Budget-Impact Analysis of Ibalizumab in the Treatment of US Medicare Beneficiaries With Multidrug-Resistant HIV-1 Infection

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BACKGROUND

- Limited antiretroviral (ARV) treatment options are available for heavily treatment-experienced individuals with multidrug-resistant (MDR) HIV-1 infection, including older United States (US) Medicare beneficiaries who have aged while on treatment.
- In March 2018, ibalizumab-uiyk (ibalizumab) was approved by the US Food and Drug Administration for use in adults with MDR HIV-1 infection who are failing their current regimen.[1]
  - Ibalizumab is a first-in-class, long-acting, humanized monoclonal antibody that is a CD4-directed postattachment HIV-1 inhibitor.
  - The treatment is administered by intravenous infusion every 2 weeks and is used in combination with optimized background therapy (OBT).
- Analyses are needed to understand the budget impact of adding ibalizumab to a Medicare health plan.

OBJECTIVE

- This study evaluates the budget impact of adding ibalizumab to a US Medicare health plan for the treatment of MDR HIV-1 infection.

METHODS

Model Structure

- A budget-impact model with an underlying Markov structure was developed to estimate the economic impact of including ibalizumab on a hypothetical Medicare plan with 1 million members (Figure 1).
- The model compared ARV drug costs and HIV management costs over a 3-year period for two scenarios: with and without ibalizumab included on the formulary as an add-on to OBT.
- Upon entering the model, Medicare beneficiaries with MDR HIV-1 infection received resistance testing to determine OBT; patients then initiated treatment with either ibalizumab + OBT or OBT alone and were classified as responders or partial/nonresponders at week 25 (based on clinical trial data) (Figure 2).
- Over the 3-year time horizon, individuals were able to transition between CD4-based health states and experience treatment failure or death from HIV-related or non–HIV-related causes.
- Upon treatment failure, individuals discontinued ibalizumab and remained on their failing OBT as nonsuppressive therapy.

Model Inputs

- Model inputs related to the size of the eligible population, drug costs, and treatment efficacy are presented in Table 1 through Table 3.
- Other direct medical costs by CD4 health state (including annual medical costs and non-ARV medication costs) and annual HIV-related mortality were obtained from the published literature.[2,3]
- For the scenario with ibalizumab on the Medicare formulary, estimates of ibalizumab uptake among those with MDR HIV-1 infection were 5% in year 1, 10% in year 2, and 15% in year 3 (based on clinical expert opinion).

Model Outcomes and Analyses

- The model estimated the following outcomes:
  - Number of Medicare beneficiaries with MDR HIV-1 infection eligible for treatment
  - Total annual and per-member per-month (PMPM) costs for each scenario
  - Incremental budget impact
- Key input parameters were tested in scenario analyses.

Table 1. Population Inputs[a]

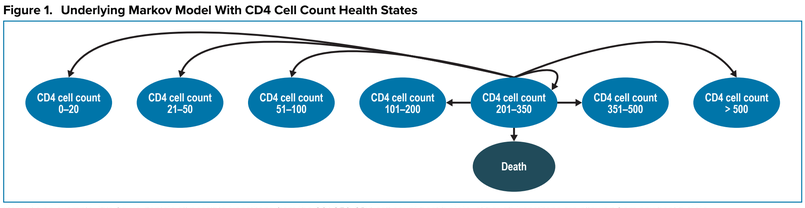
Parameter	Value	Sources and Assumptions
Total size of Medicare health plan	1,000,000	Assumption
Prevalent population (year 1)		
Percentage aged ≥ 18 years	100.0%	Assumption
Percentage of adults aged ≥ 18 years with an existing HIV diagnosis	0.35%	Centers for Medicare and Medicaid Services, 2017[4]
Percentage of diagnosed adults who are retained in HIV care	45.0%	Hall et al., 2013[5]
Percentage of patients retained in care who are currently treated with ARV therapy	89.0%	Hall et al., 2013[5]
Percentage of treated adults with MDR HIV-1 infection	4.4%	Scherrer et al., 2016[6]
Total prevalent population	*62*	*Calculated value*
Incident population (years 1-5)		
Percentage of treated adults who develop MDR HIV-1 infection each year	0.04%	Scherrer et al., 2016[6]
Total incident population per year	*0.5*	*Calculated value*

