Warfarin Dosing Service Analysis

Department of Pharmacy Services - Memorial Hermann-Texas Medical Center

Brian Gulbis, PharmD, BCPS

January 2015 to December 2015

Service Utilization

Annual Warfarin Utilization

The number of patients receiving warfarin while at Memorial Hermann-Texas Medical Center continues to increase annually (see figure 1).

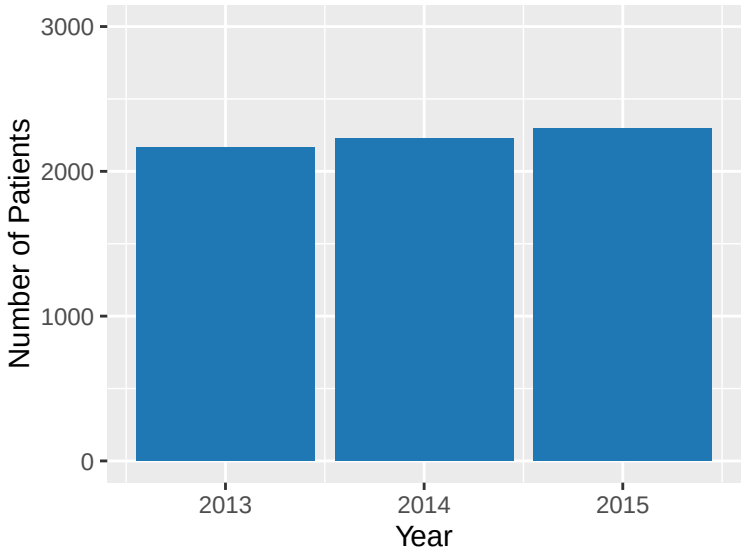

Figure 1: Number of Patients Receiving Warfarin at MH-TMC, 2013-2015

Utilization of Pharmacy Dosing Service

Utilization of the Pharmacy Dosing Service continues to increase on an annual basis (see figure 2). The Pharmacy Dosing Service is responsible for managing approximately 60% of the daily warfarin doses ordered in the hospital (see figure 3). The remainder of the doses are ordered by traditional health care providers, including physicians, nurse practitioners, and physician assistants. Many of the warfarin doses in the traditional group are ordered in consultation with a clinical pharmacist or clinical pharmacist-specialist, and all warfarin doses are reviewed and verified by a pharmacist.

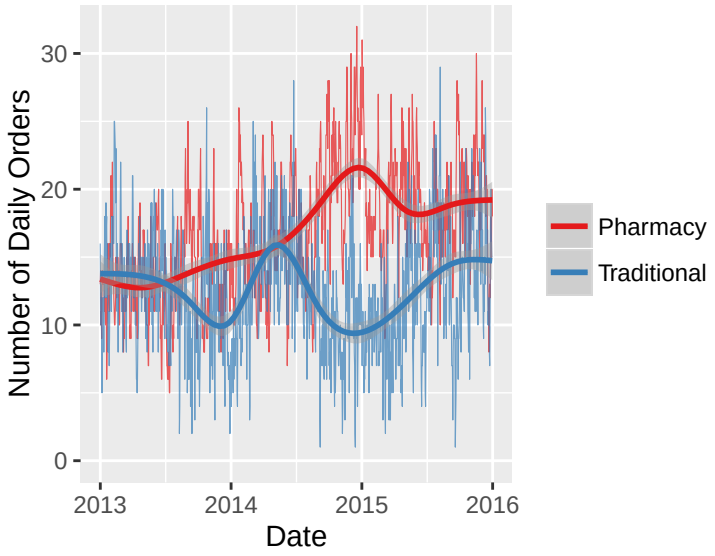

Figure 2: Daily Warfarin Orders Managed by Pharmacy and Traditional

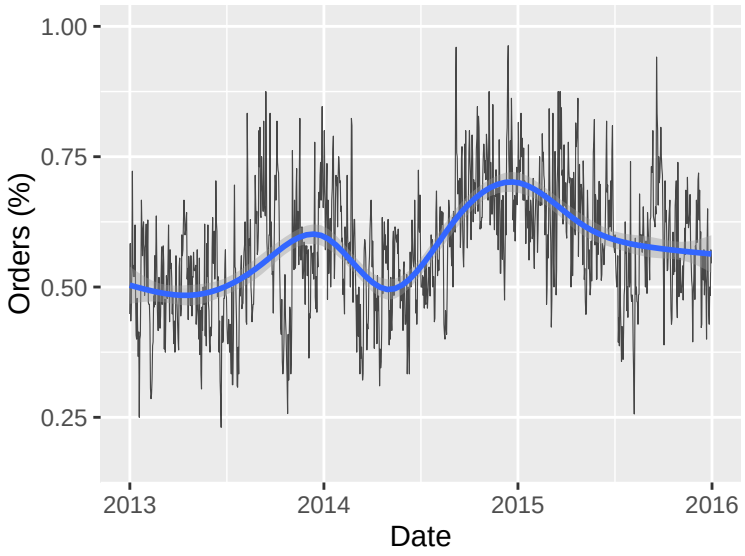

Figure 3: Percent of Daily Warfarin Orders Managed by Pharmacy Dosing Service

The medical services with the largest number of patients on warfarin include Cardiology and Internal Medicine. Utilization of the Pharmacy Dosing Service remains low among patients on the Cardiology services (see figure 4).

