Integrating Social Determinants of Health into GLP-1 Value Assessment: A Proposed Distributional Cost-Effectiveness Analysis Framework

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INTRODUCTION

- Standard cost-effectiveness analysis (CEA) values all quality-adjusted life years (QALYs) equally, disregarding social determinants of health (SDOH). This assumption leads to systematic undervaluation of interventions that primarily benefit disadvantaged populations. As a result, labeling high-cost therapies as "not cost-effective" can exacerbate existing health inequities[1].
- Integrating SDOH into CEA is essential for methodological accuracy. Frameworks that treat all QALYs as equivalent systematically misvalue interventions benefiting disadvantaged populations and risk reinforcing health inequities[1].
- This study introduces a practical approach to incorporate SDOH into value assessment, supporting equity-sensitive policy decisions.

OBJECTIVE

- To develop a framework integrating SDOH into GLP-1 value assessment using distributional CEA within a multi-criteria decision analysis (MCDA) structure. The Indian population was stratified into five SDOH quintiles, with equity weights based on Atkinson social welfare theory applied to quantify distributional impacts of coverage decisions.

METHODOLOGY

- Clinical, utility and cost parameters were sourced from *Gupta et al, 2025*[2] and adapted to the Indian context using purchasing power parity (PPP) conversion. SDOH quintile characteristics were derived from National Family Health Survey-5 distributions and World Bank India poverty data[3].
- ***SDOH vulnerability index:*** Five vulnerability quintiles were derived from 4 domains (socioeconomic, accessibility, literacy and structural factors) scaled from 0-1 and equally weighted to yield composite score from 0 (least vulnerable) to 10 (most vulnerable).
- ***Markov cohort model:*** Includes 5 health states (obesity alone, obesity with type 2 diabetes mellitus [T2DM], obesity with cardiovascular disease [CVD], obesity with both, and death), 20-year horizon and 3% discount rate.
- ***Atkinson equity weights:*** Equity weights (ε=0-2) applied to prioritize health gains in deprived groups[4].
- ***MCDA scoring:*** Four domains (clinical, economic, equity, feasibility) scored 0-100 under stakeholder scenarios[5].
- ***Probabilistic Sensitivity Analysis (PSA):*** 1,000 Monte Carlo simulations quantified uncertainty, generating CIs, acceptability frontiers, and distributional impact tables .
- Key model inputs included semaglutide weight loss of 14.9%, hazard ratios of 0.27 for type 2 diabetes and 0.80 for cardiovascular events, and a 52.5% discontinuation rate. Annual drug cost was ₹79,794, baseline utility 0.887, willingness-to-pay (WTP) threshold ₹0.54M/QALY, with ε values ranging from 0-2.0.

Table 1: Distribution of SDOH Indicators Across Quintiles

Characteristics	Q1 (Least Vulnerable)	Q2	Q3	Q4	Q5 (Most Vulnerable)
Monthly PCCE (₹)	25,000	12,000	6,500	3,200	1,400
Below poverty line (%)	2	8	22	45	72
Rural population (%)	15	35	55	72	88
Distance to facility (Km)	1.5	3.2	6.8	12.4	22.6
Literacy rate (%)	92	80	65	48	28
Insurance coverage (%)	68	45	28	14	5
SC/ST population (%)	5	18	32	52	71
Pucca housing (%)	94	78	55	32	12
SDOH composite score	**0.0**	**1.4**	**3.4**	**6.3**	**10.0**

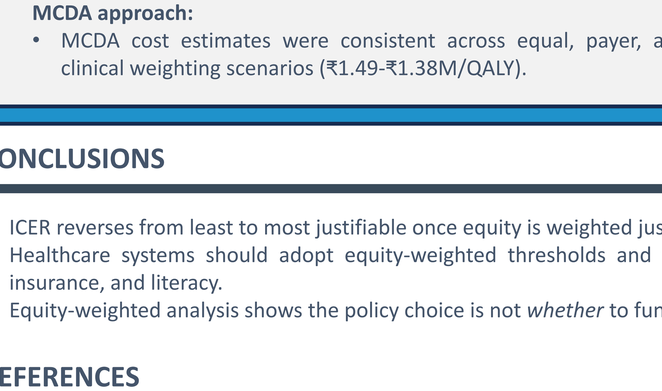
Abbreviations: ₹: Indian Rupee; Km: Kilometer; PCCE: Per Capita Consumption Expenditure; Q1: Quintile 1; Q2: Quintile 2; Q3: Quintile 3; Q4: Quintile 4; Q5: Quintile 5; SC/ST: Scheduled Caste/Scheduled Tribe; SDOH: Social Determinants of Health.

