Cost Comparison between Leuprolide 3-Month Formulation and Other Gonadotropin-Releasing Hormone Agonists as Therapy for Children with Central Precocious Puberty in China

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BACKGROUND

Central precocious puberty (CPP) is a common pediatric endocrine disease characterized by premature activation of the hypothalamic-pituitary-gonadal axis leading to sexual dysplasia in girls and boys younger than age 8 and 9, respectively.

Chinese guideline recommends Gonadotropin-releasing hormone analog sustained-release agent (GnRHa) for CPP treatment to delay bone maturity and improve adult height.[1] There are two dosing options of GnRHa drugs (1- or 3- month). However, the cost-effectiveness of different dosing forms is unknown.

OBJECTIVES

To compare the treatment costs of three GnRHa drugs, leuprolide 11.25 mg 3-month (L-3M) depot, leuprolide 3.75 mg 1-month (L-1M) depot and triptorelin 3.75 mg 1-month (T-1M) depot, as therapy for CPP children in China.

METHODS

Study Design

A 4-year cost-minimization model was developed from the societal perspective. Direct medical costs (drug costs, registration fees, injection fees and examination fees), direct non-medical costs (transportation and accommodation costs) and indirect costs (loss of salary for caregivers) were analyzed (see Fig.1). The direct medical costs and the direct non-medical costs were obtained by multiplying the average cost per hospital visit by the frequency of visits. The indirect costs were assessed by the labor loss through the human capital method. The conversion was calculated by multiplying the lost time of caregivers by the per capita daily wage.

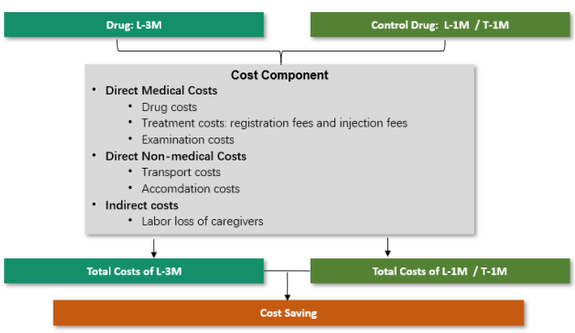


Fig.1 Study design

Modeling

This model was established by Microsoft EXCEL. Based on our research, this model set the following reasonable assumption:

- The annual frequency of hospital visits and examination for fall-off patients is 50% of that of compliant patients.

One-way sensitivity analysis was conducted to assess the uncertainty and result robustness.

Data Inputs

The model parameters included three aspects: patient distribution, medical service costs and medical resource utilization. The data came from published literature[2], official websites[3] and expert interviews. Medical service prices data were the median price summarized from Beijing, Shanghai, Shenzhen, Jiangsu, Fujian and Hunan. For parameters that could not be obtained from literature, expert interviews were conducted to collect the data. All costs were discounted at a rate of 5%.

RESULTS

Base Case

Compared to patients with L-1M and T-1M, those with L-3M were associated with 29.6 fewer injections and CPP-related hospital visits over a period of 4 years per patient (see Tab.1.).

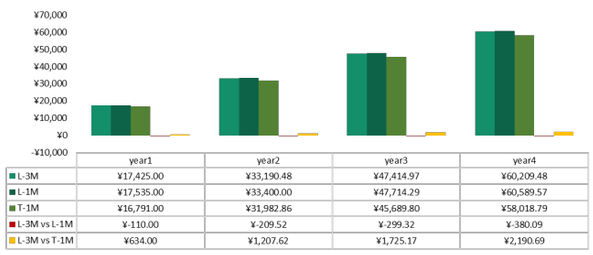
Tab.1 Patient accumulated visits in 4 years

	L-3M	L-1M	T-1M	Difference	
				L-3M vs L-1M	L-3M vs T-1M
year 1	4.0	12.0	12.0	8.0	8.0
year 2	7.8	23.4	23.4	15.6	15.6
year 3	11.4	34.2	34.2	22.8	22.8
year 4	14.8	44.4	44.4	29.6	29.6

Patients with L-3M saved a total cost of ¥17,103.91 compared to patients with L-1M, including the savings of ¥380.09 (2.2%) in direct medical costs, ¥10,684.96 (62.5%) in direct non-medical costs, and ¥6,038.87 (35.3%) in indirect costs. Additionally, patients with L-3M saved a total cost of ¥14,533.13 compared to patients with T-1M, including an incremental direct medical costs of ¥2,190.69, a saving of ¥10,684.96 in direct non-medical costs, and a saving of ¥6,038.87 in indirect costs (see Tab.2 and Fig.2.-Fig.3.).