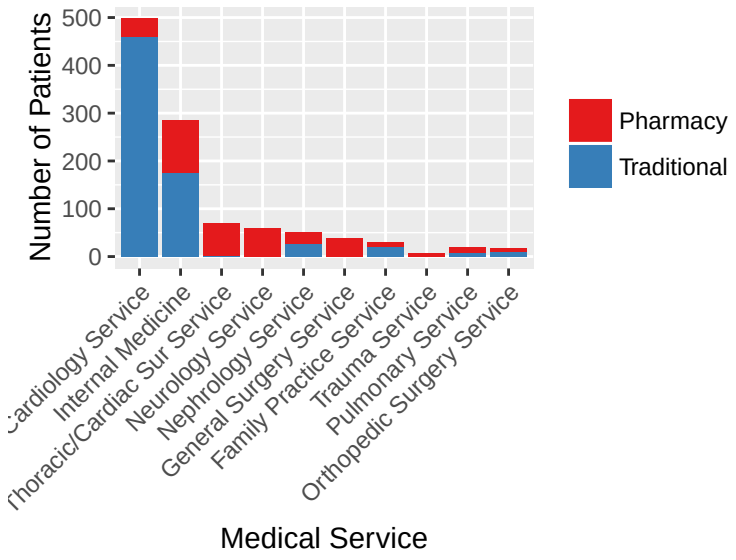

Figure 4: Pharmacy Dosing Service Utilization Among Top 10 Medical Services Ordering Warfarin

Comparison

The efficacy and safety of patients whose warfarin therapy was managed by the Pharmacy Dosing Service was compared with those patients whose warfarin therapy was managed by traditional health care providers. Patients were assigned to each group and included or excluded from the analysis using the following criteria:

- Group 1 - Pharmacy Dosing Service
  - Consult placed within 48 hours of warfarin initiation
  - At least 60% of warfarin doses placed by pharmacist
- Group 2 - Traditional Dosing

Inclusion

- January 1, 2015 to December 31, 2015
- Age 18 years or greater
- Received at least 3 doses of warfarin
- Baseline INR < 1.5

Exclusion

- Concurrent DTI or TSOAC
- Liver dysfunction
  - AST and ALT $>$ 5x ULN (concurrently)
  - ALT $>$ 10x ULN
  - T.Bili $>$ 3x ULN
- Missing goals of therapy data
- Readmission encounters

Results

This analysis of warfarin patients for 2015 marks the first time that there were a larger number of patients in the Pharmacy Dosing Service arm than in the Traditional arm (see Table 1). Patients in the Pharmacy

Dosing Service arm tended to be younger than in the Traditional arm. Additionally, there were a larger percent patients who were new to warfarin therapy in the Pharmacy Dosing Service arm.

Table 1: Demographics

	pharmacy	traditional	p
n	402	285	
Age (median [IQR])	58.00 [42.25, 68.75]	64.00 [54.00, 72.00]	<0.001
Sex = Male (%)	240 (59.7)	182 (64.1)	0.279
BMI (median [IQR])	28.48 [24.40, 33.54]	29.32 [25.18, 33.68]	0.277
Race (%)			0.096
- African American	104 (28.4)	74 (27.9)	
- Asian	12 (3.3)	1 (0.4)	
- Native Am.	0 (0.0)	1 (0.4)	
- Other	78 (21.3)	59 (22.3)	
- White/Caucasian	172 (47.0)	130 (49.1)	
Length of Stay (median [IQR])	12.10 [7.71, 19.83]	13.71 [8.04, 24.17]	0.103
Therapy = New/Previous (%)	270/132 (67.2/32.8)	143/142 (50.2/49.8)	<0.001

There were a larger percent of patients with DVT and PE managed by the Pharmacy Dosing Service, while a larger percent of patients in the Traditional arm had Atrial Fibrillation (see figure 5). There were no patients with Ventricular Assist Devices in the Pharmacy Dosing Service arm, however, this is one example of an area included in the Traditional group where the clinical pharmacist-specialists are highly involved in the daily management of warfarin through collaboration with the health care team.

