

## Young Investigator Award

### Poster Number 006

#### PROMOTING PERIMENOPAUSAL BONE HEALTH: WHAT'S THEORY GOT TO DO WITH IT?

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**BACKGROUND:** Although bone mineral density (BMD) loss accelerates during perimenopause, current guidelines do not support BMD testing to determine individualized osteoporosis risk before menopause. Most primary health care providers rely on updated information as an educational intervention to promote modifiable bone health behaviors, but few experimental studies are conducted to explore and compare the immediate effects of this information on prevention intentions.

**METHODS:** The Perimenopausal Bone Health Behaviors Model applied the *Theory of Planned Behavior (TPB)* to determine how perimenopausal women view participation in bone health behaviors (calcium intake, vitamin D intake, physical activity) and how they intentionally and behaviorally respond to updated osteoporosis prevention information typically provided in clinical practice, compared to this information with individualized BMD test results using dual energy X-ray absorptiometry (DXA) of the femoral neck, hip, lumbar spine, and forearm. A longitudinal repeated measures experimental study design randomly assigned 150 healthy perimenopausal women, ages 35-55 to a group (n=75) receiving DXA and bone health information or to a group (n=75) receiving only bone health information. Baseline demographic and anthropometric data were collected; *TPB* Prevention Intentions Questionnaire and Behaviors Questionnaire (7-day recall) were developed and administered at baseline, two weeks and two months following interventions.

**RESULTS:** 149 of 150 women completed the study. 32% of DXA group women had low bone density (T-score  $\leq -1.0$ ). Information group women increased daily calcium intake (mg) to higher-than-recommended levels ( $M = 1961.32, SD \pm 727.05$ ). DXA group women had overall higher vitamin D intake (units)  $F(1.60, 235.20) = 17.53, p < .001$ ; only women with low bone density increased daily vitamin D intake to adequate levels ( $M = 1018.47, SD \pm 1629.90$ ). The overall model predicted 27% (DXA group) to 62% (information group) of variance in *Intentions* toward preventive behaviors.

**CONCLUSIONS:** Many women enter menopause with unknown low bone density. Perimenopausal women receiving baseline DXA operationalize osteoporosis prevention behaviors differently than do women receiving only traditional prevention information. Earlier BMD screening using theoretical applications to prevention interventions may contribute to early detection of women at highest risk for osteoporosis, and may provide health care professionals with effective behavioral change strategies.

## Young Investigator Award

### Poster Number 007

#### APPROPRIATENESS OF REFERRALS TO A TERTIARY REFERRAL CENTRE FOR BMD TESTING

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**Introduction:** Evidence-based guidelines for who should have a DXA scan are well established. Much attention has appropriately focussed on increasing the proportion of persons at high risk for fracture being referred for such investigation, as many studies show current practice is suboptimal. Waiting times for DXA scans have increased substantially in some tertiary referral centres such as ours because of 1) increased awareness among referring-providers, 2) cutbacks in DXA resources and 3) at times patients or physicians with some knowledge of osteoporosis pressuring the service for a 'screening' test. Screening scans and diagnostic criteria for younger persons (such as premenopausal women) are controversial. Studies show several thousand women would need a DXA test at age 50 compared to 70 years to prevent a single fracture. Little literature exists on the extent of inappropriate requests for DXA.

**Aims:** To assess the prevalence of inappropriate requests for DXA studies at our centre using modified I.S.C.D. guidelines.

**Methods:** Collection/ analysis of data were approved by the local Ethics committee. All referrals are vetted by a consultant I.S.C.D. certified physician.

Requests are prioritized, based on established I.S.C.D.criteria, into 3 categories: 1. Priority, 2. Routine, 3. Repeat (Based on our centre's L.S.C. and patient profile). Inappropriate requests (no indication) are returned to the referring-provider for reconsideration. All referrals for an appointment in the latter half of 2008 were included in this study.

**Results:** 2025 DXA referrals reviewed: new requests=1297 and repeat=728. Information was missing on many requests(e.g. menopausal status, BMI). There were 392(19%) priority referrals, 72% of whom were not taking bone protection therapy. Almost 1 in 4 requests did not have an obvious indication for a DXA; details are shown in table-1.

Compared to those deemed appropriate for DXA scanning, inappropriate referrals were more likely to be younger females, had no risk factors for osteoporosis, have an inappropriate referral reason and have less/missing information (table-1).

