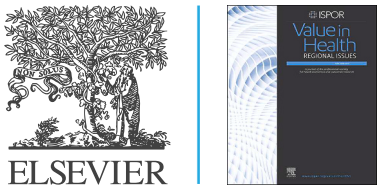

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Healthy Policy Analysis

# Hospital Budget Impact and Provider-Side Economic Evaluation of Lecanemab and Donanemab Under Japan's National Fee Schedule: A Head-to-Head Linear Model

Kotaro Makita, MD, PhD, Takuto Nishihara, MD, Yuta Arakaki, MD, Tomoya Ohida, MD, Kosei Goto, MD, PhD, Nobuo Kutsuna, MD, PhD

## ABSTRACT

*Objectives:* The study aimed to assess the provider-side financial viability of antiamyloid disease-modifying therapies for early Alzheimer's disease in Japan, we developed a linear hospital-provider model that separates a short inpatient diagnostic phase from an outpatient infusion phase.

*Methods:* Using public National Health Insurance tariffs, official 2025 drug prices, and workflow-based labor costing with time-driven activity-based costing, we estimated per-case outpatient margins and program-level break-even case volumes. Scenarios examined fee-for-service versus diagnosis procedure combination/per-diem payment system hospitals, magnetic resonance imaging surveillance intensity, purchase discounts, wage growth, routine-workflow staff time, and the scheduled 15% lecanemab price reduction effective November 1, 2025.

*Results:* At 1.5 T with no assumed wage growth, donanemab yielded positive outpatient margins from + 37,670JPY at no purchase discount to + ¥110 777 at a 2.6% discount. Lecanemab at 50 kg yielded −¥9048 at no discount and broke even at a discount of 0.304% before the scheduled price reduction and 0.358% after it. At 55 to 60 kg, the equal-discount threshold at which lecanemab overtook donanemab shifted from about 6.2% before the price reduction to 20.9% after it. Sensitivity analyses showed purchase discounts were the dominant driver, whereas labor and workflow inputs affected lecanemab more because it requires more infusions per year.

*Conclusions:* Under Japan's fee schedule, both therapies were financially viable across typical purchase-discount ranges in scenario analyses, but findings should be interpreted as provider-margin estimates rather than comparative clinical judgments.

*Keywords:* Alzheimer's disease, break-even analysis, donanemab, hospital economics, Japan, lecanemab.

Cite this article as: Makita K, Nishihara T, Arakaki Y, Ohida T, Goto K, Kutsuna N. Hospital budget impact and provider-side economic evaluation of lecanemab and donanemab under Japan's national fee schedule: a head-to-head linear model. *Value Health Reg Issues*. 2026;XX:101675. https://doi.org/10.1016/j.vhri.2026.101675

## Introduction

Antiamyloid disease-modifying therapies (DMTs) for early Alzheimer's disease, including lecanemab and donanemab, require appropriate-use recommendations (AUR)-compliant implementation with confirmation of amyloid pathology, baseline magnetic resonance imaging (MRI), and on-treatment MRI surveillance to mitigate amyloid-related imaging abnormalities (ARIA).[1-6] Although prior work has described the substantial economic burden of Alzheimer's disease/dementia and conducted payer- or societal-perspective economic evaluations and budget-impact analyses, the provider-side question in Japan—whether hospitals can operate an AUR-compliant DMT program without financial loss under the National Fee Schedule and local operational constraints—remains insufficiently characterized.[7-14]

Beyond clinical considerations, hospitals should decide whether to establish and scale DMT programs, which carry material implications for budgeting, capacity planning, and operational workflows. Under Japan's reimbursement system, outpatient care is largely fee-for-service (FFS), whereas inpatient care commonly follows the diagnosis procedure combination/per-diem payment system (DPC/PDPS), a per-diem prospective payment linked to diagnosis and length of stay strata. Consequently, the revenue structure of short diagnostic admissions (eg, 1-2 nights) differs between FFS and DPC hospitals. A robust managerial evaluation should integrate revenues from imaging and tests, inpatient basic fees, and

outpatient infusion procedure fees, together with bed-day costs and the opportunity cost of occupied beds, to derive per-case marginal contribution (Δ).[15,16]

In the outpatient phase, margins are highly sensitive to the gap between list price and purchase price (drug-price discount, δ) and to list-price revisions. Notably, lecanemab is scheduled for a 15% list-price reduction effective November 1, 2025 (200 mg: ¥38 910; 500 mg: ¥97 277), which will directly shift provider-side drug margins; future revisions for donanemab are also plausible.[17] These dynamics underscore the need for a model that remains stable under changes in drug price revision factors (k), discounts (δ), and labor costs.

Japan-based literature has not provided a provider-perspective framework that decomposes the DMT pathway into a short diagnostic admission and an outpatient infusion program, is reproducible from public sources, and accommodates FFS versus DPC/PDPS rules, positron emission tomography (PET) use, MRI surveillance requirements, purchase discounts (δ), wage growth (g), and price revisions (k).[15-18]

We evaluate whether an AUR-compliant antiamyloid DMT program can be operated without financial loss under Japan's National Fee Schedule and which factors drive per-case margins and program-level break-even volume. We hypothesize that procurement terms (δ) and list-price revisions (k) are dominant drivers and that lecanemab is more labor sensitive because of higher infusion frequency. Using a fully linear model, we derive closed-form break-even and head-to-head threshold conditions and present scenarios before and after the scheduled lecanemab list-price revision (k_L = 0.85 from November 1, 2025).[15-19]

## Methods

### Study Design, Perspective, and Setting

We conducted a provider-side economic planning study from the hospital perspective in Japan. Rather than estimating realized margins from institution-specific accounting data, the model translates public reimbursement rules and key operational levers—purchase discounts, list-price revisions, wage growth, MRI capacity, and touch time—into per-case margins and program-level break-even volumes.

