The Lifetime Probability of Dying of Cancer (Life Table) Is 25.59% for Men and 19.06% for Women, Smaller Than Cancer's Share Among That Year's Deaths (27.07% and 20.66%), While for Senility the Probability Is the Larger (20.75% vs 18.85% for Women) — Rebuilding Both from the Same Within-Age-Group Cause Shares, the Difference Is Only the Age Weights: That Year's Deaths Are Heavier at 65–84 and Life-Table Deaths Heavier at 85 and Over [M120]

Share among deaths = Σ age weights of that year's deaths × cause share within the age group; probability of dying = Σ age weights of life-table deaths × the same shares —— What separates them is whether you weight by the ages of that year's deaths or by the ages of a lifetime on the life table

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Abstract

This paper lined up, for men and women and 16 causes, the reference table "cause-specific death probability" of the 2024 abridged life tables (the probability that a person aged 0 will eventually die of the cause) and the same year's vital statistics deaths by cause and age group. Which causes are frightening or not is not discussed. These are not individual prognoses. No new mathematical theorem and no new law are claimed.

First, **the lifetime probability of dying of cancer (malignant neoplasms) was 25.59% for men and 19.06% for women, smaller than cancer's share among people who died that year (27.07% and 20.66%). Senility was the opposite: the probability (8.39% and 20.75%) was larger than the share (7.18% and 18.85%). For the other 28 pairs the difference was 0.21 points or less** (Section 4).

Second, and this is the core of this paper, **the share among deaths can be written exactly as the sum of "cause shares within age groups" weighted by the age distribution of people who died that year. Weighting the same within-age-group shares by the age distribution of deaths on the life table rebuilt the cause-specific death probability within 0.07 points of the published values. The two differ only in their weights** (Section 5).

Third, **that year's deaths are heavier than the life table at ages 65–84 (+0.063 for men, +0.047 for women) and lighter by the same amount at 85 and over. Mean age at death was 80.14 (men) and 86.18 (women) for that year's deaths and 81.09 and 87.11 on the life table** (Section 5).

Fourth, **for men's cancer, share − rebuilt probability of +1.41 points split into +0.08 under 65, +2.15 at 65–84, and −0.83 at 85 and over. For women's senility, −1.83 points split into +0.27 at 65–84 and −2.10 at 85 and over** (Section 5).

Fifth, **the direction of the difference is not decided by the mean age at death of the cause alone. Over 30 pairs, the correlation between mean age at death and "share − probability" was only −0.265. What matters is how much the cause's share differs between ages 65–84 and 85 and over** (Section 5).

Sixth, what separates them is **whether you weight by the ages of that year's deaths or by the ages of a lifetime on the life table**. When you hear that "1 in so many Japanese people dies of …," check whether it is a lifetime probability or a share among that year's deaths.

Scope note: **This paper claims no new mathematical theorem and no new law** — the cause-specific death probabilities and death counts are published, and this paper only lined them up, rebuilt them, and split them. **This paper is a structural interpretation of the shape of numbers in public aggregate data; it is not medical advice, not a diagnosis, and not a treatment recommendation. The author is not a physician. Decisions about individual health should be discussed with a physician or a medical institution. This is a preprint that has not been peer reviewed. These are not individual prognoses** — the cause-specific death probability is a number "on the life table," for a hypothetical population in which the age-specific pattern of deaths in 2024 continues for a lifetime (M003). **Which causes are frightening or not is not discussed.** Suicide is treated only as a count, without means or circumstances. The rebuilding is this paper's approximation (assuming the cause share is constant within a 5-year group), not a copy of the official method. **About the data**: The Ministry of Health, Labour and Welfare's Abridged Life Tables for 2024 and Vital Statistics (2024, final data) were obtained from e-Stat and used under the Public Data License (Version 2.0). The rebuilt probabilities and decompositions in this paper are processed figures, not figures produced by the government. What this paper adds: **rebuilding both the share among deaths and the cause-specific death probability from the same within-age-group shares, and showing, for 16 causes × men and women, that the difference is decided by the age weights alone**.