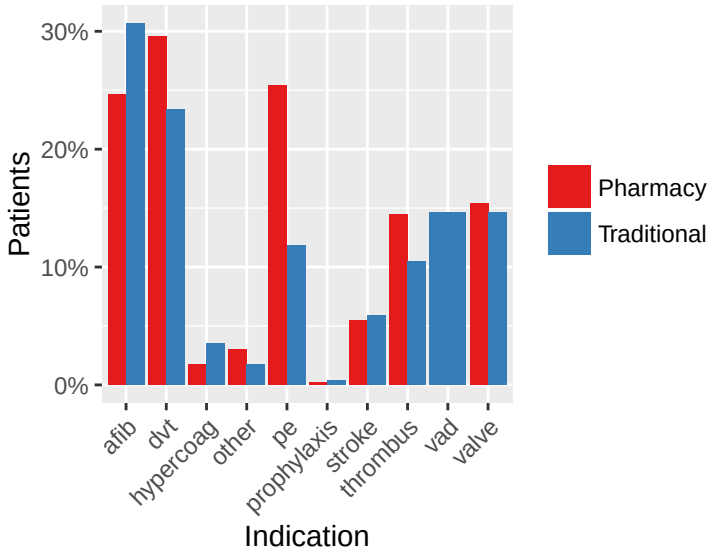

Figure 5: Indications for warfarin use

There were small differences in the discharge disposition of patients in each of the two groups, although this likely is not clinically significant (see figure 6).

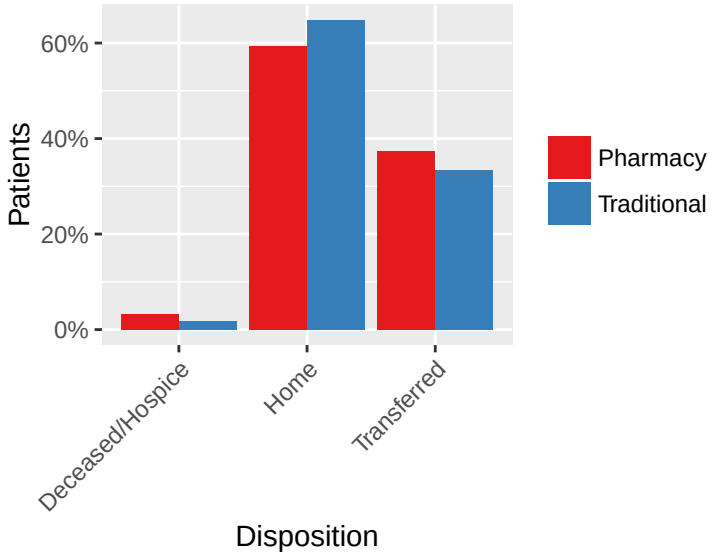

Figure 6: Disposition on discharge

The median number of days that patients received warfarin while in the hospital was lower in the Pharmacy Dosing Service arm compared with the Traditional arm (5 vs. 6 days, respectively; see figure 7).

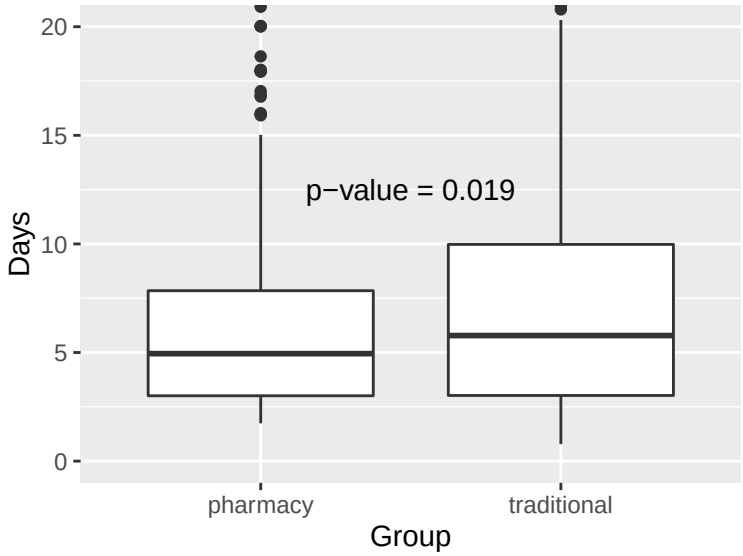

Figure 7: Inpatient Dosing Days

Efficacy Endpoints

There was a small but statistically significant greater increase in the INR in patients managed by the Pharmacy Dosing Service compared with the Traditional arm (see figures 8 and 9).