Conclusions: There are significant delays in obtaining a DXA at our centre including patients who appear high risk for fracture but are not on treatment. This is in part due to increased demand and cutbacks but also requests for individuals who do not meet criteria for a DXA. Education of referring physicians should focus on not only improving referrals for subjects at high risk, but also inappropriate referrals for subjects at low risk.

Table 1: DXA Referrals

	New Referrals	Repeat Studies
Total number	1297	728
Women(%)	1242(96)	703(96)
Mean Age(Range)yrs	20-89	20-85
Priority Referrals(%) (e.g. persons >50 yrs not on treatment with fragility fracture(74), Persons >50 yrs not on treatment taking systemic steroids(58)	310(24)	82(11)
Routine Referrals(%) (e.g., 'postmenopausal screen')	653(50)	424(58)
Inappropriate(%) (e.g. 'no reason stated(108)', 'back pain(50)', 'osteoarthritis(90)')	314(24)	218(30)

## Young Investigator Award

### Poster Number 008

#### COMMUNITY BASED OSTEOPOROSIS SCREENING AND EDUCATION OF ETHNICALLY DIVERSE POPULATIONS BY PHARMACY STUDENTS

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#### Background

Pharmacy students are an effective and underutilized resource for identifying women at risk for osteoporosis through bone mineral density (BMD) screenings and for providing osteoporosis prevention education.

#### Methods

Screenings were done at 13 no-cost community based health fairs in Los Angeles County and Orange County, California, from August 2008 to November 2009, by pharmacy students under the supervision of clinical pharmacists. Using a questionnaire, participants were asked about osteoporosis risk factors including diet, exercise, caffeine intake, calcium intake and vitamin D intake. BMD measurements were obtained by ultrasound scanning of the trabecular bone of the right foot using the Lunar Achilles Express to generate a T-score. After BMD results were obtained, participants received in-depth individualized counseling from pharmacy students, based on the questionnaire and T-score, as well as recommendations for lifestyle and nutritional modifications to improve bone health. Women with T-scores less than or equal to -1.0 were advised to see a physician for a complete DEXA scan and follow-up. Women without access to a healthcare provider were given information regarding access through local community clinics.

#### Results

In total, 615 women received a BMD screening from pharmacy students at the community outreach events. The ethnic breakdown of the participants was 69% Asian, 17% Caucasian, 11% Hispanic, 1% African American, 2% reported other. Consultations were provided in Korean, Vietnamese, Cantonese, Mandarin, Spanish, Farsi, Russian and English. 64% of the women were postmenopausal. 44% of the women were taking calcium supplements at the time of the screening. 53% had T-scores greater than or equal to -1.0, 42% had T-scores between -1.0 and -2.5, and 5% had T-scores less than or equal to -2.5. Additional subgroup data will be presented.

#### Conclusions

Community based BMD screening by pharmacy students at health fairs is an effective way to identify women at risk for osteoporosis and individually counsel participants in-depth on osteoporosis prevention. This model can be used to target high risk populations in underserved areas and is a viable option for other health professionals. These outreach efforts have also been popular with the public. In the future, we will ask participants to complete a self-addressed postcard which we will send to them two months later for a follow-up.

## Young Investigator Award

### Poster Number 009

#### **GENISTEIN AGLYCONONE DEMONSTRATES A PROTECTIVE AND REVERSIBLE EFFECT ON THE DEVELOPMENT OF STEROID-INDUCED SECONDARY OSTEOPOROSIS AND INCREASES BONE BREAKING STRENGTH IN VIVO**

