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This document contains four items supporting the transparency and independent replication of the model reported in the main manuscript: Figure S1, a graphical comparison of the base case against published estimates; Table S1, the probability distribution specifications used in the probabilistic sensitivity analysis; Table S2, the CHEERS 2022 reporting checklist location index; and the complete source code of the Monte Carlo simulation together with a replication note. All monetary values are given in Japanese yen (JPY) with United States dollar (USD) equivalents at 150 JPY per USD, consistent with the main manuscript.

Figure S1. Base case compared with published estimates

Figure S1 shows the deterministic base case of JPY 4.3 trillion (USD 28.5 billion) against two published estimates. The East Asia estimate of 1.27% of gross domestic product for productivity loss from vision impairment due to uncorrected myopia [3] implies JPY 8.5 trillion (USD 56.8 billion) for Japan. The published estimate of the total economic cost of all-cause visual impairment in Japan, at approximately 1.7% of gross domestic product [7], implies JPY 11.4 trillion (USD 76.0 billion) at current gross domestic product. As expected for a single-cause subset, the myopia-attributable base case falls below both, at approximately 37% of the all-cause figure. Because both comparators are themselves model-derived rather than direct empirical observations, agreement with them supports plausibility but does not constitute independent validation of accuracy.

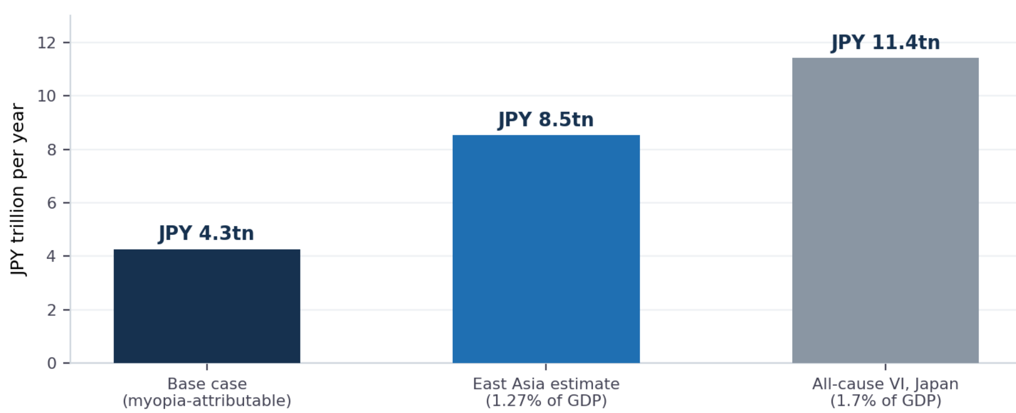

Figure S1. Deterministic base case of the annual myopia-attributable economic burden in Japan compared with the East Asia productivity-loss estimate and the published all-cause visual impairment estimate for Japan. Figure S1 is additionally supplied as a separate 300 dpi TIF file.

Table S1. Probability distribution specifications used in the probabilistic sensitivity analysis

Distributions were selected on the basis of the natural support and shape of each quantity rather than by fitting to data, since for several parameters no data exist to fit. Concentration parameters were chosen so that the resulting approximate 95% intervals matched the plausible ranges stated in Table 1 of the main manuscript. Parameters were resampled independently in each of the 10 000 iterations; no correlations were imposed between them, which is stated as a structural assumption in the main manuscript.

Parameter	Distribution	Mean	Approximate 95% range	Basis for choice
Mild-to-moderate productivity decrement	Beta (mean 0.02, concentration 190)	0.020	0.005-0.044	Bounded proportion; wide interval because no empirical anchor exists in any setting
Severe visual impairment fraction among people with high myopia	Beta (mean 0.015, concentration 250)	0.015	0.004-0.033	Bounded proportion; range spans published myopic maculopathy complication rates [5]
Employment reduction, severe visual impairment	Beta (mean 0.302, concentration 60)	0.302	0.193-0.422	Bounded proportion; centred on published global estimate [4], widened for transfer uncertainty to a high-income setting
Adult myopia prevalence	Beta (mean 0.50, concentration 400)	0.500	0.451-0.550	Bounded proportion; tight concentration reflects measurement in a large cohort [6], widened for single-region and age-range extrapolation
Average annual salary	Normal (mean 4.78, standard deviation 0.25)	JPY 4.78 million (USD 31 867)	JPY 4.28-5.28 million (USD 28 533-35 200)	Precisely measured national statistic with approximately symmetric sampling error
Caregiving multiplier	Triangular (0.4, 0.8, 1.2)	0.800	0.4-1.2 (full support)	Only a plausible minimum, mode and maximum can be stated; no distributional information available
Blended annual care spend per person with myopia	Gamma (shape 9, scale 1333)	JPY 12 000 (USD 80)	JPY 5 500-21 200 (USD 37-141)	Expenditure is strictly non-negative and right-skewed, a minority incurring much higher costs than the median

