Missed Doses of Venous Thromboembolism Prophylaxis: a Growing Problem Without an Active Management Strategy

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INTRODUCTION

Venous thromboembolism (VTE) is a leading cause of preventable harm among hospitalized patients. Consequently, considerable emphasis has been placed upon increasing prescription of VTE prophylaxis;¹ however, prophylaxis prescription does not ensure administration.

Evidence suggests many doses of prescribed VTE prophylaxis are not administered in both academic and community hospitals.² VTE prophylaxis non-administration has been associated with VTE.³ Since 2005, we have worked to improve VTE prophylaxis prescription using mandatory clinical decision support tools and prescriber performance feedback.⁴ Beginning in 2013, we have focused on interventions to improve VTE prophylaxis administration for hospitalized patients.⁴

The purpose of this study was to explore the relationship between prescription and non-administration of VTE prophylaxis in hospitalized patients. We hypothesized that non-administration would increase as prescription increased.

METHODS

In this retrospective study, we included all doses of prescribed pharmacologic VTE prophylaxis at The Johns Hopkins Hospital from January 1, 2006, through June 30, 2016. We collected data on prescription and administration from our electronic medication administration record system which requires documentation of the administration status of all doses. The Johns Hopkins Medicine Institutional Review Board approved this study.

We calculated the monthly mean number of doses prescribed in the pre-intervention (before July 1, 2013) and post-intervention (July 1, 2013, through June 30, 2016) periods. We compared the proportion of non-administered doses

in the pre- and post-intervention periods. We explored the relationship between prescribed VTE prophylaxis and non-administered doses using a Cochrane-Orcutt regression with first-order serial correlation. The regression included a break point on July 1, 2013, to assess the relationship between VTE prophylaxis medication doses prescribed and the proportion of doses not administered in the absence of interventions intended to reduce missed doses. Statistical analyses were performed using Stata/IC, version 15.1 (StataCorp, College Station, TX, 77845, USA).

RESULTS

During the study period, there were 2,622,093 doses of pharmacologic VTE prophylaxis prescribed. Of these, 377,269 (14.4%) were not administered. Monthly non-administration ranged from 8.9 to 19.4% (Fig. 1).

In the pre-intervention period, 259,165 of 1,690,655 (15.3%) prescribed doses of VTE prophylaxis were not administered. The monthly number of doses prescribed during this time increased 3-fold (range, 7,904–25,885) while the proportion of non-administered doses doubled (range, 8.9–19.4%) (Fig. 1). Non-administration increased 0.35% (95% CI, 0.16–0.53%; $p < 0.001$) for every additional 1000 doses prescribed during the same month for the pre-intervention period.

In the post-intervention period, 931,438 doses of VTE prophylaxis were prescribed and non-administration was significantly lower (15.3% vs. 12.7%, $p < 0.001$) (Fig. 1). The monthly mean number of doses prescribed was consistent (mean, 25,873; range, 24,355–27,737) (Fig. 1) in the post-intervention period.

DISCUSSION

As prescription of pharmacologic VTE prophylaxis increases, non-administration increases. This relationship highlights an important unintended consequence of implementing interventions that target only prescription. Fortunately, this relationship can be overcome with interventions to address non-administration.

Two main reasons for non-administration of VTE prophylaxis were previously identified: gaps in nurse knowledge and

Figure 1 Square dots (■) represent the monthly number of VTE prophylaxis medications doses prescribed, and circle dots represent the monthly proportion of VTE prophylaxis medication doses not administered. The solid black line represents the beginning of the post-intervention period when an active management program to decrease missed doses on VTE prophylaxis was implemented.

variation in patient preferences.⁴ Nurses have reported feeling that VTE prophylaxis is overprescribed, and that they sometimes withhold VTE prophylaxis based upon a patient's mobility status. We developed and launched learner-centric nurse education to improve knowledge about VTE and VTE prophylaxis and enhance skills in communicating this information to patients.⁵ Separately, we developed and implemented just-in-time patient-centered education to intervene when patients miss a dose of VTE prophylaxis.⁶ Both interventions were associated with significant reductions in non-administration.^{5,6} Missed doses of VTE prophylaxis are not inevitable; they can be reduced dramatically with active intervention.

This study is not without limitations. First, the study was done in a single academic medical center. Therefore, these findings may not be generalizable. However, non-administration of VTE prophylaxis has been reported at many other hospitals suggesting it is likely ubiquitous across the country.⁷ Second, our findings report an overall ecologic study of hospital performance. If non-administration varies by floor and patient population, increases may be exaggerated for some patient populations and underrepresented for others.

We found that non-administration of VTE prophylaxis increases as prescriptions increase, unless interventions targeting missed doses are employed. To replicate reductions in VTE with thromboprophylaxis demonstrated in randomized trials in real-world settings, it is essential to actively monitor and ensure appropriate administration. Future efforts to improve VTE prevention should measure both prescription and administration of VTE prophylaxis.

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Compliance with Ethical Standards:

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