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Genistein aglycone has been shown in several studies to increase bone mineral density (BMD) at the lumbar spine and femoral neck in osteopenic, postmenopausal women with no clinically significant adverse effects on the breast and uterus. In order to clarify the efficacy of genistein aglycone in the management of the underlying metabolic processes of glucocorticoid-induced osteoporosis (GIO), the following studies were conducted. The first study was carried out to assess the effectiveness of genistein aglycone in the preventive management of GIO-induced bone loss and osteonecrosis of the femoral head. In addition to a steady decrease in bone formation, a rapid weakening of bone architecture and an increase in fracture risk, chronic administration of glucocorticoids also cause avascular necrosis. A Sprague-Dawley rat model of GIO was used in this study, in which 28 female rats received injections of 30 mg/kg methylprednisolone (MP), MP + genistein (5 mg/kg, equivalent to 54 mg/day in humans), genistein alone or vehicle for 60 days. At the end of treatment, genistein was found to not only maintain but also increase BMD and bone mineral content (BMC). Serum levels of the bone formation marker, bone-alkaline phosphatase (b-ALP) were increased in the genistein group, while levels of carboxy-terminal collagen cross links (CTX), a bone resorption marker were reduced. Administration of genistein succeeded in preserving femoral breaking strength and prevented osteonecrosis, bone erosion and maintained a normal bone architecture equivalent to the vehicle group. A second study aimed to assess how genistein aglycone compared in effectiveness with alendronate. A similar animal model was used, in which GIO was induced by daily injections of MP (30 mg/kg) followed by treatment with genistein (5 mg/kg), alendronate (0.03 mg/kg) or vehicle for an additional 60 days. The genistein group demonstrated a greater increase in BMD, BMC, and in breaking strength compared to animals treated with alendronate. As seen in the previous study, the genistein treated animals also had significantly increased b-ALP serum levels and CTX levels. Genistein showed positive histological evidence of reducing bone and cartilage erosion and was able to reverse GIO more effectively than alendronate. Collectively, these results suggest that naturally derived isoflavones like genistein aglycone might be a potential new therapy for the prevention of GIO, the most important secondary cause of osteoporosis in humans. Genistein aglycone may also prevent necrotic deterioration of the femoral head caused by glucocorticoid use and could represent a unique therapy that combines powerful bone-forming as well as anti-resorptive activity. Human clinical trials are needed to assess these possibilities.

## Young Investigator Award

### Poster Number 010

#### QUANTITATIVE CT (QCT) CAN SURVEY BONE DENSITY DURING PET-CT STUDIES OF ONCOLOGY PATIENTS - THE FIRST 100 STUDIES

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**BACKGROUND:** Oncology patients are at increased risk of osteoporosis but are infrequently screened. We report our method of capturing bone density during routine performance of oncologic PET-CT studies.

**METHODS:** Study was IRB approved. 105 adult patients scheduled for FDG PET-CT (Discovery LS, GE, Milwaukee, WI) were enrolled following informed consent. In 10 patients, studies were repeated after an interval of  $179 \pm 39$  days. 15 studies were excluded due to non-malignancy (4), technical errors (7), or inability to analyze L1-L3 (3 bony metastases, 1 spinal surgery). 100 studies remained for analysis. Calibrated QCT phantom was placed under the patient and commercial software was used for analysis (QCT PRO, Mindways Software, Austin TX). Following standard PET-CT image acquisition, CT slices were reconstructed as recommended (kv 140, ma 90, 2.5 mm thickness). BMD of L1, 2 and 3 was averaged. T- and Z-scores were derived from the normative UCSF database and findings correlated with patient history, including chemotherapy. Acquired CT images were evaluated for the extent and severity of beam hardening which was correlated with clinical and technical factors.

**RESULTS:** In 100 studies performed, BMD of L1-3 averaged  $123.8 \pm 40.3$  mg/cc (mean  $\pm$  SD) (Table 1). Z score, reflecting standard deviation from age and gender matched controls, averaged  $-0.45 \pm 3.04$ . Though not statistically significant, values trended lower for patients having received prior chemotherapy ( $119.1 \pm 36.3$  mg/cc) than for chemo-naïve ( $133.6 \pm 46.9$  mg/cc) (p value = 0.09). Z score in post-chemotherapy patients ( $-0.76 \pm 3.51$ ) was also slightly lower than in chemo-naïve ( $0.20 \pm 1.49$ ) (N.S., p=0.14). While there was no clinically significant degradation in CT, beam hardening correlated significantly with patient weight and arm position (p<0.05). In 10 patients with repeat studies, an interval decrease in BMD ( $-3.3 \pm 9.7$  mg/cc) and Z-score ( $-0.10 \pm 0.29$ ) were noted which was greater in patients treated with interval chemo than those without interval therapy (small sample size precludes inferences).

**CONCLUSION:** We have successfully performed QCT in 100 PET-CT studies. QCT methodology is readily applicable to PET-CT and allows serial evaluation of BMD without additional radiation dose or inconvenience in this at-risk population. We observed a moderate decrease in BMD as compared to previously-described controls, most pronounced in patients having received chemotherapy.

Summary findings first 100 patients			
Group	N	BMD (mg/cc)	Z-score
All	100	$123.8 \pm 40.3$	$-0.45 \pm 3.04$
Chemo	68	$119.1 \pm 36.3$	$-0.76 \pm 3.51$
Naïve	32	$133.6 \pm 46.9$	$0.20 \pm 1.49$