**Title:** Impact of a pharmacist-implemented protocol on calcium monitoring and safety outcomes with denosumab use in ambulatory patients

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**Introduction:** Denosumab is associated with an increased risk of hypocalcemia. In 2017, a pharmacist-implemented protocol at Mercy Clinic Family Medicine (MFM) was developed to monitor denosumab osteoporosis therapy. The objective of this study was to assess the impact of the MFM protocol on calcium monitoring for patients taking denosumab.

**Methods:** This retrospective cohort analysis included patients who received a denosumab injection from 12/13/2017 - 12/1/2019. MFM clinic patients were matched 1:1 to patients from other Mercy East Communities clinics. The primary outcome was percentage of patients with a calcium level drawn within 30 days prior to denosumab administration. Secondary outcomes included additional safety and efficacy endpoints for denosumab. Chi-square or Fisher's exact tests, with a 2-sided alpha level of 0.05, were used to determine a difference between groups for all outcomes, except days since last calcium level, which was analyzed using a student's t-test.

**Results:** In the 206 patients included in the study, MFM patients were more likely to have a calcium level drawn within 30 days before denosumab injection (85% vs 48%, $p < 0.001$). MFM patients also had fewer days between documented calcium level and denosumab administration (mean 24 vs 98, $p = <0.001$). There was no significant difference seen in the other secondary outcomes.

**Conclusions:** The pharmacist-implemented protocol at MFM significantly improved the frequency of calcium monitoring before denosumab administration. This significant difference did not translate to the secondary clinical outcomes. The results show that pharmacists can have a significant impact on the appropriate monitoring of denosumab.