[a] Characteristics of the modeled population were based on the baseline characteristics of participants in the phase 3 clinical trial and are reported elsewhere.[7-9]

Table 2. Drug Acquisition and Administration Inputs

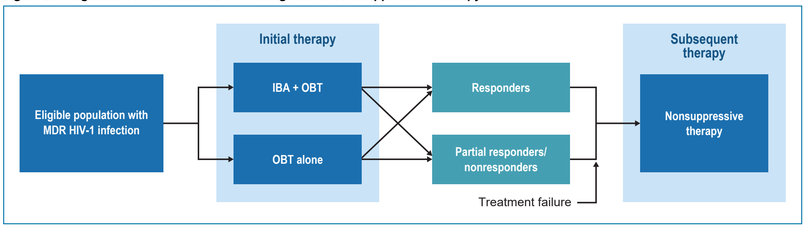
Parameter	Value	Sources and Assumptions
Ibalizumab drug acquisition costs		Red Book Online[10] (year 1 cost accounts for loading dose when starting treatment)
Year 1	$125,255	
Years 2+	$118,445	
Cost per ibalizumab administration	$259.14	Average cost assuming patients receive treatment in an outpatient clinic, outpatient infusion center, or in-home setting[11]
Annual cost of initial OBT	$52,850	Based on analysis of OBT regimens used by participants in ibalizumab's phase 3 clinical trial[12]
Annual cost of nonsuppressive therapy	$65,962	Red Book Online[10] (assuming individuals have an additional protease inhibitor or nonnucleoside reverse transcriptase inhibitor added to OBT)

Figure 1. Underlying Markov Model With CD4 Cell Count Health States



Note: As an example, this figure depicts all possible transitions from the 201-350 CD4 cell count health state, although transitions are allowed from any health state.

Figure 2. Progression From Initial OBT to Failing OBT as Nonsuppressive Therapy



IBA = ibalizumab; MDR = multidrug-resistant; OBT = optimized background therapy.

Notes: Resistance testing was conducted to determine OBT when patients entered the model and when patients experienced two consecutive visits with HIV RNA ≥ 200 copies/mL. Responders were defined as HIV RNA < 50 copies/mL at 25 weeks.

Table 3. Treatment Efficacy Inputs

Parameter	Ibalizumab + OBT	OBT Alone	Sources and Assumptions
Percentage of individuals achieving response (HIV RNA < 50 copies/mL at week 25)			
Responders	42.5%	0.0%	Ibalizumab + OBT: Emu et al., 2018[8] OBT alone: TaiMed data on file[13]
Partial responders/nonresponders	57.5%	100.0%	
3-month probability of treatment failure (2 consecutive visits with HIV RNA ≥ 200 copies/mL)			
Responders (year 1)	0.000	0.000	Ibalizumab + OBT: TaiMed data on file[9] OBT alone: Assumed equal to ibalizumab + OBT
Responders (years 2+)	0.253	0.253	
Partial responders/nonresponders	0.507	0.507	
Mean (SD) change in CD4 cell count from baseline (day 7) to:			
Week 13	36.1 (102.8)	8.8 (25.0)	Ibalizumab + OBT: TaiMed data on file[9] OBT alone: TaiMed data on file[13]
Week 25	62.4 (105.8)	40.1 (67.9)	
Week 37	64.8 (105.8)	42.5 (67.9)	Estimated based on week 25 values and Li et al., 2011[14]
Week 49	67.2 (105.8)	44.9 (67.9)	
Annual change in CD4 cell count in years 2+ of initial therapy	9.6	9.6	Li et al., 2011[14]
Annual change in CD4 cell count for nonsuppressive therapy	−22.0	−22.0	Ledergerber et al., 2004[15]

SD = standard deviation.

