Effect of Electronic Clinical Decision Support on 25(OH) Vitamin D Testing

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INTRODUCTION

There has been significant interest in vitamin D due to the high prevalence of deficiency and the association between low levels and numerous disease states such as cancer and autoimmune disease.[1] However, routine testing for 25(OH) vitamin D levels is not recommended. The Endocrine Society and Choosing Wisely endorse screening only in those with high-risk conditions.[2]

We evaluated whether a Best Practice Advisory (BPA) incorporating the Choosing Wisely guidelines at the time of order entry could decrease the rate of testing. We also sought to understand the most common reasons providers order vitamin D levels.

METHODS

An EHR-based BPA on vitamin D testing was implemented in the ambulatory clinic sites of Stanford Health Care on June 28, 2016. This retrospective cohort study evaluated orders attempted between June 1, 2015, and June 30, 2017. Informed consent was waived by our institutional review board.

When an order for 25(OH) vitamin D was placed, the EHR queried the patient chart for a history of chronic kidney/liver disease, malabsorption, granuloma-forming disorders, malignancy, diabetes, immunocompromised state, obesity, hyperparathyroidism, known deficiency, medications that increase risk for deficiency, and previous falls. If no such comorbidity was documented, an alert explained the low utility of testing. The provider could then cancel the order or override the alert with the option of entering a justification.

Our primary outcome was the vitamin D order rate, defined as the number of 25(OH) vitamin D orders per primary care visits. The order rates in the year before and after the intervention were compared using the Wilcoxon test. Shapiro-Wilk tests were performed for data normality. Free-text comments were manually reviewed and assigned to general categories by two providers, and if there was a discrepancy, a third reviewer established a consensus. Inter-rater agreement was analyzed by Cohen's kappa coefficient. All analyses were performed using SAS 9.4 (SAS Institute, Cary, NC).

RESULTS

In the year prior to the intervention, there were 59,096 vitamin D orders and 354,901 primary care visits, corresponding to an order rate of 16.7%. After the BPA was implemented, there was an immediate drop to 13.9% in July 2016 with a sustained lower testing rate of 15.7% from September 2016 to June 2017. Overall, the intervention was associated with a relative decrease of 7.2% ($p = .001$) corresponding to a savings of $300,000 annually (Fig. 1).

From July 1, 2016, to June 30, 2017, the alert fired 4592 times, 7% of all vitamin D orders. Figure 2 summarizes the BPA responses. Eleven percent of all alerts were followed. Fifty-nine percent of overridden alerts were done so with a clinical justification selected from a pre-set list of indications, the most common of which was monitoring of known vitamin D deficiency, followed by dark skin complexion. Of the alerts that were overridden with a selection of "other," 526 free-text comments were available for analysis.

The most common non-guideline-supported indications from the free-text comments were neurological symptoms (non-specific tingling, dizziness, headache), preventive care, risk factors for osteoporosis that were not guideline-supported (e.g., small frame, family history of osteoporosis), non-specific pain, and fatigue. Assessment of inter-rater agreement was excellent ($\kappa = 0.941$).

DISCUSSION

This study explores an ambulatory implementation of a BPA incorporating Choosing Wisely guidelines for 25(OH) vitamin D. Prior studies on reducing vitamin D testing have focused on
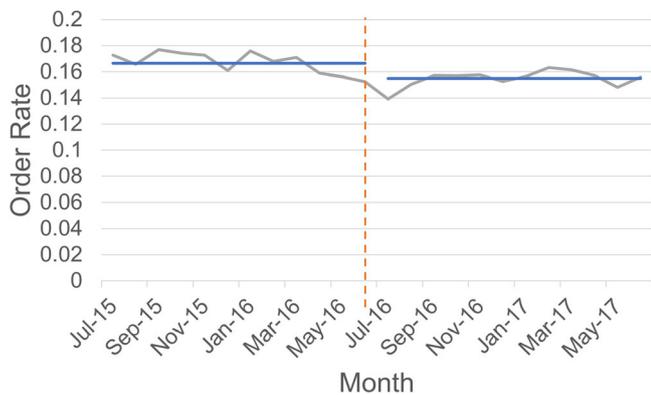
Figure 1 Vitamin D order rate before and after intervention. The order rate is defined as the number of 25(OH) vitamin D orders per primary care visits. The dashed line indicates the start of the intervention.

education and order restriction.[3] Our intervention was designed to be minimally disruptive by launching in only a small

percentage of orders, and less restrictive by allowing the provider to easily override the alert.

Our study has several limitations. The reduction in orders could have been confounded by recent emphasis on Choosing Wisely. However, because the decrease occurred soon after the BPA implementation, we believe that this effect is independent of the campaign. Another limitation is that this study was performed at a single academic healthcare system, limiting generalizability.