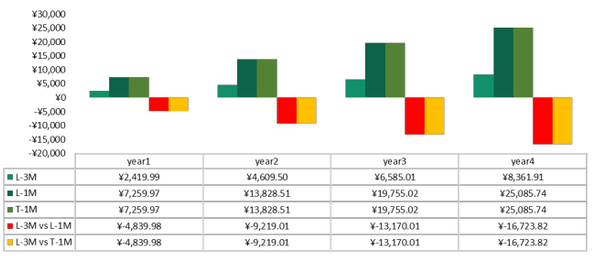
Tab.2 Accumulated costs in 4 years

	L-3M	L-1M	T-1M	Difference	
				L-3M vs L-1M	L-3M vs T-1M
Direct Medical Costs	¥60,209.48	¥60,589.57	¥58,018.79	¥-380.09	¥2,190.69
Drug costs	¥54,249.00	¥53,654.68	¥51,083.90	¥594.32	¥3,165.10
Treatment costs	¥487.20	¥1,461.61	¥1,461.61	¥-974.41	¥-974.41
Examization costs	¥5,473.28	¥5,473.28	¥5,473.28	¥0.00	¥0.00
Direct Non-medical Costs	¥5,342.48	¥16,027.44	¥16,027.44	¥-10,684.96	¥-10,684.96
Transport Costs	¥1,915.56	¥5,746.67	¥5,746.67	¥-3,831.11	¥-3,831.11
Accommodation Costs	¥3,426.92	¥10,280.77	¥10,280.77	¥-6,853.85	¥-6,853.85
Indirect Costs	¥3,019.43	¥9,058.30	¥9,058.30	¥-6,038.87	¥-6,038.87
Labor Loss	¥3,019.43	¥9,058.30	¥9,058.30	¥-6,038.87	¥-6,038.87
Total Costs	¥68,571.39	¥85,675.31	¥83,104.53	¥-17,103.91	¥-14,533.13



	year1	year2	year3	year4
L-3M	¥17,425.00	¥33,190.48	¥47,414.97	¥60,209.48
L-1M	¥17,535.00	¥33,400.00	¥47,714.29	¥60,589.57
T-1M	¥16,791.00	¥31,982.86	¥45,689.80	¥58,018.79
L-3M vs L-1M	¥-110.00	¥-209.52	¥-299.32	¥-380.09
L-3M vs T-1M	¥634.00	¥1,207.62	¥1,725.17	¥2,190.69

Fig.2 Total direct medical costs



	year1	year2	year3	year4
L-3M	¥2,419.99	¥4,609.50	¥6,585.01	¥8,361.91
L-1M	¥7,259.97	¥13,828.51	¥19,755.02	¥25,085.74
T-1M	¥7,259.97	¥13,828.51	¥19,755.02	¥25,085.74
L-3M vs L-1M	¥-4,839.98	¥-9,219.01	¥-13,170.01	¥-16,723.82
L-3M vs T-1M	¥-4,839.98	¥-9,219.01	¥-13,170.01	¥-16,723.82

Fig.3 Total direct non-medical costs and indirect costs

Sensitivity Analysis

This study employed a one-way sensitivity analysis which respectively floated the key parameters up and down by 10%. The key driver of sensitivity analyses is the unit cost of L-3M (see Fig.4). The results demonstrated the robustness of the model in different circumstances.

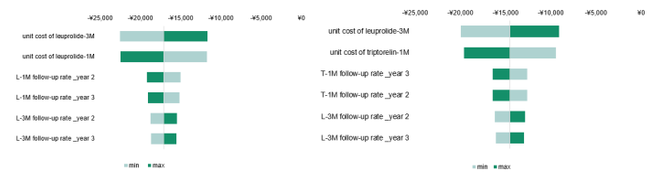


Fig.4 Sensitivity analysis
(left: L-3M vs L-1M; right: L-3M vs T -1M

LIMITATIONS

Some parameters came from expert interviews and thus may not be representative of all CPP patients in China.

CONCLUSIONS

Using L-3M is a cost-saving strategy compared to L-1M and T-1M from the societal perspective in China. Besides the difference in direct treatment costs, less injection frequency of L-3M also reduces injection-related direct non-medical and indirect costs.

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