Because this was a provider-side planning model rather than a cost-effectiveness evaluation, uncertainty was examined with deterministic 1-way analyses, structured scenarios, and probabilistic sensitivity analysis rather than hypothesis testing. The model reports 1-year per-case outcomes without discounting and derives annual break-even volume at the program level. Costs and revenues are reported in Japanese yen (price year 2025) using National Health Institute (NHI) fee-schedule points valued at ¥10 per point, tax-inclusive, within Japan's nontaxable medical-service framework.[18,20]

### Payment Context and Clinical Governance

Outpatient services are reimbursed FFS, whereas inpatient care is commonly reimbursed under DPC/PDPS; accordingly, short diagnostic stays yield different revenue structures between FFS and DPC hospitals. Clinical pathways followed AUR, including scheduled MRI surveillance for ARIA mitigation and PET assessment around 12 to 18 months for donanemab completion planning. An additional earlier MRI for lecanemab was examined in sensitivity analyses.[3-6,21,22]

### Model Overview and Notation

The model is fully linear. Core inputs are annual infusion and surveillance MRI counts, inpatient and outpatient reimbursement, MRI revenue and cost, infusion supplies, annual drug price, list-price revision factor, purchase discount, per-minute wage, touch time, length of stay (LOS), bed-day cost, and opportunity cost. Outputs are summarized as diagnostic-phase contribution ($\Delta_{diag}$), outpatient contribution ($\Delta_i$), total contribution ($\Delta_{total}$), and annual break-even volume ($N^*$). Full notation and equations are provided in the Supplementary Methods, and Appendix Figure 1 provides a conceptual overview.[20-22]

Conceptually, each evaluated patient enters a short diagnostic phase, in which payment context, LOS, diagnostic testing, and bed-related costs determine $\Delta_{diag}$. Patients who start treatment then enter the outpatient infusion phase, in which visit and infusion fees, surveillance MRI, procurement margin, and time-driven activity-based costing (TDABC)-based labor determine $\Delta_i$. Program-level feasibility is read from $\Delta_{total} = \Delta_{diag} + \Delta_i$ and the break-even case volume $N^*$. Appendix Figure 1 provides a conceptual overview.

### Equations (Referenced; full LaTeX in Supplement)

Diagnostic phase (FFS): inpatient basic fees + itemized diagnostics (MRI, cerebrospinal fluid [CSF], neuropsychological batteries) − $(C_{bed} + C_{opp}) \times$ LOS. (Eq. 1)[23-27]

Diagnostic phase (DPC/PDPS): per-diem inclusive payment × LOS + allowed itemized add-ons − $(C_{bed} + C_{opp}) \times$ LOS. (Eq. 2)[26,27]

Outpatient phase (drug-specific):

$$\boldsymbol{\Delta_i} = \underbrace{\boldsymbol{\kappa_i}}_{\substack{\text{non-drug net} \\ \text{(visit + infusion + MRI)}}} - \underbrace{(\mathbf{1}+\boldsymbol{g})\,\text{Labor}_{\boldsymbol{i}}}_{\text{TDABC: } \sum_j \boldsymbol{r_j t_{j,i} n_i}} + \underbrace{\boldsymbol{k_i}\,\boldsymbol{P_i(w)}\,\boldsymbol{\delta_i}}_{\text{drug price margin}}, \quad \text{(Eq. 3)}$$

where $\boldsymbol{g}$ is wage growth. (Eq. [3])[28,29]

Threshold discount for break-even (outpatient-only), head-to-head boundaries under same/different $\delta$, and wage sensitivity are defined as follows.

$$\delta_i^* = \max\left\{0, \frac{(1+g)\text{Labor}_i - \kappa_i}{k_i P_i(w)}\right\} \quad \text{(Eq. 4)}$$

$$\widehat{\delta}_{L=D}(w,g) = \frac{(\kappa_D - \kappa_L) + (1+g)(\text{Labor}_L - \text{Labor}_D)}{k_L P_L(w) - k_D P_D} \quad \text{(Eq. 5)}$$

$$\delta_L^{\text{parity}}(w,g;\delta_D) = \frac{(\kappa_D - \kappa_L) + (1+g)(\text{Labor}_L - \text{Labor}_D) + k_D P_D \delta_D}{k_L P_L(w)} \quad \text{(Eq. 6)}$$

$$\frac{\partial \Delta_i}{\partial g} = -\text{Labor}_i \quad \text{(Eq. 7)}$$

$$\text{Program} - \text{level totals}: \boldsymbol{\Delta_{total}} = \boldsymbol{\Delta_{diag}} + \boldsymbol{\Delta_i} \quad \text{(Eq. 8)}$$

$$\boldsymbol{N^*} = \boldsymbol{F_{fixed}} / \boldsymbol{\Delta_{total}} \quad \text{(Eq. 9)}$$

### Parameterization and Data Sources (Base Case)

Base-case inputs were taken from the NHI fee schedule, official list prices and revision notices, and national wage statistics. Key outpatient values were $\boldsymbol{R_{visit}} = \mathbf{1,280}\,\boldsymbol{JPY}$, $\boldsymbol{R_{MRI}} = \mathbf{19,000}\,\boldsymbol{JPY}$ at 1.5 T, $\boldsymbol{C_{MRI}} = \mathbf{3,000}\,\boldsymbol{JPY}$, $\boldsymbol{C_{sup}} = \mathbf{700}\,\boldsymbol{JPY}$ per infusion, $\boldsymbol{n_L} = \mathbf{26}$, $\boldsymbol{n_D} = \mathbf{12}$, $\boldsymbol{m_L} = \mathbf{3}$, and $\boldsymbol{m_D} = \mathbf{4}$.MRI technical fees, reading rules, and same-month repeat-imaging rules followed the fee schedule, and all monetary values were treated as tax-inclusive claims. Full fee codes, unit values, and scenario ranges are listed in Appendix Table 1.[23-25,28,29]

