Lumanity

POSTER EE207

# Does Your 1-Million-Member Cohort Tell the Whole Story? Rethinking Eligible Population Estimation in Chronic Disease Budget Impact Analyses in the US

Authors: Annika Bjerke[1], Tyler Mantaian[1], and Yang Meng[1]

Affiliations: 1. Lumanity, Morristown, NJ.

## INTRODUCTION

### In chronic disease budget impact (BI) models, how the "eligible patient population" is defined and accrued over time is a primary driver of affordability results

- BI projections are widely used to assess the affordability of health care interventions and to inform reimbursement and formulary decisions (e.g. tier placement, copay/coinsurance design, and net price negotiation).[1,2] The credibility of BI estimates depends heavily on accurately estimating the eligible patient population over the modeled time horizon
- Standard BI analyses often assume a simplified approach to defining the eligible population in a hypothetical health plan (commonly a 1-million-member plan). While this can be operationally convenient, it can implicitly assume stable enrollment, simple patient accrual, and/or limited differentiation between how prevalent and incident patients contribute to utilization over time. These assumptions are especially consequential in chronic conditions, where disease prevalence, incidence, long treatment durations, and multi-year time horizons can cause eligible patient counts to evolve materially from Year 1 to later years
- Given these complexities, a structured approach to estimating eligible populations in chronic disease BI modeling is needed to ensure projects reflect realistic population accrual and treatment dynamics over time

## OBJECTIVES

### This BI analysis evaluates multiple approaches to defining the eligible patient population for a chronic condition

- Specifically, we assess how alternative methods for constructing the eligible population from a hypothetical 1-million-member plan influence projected BI over a 3-year time horizon

## METHODS

- We developed a model in Microsoft-Excel® using hypothetical population, epidemiology, and treatment inputs to estimate BI over a 3-year time horizon
- We evaluated three population estimation approaches:

1. Continuous cohort: a single 1-million-member population over 3 years – prevalence applied in Year 1 and incidence applied annually (Table 1a)
2. Disease growth cohort: same as Option 1, but incidence increases annually (Table 1b), reflecting improved diagnosis or expanding at-risk populations, for example
3. Annual refresh: full 1-million-member cohort reset each year – prevalence and incidence applied annually (i.e. cohort in each year is mutually exclusive) (Table 1c)

- Prevalence and incidence were set at 5 per 100,000 persons and 1 per 100,000 persons, respectively, resulting in an eligible population of 60 patients in Year 1 (Table 1). Mortality for the hypothetical chronic disease was not modeled over the 3-year time horizon
- A hypothetical intervention ($200 per week for drug acquisition costs) and one comparator ($100 per week) were considered with patients remaining on treatment across the time horizon (i.e. no treatment discontinuation)
- Annual uptake of the intervention and comparator was assumed to be: 10% / 90% in Year 1, 20% / 80% in Year 2 and 30% / 70% in Year 3. Patients entered at the start of the year annually and were assumed to initiate treatment immediately

**Figure 1: Analysis overview**

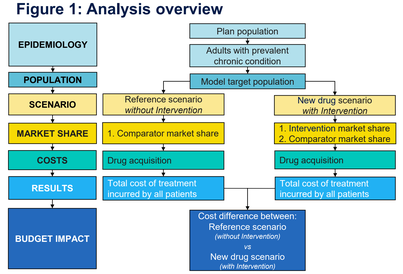



**Table 1: Patient population across scenarios**

**Table 1a: Option 1, continuous cohort**

| Option 1 | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Plan size | 1,000,000 | 1,000,000 | 1,000,000 |
| Prevalence | 5 per 100,000 | N/A | N/A |
| | 50 | N/A | N/A |
| Incidence | 1 per 100,000 | 1 per 100,000 | 1 per 100,000 |
| | 10 | 10 | 10 |
| **Total eligible population** | **60** | **70** | **80** |

**Table 1b: Option 2, disease growth cohort**

| Option 2 | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Plan size | 1,000,000 | 1,000,000 | 1,000,000 |
| Prevalence | 5 per 100,000 | N/A | N/A |
| | 50 | N/A | N/A |
| Incidence | 1 per 100,000 | 2 per 100,000 | 3 per 100,000 |
| | 10 | 20 | 30 |
| **Total eligible population** | **60** | **80** | **110** |

**Table 1b: Option 3, annual refresh**

| Option 3 | Year 1 | Year 2 | Year 3 |
|---|---|---|---|
| Plan size | 1,000,000 | 1,000,000 | 1,000,000 |
| Prevalence | 5 per 100,000 | 5 per 100,000 | 5 per 100,000 |
| | 50 | 50 | 50 |
| Incidence | 1 per 100,000 | 1 per 100,000 | 1 per 100,000 |
| | 10 | 10 | 10 |
| **Total eligible population** | **60** | **60** | **60** |

- Annual outcomes included total per year (TPY), per member per month (PMPM), and per treated member per month (PTMPM) BI

## RESULTS

### Differences in BI results across patient population approaches are not visible in Year 1, but widen substantially over time

- Year 1 results are identical across all three approaches (TPY $31,307; PMPM $0.0026; PTMPM $0.1565), since all options start from the same eligible population assumptions in Year 1 (Table 2)
- Divergence emerges in Year 2 and accelerates in Year 3 as eligible population accrual differs by approach, resulting in a widening spread in TPY BI (Year 2 range: $62,614–83,484; Year 3 range: $93,921–172,184) (Table 2)
- By Year 3, the gap between the highest- and lowest-impact approaches reaches $78,263 in TPY BI, underscoring the impact of different population estimation approaches (Figure 2)

