Cost-effectiveness Analysis of GLP-1 RA to Prevent Type 2 Diabetes among Teenagers in the United States

EE329

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Background

- Obesity affects 20% of U.S. youth and is driving a rapid increase in type 2 diabetes (T2D) incidence, often resulting in more severe health outcomes than type 1 diabetes.[1-2]
- While GLP-1 receptor agonists (GLP-1 RAs) show clinical promise for adolescent weight management and T2D prevention, their adoption is currently hindered by high costs, safety concerns, and limited insurance coverage.

Objective

- To assess the clinical effectiveness, costs, and cost-effectiveness of GLP-1 RA among a hypothetical 1,660K U.S. children with overweight and obesity on weight reduction and diabetes risk reduction.

Methods

- Model: Markov model developed in Microsoft Excel, simulating annual health state transitions across seven states: Normal Healthy weight; Normal Overweight/Obesity; Prediabetes Healthy weight; Prediabetes Overweight/Obesity; Diabetes Healthy weight; Diabetes Overweight/Obesity; and Death.
- Population: 1,660K U.S. children aged 10 with overweight or obesity, projected over a 10-year horizon until age 20.
- Strategies:
  - *Status Quo*: No medication.
  - *Liraglutide*: GLP-1 RA treatment for one year.
  - *Orlistat*: Orlistat treatment for one year.
  - *Metformin*: Metformin treatment for one year.
- Input Parameters: Transition probabilities derived and calibrated from national statistics and literature, utility values, and costs (2023USD) (Table 1).
- Projected Outcomes:
  - Clinical: Number of individuals with obesity, prediabetes, and diabetes; Life Years (LYs).
  - Economic: Quality-Adjusted Life Years, Total costs (healthcare and societal perspectives), and Incremental Cost-Effectiveness Ratios.
- Sensitivity Analyses: One-way sensitivity analyses to test parameter uncertainty and probabilistic sensitivity analyses with a willingness-to-pay threshold up to $100,000.

***Liraglutide* is the most clinically effective option for reducing obesity and diabetes, but its high cost makes it cost-prohibitive.**

***Metformin*'s superior cost-effectiveness makes it the most practical candidate for expanding adolescent obesity insurance coverage.**

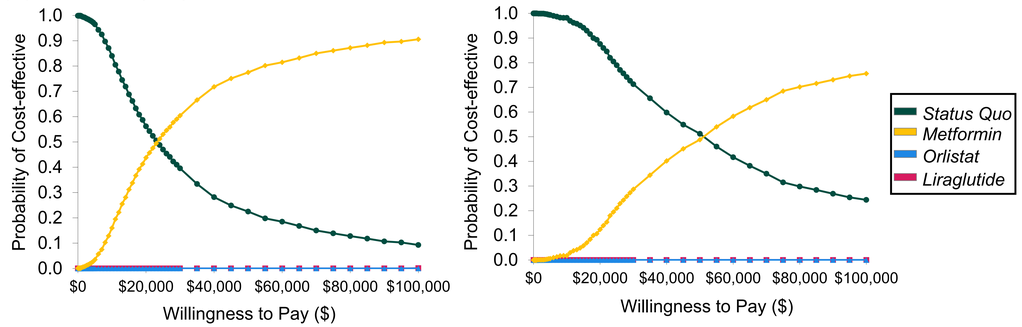
Table 1. Selected model input parameters