### Drug Prices, Revision Factor, and Vial Rounding

List-price revisions enter multiplicatively via $\boldsymbol{k_i}$ (eg, $\boldsymbol{k_L} = \mathbf{0.85}$ for a 15% reduction effective November 1, 2025, list prices 200

mg = ¥38 910; 500 mg = ¥97 277). The purchase discount $\boldsymbol{\delta_i}$ is defined as the proportional gap between list and purchase prices (inclusive of tax). For lecanemab, the model vializes each dose using 200/500 mg vials with ceiling to the minimal integer vial count that covers 10 mg/kg (wastage cost implicitly included in $\boldsymbol{P_L}(\boldsymbol{w})$); for donanemab, fixed-dose scheduling (eg, 700 → 1400 mg monthly) is parameterized without weight dependence. These rules feed $\boldsymbol{P_i}(\boldsymbol{w})$ in Eq. [3].[30-32]

### Labor Costing (TDABC)

Per-minute wages for physicians (MD), nurses (RN), and pharmacists (RPh) were derived from national statistics; base-case values were approximately 107.4, 44.8, and ¥49.9/minutes, respectively. Base-case touch time was 10/20/16 minutes per infusion for MD/RN/RPh for both drugs, so annual labor differed because annual infusion counts differed (26 vs 12). Annual labor cost for drug i was $\text{Labor}_i = \Sigma_j\, r_j\, t_{j,i}\, n_i$, with wage growth g applied linearly. Touch time was defined as active staff time attributable to one infusion visit, excluding passive chair occupancy. We additionally examined an institution-informed routine-workflow scenario based on preexisting workflow maps from a Japanese hospital (15/22/16 minutes per infusion), excluding infrequent escalation tasks.[33-37]

### Diagnostic-Phase Specification (FFS vs DPC/PDPS)

For FFS hospitals, revenues include inpatient basic fees × length of stay, MRI (E202) + reading (E203) + electronic image management add-on, CSF procedures, and neuropsychological tests (eg, D285, with the "1 test type per day" constraint). For DPC/PDPS hospitals, per-diem inclusive payments (by day stratum and coefficients) apply with rules on which itemized services can be billed in addition.

We implement $\Delta_{\text{diag}}$ by hospital type using Eq. (1)/Eq. (2) with $C_{\text{bed}}$ and $C_{\text{opp}}$ per occupied day. We treat $C_{\text{opp}}$ as a facility-level policy variable (eg, 0/¥5000/¥10 000 per bed-day) that captures the forgone contribution of the "next-best patient" during high occupancy. In practice, hospitals may approximate this parameter as the contribution margin per bed-day of the alternative admission most likely to be displaced: expected reimbursed revenue minus variable cost, divided by expected occupied days. Short-stay scheduling (eg, Day 2 CSF; Day 3 morning Behavioral Assessment of the Dysexecutive Syndrome; discharge) is represented to meet coding constraints while minimizing LOS.[38,39]

### Outcomes

The primary outcome is $\boldsymbol{\Delta}$ (JPY per case-year); the secondary program-level outcomes are $\boldsymbol{\Delta_{\text{total}}}$ and $\boldsymbol{N^*}$. Sign conventions are stated explicitly (profit > 0). We report outpatient-only results and combined diagnostic + outpatient results; the latter inform $\boldsymbol{N^*}$.[21,22] Assumptions aligned with fee-schedule rules:

- E203 reading fee limited to once per calendar month per patient (CT/MRI combined)
- electronic image management add-on: 120 points per series (once per series)
- second imaging in the same month: technical fee paid at 80%
- MRI field strength effect: 3 T vs 1.5 T increases MRI revenue by + 270 points (¥2700) per MRI
- all prices and fees are tax-inclusive claim amounts; point value is ¥10

These assumptions are enforced uniformly in both phases.[20,24,25]

In the base case, the outpatient phase included routine protocol-driven MRI surveillance only. Nonroutine ARIA management was defined separately as escalation scenarios: (1) unscheduled outpatient reassessment with additional MRI, (2) symptomatic ARIA requiring urgent evaluation, serial MRI, and temporary infusion interruption, and (3) severe ARIA requiring unplanned admission and specialist consultation. Provider-side impact was interpreted as the balance of additional reimbursable services, incremental resource use, and forgone infusion margin during interruption or discontinuation.

### Base-Case Parameterization (Public Inputs; Reference Scenario)

Base-case values were constructed from public national sources and are intended for scenario evaluation rather than realized-margin estimation. The purchase-discount prior was centered on 2.6% from national survey data, wage growth was treated as a scenario parameter, and facility-specific substitution was enabled through Appendix Table 1 and the parameter workbook.

Unless otherwise stated: $R_{\text{visit}}$ = ¥1280; $R_{\text{MRI}}$ = ¥19 000 (1.5 T); $C_{\text{MRI}}$ = ¥3000; $C_{\text{sup}}$ = ¥700/infusion; $n_L$ = 26, $n_D$ = 12; $m_L$ = 3, $m_D$ = 4; per-minute wages as above; base-case touch times MD/RN/RPh = 10/20/16 minutes per infusion; an institution-informed routine-workflow scenario of 15/22/16 minutes per infusion was examined separately; $k_L$ = 0.85 (postrevision scenario in addition to prerevision); and δ was explored over 2% to 10% centered on 2.6% (from national surveys). Body-weight scenarios for lecanemab include 50 kg and 55 to 60 kg to illustrate vialization effects.[30-32]

