Ferric Citrate: An Iron-based Oral Phosphate Binder

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Introduction
• Ferric citrate, an investigational phosphate binder for the treatment of hyperphosphatemia in dialysis patients, has been shown in clinical trials to increase serum ferritin and saturated transferrin (TSAT) and reduce use of erythropoiesis-stimulating agents (ESAs) and intravenous (IV) iron.1–5
• We identified 2,037 concurrent, non-treatment related rises in TSAT (≥ 10%) and ferritin (15%–25%) between 6/1/08 and 12/31/10, excluding patients with IV iron dosing.
• We developed a cost-offset model quantifying potential cost savings associated with reduced ESA and IV iron dosing observed in hemodialysis patients experiencing similar increases in iron storage markers to patients in ferric citrate clinical studies.

Methods
Model
• The economic model was created to derive expected monthly costs for ferric citrate and comparator binders in terms of phosphate binder, ESA, and IV iron costs.
• The model calculates the expected monthly cost, first assuming all patients are treated with ferric citrate, and a second time, assuming all patients are treated with ferric citrate; the difference between the two models represents the incremental cost of ferric citrate.
• The average per session ESA dose for ferric citrate is adjusted to reflect expected changes due to associated rises in TSAT and ferritin.

Model Inputs
• The model assumed efficacy of ferric citrate and comparator binders was equivalent to manage bone and mineral disease.
• Unit costs for phosphate binders, ESAs, and IV iron were derived from published sources.1–3
• We assumed price equivalence between ferric citrate and the comparator phosphate binders in the base case.
• Average monthly ESA and iron utilization were derived from Bond et al., 2011. Potential changes in iron and ESA dosing with ferric citrate administration were also estimated.4

Model Outputs
• Per patient monthly costs were calculated for ferric citrate and the comparator phosphate binders as described.
• The incremental cost of ferric citrate was calculated by subtracting the per patient monthly cost of the comparator phosphate binder from the per patient monthly cost of ferric citrate.
• Results were calculated for the overall patient population, and for moderate (4,500–9,000 sessions per month) and high (9,000 sessions per month) ESA users separately.

Sensitivity Analysis
• Sensitivity analysis used the model default parameters; two-month savings (overall population) is presented.

Results
• We identified 2,037 concurrent, non-treatment related rises in TSAT (>10%) and ferritin (15%–25%) between 6/1/08 and 12/31/10, excluding patients with significant change in iron or ESA dose, hemoglobin, or change in phosphate binder in the prior month.4
• A mean decrease in ESA dose of 500.2 units was measured for all patients, while a 17.3 mg mean decrease was observed for patients with the highest baseline ESA and IV iron doses.
• A mean decrease in iron dose of 5.79 mg was measured for all patients, while a 17.3 mg mean decrease was observed for patients with the highest baseline ESA and IV iron doses.

Table 1. Cost-Offset Model: Clinic and Population Assumptions

<table>
<thead>
<tr>
<th>Assumption</th>
<th>Per Patient</th>
<th>Per Clinic</th>
</tr>
</thead>
<tbody>
<tr>
<td>ESA Users (&lt; 17)</td>
<td>$229</td>
<td>$5,360</td>
</tr>
<tr>
<td>Moderate ESA Users (17+)</td>
<td>$125</td>
<td>$2,103</td>
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Table 2. Potential Cost Savings With Ferric Citrate

<table>
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<tr>
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<tbody>
<tr>
<td>High ESA Users (&lt; 17)</td>
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<td>$125</td>
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Conclusions
• In addition to controlling patients’ serum phosphorus, ferric citrate has the added benefit of increasing patients’ iron stores; this may reduce anemia treatment costs.
• Based on physician behavior in response to ferritin and TSAT increases and ferric citrate clinical trial results, and considering model assumptions, there could be cost savings with ferric citrate compared to IV iron use.
• Sensitivity analyses show that potential reductions in ESA utilization associated with ferric citrate have the largest impact on model treatment costs, followed by the price of the phosphate binders themselves.
• Special consideration: Potential ESA-sparing dosing trends have not been measured since the June 2011 revision to FDA-approved ESA labels—which suggest dosing to a target hemoglobin level of < 11 g/dL.6

References

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Figure 1. Model Calculation

Figure 2. Sensitivity Analysis: 2-Month Clinic Savings

Tornado Diagram of One-Way Sensitivity Analyses

Figure 3. Sensitivity Analysis: 2-Month Clinic Savings

Table 3. Cost Savings (Total Populations), Thousands

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