Parameters	Values	Range	Source
Natural history			
Relative risk			
Prediabetes of Overweight/Obesity vs Healthy weight	2.50	(1.4-5.5)	Assumed
Diabetes of Overweight/Obesity vs Healthy weight	2.50	(1.4-5.5)	[3,4]
Remission from Diabetes of Healthy weight vs Overweight/Obesity	70.86	(8.78-589)	[5]
Mortality of Overweight/Obesity vs Healthy weight	4.04	(2-8.17)	[6]
Mortality of Prediabetes vs Normal	1.13	(1.1-1.17)	[7]
Mortality of Diabetes vs Normal	1.89	(1.74-2.04)	[8]
Proportion of diagnosed individuals			
Prediabetes	0.10		[9]
Diabetes	0.23		[10]
Transition probability from Obesity to Healthy weight			
Liraglutide	0.21	(0.1-0.31)	[11]
Orlistat	0.17	(0.12-0.23)	[12]
Metformin	0.15	(0.05-0.24)	
Utilities			
Normal	0.97		Estimated
Healthy weight	0.98		[13]
Overweight/Obesity	0.95		
Prediabetes	0.93	(0.76-1)	[14]
Healthy weight	0.95		Estimated
Overweight/Obesity	0.92		
Diabetes	0.87	(0.67-1)	[14]
Healthy weight	0.89		Estimated
Overweight/Obesity	0.87		
Costs (per year, 2023USD)			
Drug costs			
Liraglutide	15,540	(11,440-16,340)	[15,16]
Orlistat	8,544		[15]
Metformin	540		
Health care costs			
Normal Healthy weight	2,226		[15]
Overweight/Obesity (addition to Healthy weight)	+135	(16-234)	[17]
Prediabetes (addition to Healthy weight)	+98		[18]
Diabetes (addition to Healthy weight)	+248		
Caregiver costs	600	(480-1,200)	[19]

Table 2. Results of base case analyses of the impacts of four medication strategies for body weight and T2D on population, QALYs, costs, and cost-effectiveness.

	Population projection (thousand)			QALYs (thousand)	Costs (million 2023USD)		ICER (Cost/QALYs)	
	Obesity	Prediabetes	Diabetes		Healthcare	Societal	Healthcare	Societal
Status Quo	1,244	530	89	13,104	33,230	33,230	-	-
Metformin	1,232	527	86	13,130	33,907	34,729	26,000	58,000
Orlistat	1,229	526	85	13,138	44,473	45,268	Dominated	Dominated
Liraglutide	1,223	525	83	13,150	52,715	53,472	940,000	937,000

Figure 1. Results of probabilistic sensitivity analyses of four medication strategies



Results

- **Base case** (Table 2)
  - *Liraglutide* was the most clinically effective intervention, projected to prevent 21,000 cases of youth obesity and 6,000 cases of diabetes over 10 years.
  - *Metformin* was the most cost-effective strategy, with an ICER of $26,000/QALY vs. $940,000/QALY for *Liraglutide* (healthcare perspective).
- **One-way sensitivity analyses**
  - The cost-effectiveness was primarily driven by their effectiveness in reducing BMI; under optimal clinical performance, *Liraglutide*'s ICER improved to $331,000/QALY, while *Metformin*'s dropped to $10,000/QALY.
- **Probabilistic sensitivity analyses** (Figure 1)
  - At a standard willingness-to-pay threshold of $100,000/QALY, *Metformin* was the most likely cost-effective strategy, whereas *Liraglutide* had a near 0% probability of being cost-effective.

1. Watson et al. *MMWR*. 2022
2. Dabelea et al. *JAMA*. 2017
3. Wang et al. *Diabetes Metab Res Rev*. 2010
4. Ganz et al. *Diabetol Metab Syndr*. 2014

Conclusions

- *Liraglutide* offers superior clinical results but remains cost-prohibitive.
- *Metformin* is the most economically viable strategy for improving long-term adolescent health. Expanding insurance coverage for Metformin in obesity management is a justified public health priority given its significant cost-effectiveness.

Limitations

- The Markov model uses categorical health states, simplifying continuous clinical metrics like BMI percentiles and HbA1c levels.
- The 10-year horizon, necessitated due to shifting clinical definitions of obesity between adolescence and adulthood, may underestimate the lifetime economic benefits of early intervention.

5. Kanbour et al. *Lancet Diabetes Endocrinol*. 2025
6. Lindberg et al. *PLoS One*. 2020
7. Cai et al. *BMJ*. 2020
8. Yang et al. JAMA Netw Open. 2019
9. CDC
10. American Diabetes Association. 2023
11. Claudia et al. N Engl J Med. 2024
12. O'Connor et al. JAMA. 2017
13. Gortmaker et al. Health Aff. 2015
14. Rhodes et al. J Pediatr. 2012
15. Mital & Nguyen. JAMA Netw Open. 2023
16. Liu et al. J Manag Care Spec Pharm. 2025
17. Ward et al. PLoS One. 2021
18. Khan et al. Popul Health Manag. 2017
19. Focus Family Care 2025

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