

# Changes in Serum Phosphorus, Pill Burden, and Medication Possession Ratio among Chronic Hemodialysis Patients who Converted to Sucroferric Oxyhydroxide as Part of Routine Care

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#### Introduction

- Elevated serum phosphorus is common in patients with end-stage renal disease (ESRD) and has been associated with increased cardiovascular events and mortality.¹ Phosphate binders are widely used to achieve serum phosporus control in ESRD patients. However, the large pill burden associated with these medications may decrease adherence to therapy.²,3
- Sucroferric oxyhydroxide (SO) is an iron-based phosphate binder that was launched in the US in 2014. In clinical trials, SO demonstrated equivalent control of serum phosphorus and lower daily pill burden relative to sevelamer.<sup>4,5</sup>

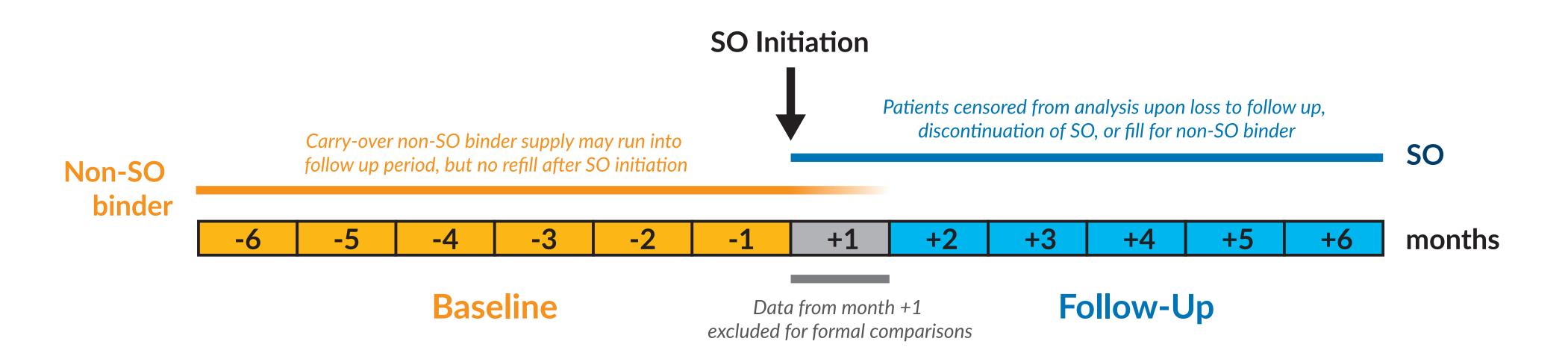
# Objective

To examine changes in serum phosphorus, total phosphate binder pill burden, and medication possession ratio (MPR; a measure of medication adherence) among chronic hemodialysis patients who converted from use of a baseline phosphate binder to SO as part of routine care

#### Methods

- Data for this retrospective study were derived from the deidentified electronic health records of a large dialysis organization (LDO). Patients eligible for inclusion in the study were those who received chronic hemodialysis care at the LDO, were ≥18 years old, were not Veterans Affairs beneficiaries, and were enrolled in the LDO's pharmacy benefits service for at least 180 days prior to receipt of a first prescription fill for SO.
- Patients converting to SO use (N = 490) were defined from prescription fill data as those who had an active prescription for another (non-SO) phosphate binder within 14 days prior to SO initiation, but subsequently did not refill the prescription for the non-SO binder.
- Patients contributed up to 12 months of data to the analysis during 2 time periods (Figure 1):
- Baseline: 6 months leading up to SO initiation
  Follow-up: 6 months following SO initiation
- Following SO initiation, patients were censored from the analysis:
- at time of loss to follow-up (death, transfer of care, transplant, withdrawal from dialysis, disenrollment from LDO pharmacy benefits service)
- at the beginning of a month in which a change in dialysis modality was observed, in which SO was discontinued, or in which the patient received a fill for any non-SO binder after exhaustion of the original supply of first-line non-SO binder
- Outcomes assessed were mean serum phosphorus, percentage of patients with serum phosphorus ≤ 5.5 mg/dL, total daily phosphate binder pill burden, and total phosphate binder MPR (considered only for the subset of patients not enrolled in the LDO pharmacy's automated refill management service).
- Monthly descriptive analyses of outcomes considered all available data. Formal comparisons of outcomes over follow-up vs baseline were made using generalized linear models and excluded data from month +1 (ie, the month immediately following SO initiation); only those patients who remained in the analysis through month +2 and thus contributed data to follow-up were considered in these comparisons (N = 332).
- Month +1 data were excluded from formal comparisons to account for the situation where a patient may still have had an active prescription for their prior phosphate binder during the first month of SO use.

