of BMD medications could prove beneficial. The findings in this study also suggest further research in the area of BMD levels and prescriptions for growth hormones of individuals with PWS is warranted. Lastly, institutional policies should be reviewed and potentially updated to include IDD individuals receiving early bone scans to prevent osteoporosis among this at-risk population.

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Competing interest

The authors do not have any financial or personal conflict of interest related to this paper.

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