Supplemental Online Content

Dawood NB, Shu ML, Tseng C-H, et al. An electronic medical record–based decision support tool for the diagnosis of primary hyperparathyroidism. *JAMA Intern Med*. Published online July 25, 2022. doi:10.1001/jamainternmed.2022.2684

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This supplemental material has been provided by the authors to give readers additional information about their work.

Online-Only Material

eTable 1. CPT/ICD-9 Codes for Nonparathyroid Causes of Hypercalcemia

CPT Code	Description
179378	HYPERCALCEMIA ASSOCIATED WITH CHRONIC DIALYSIS
179376	HYPERCALCEMIA DUE TO A DRUG
179372	HYPERCALCEMIA DUE TO GRANULOMATOUS DISEASE
179374	HYPERCALCEMIA DUE TO HYPERTHYROIDISM
179375	HYPERCALCEMIA DUE TO IMMOBILIZATION
295851	HYPERCALCEMIA DUE TO LITHIUM
179373	HYPERCALCEMIA DUE TO SARCOIDOSIS
179377	HYPERCALCEMIA DUE TO THIAZIDE AND VITAMIN A
371448	HYPERCALCEMIA OF MALIGNANCY
736778	HISTORY OF MALIGNANCY ASSOCIATED HYPERCALCEMIA
179382	MAHC (MALIGNANCY ASSOCIATED HYPERCALCEMIA)
179383	MALIGNANCY ASSOCIATED HYPERCALCEMIA
ICD-9 728.88	RHABDOMYOLYSIS

eTable 2. CPT Codes for Calcium-Rich Metal Implantation in Orthopedic Surgery Patients

CPT Code	Description
27487	REVISE KNEE JOINT REPLACE, ALL PARTS
27134	REVISE TOTAL HIP REPLACEMENT
11011	DEBRIDE ASSOCIATED OPEN FRACTURE/DISLOCATION SKIN/MUSCLE
11010	DEBRIDE ASSOCIATED OPEN FRACTURE/DISLOCATION SKIN/SUBCUTANEOUS

eTable 3. ICD9 and ICD10 Codes for Clinical Sequelae of Primary Hyperparathyroidism

ICD-9/ICD-10 Codes	Description
ICD-10: S72 ICD-9: 820, 821	FEMUR FRACTURE
ICD-10: S12	CERVICAL FRACTURE
ICD-10: S32	LUMBOSACRAL FRACTURE
ICD-10: S22.0	THORACIC FRACTURE
ICD-9: 805, 806	SPINAL FRACTURE
ICD-10: N20 ICD-9: 592.0	NEPHROLITHIASIS/NEPHROCALCINOSIS
ICD-10: M85.8, M80, M81.0 ICD-9: 733.9, 733.00, 268.2	OSTEOPENIA/OSTEOPOROSIS
ICD-10: E21.3 ICD-9: 252.0	HYPERPARATHYROIDISM

eFigure. EMR-Based Tool Prompting PTH Assessment in Patients with Hypercalcemia

eMethods. Subjects and Methods (Expanded)

Tool Design: The tool was developed as a "Best Practices Advisory" within the Epic Systems Software. It appears as a pop-up notification in the orders tab of the patient chart. The algorithm is designed to detect abnormal calcium values in the two years prior to implementation and firing. The display includes both normal and abnormal historical calcium levels for reference; normal values do not prompt firing of the alert. Physicians in the departments of primary care, endocrinology, orthopedic surgery, and endocrine surgery were given the following options to address the alert: (1) order PTH alone or PTH with calcium, (2) defer to another provider (alert reappears in next encounter), (3) dismiss alert (temporarily cancels alert), or (4) deem the alert inappropriate for this patient (prompts free text response).

Exclusion Criteria: The exclusion criteria were an estimated glomerular filtration rate (eGFR) <30 mL/min/1.73 m^3 [0.5mL/s/m^2] or a history of ≥1 serum level monitoring the use of an immunosuppressant (sirolimus, tacrolimus, everolimus, mycophenolic acid, and cyclosporine), to exclude those with secondary and tertiary hyperparathyroidism due to renal transplantation, respectively. Patients with secondary hyperparathyroidism attributable to vitamin D deficiency (serum 25-OHD <30 ng/mL [74.9 nmol/L]) were excluded as well. Also excluded were patients with recorded diagnoses of non-parathyroid causes of hypercalcemia and elevated calcium levels caused by calcium-rich metal implantation during recent orthopedic surgery (Appendix A&B).

Baseline Period: During a silent run-in period from March 2020 to May 2020, the alert was active but invisible to users, which enabled the acquisition of baseline data. Patients in the silent run-in period were followed until September 2020, resulting in a median follow-up of 5 months. While they did not

undergo PTH work-up during this silent period, they still met criteria to re-trigger the alert during the active implementation period. Patients from the silent period were included in the intervention group if they underwent PTH work-up following alert activity during the implementation phase of the study.

Statistical Methods: We used Fisher's exact test to compare categorical variables, and the Wilcoxon rank-sum test to compare continuous variables between patients with and without PTH measurement. All tests were two-sided and all analyses performed in R-3.6.2 (www.r-project.org).