Figure 1: Study Design



#### Results

- Characteristics of patients converting to SO (N = 490) are shown in Table 1.
- At the time of SO initiation, 66.3% of patients were using sevelamer, 19.2% were using calcium acetate, and 12.7% were using lanthanum carbonate.
- Mean serum phosphorus at SO initiation was 7.2 mg/dL; 17.6% of patients had serum phosphorus ≤ 5.5 mg/dL.
- Of the 490 qualifying patients who converted to SO use, 168 discontinued SO during follow-up, 62 were censored upon initiation of a non-SO binder after SO initiation, and 26 were censored for other reasons (death, transfer of care, disenrollment from pharmacy benefits service, transplant, withdrawal from dialysis, modality change).
- Table 1: Characteristics of Patients at Time of SO Initiation

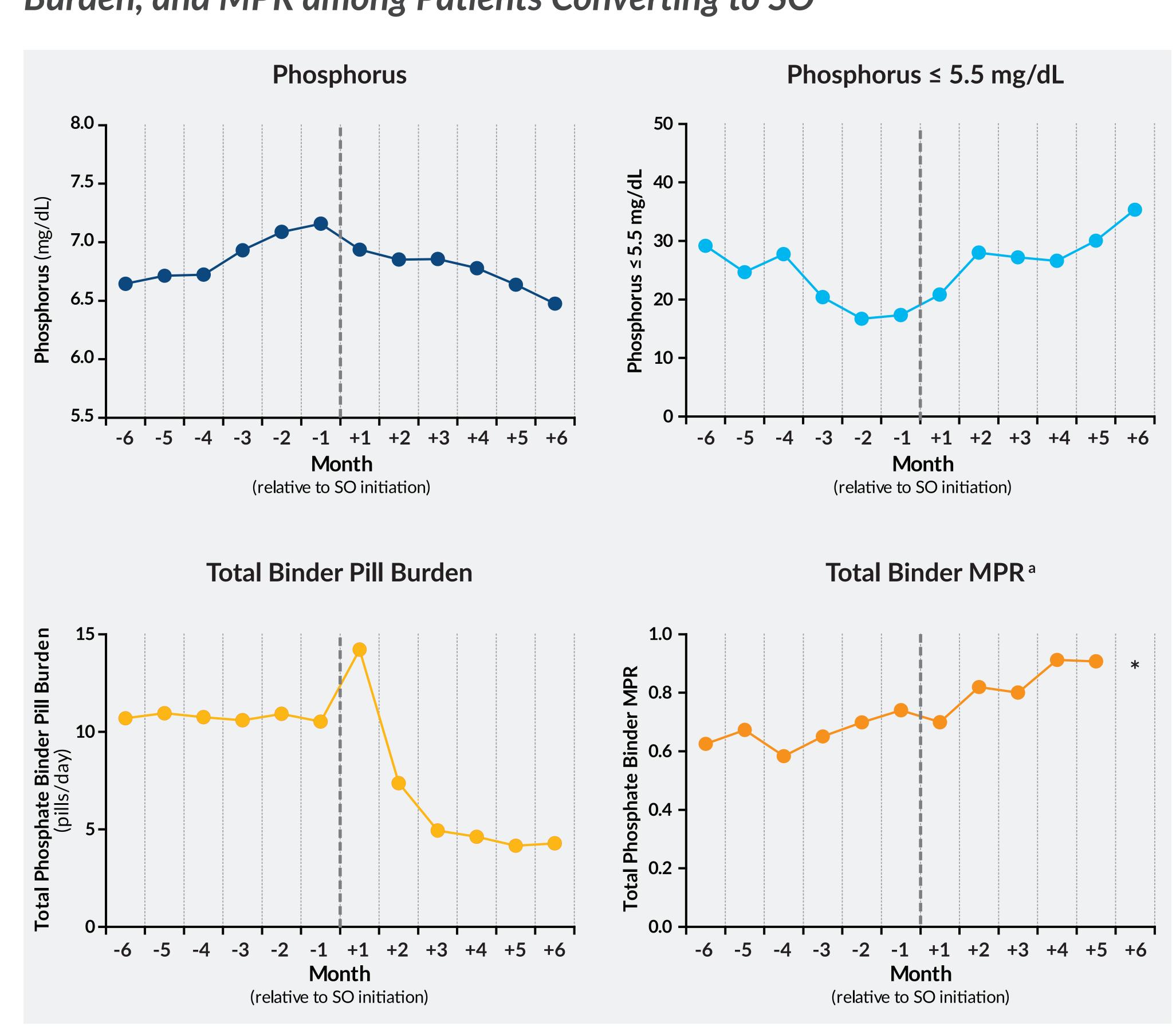
		SO Converters
		N = 490
Age, years	mean ± SD	50.3 ± 13.4
Sex	n (%)	2/2/52 5
Male Female		262 (53.5) 228 (46.5)
Race	n (%)	4.0.4.40=.0\
White Black		136 (27.8) 220 (44.9)
Hispanic		106 (21.6)
Asian		17 (3.5)
Other/unknown/missing		11 (2.2)
Access	n (%)	
Arteriovenous fistula		387 (79.0)
Arteriovenous graft Central venous catheter		72 (14.7) 31 (6.3)
Vintage, mo	median [p25, p75]	48 [26, 83.5]
Weight, kg	mean ± SD	87.7 ± 25.1
BMI, kg/m <sup>2</sup>	mean ± SD	30.3 ± 8.1
Kt/V	mean ± SD	1.54 ± 0.24
Calcium, mg/dL	mean ± SD	9.0 ± 0.8
Calcium ≤ 10.2 mg/dL	n (%)	472 (96.3)
Phosphorus, mg/dL	mean ± SD	7.2 ± 1.8
Phosphorus ≤ 5.5 mg/dL	n (%)	86 (17.6)
Ca x P product, mg <sup>2</sup> /dL <sup>2</sup>	mean ± SD	64.1 ± 16.2
PTH, pg/mL	median [p25, p75]	533 [333, 878]
PTH 150-600 pg/mL	n (%)	255 (52.0)
nPCR, g/kg/day	mean ± SD	1.08 ± 0.3
Serum albumin, g/dL	mean ± SD	$4.0 \pm 0.3$
Hemoglobin, g/dL	mean ± SD	11.0 ± 1.3
Ferritin, ng/mL	mean ± SD	695 ± 331
TSAT, %	mean ± SD	29.4 ± 11.5
ESA use	n (%)	424 (86.5)
IV iron use	n (%)	392 (80.0)
IV vitamin D use	n (%)	438 (89.4)
Cinacalcet use	n (%)	162 (40.2)
Non-SO binder use	n (%)	
Calcium acetate		94 (19.2)
Lanthanum carbonate		62 (12.7)
Sevelamer		325 (66.3)

