EE266

A Cost-Utility Analysis of Ferric Derisomaltose Versus Ferric Carboxymaltose in Patients with Iron Deficiency Anemia in China

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Background

Iron deficiency anemia (IDA) is the most common nutritional deficiency in the world, affecting 30% of the global population.[1] In China specifically, IDA is estimated to affect 176 million people.[2]

Intravenous (IV) iron is the recommended treatment for patients with iron deficiency anemia (IDA) who are unresponsive to oral iron treatment, or require rapid iron replenishment. Ferric derisomaltose (FDI) and ferric carboxymaltose (FCM) are two high-dose, rapid infusion, IV iron formulations that have recently been compared in three head-to-head randomized controlled trials (RCTs), which showed significantly higher incidence of hypophosphatemia after administration of FCM than FDI.

The objective of the present study was to evaluate the cost-utility of FDI versus FCM in patients with IDA in China.

Methods

A previously-published patient-level simulation model was used to model the cost-utility of FDI versus FCM in China.[3] Each simulated patient was assigned baseline values for age, bodyweight, and hemoglobin values that were randomly and independently sampled from baseline distributions informed by a Chinese RCT of FCM (Table 1).[4] The mean iron need for each patient and therefore the number of infusions of FDI and FCM was then modeled based on the approved posology of the respective formulations in line with the simplified tables of iron need in the respective product labelling. Data on the incidence of hypophosphatemia were obtained from the PHOSPHARE-IDA RCT,[5] while disease-related quality of life was modeled based on SF-36v2 data from the PHOSPHARE-IBD RCT and a published diminishing marginal utility model.[6,7] FDI and FCM were assumed to be priced at parity in the base case analysis.

Costs were captured from the perspective of the Chinese healthcare system over a five-year time horizon. An annual discount rate of 3.0% was applied to future QoL effects and costs, based on precedent in previous cost-effectiveness studies conducted within China. As no formal willingness-to-pay (WTP) threshold currently exists in China, a WTP of 85,698 RMB was adopted, reflecting the 2022 Chinese Gross Domestic Product (GDP) per capita.[8]

All costs outcomes were reported in 2023 Renminbi (RMB) and were recorded and summarized alongside quality-adjusted life expectancy (expressed in quality-adjusted life years [QALYs]) and survival outcomes (with analyses performed separately for FDI and FCM). Where applicable, final incremental cost-utility ratios (ICURs) were calculated based on the differences between the FDI and FCM arms. One-way and probabilisitic sensitivity analyses were performed, as were scenario analyses in which the price of FCM was reduced by 25% and 50% relative to the FDI list price.

Results

Base case results

Over five years, patients received 3.98 courses of iron treatment on average, requiring 0.90 fewer infusions of FDI than FCM (7.69 versus 6.79). This resulted in iron procurement and administration cost savings of RMB 508 with FDI (RMB 3,927 versus RMB 3,420). Reduced hypophosphatemia incidence and a larger improvement in fatigue with FDI resulted in an increase of 0.073 QALYs, and further cost savings of RMB 807, driven by reduced need for phosphate testing and replenishment (Table 2). FDI was therefore the dominant intervention.

Table 1. Baseline patient characteristics and disease parameters

Item	Baseline value		Source
Baseline mean (SD) age, years	39.40 (9.31)		NCT03591406.[4]
Baseline mean (SD) bodyweight, kg	60.07 (12.0)		
Pre-treatment mean (SD) hemoglobin level, g/dL	7.9 (1.48)		
Median time to IDA recurrence, months	16.00 (4.34)		Kulnigg *et al.*[9]
Hypophosphatemia	**FDI**	**FCM**	Zoller *et al.*[6]
Patients experiencing any hypophosphatemia (<2mg/dL) %	3.4	65.10	

Abbreviations: FCM, ferric carboxymaltose; FDI, ferric derisomaltose; IDA, iron deficiency anemia; SD, standard deviation.

Table 2. Health economic results from the base case and price scenario analyses

	Life expectancy (years)			Quality-adjusted life expectancy (QALYs)			Costs (2023 RMB)			ICUR (RMB/ QALY)
	FCM	FDI	Δ	FCM	FDI	Δ	FCM	FDI	Δ	
Base case analysis	4.972	4.972	**0.000**	2.594	2.667	**+0.073**	4,735	3,420	**-1,315**	FDI dominant
Scenario analyses										
Ferric carboxymaltose price -25%	4.972	4.972	**0.000**	2.594	2.667	**+0.073**	3,814	3,420	**-395**	FDI dominant
Ferric carboxymaltose price -50%	4.972	4.972	**0.000**	2.594	2.667	**+0.073**	2,894	3,420	**+525**	7,223

Abbreviations: Δ, delta/difference; FCM, ferric carboxymaltose; FDI, ferric derisomaltose; QALYs, quality-adjusted life years; RMB, Renminbi.