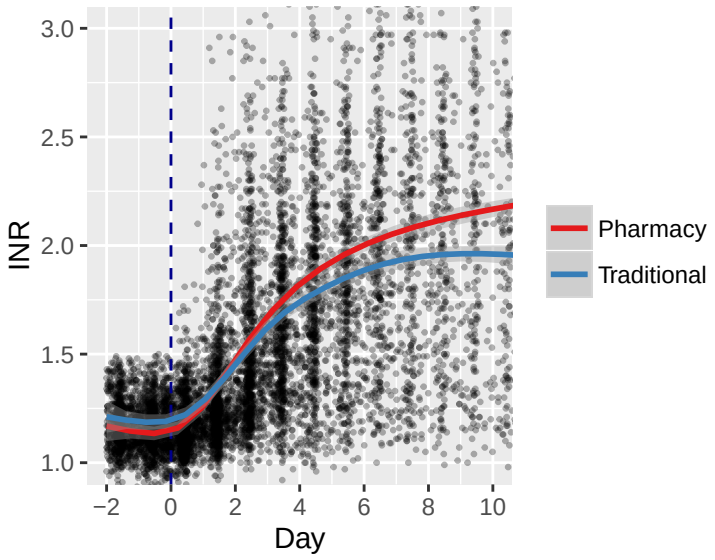

Figure 8: INR response after starting warfarin

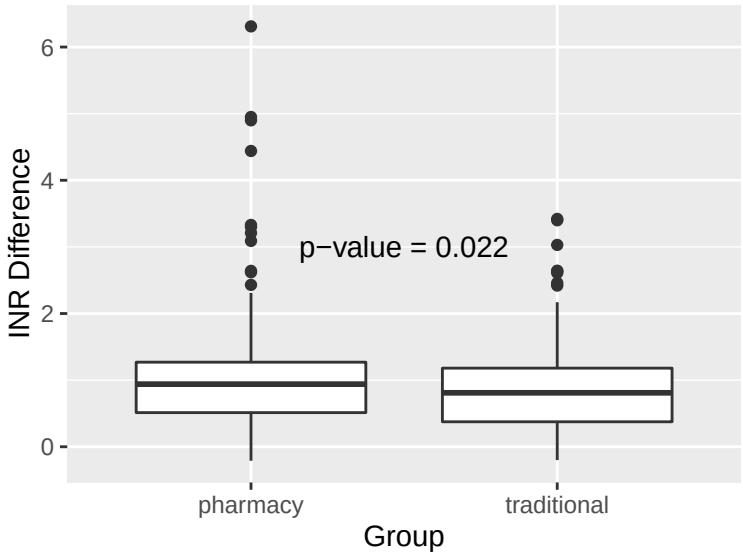

Figure 9: Change in INR

The percent of time the INR was in the therapeutic range was similar between the two groups (see figure 10).

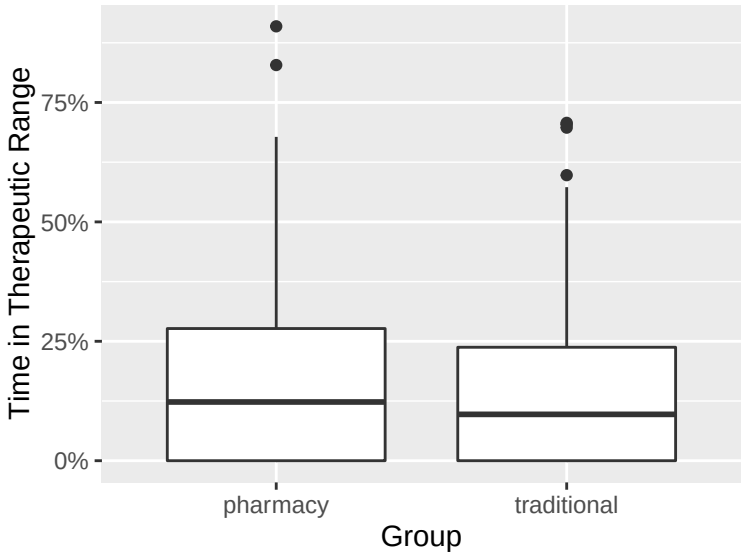

Figure 10: Percent of time INR is within therapeutic range

Safety Endpoints

With the exception of a few outlier patients, the percent of time the INR was critical (defined as an INR >/= 4) was very small (median < 0.00001% in both groups; see figure 11).

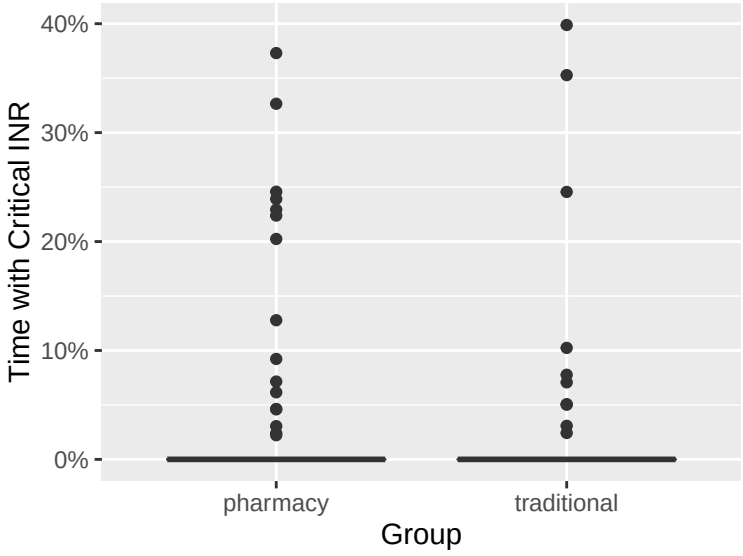

Figure 11: Percent of time INR is critical (at or above 4)

There was a trend towards a greater decrease in the hemoglobin in the Traditional group compared with the Pharmacy Dosing Service, although the difference did not reach statistical significance (see figures 12 and 13).

