

# Bone Health and Falls: Fracture Risk in Breast Cancer Survivors With Chemotherapy-Induced Amenorrhea

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**M**ore than two million breast cancer survivors are living in the United States, with about 24% of them diagnosed prior to menopause (aged 50 years and older) (American Cancer Society, 2007). Although type of treatment varies with disease stage, most breast cancer survivors are treated with chemotherapy and hormone therapy. Although hormone manipulation is reserved for survivors with estrogen receptor-positive tumors, this receptor status is found in most breast cancers (American Cancer Society; Eifel et al., 2001). Premenopausal breast cancer survivors are at risk for chemotherapy-induced amenorrhea (Bruning et al., 1990; Goodwin et al., 1999) that abruptly reduces circulating estrogen levels after menopause. Breast cancer survivors treated with aromatase inhibitors (AIs) experience additional declines in estrogen from nonovarian sources. Low estrogen is associated with bone loss (Shapiro, Manola, & Leboff, 2001) and neuromuscular declines, and chemotherapy for breast cancer may compound these losses with the associated bone and muscle loss (Cheney, Mahloch, & Freeny, 1997; Demark-Wahnefried et al., 2001; Freedman et al., 2004; Greep et al., 2003; Harvie, Campbell, Baildam, & Howell, 2004; Kutynec, McCargar, Barr, & Hislop, 1999), weight gain (Costa, Varella, & del Giglio, 2002; Demark-Wahnefried et al., 2001; Demark-Wahnefried, Rimer, & Winer, 1997; Demark-Wahnefried, Winer, & Rimer, 1993; Hoskin, Ashley, & Yarnold, 1992), and neurologic symptoms such as numbness in extremities (Boehmke & Dickerson, 2005) and cognitive difficulties (Ahles et al., 2002; Schagen, Muller, Booger, Mellenbergh, & van Dam, 2006) that could contribute to falls (American Geriatric Society, 2001; Richardson & Hurvitz, 1995). Poor bone health and increased fall risk contribute to heightened risk for fracture (Frost, 2001); therefore, treatment-related side effects could increase fracture risk in prematurely menopausal breast cancer survivors.

More than two-thirds of breast cancer survivors aged 40 years and older and 40% of breast cancer survivors younger than age 40 experience chemotherapy-induced

**Purpose/Objectives:** To describe risk factors for fracture—bone health and falls—among breast cancer survivors with chemotherapy-induced amenorrhea.

**Design:** Cross-sectional and prospective cohort.

**Setting:** National Cancer Institute-designated cancer center in the Pacific northwest region of the United States.

**Sample:** Breast cancer survivors with chemotherapy-induced amenorrhea (N = 35;  $\bar{X}$  age = 46 years; one year after chemotherapy) compared to cancer-free controls (N = 26;  $\bar{X}$  age = 41 years).

**Methods:** One two-hour testing session at baseline, 12-month follow-up, monthly postcards.

**Main Research Variables:** Clinical characteristics and number of falls, leg strength, bone mineral density (BMD), body composition, and bone turnover.

**Findings:** No significant differences between groups for BMD at either time point. Significantly more breast cancer survivors had low-spine BMD based on T scores and elevated bone turnover versus controls at baseline and follow-up. Breast cancer survivors with low-spine BMD have significantly lower body mass index, lean mass, and leg strength, and had stage II disease more often than breast cancer survivors with normal BMD. Significantly more breast cancer survivors (75%) experienced at least one fall compared to 46% of controls. Among breast cancer survivors, those who had fallen had significantly lower leg strength and calcium intakes than those who had not.

**Conclusions:** Breast cancer survivors with chemotherapy-induced amenorrhea, particularly those with muscle weakness, may be at increased risk of fracture.

**Implications for Nursing:** Breast cancer survivors with chemotherapy-induced amenorrhea should be evaluated for low bone mass and fall risk and considered for therapeutic intervention to lower fracture risk.

amenorrhea (Bruning et al., 1990; Goodwin et al., 1999). Premenopausal-aged women who stop menstruating during or following cancer therapy have a 10%–15% lower spine bone mineral density (BMD) compared to women who retain menses (Bruning et al.; Headley, Theriault, LeBlanc, Vassilopoulou-Sellin, & Hortobagyi, 1998). Prospective studies report annual rates of bone