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1. Notation and question

- **Cause-specific death probability**: a reference table of the abridged life tables. The table's note says that it is calculated "on the life table" as the probability of the cause of death a person of a given age will eventually die of. This paper uses the values at age 0.
- **Share among deaths**: of people who died in 2024 (with known age), the share who died of the cause.

- **Cause share within an age group** s(x): deaths from the cause in 5-year group x ÷ all deaths in that group (21 groups up to 100 and over).
- **Two weights**: w(x), the age distribution of people who died that year; v(x), the distribution of age at death for a person aged 0 on the life table (difference in survivors at the first age of each group ÷ 100,000).
- **Share among deaths = Σ w(x) s(x)**; **rebuilt probability of dying = Σ v(x) s(x)**.

Question: How different are the lifetime probability of dying of a cause and its share among that year's deaths? Where does the difference come from?

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2. Preview and design

Written honestly: M011 used the same tables and noted in one observation that "the share among that year's deaths and the life-table death probability are close but not the same (for women's senility, 18.85% and 20.75%)." This paper puts that at its core, rebuilds both from the same within-age-group shares for 16 causes × men and women, and measures where the difference comes from.

	Content
Data	2024 abridged life tables Table 1 and Table 2 and the reference table "cause-specific death probability"; Vital Statistics 2024, Volume 2, Table 2 (deaths by cause, sex, and 5-year age group). The same files as M011
Noticed in preview	The difference between share and probability was large only for cancer (share larger) and senility (probability larger)
Noticed in preview (2)	The 16 causes of the probability table could each be matched to the names in the CSV by their short-list cause codes
Compared	Share and probability (published and rebuilt), the two weights, and the split into three age bands

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3. Data and checks

Calculation 3.1 Six files — the two life tables, the cause-specific death probability table, the method and errata PDFs, and the death count CSV — were fixed by SHA-256, and the following were checked.

- The age-0 probabilities for men and women × 16 causes can be read from the probability table. The same 16 causes and the total can be read from the death table for men and women and 21 age groups, with no missing marks (such as "・") in the rows used.
- Sum of the 21 groups + unknown age = total (16 causes and total; men and women). Deaths with known age: 819,298 men and 785,537 women (unknown age 411 and 132).
- The life table's survivors l(0) is 100,000, and v sums to 1.
- Share among deaths = Σ w(x) s(x) holds exactly for men and women × 16 causes.

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4. Probability and share

Calculation 4.1 Share among deaths and lifetime probability of dying (2024; selected)

Sex	Cause	Share among deaths (%)	Probability, published (%)	Probability, rebuilt (%)	Share − probability	Mean age at death
Men	Cancer	27.07	25.59	25.66	+1.48	78.1
Men	Heart disease	13.60	13.70	13.71	−0.10	80.6
Men	Pneumonia	5.68	5.89	5.89	−0.21	84.7
Men	Suicide	1.63	1.69	1.69	−0.06	53.7
Men	Senility	7.18	8.39	8.35	−1.21	89.7
Women	Cancer	20.66	19.06	19.12	+1.60	79.5
Women	Heart disease	14.63	14.77	14.77	−0.14	88.2
Women	Cerebrovascular disease	6.57	6.46	6.47	+0.11	86.1
Women	Suicide	0.80	0.83	0.84	−0.03	52.8
Women	Senility	18.85	20.75	20.69	−1.90	93.2

Observation 4.2: **For cancer, the share among people who died that year (27.07% for men and 20.66% for women) was larger than the lifetime probability of dying of it (25.59% and 19.06%). For senility, conversely, the probability (8.39% and 20.75%) was larger than the share (7.18% and 18.85%). Excluding cancer and senility, the difference for the other 28 pairs was 0.21 points or less.** The table shows 10 of the 32 pairs; the rest are in the checker's output. Dividing by deaths including unknown age, men's cancer share is 27.06% (the figure in M011).