**Table 2: Patient population across scenarios**

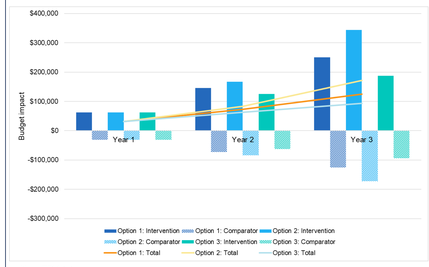
| BI across options | Year 1 | Year 2 | Year 3 | Years 1–3 |
|---|---|---|---|---|
| **TPY BI** | | | | **Cumulative** |
| Option 1 | $31,307 | $73,049 | $125,227 | **$229,583** |
| Option 2 | $31,307 | $83,484 | $172,184 | **$286,975** |
| Option 3 | $31,307 | $62,614 | $93,921 | **$187,843** |
| **PMPM BI** | | | | **Average** |
| Option 1 | $0.0026 | $0.0061 | $0.0104 | **$0.0064** |
| Option 2 | $0.0026 | $0.0070 | $0.0143 | **$0.0080** |
| Option 3 | $0.0026 | $0.0052 | $0.0078 | **$0.0052** |
| **PTMPM BI** | | | | **Average** |
| Option 1 | $0.1565 | $0.4261 | $0.8348 | **$0.4725** |
| Option 2 | $0.1565 | $0.5566 | $1.5783 | **$0.7638** |
| Option 3 | $0.1565 | $0.3131 | $0.4696 | **$0.3131** |

**Key:** BI, budget impact; PMPM, per member per month; PTMPM, per treated member per month; TPY; total per year.

### The population approach materially changes 3-year affordability conclusions (Option 2 highest, Option 3 lowest)

- Option 2 produces the highest cumulative TPY BI ($286,975), 25% higher than Option 1 ($229,583) and 53% higher than Option 3 ($187,843)
- Option 3 produces the lowest cumulative TPY BI ($187,843), representing an 18% reduction versus Option 1 and a 35% reduction versus Option 2
- While PMPM values remain small in absolute terms, relative differences are meaningful: average PMPM ranges from $0.0052–0.0080 across options, and average PTMPM ranges from $0.3131–0.7638 – indicating that the choice of eligible population approach can change the perceived affordability of the intervention

**Figure 2: Detailed TPY BI across patient population approaches**




**Key:** TPY, total per year.

## DISCUSSION

### Eligible population methodology should be selected based on the decision context as it can materially change BI conclusions

- This analysis shows that chronic disease BI projections are highly sensitive to how the eligible population is constructed and accrued over time; methods that appear equivalent in Year 1 can diverge substantially across a multi-year horizon
- As a result, the "right" approach is not one-size-fits-all; it should reflect the payer audience, enrollment assumptions, and disease dynamics (stable vs changing incidence, expected diagnostic expansion, and whether the goal is a longitudinal projection vs annual snapshots)
- To improve transparency and interpretability, BI models should explicitly state whether the eligible population reflects (a) a continuous cohort with incident additions, (b) a growing disease environment, or (c) mutually exclusive annual refreshes, and describe the implications for how patients accrue over time

### Each approach answers a different payer question

- Option 1 (continuous cohort) reflects a longitudinal view of the same health plan over time, where baseline prevalence is captured in Year 1 and only newly incident patients accrue thereafter
- Option 2 (disease growth cohort) extends the longitudinal view by allowing the flow of new patients to increase over time, aligning to disease areas with rising incidence or expanding diagnosis/eligibility
- Option 3 (annual refresh) treats each year as a separate snapshot with a reset plan population, so results primarily reflect changing uptake patterns rather than multi-year accumulation of treated patients

## KEY TAKEAWAYS

- Eligible population methodology is a major driver of chronic disease BI; differences may be minimal in Year 1 but compound over time
- In this illustrative example, changing only the population approach produced a wide range in 3-year BI (TPY: ~$188K–287K; PMPM: $0.0052–0.0080; PTMPM: $0.3131–0.7638)
- PMPM values are small in absolute terms, but relative differences across methods can meaningfully change affordability conclusions

## CONCLUSIONS

- How the 1-million-member population is defined, and how prevalence/incidence are applied, can substantially alter BI projections for chronic diseases
- A continuous cohort approach may be most appropriate when modeling a stable, longitudinal plan population with incident patient accrual; a disease growth approach may be better when incidence is expected to rise; and an annual refresh approach may better reflect contexts with substantial membership turnover or coverage resets
- Because the "right" population method depends on payer context and disease dynamics, BI analyses should include clear justification of the selected approach and (when feasible) scenario testing to demonstrate sensitivity to population assumptions

## REFERENCES

1. Ghabri and Mauskopf. The use of budget impact analysis in the economic evaluation of new medicines in Australia, England, France and the United States; Springer, 2018: 173–5.
2. Sullivan SD, Mauskopf JA, Augustovski F, et al. Budget impact analysis—principles of good practice: report of the ISPOR 2012 Budget Impact Analysis Good Practice II Task Force. Value in health. 2014; 17(1):5–14.

An electronic version of the poster can be viewed by scanning the QR code.

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