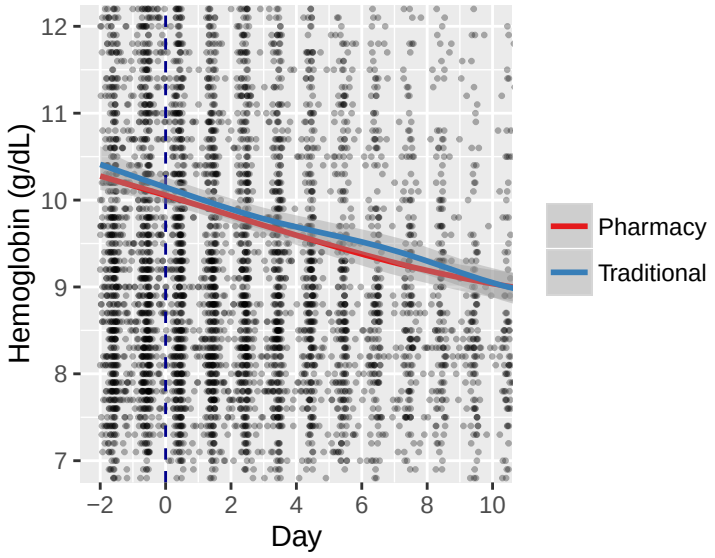

Figure 12: Change in hemoglobin after starting warfarin

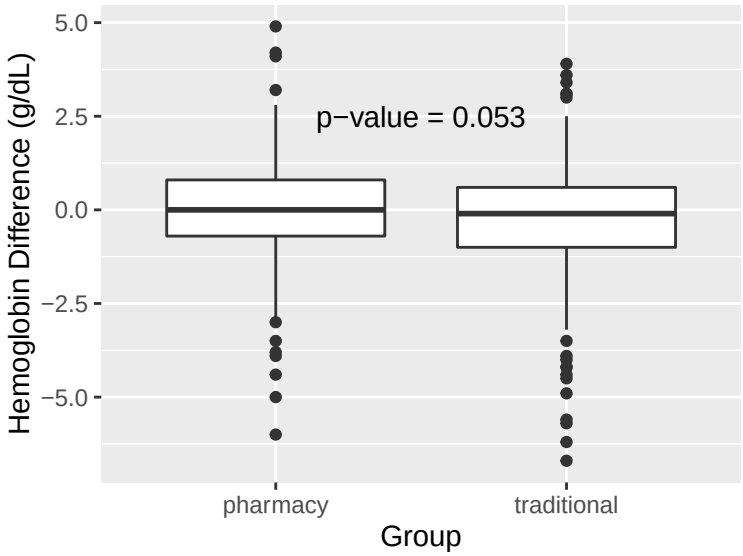

Figure 13: Change in Hemoglobin

Historical Comparison

A secondary analysis was performed, comparing the Pharmacy Dosing Service against itself (2015 vs. 2013 to 2014). The same inclusion and exclusion criteria were used. Patient demographics were similar between the two groups, except for a slightly younger median age in the 2015 group (see Table 2).

Table 2: Demographics

	current	historical	p
n	402	866	

	current	historical	p
Age (median [IQR])	58.00 [42.25, 68.75]	59.00 [46.00, 71.00]	0.048
Sex = Male (%)	240 (59.7)	505 (58.3)	0.685
BMI (mean (sd))	29.95 (8.50)	29.90 (9.26)	0.926
Race (%)			0.189
- African American	104 (28.4)	245 (31.2)	
- Asian	12 (3.3)	15 (1.9)	
- Latin American	0 (0.0)	1 (0.1)	
- Other	78 (21.3)	133 (16.9)	
- White/Caucasian	172 (47.0)	392 (49.9)	
-Length of Stay (median [IQR])	12.10 [7.71, 19.83]	11.85 [7.38, 18.62]	0.172
Therapy = New/Previous (%)	270/132 (67.2/32.8)	604/262 (69.7/30.3)	0.390

Among the medical services which utilize warfarin the most, there was a slight increase in number of Pharmacy Dosing Serivce patients on the Cardiology service in 2015 and a slight decrease in patients on Internal Medicine (see figure 14).