RESULTS

- For a hypothetical Medicare plan with 1 million members, approximately 62.6 individuals with MDR HIV-1 are expected to be treated with ARV therapy in year 1.
- Over the 3-year period, total costs of ARV therapy and other direct medical costs are estimated at approximately $13.5 million for the scenario without ibalizumab on the formulary and $14.8 million for the scenario with ibalizumab.
- Adding ibalizumab to the formulary is expected to result in an annual budget impact of $252,561 ($0.021 PMPM) in year 1, $447,839 ($0.037 PMPM) in year 2, and $651,349 ($0.054 PMPM) in year 3 (Figure 3).
- Scenario analyses indicated that results are most sensitive to ibalizumab uptake projections, although results are also affected by alternate assumptions related to treatment failure and ibalizumab discontinuation rates (Table 4).

Figure 3. Total Annual Budget Impact of Introducing Ibalizumab to Medicare Plan With 1 Million Members

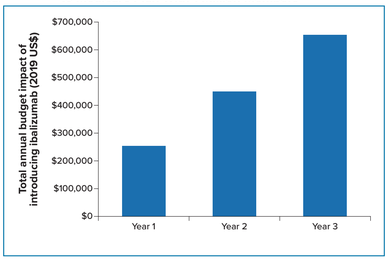


Table 4. Budget-Impact Scenario Analyses for Medicare Plan With 1 Million Members

	Incremental Annual Budget Impact		
Scenario	Year 1	Year 2	Year 3
Base case	$252,561	$447,839	$651,349
Lower percentage discontinuing ibalizumab in nonsuppressive therapy (75% discontinuation)	$286,242	$488,452	$667,657
Treatment failure alternatively defined based on the time to protocol-defined virologic failure[a]	$328,912	$535,592	$720,085
Lower annual nonsuppressive therapy drug costs ($52,850, assumes nonsuppressive therapy cost equals cost of OBT for the initial regimen)	$259,466	$481,028	$691,816
Lower ibalizumab uptake (−50%)	$126,280	$222,450	$321,075
Higher ibalizumab uptake (+50%)	$505,121	$898,968	$1,313,811
Lower drug costs borne by payer (assumes 10% coinsurance for ibalizumab, $25 copayment for all other ARV drugs)	$227,338	$406,008	$594,030
Lower drug costs borne by payer (assumes $25 copayment for all ARV drugs, including ibalizumab)	$251,496	$446,361	$648,561

[a] Scenario analysis defined virologic failure as 2 consecutive viral load measurements with < 0.5 $\log_{10}$ decline from baseline. The 3-month probabilities of treatment failure were 0.000 for responders in year 1, 0.109 for responders in years 2+, and 0.210 for partial responders/nonresponders.

LIMITATIONS

- Treatment efficacy data were obtained from ibalizumab's small, single-arm, 24-week phase 3 clinical trial.
  - The budget-impact model used projected efficacy for ibalizumab + OBT beyond the trial period and estimated efficacy for OBT alone using results from ibalizumab's phase 2a clinical trial.
- The analysis did not explicitly model ibalizumab-specific adverse events; costs related to general treatment-related adverse events were captured in the model as part of other direct medical costs by CD4 cell count.
- Several of the model inputs (e.g., nonsuppressive therapy efficacy, mortality) were based on somewhat dated estimates from the published literature, although these were the most recent estimates identified.

DISCUSSION

- Including ibalizumab on a US Medicare health plan is expected to result in a relatively low budget impact that remains low over a 3-year time period and across a range of scenario analyses.
- These results do not include the public health or economic benefits of avoided secondary infections resulting from improved virologic suppression or any indirect benefits that may be associated with the use of ibalizumab (as is customary with budget-impact analyses).
- Medicare beneficiaries with MDR HIV-1 infection have limited remaining treatment options. Ibalizumab may serve as an important treatment option for this population by helping to improve health outcomes with limited budget impact.

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DISCLOSURES

- Funding for this study was provided by Theratechnologies, Inc. Authors maintained independent scientific control of the study design and analyses.

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