### Sensitivity and Uncertainty Analysis

- Deterministic (1-way): We varied purchase discounts by ±1 percentage points to 5 percentage points, assumed wage growth by 0% to 20%, role-specific touch times by +1 minute per infusion, MRI field strength (1.5 T → 3 T), and postrevision list-price scenarios. To interrogate the TDABC staff-time assumptions specifically, we also examined an institution-informed routine-workflow scenario (MD/RN/RPh = 15/22/16 minutes per infusion) against the 10/20/16-minute reference base case.
- Scenario: FFS vs DPC/PDPS hospitals; short-stay lengths LOS; $C_{\text{opp}}$ at 0/¥5000/¥10 000 per bed-day; with/without PET in diagnostics; ARIA escalation scenarios as defined above; donanemab completion after amyloid clearance (12-18 months); and a referral-to-treatment flow parameter (q) representing the proportion of diagnostic candidates who ultimately initiate outpatient DMT (eg, q = 0.3/0.5/0.7), reported as expected contribution per referred candidate. For donanemab, we also considered the year-1-to-year-2 planning implication that treatment completion after amyloid clearance reduces carryover infusion revenue and increases dependence on new-patient acquisition to cover fixed program costs.
- Probabilistic (Monte Carlo): We performed 10 000 draws with purchase discounts modeled as $N$(2.6%, 1.0 percentage point), wage growth as $N$(0, 5%), and additional role-specific touch time per infusion (MD/RN/RPh) as U(0, 1 minute). MRI capacity/field strength was represented as a discrete uncertainty with P(MRI = 3 T) = 0.30 (otherwise 1.5 T). Outputs were distributions of the outpatient margin by drug and scenario. These priors were selected to represent plausible operational variation rather than institution-specific empirical distributions; alternative priors and correlations can be specified in the accompanying workbook.

### Model Validation, Ethics, Funding, and Transparency

Model validation comprised face validity review with clinical and reimbursement experts, internal dimensional and spot-check verification, and external consistency checks against official fee-schedule and price revision documents. We also confirmed that the institution-informed routine-workflow scenario defined a plausible operating envelope around the reference base case. This study used public aggregate reimbursement and price sources, and preexisting workflow descriptions from a Japanese hospital were used only to inform a touch-time scenario; no individual-level patient or staff data and no new observational measurements were collected; therefore, IRB review was not required.[23-25]

## Results

All results reported below are model-implied scenario outputs conditional on Japan's fee schedule and the parameter set in Appendix Table 1. They are intended for comparative planning and threshold-based decision support and not as empirical estimates of realized margins at any specific institution.

### Outpatient Margins: Linear Structure and Base-Case Implications

Per-case annual outpatient margins follow Eq. (3): $\Delta_i$ = (nondrug net contribution) + (drug price margin) − (labor). Because the model is fully linear, the discount rate $\boldsymbol{\delta}$ and list-price revision factor $\boldsymbol{k}$ affect margins linearly, and labor terms scale in direct proportion to per-minute wages and number of infusions. Consequently, comparative statics and pre-/postrevision scenarios require only parameter substitution without altering the model structure. Figure 1 visualizes $\Delta_i$ across $\boldsymbol{\delta}$ ($x$-axis) and wage growth $\boldsymbol{g}$ ($y$-axis): for lecanemab (L), the white contour traces the break-even line ($\Delta$_i = 0); for donanemab (D), $\Delta_i$ remains positive across $\boldsymbol{\delta} \in [\mathbf{0}, \mathbf{10}]\%$ and $\boldsymbol{g} \in [\mathbf{0}, \mathbf{20}]\%$.

Base-case nondrug net contribution ($\kappa$) is ¥63 080 for L and ¥70 960 for D. Annual labor totals are approximately ¥72 128 (L) and ¥33 290 (D). Thus, the nondrug minus labor net equals −¥9048 (L) and + 37 670JPY (D); L is slightly negative at $\delta$ = 0, whereas D is positive even without drug discounts. Upgrading MRI from 1.5 T to 3 T increases per-MRI net revenue by ¥2700, lifting $\kappa$ by + 8100JPY (L; 3 MRIs/year) and + 10 800JPY (D; 4 MRIs/year).

Within the tested ranges, the qualitative pattern was stable: donanemab remained less labor sensitive, whereas purchase discount dominated variance for both drugs.

### Prerevision Scenario (Through October 2025)

Prerevision annual list prices (tax-inclusive claims) are 2 975 518 JPY (L, 50 kg), 3 570 606 JPY (L, 55-60 kg), and 2 811 816 JPY (D). Substituting into Eq. (3) yields:

$$\text{L (50 kg)} : \Delta_i = -9048\text{JPY at } \boldsymbol{\delta} = \mathbf{0};\ +68\,315 \text{ at } \boldsymbol{\delta} = \mathbf{2.6}\%;\ +139\,728 \text{ at } \mathbf{5}\%;\ +288\,504 \text{ at } \mathbf{10}\%.$$

$$\text{L (55 − 60 kg)} :\ +83\,788\ (2.6\%);\ +169\,482\ (5\%);\ +348\,013\ (10\%).$$

$$\text{D} :\ +37\,670\ (0\%);\ +110\,777\ (2.6\%);\ +178\,261\ (5\%);\ +318\,852\ (10\%).$$

The outpatient break-even discount for L is ≈0.304% (50 kg) and ≈0.253% (55-60 kg); if, very small relative to realistic ranges (2%-10%).

### Postrevision Scenario (From November 2025) and Head-to-Head Thresholds

Applying the 15% list-price reduction for L ($\boldsymbol{k_L} = \mathbf{0.85}$) gives annual list prices of 2 529 202 JPY (50 kg) and 3 034 980 JPY (55-60 kg). The break-even $\boldsymbol{\delta}$ for L rises slightly to ≈0.358% (50 kg) and ≈0.298% (55-60 kg). Under an equal-δ assumption, the dominance boundary at 55 to 60 kg shifts markedly from ≈6.2% (before revision) to ≈20.9% (after revision), expanding D's advantage at realistic $\boldsymbol{\delta}$. At 50 kg, $\boldsymbol{k_L P_L(w)} - \boldsymbol{k_D P_D} < \mathbf{0}$; thus, L cannot dominate D under equal δ (no finite boundary).