RESULTS

The equity trap in numbers:

- Over 20 years, disadvantaged quintiles gain fewer QALYs from semaglutide (Q1: 0.354 vs. Q5: 0.218). Q5 achieves 38% fewer QALYs than Q1, reflecting inequities from adherence and access barriers rather than differences in drug efficacy.
- Unadjusted ICERs range ₹1.3-1.4M/QALY, far above India's WTP threshold (₹0.5 M). Standard CEA rejects coverage for all quintiles.

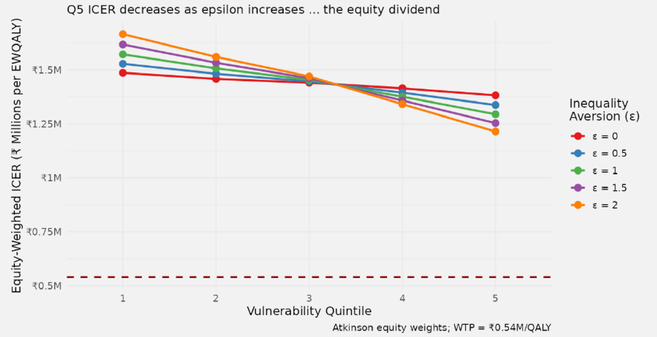
Figure 1: Unadjusted ICER by Vulnerability Quintile
Semaglutide vs Standard Care ... 20-Year Horizon



The equity dividend:

- Applying Atkinson equity weight (ε=2); Q5's ICER falls to ₹1.2M/QALY while Q1's rises to ₹1.6M/QALY. Under equity weighting, the least justifiable drug in standard CEA becomes most justifiable.

Figure 2: Equity-Weighted ICER by Quintile and Epsilon
Q5 ICER decreases as epsilon increases ... the equity dividend



MCDA approach:

- MCDA cost estimates were consistent across equal, payer, and clinical weighting scenarios (₹1.49-₹1.38M/QALY).
- In contrast, equity-preferred weighting reduced costs per EWQALY from ₹1.57M (Q1) to ₹1.27M (Q5), underscoring vulnerable quintiles.

Table 2: MCDA Cost Estimates by Stakeholder Weighting Scenario

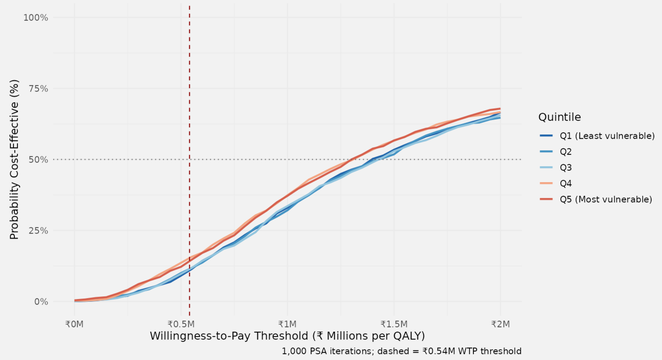
Scenario	Domain weights	Q1	Q2	Q3	Q4	Q5
Equal weights	Clinical 25% Economic 25% Equity 25% Feasibility 25%	1.49	1.46	1.44	1.41	1.38
Payer-preferred	Clinical 20% Economic 40% Equity 20% Feasibility 20%	1.49	1.46	1.44	1.41	1.38
Equity-preferred	Clinical 20% Economic 20% Equity 40% Feasibility 20%	1.57	1.49	1.44	1.36	1.27
Clinical-preferred	Clinical 40% Economic 20% Equity 20% Feasibility 20%	1.49	1.46	1.44	1.41	1.38

Abbreviations: ₹: Indian Rupee; EWQALY: Equity-Weighted QALY; M: Million; QALY: Quality-Adjusted Life Year; Q1: Quintile 1; Q2: Quintile 2; Q3: Quintile 3; Q4: Quintile 4; Q5: Quintile 5.
Note: All cost estimates are expressed as (₹) Indian Rupee in Millions per QALY or EWQALY.

PSA confirmation:

- Equity-impact acceptability frontiers confirm Q5's advantage at higher WTP thresholds. Credible intervals are wider for Q5, highlighting evidence gaps in deprived populations; uncertainty is the greatest where equity matters most.

Figure 4: Equity-Impact Acceptability Frontiers
Probability semaglutide is cost-effective at each WTP threshold



CONCLUSIONS

- ICER reverses from least to most justifiable once equity is weighted justifying conditional reimbursement for high-vulnerability quintiles.
- Healthcare systems should adopt equity-weighted thresholds and tie reimbursement for vulnerable quintiles to concurrent investment in access, insurance, and literacy.
- Equity-weighted analysis shows the policy choice is not *whether* to fund, but *how* to fund it, emphasizing feasibility barriers over clinical efficacy.

REFERENCES

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