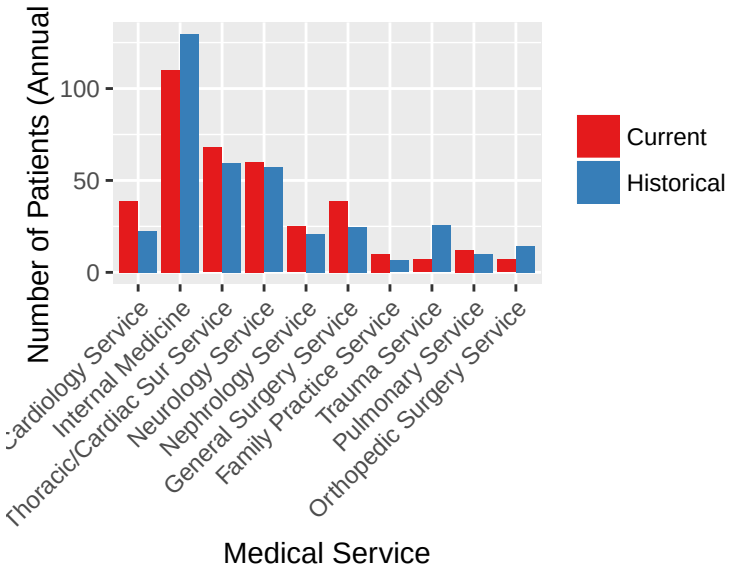

Figure 14: Pharmacy Dosing Service Utilization Among Top 10 Medical Services Ordering Warfarin

The indications for anticoagulation remain relatively unchanged from 2013-2014 to 2015 (see figure 15), as do the discharge dispositions (see figure 16).

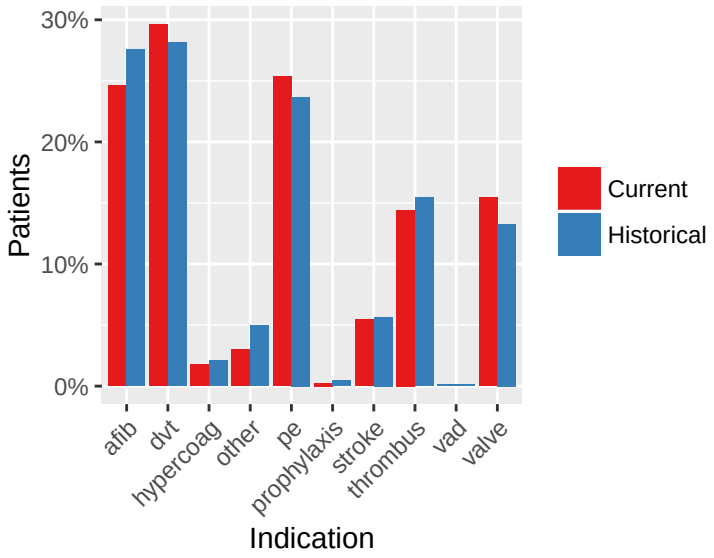

Figure 15: Indications for warfarin use

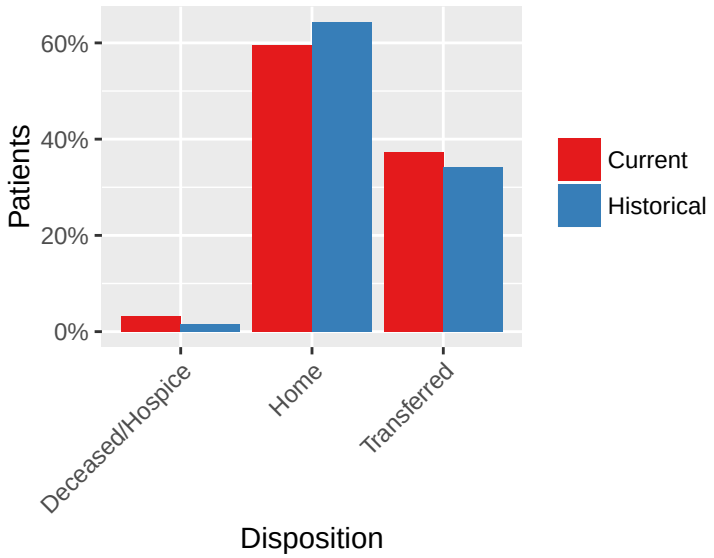

Figure 16: Disposition on discharge

The median number of days that patients received warfarin while in the hospital remains unchanged from 2013-2014 to 2015 (see figure 17).

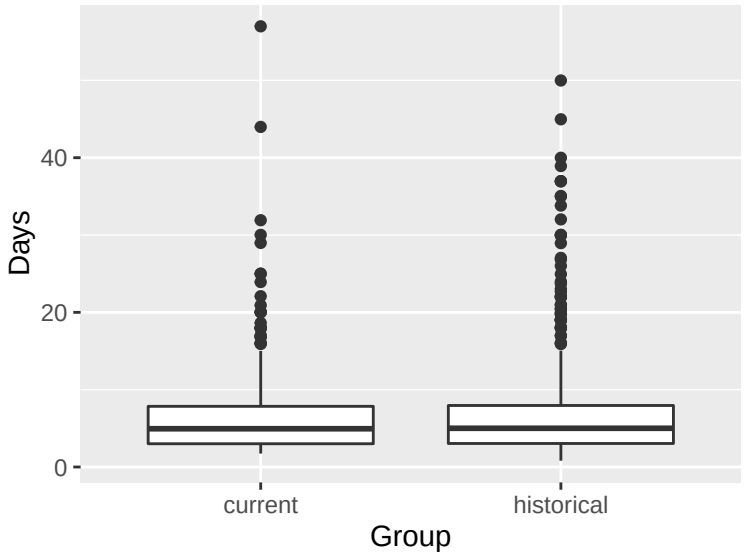

Figure 17: Inpatient Dosing Days

Efficacy Endpoints

The increase in INR was similar between the 2013-2014 and 2015 groups (see figures 18 and 19).

