Changing Hemoglobin Targets: Effects on Epoetin Alfa, Intravenous Iron, and Iron Storage Measures From 2009–2012

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Introduction

- In order to treat the underlying causes of anemia in patients wtih end-stage renal disease (ESRD)–inadequate endogenous erythropoietin production and iron deficiency–patients receive both epoetin alfa (EPO) and intravenous (IV) iron during hemodialysis sessions. Because iron repletion is needed for optimal response to erythropoiesis-stimulating agents (ESAs), dosing of both IV iron and ESAs is coordinated.[1]
- Since the introduction of ESAs in 1989, anemia management in patients with ESRD has evolved in response to many factors, including most recently the March 2010 revision of the Centers for Medicare and Medicaid Services (CMS) Erythropoietin Monitoring Policy (EMP);[2] the October 2010 Cardiovascular and Renal Drugs Advisory Committee (CARDAC) recommendation;[3] the June 2011 label revisions modifying the target hemoglobin (Hb) used for EPO dosing;[1] and bundling of CMS reimbursement for dialysis services with that of injectable anemia medications.[4] The United States Renal Data System reported that in 2011, EPO dosing and Hb levels decreased significantly in dialysis patients.[5]
- To better understand how anemia treatment has changed, the current analysis was undertaken to examine monthly EPO and IV iron dosing, Hb levels, as well as serum ferritin levels and TSAT between 2009 and 2012.

Objectives

- Understand the temporal inter-relationships between the following variables among hemodialysis patients:
  - Proportion of patients receiving IV iron and EPO each month
  - Mean monthly EPO doses and IV iron dose
  - Mean Hb
  - Mean serum ferritin
  - Mean TSAT

Methods

Patients

- This retrospective analysis studied the electronic medical records of patients aged ≥ 18 years receiving in-center dialysis between 1 January 2009 and 30 April 2012.

Analysis

- This analysis sought to identify dosing patterns of IV anemia medications and lab values. Monthly means were calculated, and the slope was visually compared across potential inflection points. Iron dose was calculated by 4-month periods. A piecewise regression analysis was conducted to statistically confirm changes. Yearly demographic tables were produced to confirm that large-scale changes had not occurred in the underlying population.

Results

Table 1. Patient Demographics

Characteristic	2009	2010	2011	2012
Sample size (N)	152,434	158,799	172,305	140,366
Gender (female, %)	44.04	43.82	43.81	43.97
Vintage in years, mean (SD)[a]	3.571 (3.631)	3.656 (3.694)	3.738 (3.720)	3.875 (3.788)
Age in years, mean (SD)	61.08 (15.17)	61.30 (15.09)	61.45 (15.03)	61.77 (14.89)
BMI (kg/m^2) mean (SD)	28.47 (7.93)	28.63 (7.87)	28.78 (8.10)	28.57 (7.73)
Primary Cause of Disease (%)				
Diabetes	44.23	44.21	43.95	44.47
Hypertension	29.29	29.55	29.41	29.85
Chronic GLN	5.34	5.13	4.89	4.90
Congenital KD	2.34	2.28	2.23	2.20
Other	18.79	18.84	19.52	18.57
Race/Ethnicity (%, > 3% frequency)				
White	41.16	40.89	40.62	38.20
Black	35.94	36.11	34.55	36.77
Hispanic	14.89	15.03	15.68	16.84
Asian	3.33	3.42	3.49	3.58
Primary Insurer (%)				
Medicare	79.02	78.94	78.75	80.28
Medicaid	6.96	6.95	6.84	7.42
Other	11.45	10.78	10.16	8.67
Veterans Affairs	1.76	2.08	2.23	2.27
No Insurance	0.80	1.25	1.31	0.96

Abbreviations: SD, standard deviation; BMI, body mass index; GLN, glomerulonephritis; KD, kidney disease.
[a]Vintage only for patients receiving dialysis by January 1 of given year.

Figure 1. Mean Hb Concentrations

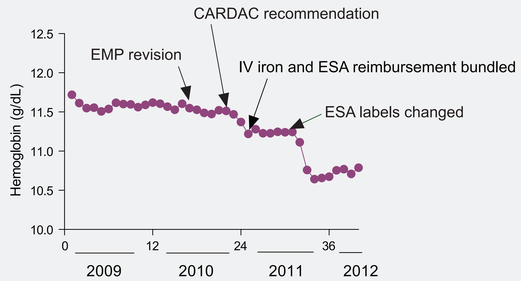

Figure 2. Mean Serum Ferritin and TSAT

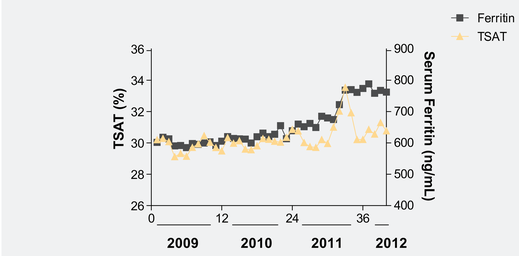

Figure 3. Mean Proportion of Patients Receiving IV Iron and EPO

Figure 4. Mean Dose of IV Iron and EPO

Summary

- Mean Hb levels fell over the study period.
  - The monthly mean Hb for patients in April 2012 was 10.79 g/dL versus 11.72 g/dL in January 2009; there was a precipitous fall in Hb in the last 6 months of 2011.
- Mean EPO dose fell over the study period.
  - In January 2009, 92.78% of patients received a mean EPO dose of 72,965 U (SD, 72,709), compared to April 2012 when 86.48% of patients received a mean EPO dose of 46,978 U (SD, 45,745).
- However, since 2011, more patients are receiving iron.
  - In April 2009, 64.40% of patients received IV iron, versus 74.94% in April 2012 .
- Mean monthly IV iron dose fell.
  - In April 2009, the mean monthly IV iron dose was 290 mg versus 241 mg in April 2012, possibly because mean IV iron dose fell as the proportion of patients receiving low-dose iron increased.

Conclusions

- Over the period of observation, mean serum ferritin and TSAT increased. A dramatic change in mid-2011 likely reflected a decrease in mean Hb associated with the FDA ESA label change.
- Since 2009, considerable changes in the dosing of anemia medications have been measured, and these changes affected the mean Hb, ferritin, and TSAT among dialysis patients.

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