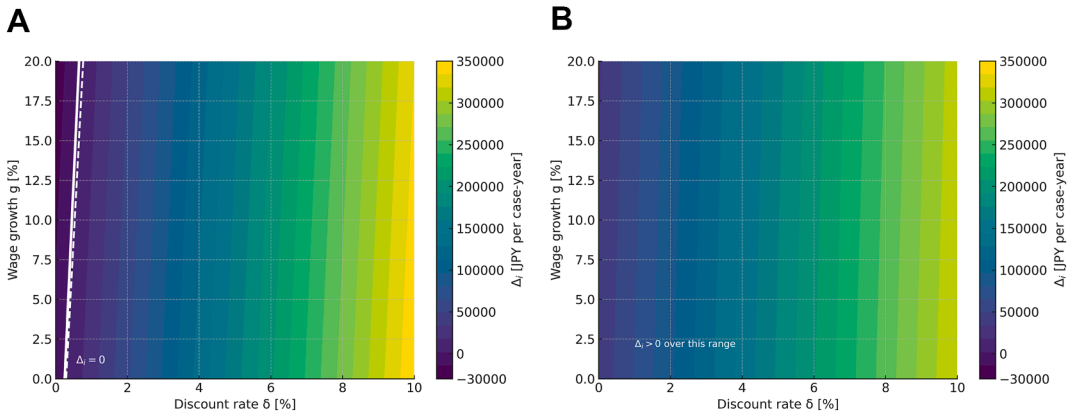
Allowing unequal discounts gives linear conditions from Eq. (6). After revision at 60 kg,

$$\boldsymbol{\delta_L} \gtrsim \mathbf{1.54}\% + \mathbf{0.927}\ \boldsymbol{\delta_D}.$$

For example, with $\boldsymbol{\delta_D} = \mathbf{2.6}\%$, $\boldsymbol{\delta_L} \gtrsim \mathbf{3.95}\%$ is needed for parity. At 50 kg,

$$\boldsymbol{\delta_L} \gtrsim \mathbf{1.85}\% + \mathbf{1.112}\ \boldsymbol{\delta_D}.$$

**Figure 1.** Outpatient margin landscapes (δ × growth [g]; $\Delta_i$ in JPY per case year). The lecanemab panel includes a white contour denoting the break-even line ($\Delta_i$ = 0). No break-even contour is shown for donanemab because $\Delta_i$ remains positive across the plotted ranges of δ and g.



Hence, at $\delta_D = 2.6\%$ one needs $\delta_L \gtrsim 4.74\%$. Hence higher body weight systematically improves L's position by increasing $P_L(w)$ and reducing the slope $k_D P_D / (k_L P_L(w))$ (see Table 1).

### Sensitivity and Uncertainty

Tornado analyses (Fig. 2) show that δ is the dominant driver: + 1 pp in δ changes $\Delta_i$ by + 35 706JPY for L (60 kg, pre-revision) and + 28 118JPY for D. Switching to 3 T adds + 8100JPY (L) and + 10 800JPY (D). A + 10% wage growth reduces $\Delta_i$ by approximately −7.2k JPY for L and −3.3k JPY for D. + 1 minute per infusion changes $\Delta_i$ by −¥2793 (MD), −¥1166 (RN), and −¥1296 (RPh) for L; with $n$ = 12, D's labor sensitivities are roughly half of L (−1289/−538/−599 JPY, respectively).

Monte Carlo (10 000 draws) using $\delta \sim \mathcal{N}(2.6\%, 1.0\text{pp})$, $g \sim \mathcal{N}(0, 5.0\text{pp})$, extra touch time $\sim \mathcal{U}(0, 1\text{ min})$, and $P(\text{MRI} = 3\text{T}) = 0.30$ yields mean $\Delta_i$ of ≈¥+84 000 for L and ≈¥+113 000 for D, with 95% uncertainty intervals (2.5th-97.5th percentiles) of + 13 000 to + ¥154 000 (L) and + 57 000 to + ¥169 000 (D). The probability of $\Delta_i < 0$ is ≈1% to 3% for L and ≪ 1% for D. Dispersion is driven mainly by $\delta$; $g$ and + 1 minutes contribute modestly; 3 T shifts distributions slightly rightward.

As an operational stress test, scaling the touch-time perturbation from +1 minute to +5 minutes per infusion (ie, 5 × the 1-way deltas in Fig. 2) reduces $\Delta_i$ by approximately −26k JPY for lecanemab and −12k JPY for donanemab (base case), whereas a + 1 pp increase in δ increases $\Delta_i$ by + 35 706JPY (L) and + 28 118JPY (D), confirming that purchasing terms dominate variance, whereas operational variation is secondary within plausible ranges.

In the institution-informed routine-workflow scenario based on preexisting role-specific workflow maps from a Japanese hospital (15/22/16 minutes per infusion for MD/RN/RPh), outpatient margins decreased by approximately 16.3k JPY for lecanemab and 7.5k JPY for donanemab relative to the 10/20/16-minute reference base case. Even under this more time-intensive routine-path scenario, procurement terms remained the dominant margin driver.

### Diagnostic-Phase Contribution (FFS vs DPC/PDPS)

As defined by Eq. (1) to (2), $\Delta_{diag}$ depends on length of stay $d$, bed-day cost $C_{bed}$, opportunity cost $C_{opp}$, and the coexistence rules for itemized billing under DPC/PDPS and is independent of drug prices. In short diagnostic admissions, DPC/PDPS tends to absorb more services within per-diem bundles; FFS facilities can realize higher $\Delta_{diag}$ under identical clinical workflows. In both settings, "an extra inpatient night" reduces profit by $C_{bed} + C_{opp}$. Operational designs, such as day 2 CSF and day 3 morning Behavioral Assessment of the Dysexecutive Syndrome, satisfy coding constraints while minimizing $d$.