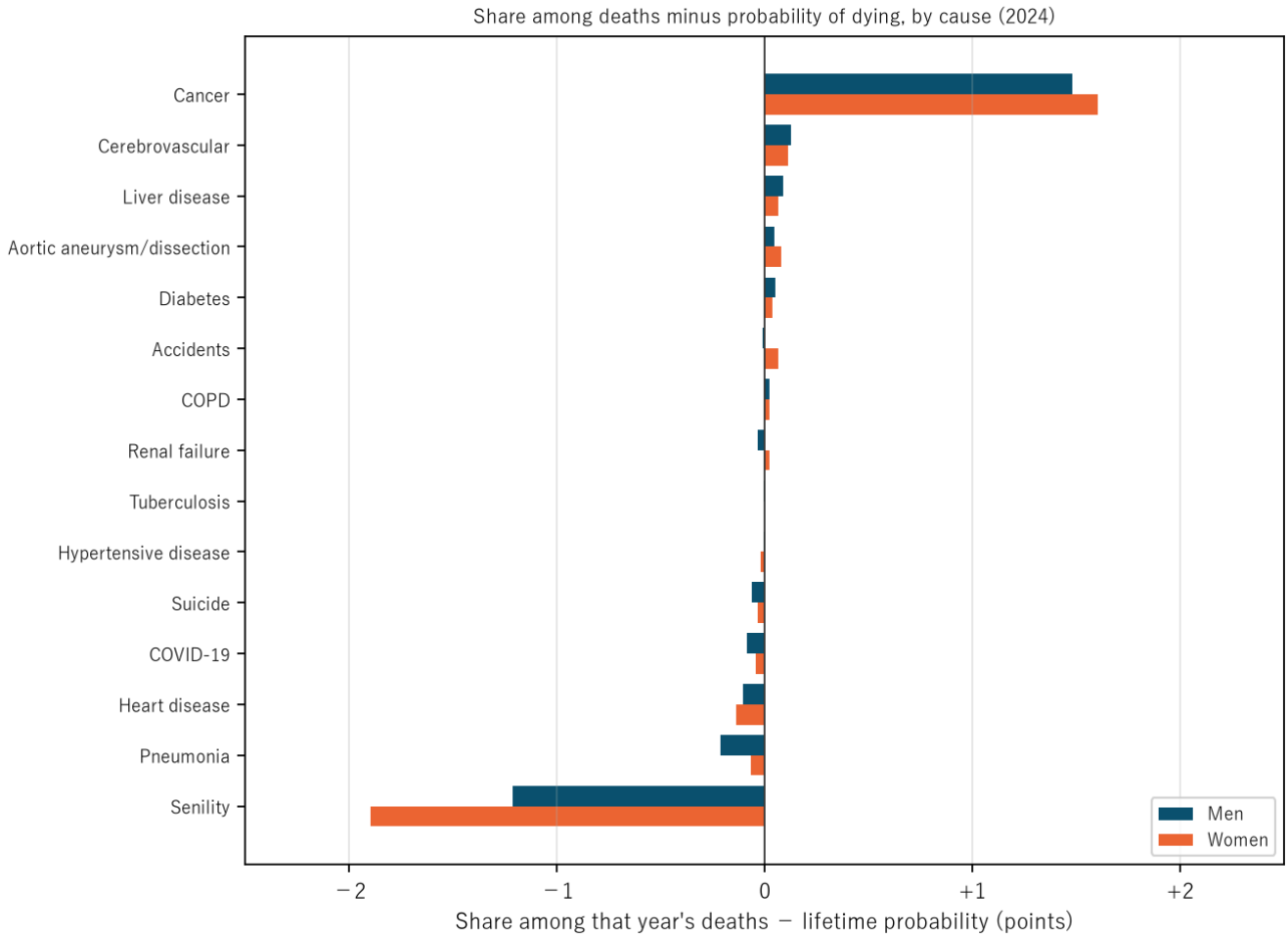


Figure 2: "Share among that year's deaths − lifetime probability of dying" by cause (navy = men; orange = women).

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5. The core — weighting by the ages of that year's deaths or of a lifetime on the life table

Observation 5.1: **The share among deaths can be written exactly as Σ w(x) s(x), and applying the life-table weights v(x) to the same s(x) rebuilt the cause-specific death probability within at most 0.07 points (men's cancer) of the published values.** The difference between share and probability is therefore almost entirely the difference in weights, Σ (w − v) s.