Demographic variables are defined as of the date of SO initiation; dialysis treatment-related variables and laboratory values are defined as of the dialysis treatment on or most recently preceding the date of SO initiation within 90 days; medication use is defined as of the date of SO initiation.

Abbreviations: BMI, body mass index; ESA, erythropoiesis-stimulating agent; IV, intravenous; MBD, metabolic bone disease; nPCR, normalized protein catabolic rate; p25, 25<sup>th</sup> percentile; p75, 75<sup>th</sup> percentile; PTH, parathyroid hormone; SD, standard deviation; SO, sucroferric oxyhydroxide; TSAT, transferrin saturation

- Longitudinal trends in serum phosphorus, total phosphate binder pill burden, and total phosphate binder MPR are shown in Figure 2. Formal comparisons of these measures over baseline vs follow-up are shown in Table 2.
- Following conversion to SO:
- Mean serum phosphorus declined while the proportion of patients with serum phosphorus ≤ 5.5 mg/dL increased.
- Total phosphate binder pill burden declined.
- Among patients not enrolled in the LDO pharmacy's automated refill management service (n = 30), total phosphate binder MPR increased.

Figure 2: Longitudinal Trends in Serum Phosphorus, Phosphate Binder Pill Burden, and MPR among Patients Converting to SO



\* Data points representing 10 patients or fewer not shown
a Limited to patients not enrolled in LDO pharmacy's automated refill service

Table 2: Comparisons of Serum Phosphorus, Phosphate Binder Pill Burden, and MPR among Patients Converting to SO—Baseline vs Follow-Up

N = 332 <sup>a</sup>	Baseline (months -6 to -1)	Follow-Up (months +2 to +6)	P-Value	
Serum phosphorus, mg/dL				
mean	6.9	6.8	0.02	
(95% CI)	(6.8, 7.1)	(6.6, 6.9)		
Serum phosphorus ≤ 5.5 mg/dL				
%	21.7	28.8	< 0.001	
(95% CI)	(19.1, 24.5)	(24.9, 33.0)		
Total PB pill burden, pills/day				
mean	10.8	5.5	< 0.001	
(95% CI)	(10.1, 11.5)	(5.1, 6.0)		
<b>Total PB MPR</b> b (n = 30)				
mean ± SD	$0.68 \pm 0.24$	$0.80 \pm 0.22$	0.01 <sup>c</sup>	
median [p25, p75]	0.68 [0.52, 0.87]	0.83 [0.70, 0.93]		

<sup>a</sup> Formal comparisons excluded data from month +1 and considered only those patients who remained in the analysis through month +2 and thus contributed data to follow-up.

<sup>b</sup> Limited to patients not using LDO pharmacy's automated refill management service.
<sup>c</sup> Models did not converge due to sparse data; comparisons of follow-up to baseline for MPR were made using paired t-tests.

Abbreviations: CI, confidence interval; MPR, medication possession ratio; PB, phosphate binder; SD, standard deviation; SO, sucroferric oxyhydroxide

### Summary and Conclusions

- In a cohort of chronic hemodialysis patients converting to SO use as part of routine care, improvements in serum phosphorus were observed, along with a 49% decrease in daily phosphate binder pill burden.
- Among the subset of patients not receiving automated prescription refills, total phosphate binder MPR increased from 0.68 to 0.80 following SO initiation.
- These results suggest that the lower pill burden associated with SO relative to other phosphate binders may promote increased adherence to therapy and thereby result in improved serum phosphorus control.

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