### Program-level Results: $\Delta_{total}$ and Annual Break-even $N^*$

Program-level margins are $\Delta_{total} = \Delta_{diag} + \Delta_i$ (Eq. [8]), with the required annual case volume given by $N^* = F_{fixed} / \Delta_{total}$ (Eq. [9]). Increasing $\Delta_i$ (via higher $\delta$, 3 T, or workflow gains) and/or $\Delta_{diag}$ (via short-stay design and permissible add-ons) reduces $N^*$ proportionally. Conversely, the L price revision ($k_L = 0.85$) lowers $\Delta_i$ and increases the slope of the "required cases vs profit target" lines for L, implying more cases are needed to reach any fixed target. Figure 3 summarizes these trade-offs and shows how facilities can read $N^*$ from their own $F_{fixed}$, $\Delta_{diag}$, and $\Delta_i$.

## Discussion

We developed a fully linear, reproducible provider-side model that separates a short diagnostic admission from an outpatient infusion program to evaluate the managerial viability of anti-amyloid DMTs under Japan's National Fee Schedule. Outpatient margins decompose into nondrug net contribution, the drug procurement margin (driven by δ and k), and labor (TDABC), enabling closed-form break-even and head-to-head thresholds and rapid scenario updates as prices, wages, and MRI requirements change.

Diagnostic admissions are best viewed as a capacity and payment-rule problem: hospitals need a short, compliant pathway that minimizes avoidable bed-days while remaining within coexistence and frequency constraints.

In this framework, length of stay is the principal negative lever through (1) variable bed-day costs and (2) the opportunity cost of bed occupancy when demand is high. Treating the opportunity cost ($C_{opp}$) explicitly as a local policy parameter aligns with the economic literature on hospital bed management and clarifies when "1 extra night" can dominate the financial picture even when the diagnostic workup is unchanged. Our model formalizes these trade-offs while enforcing fee-schedule constraints relevant to short diagnostic stays (eg, imaging/reading limits and coding constraints for neuropsychological batteries).[21-27,38,39]

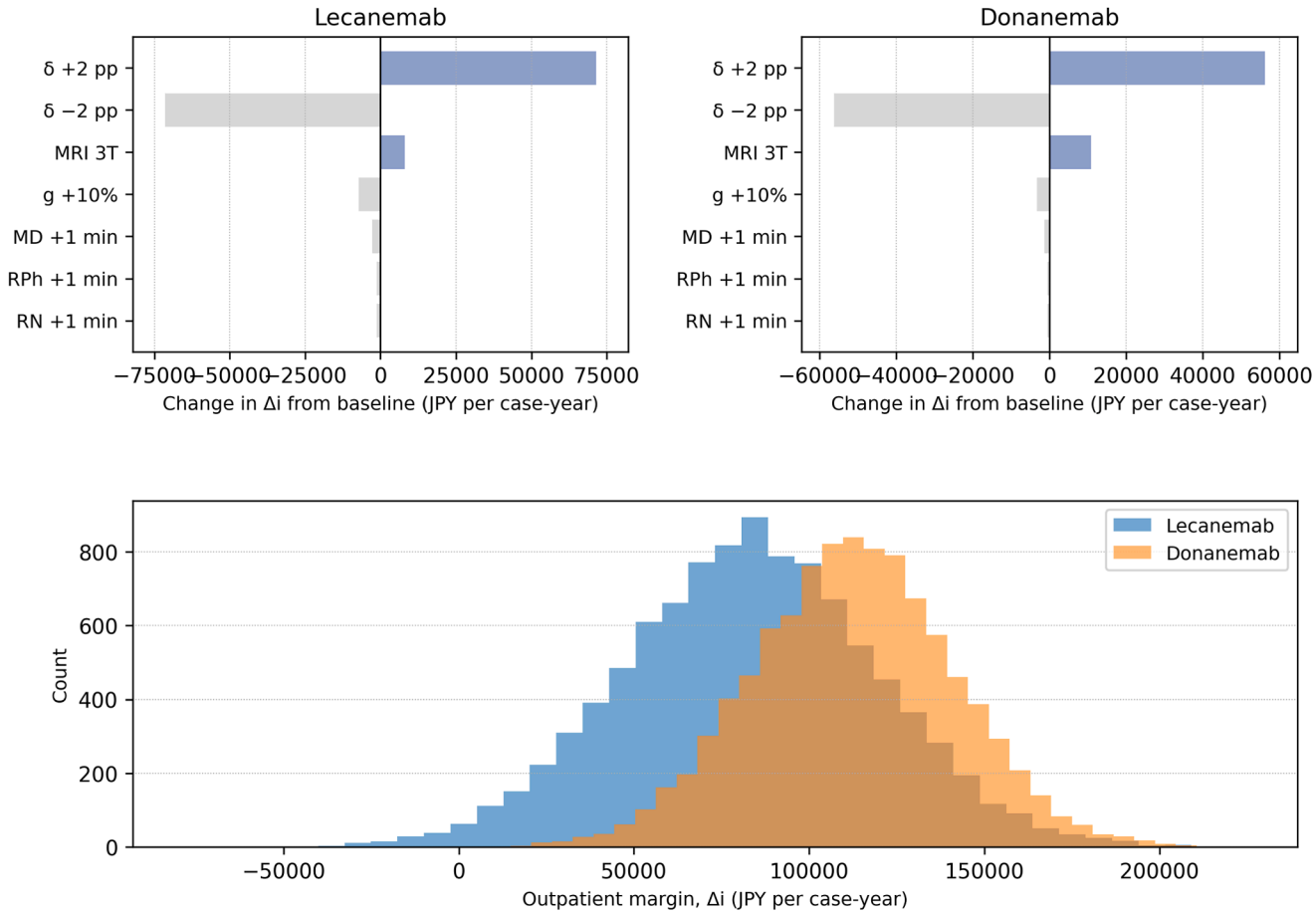
In the outpatient phase, margin depends mainly on 2 components: procurement margin, driven by δ and k, and workflow cost, driven by touch time and wages, with MRI surveillance contributing a smaller systematic add-on. Because Eq. (3) is linear, procurement terms and list-price revisions act as contracting and policy levers, whereas TDABC-based labor acts as a

