

## SWAN Fact Sheet: Bone Health over the Menopause Transition\*

Osteoporotic fractures usually occur in older postmenopausal women, however, bone loss leading to osteoporosis begins before menopause. The SWAN study followed a cohort of initially pre- and early perimenopausal women through the transition into postmenopause, and longitudinally tracked their bone health; we list below the major findings.

- A period of fast bone loss starts one year before the final menstrual period. This is generally (but not always) when there has been no menses for 3 or more months but some bleeding in the last year [1]. Bone loss is fast for around 3 years, and continues in postmenopause, but more slowly [2].
- During the period of fast loss, bone density declines on average about 2% each year, with greater declines in the spine than in the hip. Over 10 years, cumulative bone density decline is around 10% [2]. This is accompanied by loss of bone quality and strength (the ability to resist breakage or fracture) [3,4].
- Women who lose more bone density during the menopause transition have more fractures in postmenopause [5].
- Women with earlier menopause have lower bone density in postmenopause and more fractures [6].
- Several SWAN findings demonstrate the importance of looking beyond bone density:
  - Women who are obese have greater bone density than women without obesity [7], but it does not necessarily translate to more bone strength [8]. Obese women had as many fractures as non-obese women in SWAN, but compared to non-obese women with similar bone density, obese women had significantly more fractures [8].
  - Bone density is higher in women with type 2 diabetes than in women without diabetes; yet, bone strength is lower in diabetic women [9] and they experience more fractures than women without diabetes [10]. This may be due to lower bone quality [11], earlier menopause, and faster bone loss in diabetic women [10].
  - A higher level of C-reactive protein, a marker of inflammation, that has been related to life stresses and adversity, is associated with greater bone density, but not with greater bone strength. SWAN women with higher levels of C-reactive protein had more fractures than women with lower levels of C-reactive protein [12]. In addition, increase in C-reactive protein level over time was associated with faster decline in bone density [13].

### What can you do to maximize bone health?

- In premenopausal and early perimenopausal women, physical activity, be it doing housework or sports and regular exercise, is associated with greater bone density and bone strength [14,15]. Thus, women who are physically active enter the menopause transition (when bone is lost) with greater bone reserves.
- Vitamin D sufficiency (25-hydroxyvitamin D levels >20 ng/ml) increased over time in SWAN women [16]. SWAN women with adequate vitamin D levels had fewer fractures than women with low levels [17].
- Working with your health care provider to control body weight, blood glucose, and chronic inflammation is important for overall health. Whether doing so also lessens bone loss cannot be learned from SWAN; clinical trials of the effects of lowering glucose, inflammatory markers, and weight on bone loss are needed.

**For more information, please check out:**

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10. Khalil N, Sutton-Tyrrell K, Strotmeyer ES, Greendale GA, Vuga M, Selzer F, Crandall CJ, and Cauley JA. Menopausal bone changes and incident fractures in diabetic women: a cohort study. *Osteoporosis international.* 2011 May; 22(5): 1367-76.
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13. Greendale GA, Jackson NJ, Han W, Huang M, Cauley JA, Karvonen-Gutierrez C, Karlamangla AS. Increase in C-Reactive Protein Predicts Increase in Rate of Bone Mineral Density Loss: The Study of Women's Health Across the Nation. *JBMR Plus.* 2021 Apr; 5(4): e10480.
14. Greendale GA, Huang MH, Wang Y, Finkelstein JS, Danielson ME, Sternfeld B. Sport and home physical activity are independently associated with bone density. *Medicine and Science in Sports and Exercise* 2003 Mar 1;35(3):506-12.
15. Mori T, Ishii S, Greendale GA, et al. Physical activity as determinant of femoral neck strength in adult women. Findings from The Hip Strength Across The Menopausal Transition Study. *Osteoporos Int* 2014; 25: 265–72.
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\*SWAN recognizes that race is a social construct and that including race/ethnicity in describing our findings is complicated, with there being reasons for and against doing such. We and others are actively reviewing the best approach to ensure that we provide patients with the best information about their health.