Observation 5.2: **That year's deaths were heavier than life-table deaths at ages 65–84 (w − v sums to +0.063 for men and +0.047 for women) and lighter by the same amount at 85 and over. Under 65 they hardly differed.** Mean age at death was 80.14 (men) and 86.18 (women) for that year's deaths and

81.09 and 87.11 on the life table; the life-table mean is almost the same as life expectancy at birth (81.09 and 87.13 years). The ages of that year's deaths are a distribution under that year's population age structure, while the ages of life-table deaths are the distribution over a lifetime of a hypothetical population.

Observation 5.3: **Men's cancer "share − rebuilt probability" of +1.41 points split into +0.08 under 65, +2.15 at 65–84, and −0.83 at 85 and over. Women's senility −1.83 points split into −0.00 under 65, +0.27 at 65–84, and −2.10 at 85 and over.** Cancer's share among deaths is higher at 65–84 (0.340 for men and 0.341 for women) than at 85 and over (0.183 and 0.122), so it comes out larger in the band where that year's deaths are heavier. Senility's share is higher at 85 and over (0.142 and 0.265) than at 65–84 (0.031 and 0.056), so it comes out larger in the band where life-table deaths are heavier.

Observation 5.4: **The direction of the difference is not decided by mean age at death alone. Over 30 pairs, excluding the traffic accident sub-item, the correlation between mean age at death and "share − probability" was −0.265.** For suicide (mean age at death 53.7 and 52.8), the difference was small, −0.06 and −0.03, because the two weights hardly differ under 65.