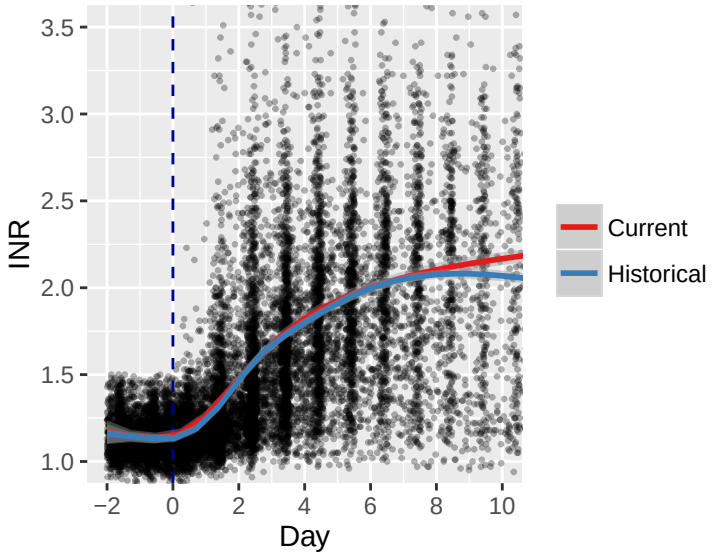

Figure 18: Change in INR after starting warfarin

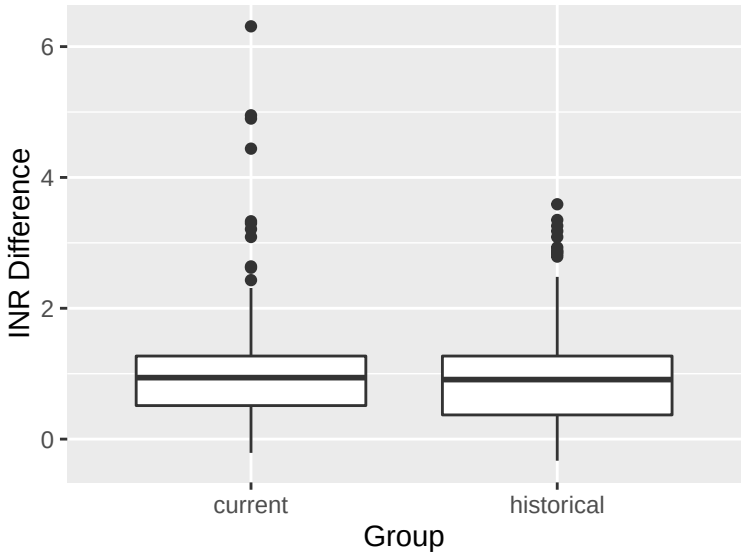

Figure 19: Change in INR

The median percent of time the INR was within the therapeutic range increased slightly in 2015 compared with 2013-2014, although the difference was not statistically significant (see figure 20).

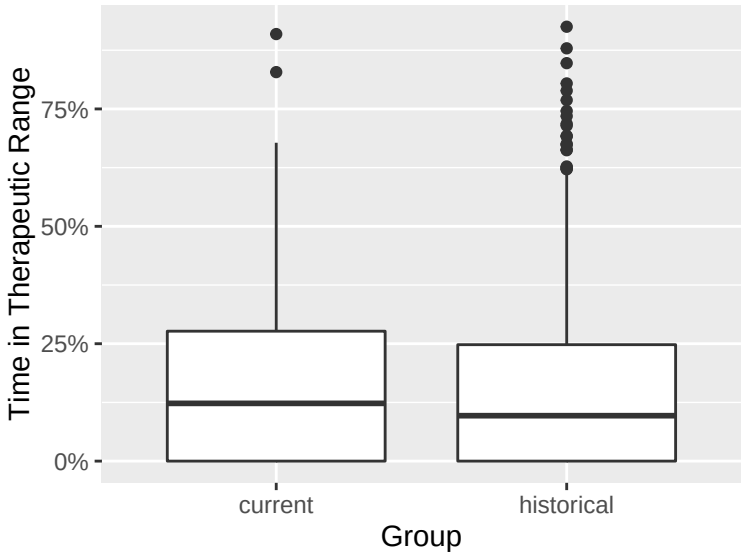

Figure 20: Percent of time INR is within therapeutic range

Safety Endpoints

The median percent of time the INR was critical remains very low in both 2013-2014 and 2015 (see figure 21).

