Association between Age at First Birth and BMD in premenopausal, perimenopausal individuals

AABA 2025, poster

| Abstract:  It is understood that reproduction has effects on the skeletal system, including the depletion of calcium from maternal bone stores during gestation and lactation. It is also known that the adolescent period of human development is essential to the accrual of total bone mineral density, which in turn is crucial to the prevention of osteoporosis and other detrimental bone-density loss disorders later in life. The aim of this study is to understand if there is a relationship between AFB and early osteoporosis, and if so, are individuals whose first births occurred before the age of peak BMD accrual (PBMDA, accepted to be around 20 years of age) at a higher risk for early osteoporosis than individuals whose first births occurred at/after the age of PBMDA. This study used both whole spine and femoral neck BMD as a measure of osteoporosis, demographic information, and AFB reports from publicly-available CDC NHANES data from 1999-2018. Preliminary analyses of a subsection of the larger data (2007-2008, 2009-2010) suggest that there is no statistically significant relationship between AFB before PBMDA and osteoporosis. Analyses indicate there may be an association between AFB before PBMDA and decreased BMD measurements, suggesting beginnings of premature degradation, such as osteopenia, which will be further explored in the larger analyses. This study delivers detailed analyses of NHANES longitudinal data in respect to potential associations between young motherhood and premature skeletal degradation, aiming to provide baseline information for important future studies considering the relationships between pregnancy, lactation, and skeletal health. |
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| * NHANES dataset   + 1999-2018?     - Large dataset, maybe too large for quick analysis   + 2010-2018?     - Starts where other studies left off, maybe too small   + 2008-2018?     - 10 years, maybe not large enough? * BMD as an indicator of osteoporosis * BMD of lumbar spinal, femoral neck, and total femoral seem to be the most widely used areas of interest   + DXA whole body has lumbar spine BMD, DXA femur has femoral neck and total femur * Focus on age at first birth, not lactation for this comparison * Cross sectional study: observational studies that analyze data from a population at a single point in time; often used to measure the prevalence of health outcomes, understand determinants of health, and describe features of a population * Many similar analyses seem to be using LMM, one-way ANOVAs, or linear regression, logistic regression * Imputing missing values? Vs removing them * Average age of menopause accepted by Menopause. *Nat Rev Dis Primers* 1, 15054 (2015). <https://doi.org/10.1038/nrdp.2015.54> at 49yo |
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| Codes:  DEMO\_X: demographic data, year  DEMO\_H: 2013-2014 Demographics Data - Continuous NHANES  DEMO\_I: 2015-2016 Demographics Data - Continuous NHANES  DXX\_X\_X: DEXA scan data; femur, spine, whole body; year  DXX\_H: 2013-2014 Dual-Energy X-ray Absorptiometry - Whole Body  DXX\_I: 2015-2016 Dual-Energy X-ray Absorptiometry - Whole Body  RIAGENDR: gender, coded 1 = male, 2 = female  RHQ031 - Had regular periods in past 12 months  RHD043 - Reason not having regular periods |
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Research questions:

1. Is there a relationship between parity and BMD in premenopausal and perimenopausal individuals?
2. Relationships between x and BMD
3. Is there a relationship between interbirth intervals and BMD in premenopausal, perimenopausal individuals?
   * 1. Are individuals with shorter interbirth intervals at higher risk for pregnancy- and lactation-associated osteoporosis (PLO) than individuals with longer interbirth intervals?
        1. We already know that a shorter IBI puts individuals at a higher risk for postmenopausal osteoporosis, but does this trend extend backwards in the window of fertility for younger, still-reproducing individuals?
   1. Is there a relationship between age at first birth and BMD in premenopausal, perimenopausal individuals?
      1. Are individuals whose first births occurred before the age of peak BMD at higher risk for PLO than individuals whose first births occurred during or after the age of peak BMD?
         1. “Age at attainment of peak femoral neck, total hip and lumbar spine BMD were 18.7 years, 19.0 years and 20.1 years, respectively in females” (Xue et al., “Age at Attainment of Peak Bone Mineral Density and Its Associated Factors.”)
4. If there is a relationship found, what evolutionary mechanisms are or are not at work to maintain this detrimental effect of pregnancy?

Hypotheses:

1. I predict that there will be an inverse relationship between parity and BMD in premenopausal, perimenopausal individuals, meaning that as the number of offspring an individual has increases, their BMD will decrease.
   1. I predict that there will be a direct relationship between interbirth intervals and BMD in premenopausal, perimenopausal individuals, meaning that as the length of interbirth intervals decreases, BMD will also decrease because the skeleton will not have adequate amounts of time to recover lost vitamins and minerals.
   2. I predict that there will be a direct relationship between age at first birth BEFORE peak BMD accrual and current BMD in premenopausal, perimenopausal individuals, meaning that as the age of first reproduction decreases, so will BMD. I also predict that this relationship will differ when the age of first birth occurs after peak BMD accrual, and then not demonstrate a relationship.