This study also provides insight into the most common reasons for vitamin D testing. We identify misconceptions regarding the role of vitamin D in neurological symptoms, osteoporosis prevention, non-specific pain, and fatigue, providing valuable data for further educational initiatives.

Our BPA demonstrates that it is possible to reduce utilization of testing while being minimally disruptive. Such interventions can promote cost-effective care while respecting physician autonomy and workflow.
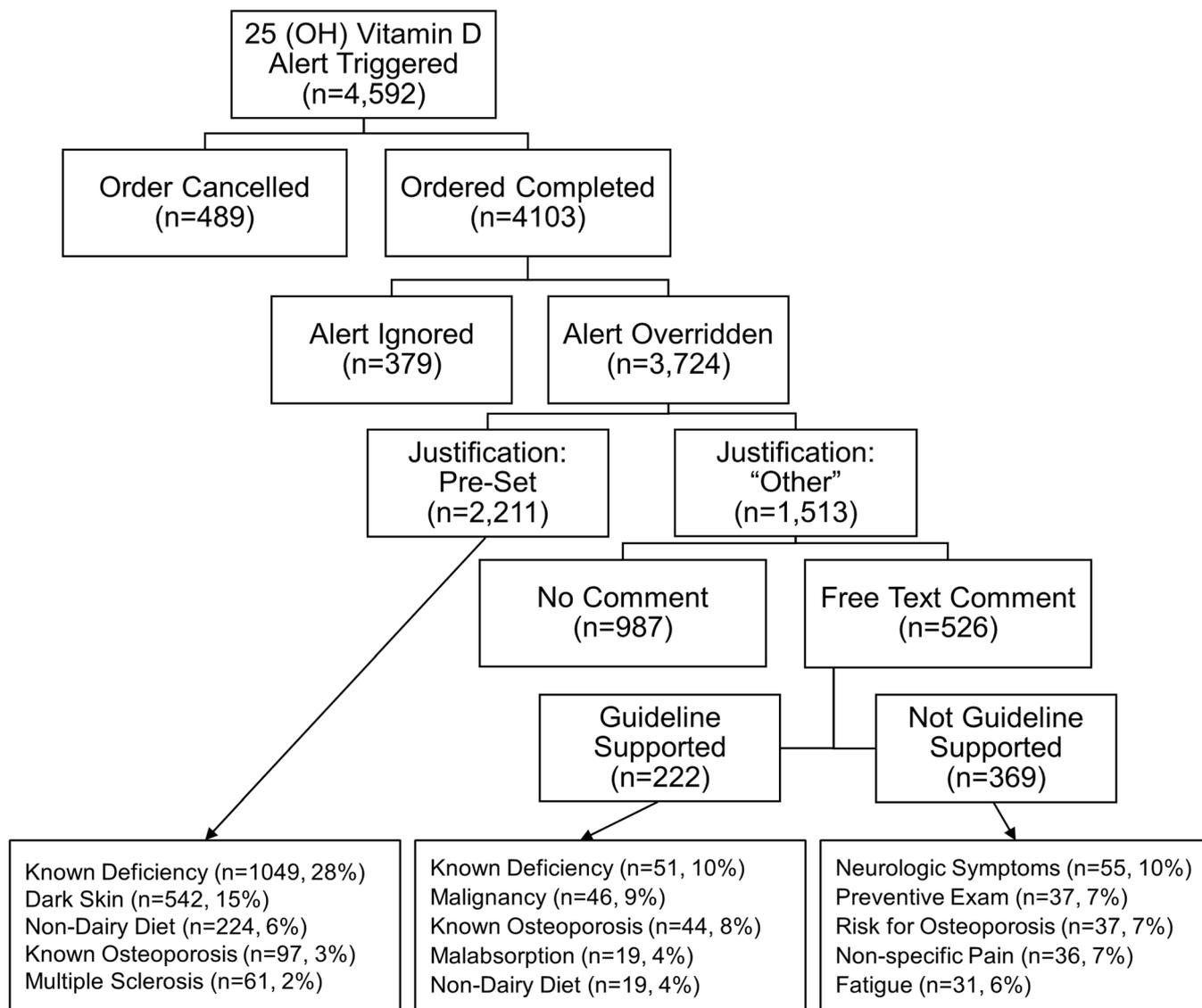

Figure 2 Responses to best practice alert. Providers adhered to, ignored, or overrode the alert. Overrides involved choosing from a pre-set list of justifications or choosing "Other" and then providing an optional free text response. The five most common justifications for overriding the alert are presented as a counts and percentages.

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Compliance with Ethical Standards:

Informed consent was waived by our institutional review board.

Conflict of Interest: *The authors declare that they do not have a conflict of interest.*

Prior Presentations: *None.*

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