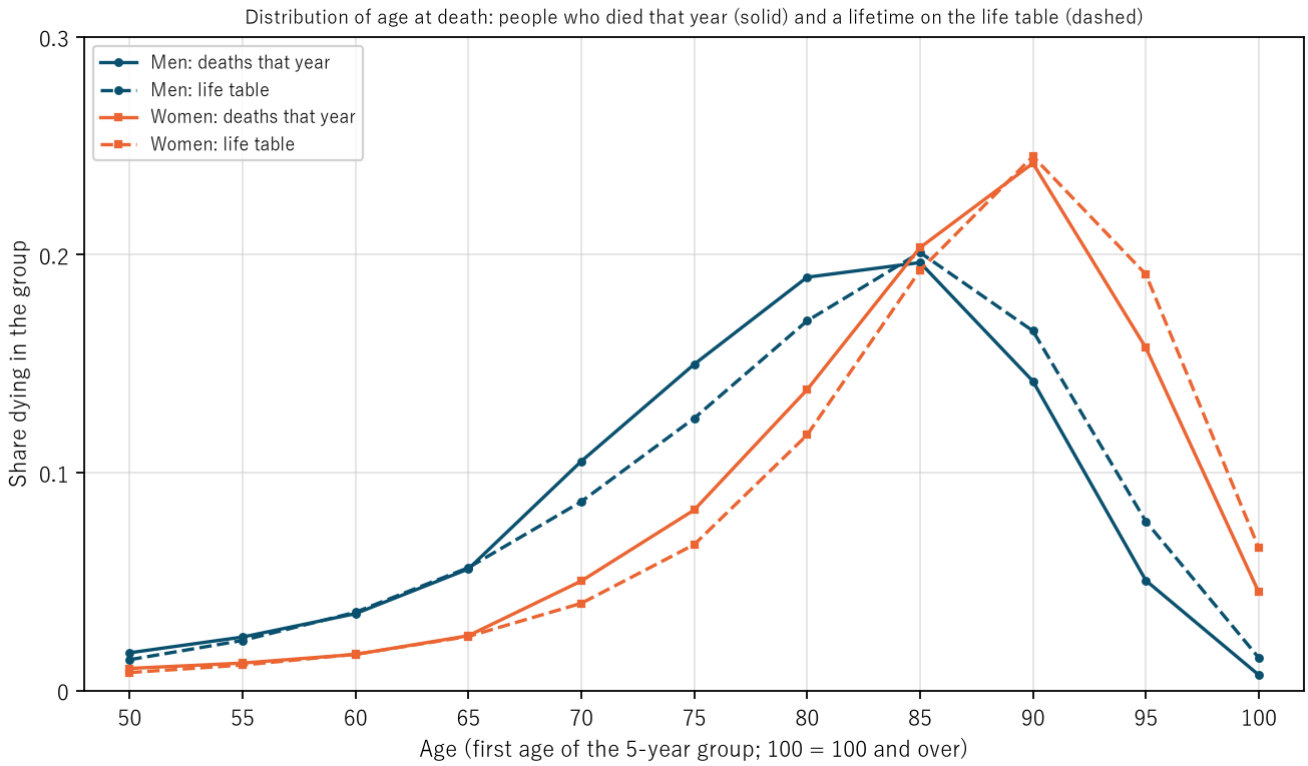


Figure 1: Distribution of age at death (50 and over): people who died that year (solid) and a lifetime on the life table (dashed). Navy = men; orange = women.

6. Relation to earlier papers

M003 showed that life expectancy is a "period" figure built from that year's age-specific pattern of deaths, not the number of years anyone actually lives. The cause-specific death probability in this paper is a period figure of the same kind, and it differs from the share among that year's deaths in its weights. M011 used the same tables, showed that the years gained without cancer are not set by the probability of dying alone, and noted in one observation that the share and the probability differ slightly. This paper put that difference at its core, rebuilt both from the same within-age-group shares, and showed that the difference is decided by the weights alone.

7. Limitations

1. **These are not individual prognoses.** Which causes are frightening or not is not discussed.
2. The rebuilding approximates the cause share as constant within a 5-year group and is not a copy of the official method (difference from the published values at most 0.07 points).
3. The share among deaths is the share among deaths with known age. Including unknown age, it differs slightly (27.06% for men's cancer).
4. Causes are the underlying causes on death certificates; changes in how they are classified are not addressed.
5. Only the single year 2024 was examined.

Conclusion

The lifetime probability of dying of cancer was smaller than cancer's share among that year's deaths, and senility was the opposite. The two are sums of the same within-age-group cause shares with different weights. That year's deaths are heavier at 65–84, and a lifetime on the life table is heavier at 85 and over.

So causes common at 65–84 come out larger as a share, and causes common at 85 and over come out larger as a probability.

What separates them is one thing — whether you weight by the ages of that year's deaths or by the ages of a lifetime on the life table.

When you hear that "1 in so many Japanese people dies of …," **check whether it is a lifetime probability or a share among that year's deaths.** Neither is an individual prognosis.

Data and reproduction

Data	Ministry of Health, Labour and Welfare, Abridged Life Tables for 2024, Table 1, Table 2, and reference table "cause-specific death probability"; Vital Statistics 2024 (final data), Volume 2, Table 2 (e-Stat; accessed 25 September 2026)
Terms of use	Public Data License (Version 2.0). The rebuilt probabilities and decompositions in this paper are processed figures, not figures produced by the government
Coverage	2024; men and women; 16 causes (as listed in the probability table); 21 five-year age groups
Verification	`検算/M120.py` (`--zu` also draws the figures). Every number in the text is taken from `検算/M120_output.txt`
Raw data	The six files in `data/` (two life tables, the probability table, the method and errata PDFs, and the death count CSV) and `data/SOURCES.md` (terms of use, SHA-256, cause code mapping)
Figures	`図/M120_zu1` and `図/M120_zu2` (png, svg, English versions)

References

- Ministry of Health, Labour and Welfare. Abridged Life Tables for 2024, Table 1 and Table 2; reference table: cause-specific death probability (in Japanese). e-Stat (accessed 25 September 2026). https://www.e-stat.go.jp/
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- Yamagishi, Y. (2026). Life Expectancy Is Not the Number of Years Anyone Actually Lives [M003]. Zenodo. https://doi.org/10.5281/zenodo.22963485
- Yamagishi, Y. (2026). Years Gained "Without Cancer" Are Not Set by the Probability of Dying of It Alone [M011]. Zenodo. https://doi.org/10.5281/zenodo.22966052