**Table 1.** Summary of key outpatient outputs under the base-case parameterization.

| Drug | Scenario | Body weight | $\Delta_i$ at $\delta$ = 0% | $\Delta_i$ at $\delta$ = 2.6% | Break-even $\delta$* |
|---|---|---|---|---|---|
| Lecanemab | Before revision | 50 kg | −9048 | + 68 315 | 0.304% |
| Lecanemab | Before revision | 55-60 kg | −9048 | + 83 788 | 0.253% |
| Donanemab | Before revision | NA | + 37 670 | + 110 777 | 0.000% |
| Lecanemab | After revision | 50 kg | −9048 | + 56 711 | 0.358% |
| Lecanemab | After revision | 55-60 kg | −9048 | + 69 861 | 0.298% |
| Donanemab | After revision | NA | + 37 670 | + 110 777 | 0.000% |

Values are outpatient-phase scenario outputs implied by Eq. (3) (growth [g] = 0, MRI = 1.5 T, no extra touch-time deltas). The asterisk in δ* denotes the break-even purchase-discount threshold; 0.000% indicates that no positive purchase discount is required because the outpatient margin is already positive with no purchase discount. Detailed threshold and sensitivity summaries are provided in Appendix Table 2.

**Figure 2.** Sensitivity and uncertainty of the outpatient margin. The tornado plots show 1-way perturbations ordered from largest to smallest absolute impact on $\Delta_i$. The lower panel shows Monte Carlo distributions of $\Delta_i$ under joint uncertainty in δ, growth (g), extra touch time, and MRI field strength.




workflow lever that may change with task design, staffing, and documentation standardization. This interpretation is consistent with the TDABC literature, and MRI surveillance is best treated as a scenario rather than a fixed constant.[33-37,40-42]

At the policy level, provider-side models of this kind can inform fee-schedule revision and regional implementation planning by showing how reimbursement of surveillance MRI, infusion services, and short diagnostic admissions affects hospital participation and patient access.

The closed-form conditions (Eq. [4-6]) provide decision rules showing how margins change with procurement terms (δ) and list-price revisions (k). Because product- and timing-specific discounts can differ, equal-δ head-to-head comparisons may be misleading; the framework therefore supports unequal-δ planning. For lecanemab, vial rounding makes the effective annual list-price weight-dependent; thus, local body-weight distributions can shift dominance boundaries mechanically.[30-32]

Because not all diagnostic candidates initiate DMT, we incorporate referral-to-treatment attrition using q and report expected contribution per referred candidate by combining diagnostic-phase contribution for all evaluated patients with outpatient contribution for initiators. This program-level view supports budgeting and capacity planning under both FFS and DPC/PDPS settings.[21-27]

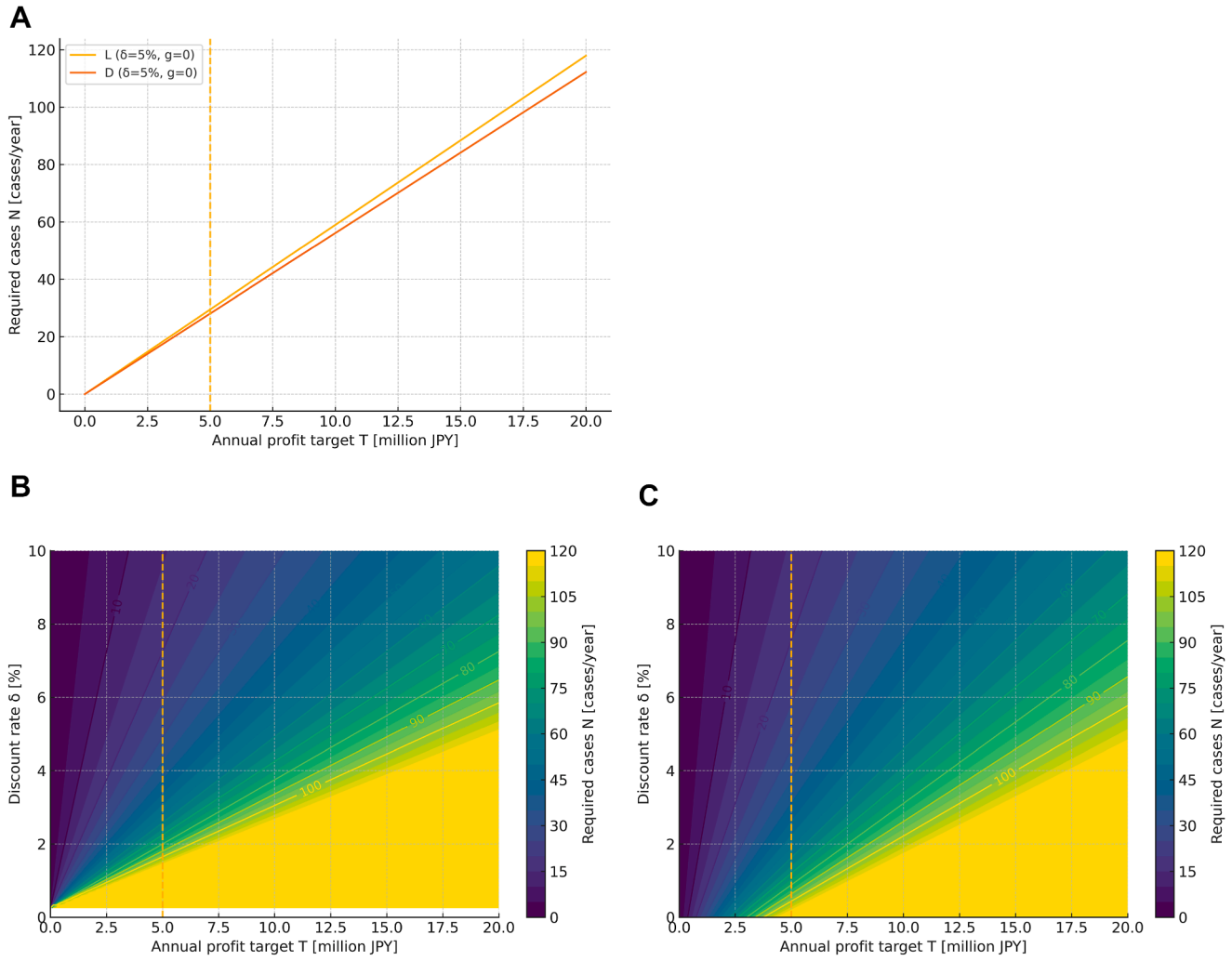
These head-to-head comparisons should be interpreted strictly from a provider-margin perspective. Clinical efficacy, safety profiles, MRI burden, and patient preference may justify adoption choices independently of the financial thresholds reported here.