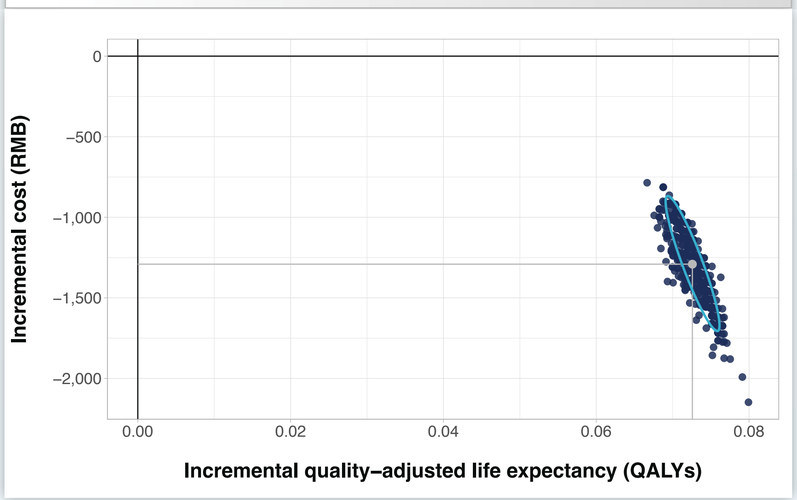
Sensitivity and scenario analyses

In the probabilistic sensitivity analysis, all ICURs fell within the south-eastern quadrant of the cost-utility plane, representing reduced costs and improved quality-adjusted life expectancy, and consistent dominance of FDI over FCM (see Figure 1). At all WTP thresholds between RMB 0.00 and RMB 161,952, FDI was 100% likely to be a cost-effective strategy.

Results from one-way sensitivity analyses showed that baseline bodyweight was the largest single driver of base case outcomes (Figure 2), followed by the effectiveness and cost discount rates. Baseline hemoglobin, and oral and IV phosphate costs also featured in the ten most substantial drivers of model outcomes, as did the parameters of the diminishing marginal utility model.

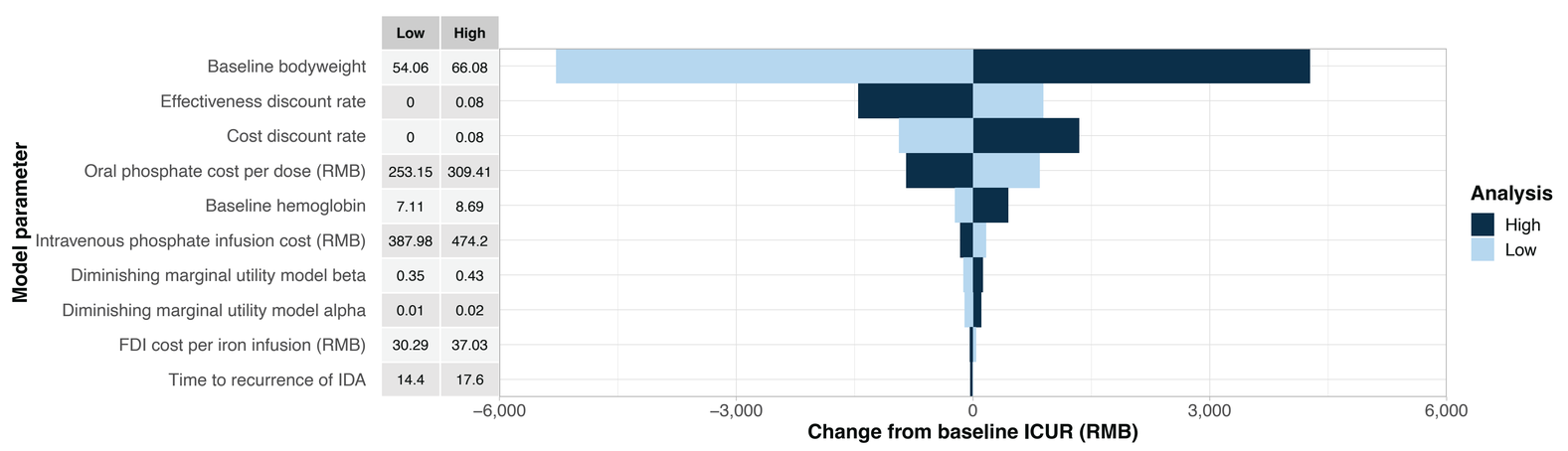
Price scenario analyses showed that FDI would still be cost saving overall when FCM was discounted at up to 35.7% of the FDI list price, and FDI would still be highly cost-effective even when FCM was discounted to 50% of the FDI list price (Table 2).

Figure 1. Scatterplot from the probabilistic sensitivity analysis



Abbreviations: QALYs, quality-adjusted life years; RMB, Renminbi.

Figure 2. Tornado plot of one-way sensitivity analysis results



Abbreviations: FDI, ferric derisomaltose; ICUR, incremental cost-utility ratio; IDA, iron deficiency anemia; RMB, Renminbi.

Conclusions

Relative to FCM, FDI brought about larger improvements in fatigue and consequent improvements in quality-adjusted life expectancy.

FDI also reduced costs driven by a reduction in the number of iron infusions required to address the iron need, combined with reduced phosphate monitoring and replenishment costs.

Scenario analyses showed that FDI would remain highly cost-effective versus FCM even with FCM available at a 50% discount to the FDI list price.

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