USD - United States dollar, JPY - Japanese yen. USD equivalents are given at 150 JPY per USD. Beta distributions are parameterised as Beta(mean x concentration, (1 - mean) x concentration). The Gamma distribution is parameterised by shape k = (mu/sigma) squared and scale theta = sigma squared / mu, with mu = 12 000 and sigma = 4 000.

Table S2. Location of CHEERS 2022 reporting items

The completed CHEERS 2022 checklist is submitted as a separate file. Because the main manuscript uses unnumbered section headings, checklist locations are given by section name. Table S2 summarises where the items most relevant to model transparency are reported.

Item	Topic	Location in the main manuscript
16	Rationale and description of model	Methods, Study design; Methods, Calculation; Methods, Structural assumptions; source code in this document

Item	Topic	Location in the main manuscript
17	Analytics and assumptions	Methods, Probabilistic sensitivity analysis; Methods, Comparison with published estimates
20	Characterising uncertainty	Methods, Selection of probability distributions; Results, Probabilistic sensitivity analysis; Table S1 of this document
22	Study parameters	Table 1 of the main manuscript, including the provenance column; Table S1 of this document
24	Effect of uncertainty	Results, Probabilistic sensitivity analysis; Discussion; Discussion, Limitations
27	Conflicts of interest	Disclosure of interest

