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Smoking and Depressive Symptoms in Adolescent Girls Are "Red Flag" for Postmenopausal Osteoporosis

First-Time Study Shows Smoking and Depression in Adolescents have Negative Impact on Bone Mineral Density, say Investigators in the *Journal of Adolescent Health*

Philadelphia, PA, April 3, 2013 – Depression, anxiety, and smoking are associated with lower bone mineral density (BMD) in adults, but these factors have not previously been studied during adolescence, when more than 50% of bone accrual occurs. This longitudinal preliminary study is the first to demonstrate that smoking and depressive symptoms in adolescent girls have a negative impact on adolescent bone accrual and may become a red flag for a future constrained by low bone mass or osteoporosis and higher fracture rates in postmenopausal years. The study is published in the *Journal of Adolescent Health*, the official journal of the Society for Adolescent Health and Medicine (SAHM).

Osteoporosis is a costly health problem. Although it is primarily evident in postmenopausal women, its roots can be traced to periods of growth, including adolescence. The National Osteoporosis Foundation estimates that ten million Americans already have osteoporosis and an additional 34 million are at risk. In 2005, there were an estimated two million fractures attributed to osteoporosis costing an estimated $19 billion. These numbers are expected to rise to three million fractures and $25.3 billion in costs each year by 2025, presenting a significant public health burden.

Meta-analyses have shown that adult depression is associated with osteoporosis and lower bone mineral density (BMD). Smoking also has a negative impact on bone health, with adult smokers having lower BMD compared to nonsmokers, likely increasing lifetime fracture risk by as much as 31%.

Depression and anxiety increase in adolescence, particularly in girls, and smoking and alcohol use are often initiated at this time. Both depression and substance use often become chronic after adolescence. There is however a dearth of information on whether these factors affect bone accrual in adolescence.

Investigators from the Cincinnati Children's Hospital, University of Cincinnati College of Medicine, and The Pennsylvania State University recruited 262 healthy girls between 11 and 19 years from a teen health clinic in a large children's hospital and its surrounding community to represent typically developing adolescents and enrolled them in four age cohorts (11, 13, 15, and 17 years). The goal was to have each age cohort reflect the number of smokers proportional to national statistics. The girls each attended three annual onsite visits. Phone interviews were conducted at three-month intervals between annual visits.

Bone accrual trajectories from ages 11 to 19 were estimated for total-body bone mineral content (TB BMC) and lumbar spine and total hip bone mineral density (BMD).

Investigators found that while smokers entered adolescence with equivalent levels of lumbar spine and total hip BMD, overall BMD accrual across adolescence was significantly lower as smoking frequency increased. Depressive symptoms showed a slightly different pattern. Girls with higher levels of symptoms had significantly lower lumbar spine BMD consistently across adolescence. There also was no association between alcohol use or anxiety symptoms or their interactions with age on any bone measure.

"Adolescence is a crucial period of development that lays the foundation for women's health across the lifespan," says lead investigator Lorah D. Dorn, PhD, of Cincinnati Children's Hospital Medical Center and University of Cincinnati College of Medicine, Department of Pediatrics, Cincinnati, Ohio. "As much bone is accrued in the two years surrounding menarche as is lost in the last four decades of life.

"To our knowledge, our study is the first to test and demonstrate that smoking behavior and depressive symptoms in girls have a negative impact on bone accrual across adolescence. It may be premature to advocate screening for BMD in adolescents with depressive symptoms or those who smoke, but our study should be replicated to determine whether greater vigilance in monitoring bone mineral status is necessary," she concludes.

In a commentary published in the same issue Giovanni Cizza, MD, PhD, MHSc, and Kristina I. Rother, MD, MHSc, of the National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, praised the clinical and public health importance of the research question and mentioned a number of potential biological and social factors that may have contributed to these interesting results, such as the role of body-mass index (BMI), socio-economic status, meal schedules, and the difficulty of identifying depressive symptoms in adolescence, which is "a time of great changes and psychological turmoil."

Cizza and Rother pose a number of questions, concluding that, "More research is needed to better understand the mechanisms mediating bone accrual; as an example, do sleep disturbances, whether due to depressive symptoms or simply secondary to voluntary sleep deprivation, impair bone accrual?"

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NOTES FOR EDITORS

"Longitudinal Impact of Substance Use and Depressive Symptoms on Bone Accrual Among Girls Aged 11-19 Years," by Lorah D. Dorn, PhD, Sarah J. Beal, PhD, Heidi J. Kalkwarf, PhD, Stephanie Pabst, Med, Jennie G. Noll, PhD, and Elizabeth J. Susman, PhD. DOI: http://dx.doi.org/10.1016/j.jadohealth.2012.10.005

"An Ounce of Prevention: Securing Bone Health in Adolescence," by Giovanni Cizza, MD, PhD, and Kristina I. Rother, MD. DOI http://dx.doi.org/10.1016/j.jadohealth.2013.01.016

Both are published in the *Journal of Adolescent Health*, Volume 52, Issue 4 (April 2013), published by Elsevier.

Full text of the article is available to credentialed journalists upon request. Contact Eileen Leahy at 732-238-3628 or e.leahy@elsevier.com to obtain copies. Journalists wishing to interview Lorah D. Dorn should contact Nicholas Miller at 513-803-6035, nicholas.miller@cchmc.org, or Jim Feuer at 513-636-4656, jim.feuer@cchmc.org. Journalists may contact Giovanni Cizza at cizzag@intra.niddk.nih.gov.

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