Donanemab may appear financially attractive in year 1 because outpatient margins remain positive even at δ = 0%; however, after amyloid-clearance assessment at 12 to 18 months, carryover infusion revenue may fall for patients who complete treatment. In a mature program, fixed costs would then be covered only if new patients continue to enter the program. This is a budgeting issue rather than a statement of comparative clinical value.

From a managerial standpoint, the model translates into a small set of actionable levers:

(1) procurement/contracting: monitor product-specific δ and update threshold conditions (Eq. [3-6]) after scheduled price revisions; use realistic δ ranges rather than a single point estimate.[30-32]
(2) workflow standardization (TDABC): reduce touch time through task shifting, standardized templates, and streamlined documentation/verification; small time reductions accumulate more for higher-frequency regimens.[33,34,40-42]

**Figure 3.** Required case volume to reach an annual profit target. The line panel shows the required annual case volume as the target profit changes, and the heat-map panels show how required case volume shifts with the target profit and the purchase discount.




(3) imaging capacity and compliance: secure surveillance MRI and reading capacity while respecting fee-schedule constraints (monthly limits, reduced reimbursement for repeated imaging); treat protocol changes as scenarios.[23-25]
(4) diagnostic bed management: design short-stay pathways that satisfy coexistence rules while minimizing avoidable LOS; treat opportunity cost ($C_{opp}$) as a local parameter reflecting occupancy pressure, and approximate it from the contribution margin per bed-day of the next-best displaced admission.[21-27]
(5) program planning with attrition (q): plan staffing/capacity on a "referred candidate" basis when initiation rates are uncertain, and report expected contribution per referred candidate in addition to per-initiator margins.[3-5]

## Limitations

First, the base case relies on public aggregate reimbursement and price inputs rather than realized institution-specific billing, accounting, or purchasing contracts. Second, staff touch-time inputs were framed as reference assumptions and were only anchored by preexisting workflow maps from a Japanese hospital; we did not add a prospective time-and-motion validation data set. Third, procurement discounts, imaging arrangements, DPC/PDPS coefficients/strata, and bed opportunity costs vary across facilities and over time; therefore, local substitution remains essential. Fourth, severe ARIA-related resource use and treatment interruptions were represented as explicit escalation scenarios rather than patient-level microcosting or a state-transition model, and the year-1-to-year-2 revenue transition for donanemab was discussed as a planning implication rather than fully modeled as long-term program cash flow. Finally, because the framework is tightly linked to Japan's 2024/2025 NHI fee schedule and DPC/PDPS rules, the specific monetary outputs are not directly generalizable to other health systems in the region.

DMT deployment should jointly satisfy clinical value (slowed progression) and managerial feasibility. Our linear model (Eq. [1-9]) allows transparent updates as price revisions, wages, MRI capacity, and workflow assumptions change, and clarifies how these shocks map to adoption decisions. After revision, equal-discount comparisons shrink lecanemab's advantage region, particularly in lighter populations, favoring donanemab; yet, unequal-discount trade-offs and body-weight distributions

leave clear regions where lecanemab remains financially viable. These financial comparisons should be interpreted alongside, not instead of, clinical effectiveness, safety, and patient-preference considerations.

## Conclusions

We developed a transparent provider-side planning framework for antiamyloid DMT implementation in Japan. In scenario analyses, margins were driven primarily by procurement terms and scheduled list-price revisions, whereas operational factors had smaller drug-specific effects, with lecanemab remaining more labor sensitive because of higher infusion frequency. These estimates should be read as decision-support scenarios and updated with local purchasing terms, workflow inputs, MRI capacity, and bed-day assumptions when available.

## Author Disclosures

Author disclosure forms can be accessed below in the Supplemental Material section.

## Supplemental Material

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.vhri.2026.101675.

## Article and Author Information

**Accepted for Publication:** May 28, 2026

**Published Online:** xxxx

doi: https://doi.org/10.1016/j.vhri.2026.101675

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**Authorship Confirmation:** All authors certify that they meet the ICMJE criteria for authorship.

**Funding/Support:** The authors received no financial support for this research.

**Data Availability:** Parameter workbook, Supplementary Methods, Appendix Figure 1, and revised figure scripts are available for replication and local substitution of operational inputs.

**Ethical Approval:** Public aggregate reimbursement and price sources and pre-existing workflow descriptions from a Japanese hospital were used; no individual-level patient or staff data were collected, and institutional review board approval was not required.

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