Monte Carlo simulation source code

The complete source code is reproduced below. It uses a seeded linear congruential pseudo-random number generator so that results are exactly reproducible, and standard samplers for the Beta, Normal, Gamma and Triangular distributions. It requires no external dependencies and runs in any standard Node.js environment. The code is released for reproduction, modification and redistribution for academic and non-commercial purposes with attribution to this publication.

```
// Monte Carlo probabilistic sensitivity analysis
// Annual myopia-attributable economic burden in Japan
// 10 000 iterations, joint resampling of all uncertain parameters
// Ryo Kubota, 2026.  Run: node psa.js

const fs = require("fs");

// Seeded linear congruential generator, for exact reproducibility
function rng(seed = 20260521) {
  let s = seed >>> 0;
  return () => { s = (s * 1664525 + 1013904223) >>> 0; return s / 0xFFFFFFFF; };
}
const U = rng();

// --- distribution samplers ---
function normal(mu, sd) {                                // Box-Muller
  const u1 = Math.max(U(), 1e-12), u2 = U();
  return mu + sd * Math.sqrt(-2 * Math.log(u1)) * Math.cos(2 * Math.PI * u2);
}
function gam(sh, sc = 1) {                               // Marsaglia-Tsang
  if (sh < 1) return gam(sh + 1, sc) * Math.pow(U(), 1 / sh);
  const d = sh - 1 / 3, c = 1 / Math.sqrt(9 * d);
  while (true) {
    let x, v;
    do { x = normal(0, 1); v = 1 + c * x; } while (v <= 0);
    v = v * v * v;
    const u = U();
    if (u < 1 - 0.0331 * x * x * x * x) return d * v * sc;
    if (Math.log(u) < 0.5 * x * x + d * (1 - v + Math.log(v))) return d * v * sc;
  }
}
function beta(a, b) { const x = gam(a), y = gam(b); return x / (x + y); }
function betaMN(m, n) { return beta(m * n, (1 - m) * n); }  // mean m, concentration n
function tri(min, mode, max) {
  const u = U(), F = (mode - min) / (max - min);
  return u < F ? min + Math.sqrt(u * (max - min) * (mode - min))
               : max - Math.sqrt((1 - u) * (max - min) * (max - mode));
}

// --- fixed Japanese inputs ---
const jp = { gdp_tn: 671, pop_m: 123.3, laborForce_m: 69.3, highMyopiaPrev: 0.08 };

const N = 10000, S = [], T = [];
for (let i = 0; i < N; i++) {
  const mildMod    = betaMN(0.02, 190);   // Beta,       mean 0.020
  const severeFrac = betaMN(0.015, 250);  // Beta,       mean 0.015
  const emplRed    = betaMN(0.302, 60);   // Beta,       mean 0.302
  const myopiaPrev = betaMN(0.50, 400);   // Beta,       mean 0.500
  const salary     = Math.max(3.5, normal(4.78, 0.25));   // Normal, JPY million
  const cgMult     = tri(0.4, 0.8, 1.2);                  // Triangular
  const k = (12000 / 4000) ** 2, th = 12000 / k;
  const careSpend  = gam(k, th);                          // Gamma, JPY per person

  const m = jp.laborForce_m * myopiaPrev;                 // myopic workers, million
  const h = jp.laborForce_m * jp.highMyopiaPrev;          // high-myopic workers
  const s = h * severeFrac;                               // severe VI workers

  const pm = (m * 1e6 * mildMod * salary * 1e6) / 1e12;   // JPY trillion
  const ps = (s * 1e6 * emplRed * salary * 1e6) / 1e12;
  const tr = ((jp.pop_m * myopiaPrev) * 1e6 * careSpend) / 1e12;
  const cg = ps * cgMult;
  const tot = pm + ps + tr + cg;

  S.push({ mildMod, severeFrac, emplRed, myopiaPrev, salary, cgMult, careSpend,
           total: tot, prodShare: (pm + ps) / tot });
```

```
  T.push(tot);
}

const pct = (a, p) => { const x = [...a].sort((u, v) => u - v);
  return x[Math.min(x.length - 1, Math.floor(p / 100 * (x.length - 1)))]; };
const mean = a => a.reduce((u, v) => u + v, 0) / a.length;

console.log("median", pct(T, 50).toFixed(2),
            "IQR", pct(T, 25).toFixed(2), "-", pct(T, 75).toFixed(2),
            "95% CrI", pct(T, 2.5).toFixed(2), "-", pct(T, 97.5).toFixed(2),
            "prodShare", (mean(S.map(x => x.prodShare)) * 100).toFixed(0) + "%");

// --- driver ranking, Spearman rank correlation ---
function rc(xs, ys) {
  const rk = a => { const ix = a.map((v, i) => [v, i]).sort((p, q) => p[0] - q[0]);
    const r = new Array(a.length); ix.forEach(([_, i], p) => r[i] = p + 1); return r; };
  const rx = rk(xs), ry = rk(ys), mx = mean(rx), my = mean(ry);
  let n = 0, dx = 0, dy = 0;
  for (let i = 0; i < rx.length; i++) {
    n += (rx[i] - mx) * (ry[i] - my); dx += (rx[i] - mx) ** 2; dy += (ry[i] - my) ** 2;
  }
  return n / Math.sqrt(dx * dy);
}
["mildMod","careSpend","severeFrac","myopiaPrev","salary","emplRed","cgMult"]
  .map(p => ({ p, rho: rc(S.map(x => x[p]), S.map(x => x.total)) }))
  .sort((a, b) => Math.abs(b.rho) - Math.abs(a.rho))
  .forEach(d => console.log("  ", d.p, d.rho.toFixed(3)));
```

Replication note

To reproduce the results reported in the main manuscript, save the source code above as a file named psa.js and run it with Node.js version 18 or later. The console output will be:

```
median 3.95 IQR 2.99 - 5.19 95% CrI 1.70 - 8.33 prodShare 77%
   mildMod 0.969
   careSpend 0.140
   myopiaPrev 0.118
   salary 0.106
   severeFrac 0.049
   emplRed 0.022
   cgMult 0.004
```

These values correspond to the reported probabilistic median of JPY 4.0 trillion (USD 26.4 billion), interquartile range of JPY 3.0-5.2 trillion (USD 19.9-34.6 billion), 95% credible interval of JPY 1.7-8.3 trillion (USD 11.4-55.6 billion), and mean productivity share of 77%. The driver ranking corresponds to Figure 2 of the main manuscript, in which the mild-to-moderate productivity decrement dominates with a Spearman rank correlation of 0.97.

The deterministic base case reported in Table 2 of the main manuscript is obtained by evaluating the same four component formulas at the base parameter values given in Table 1, without resampling. The scenario range of JPY 2.6-5.9 trillion (USD 17.4-39.5 billion) is obtained by evaluating those formulas with the mild-to-moderate productivity decrement set to 0.01 and 0.03 respectively while holding all other parameters at their base values. The 2050 scenario figures are obtained by scaling the base case by the ratios implied by the published trend statements cited in the main manuscript, and are illustrative rather than predictive.

Any reader may therefore reproduce, audit or refute every figure reported in this study without contacting the author. The author welcomes independent replication and would regard a published re-analysis reaching different conclusions as a legitimate and useful outcome.

References cited in this document

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Reference numbers correspond to the numbering used in the main manuscript.