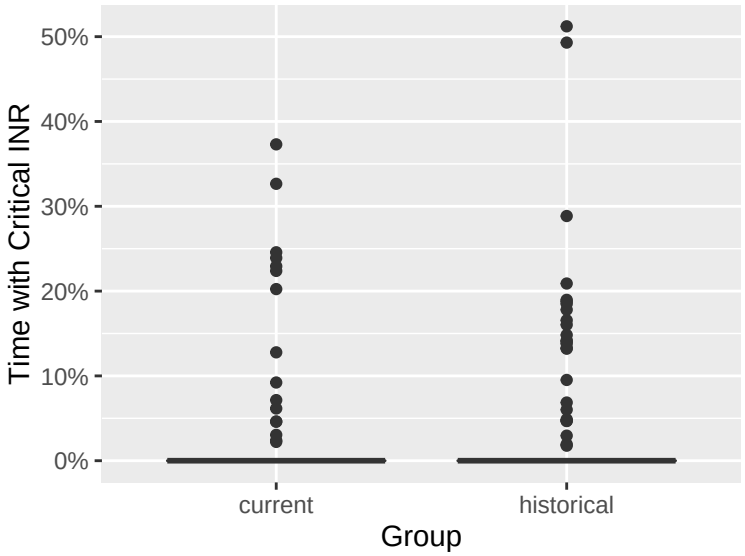

Figure 21: Percent of time INR is critical (at or above 4)

There was a trend towards less of a decrease in the hemoglobin in 2015 compared with 2013-2014, although the difference did not reach statistical significance (see figures 22 and 23).

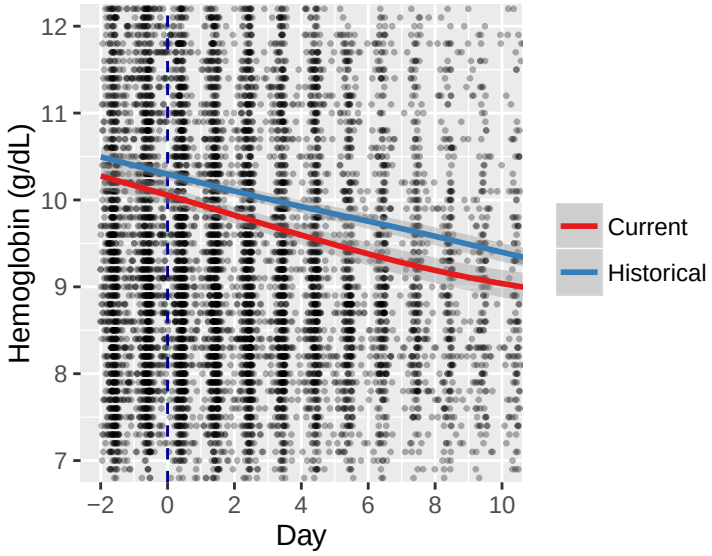

Figure 22: Change in hemoglobin after starting warfarin

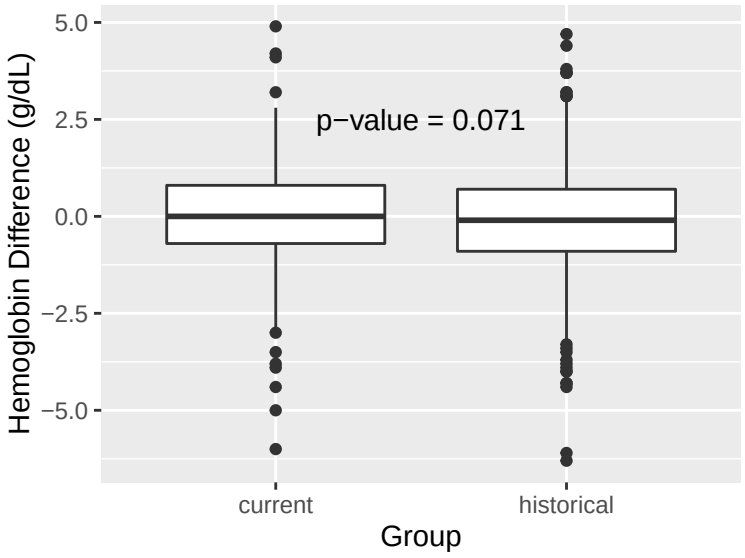

Figure 23: Change in Hemoglobin

Conclusions

- Utilization of the Pharmacy Dosing Service continues to increase.
- Patients managed by the Pharmacy Dosing Service had a larger increase in the INR compared with Traditional management.
- There was a trend towards a larger decrease in the hemoglobin in patients in the Traditional group compared with the Pharmacy Dosing Service.
- There were no major differences in efficacy or safety outcomes when comparing patients managed by the Pharmacy Dosing Service in 2013-2014 with 2015.

Statistical Analysis

Data preparation and statistical analysis were performed using R version 3.3.1 (2016-06-21) on a windows x64 system.

Reference

R Core Team (2016). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.