Supplementary data

Methods

All data used in this analysis are publicly available national data. The number of deaths were taken from the Vital Statistics, which include the monthly deaths by cause, sex, and age (5-year age groups). The target samples were limited to Japanese individuals living in Japan. Population estimates by age group required for the age-adjusted analysis are from the Statistics Bureau of the Ministry of Internal Affairs and Communications.

Total number of vaccinations to date was cited from the Japanese Prime Minister's Official Residence Website.

For age adjustment, smoothed standard population data from 2015 was used for cancers affecting both sexes, and the "sex-specific smoothed standard population dataset 1" from 2015 was used for female-specific cancers.

95% Confidence intervals (95%CI) were calculated using the reference "Direct Standardization (Age-Adjusted Death Rates). March 1995; Healthy People 2000 Statistical Notes Number CDC/National 6-Revised, Center for Health Statistics".

Figures S1-1, 1-2, 2-1, 2-2, 2-3, 3-1, 3-2, and 3-3 show excess/deficit-mortality rates and number of COVID-19 vaccinations for each month.

The horizontal axis indicates each month in 2020-2022, while the vertical axis indicates the difference between the age-adjusted mortality rates for each month and that of same month during the baseline period (2017-2019) for each cancer type (per 100,000 persons, annualized). Red bars indicate a positive difference and blue bars a negative difference. The green dashed line indicates the difference between the monthly mortality rate and the upper limit of the 95% CI for mortality in that month of the baseline years (2017-2019) if the mortality exceeded the baseline, and the lower limit of 95% CI if the mortality rate was under the baseline.
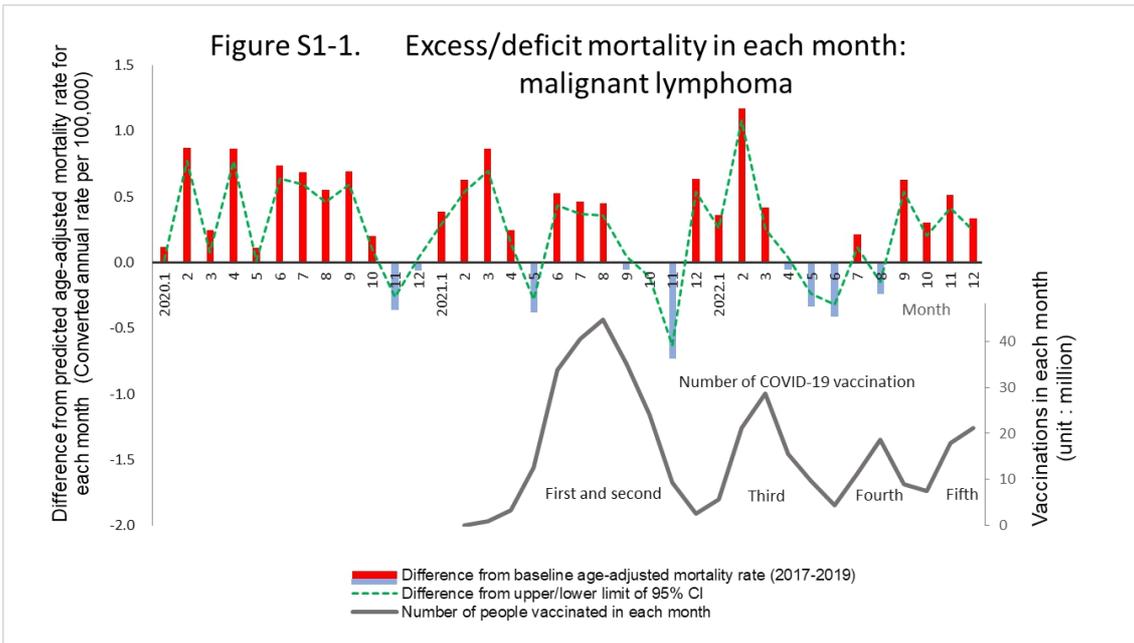
Figure S1-1. Excess/deficit mortality in each month: malignant lymphoma

From 2020 to 2022, many of the monthly mortality rates exceeded the zero-line.
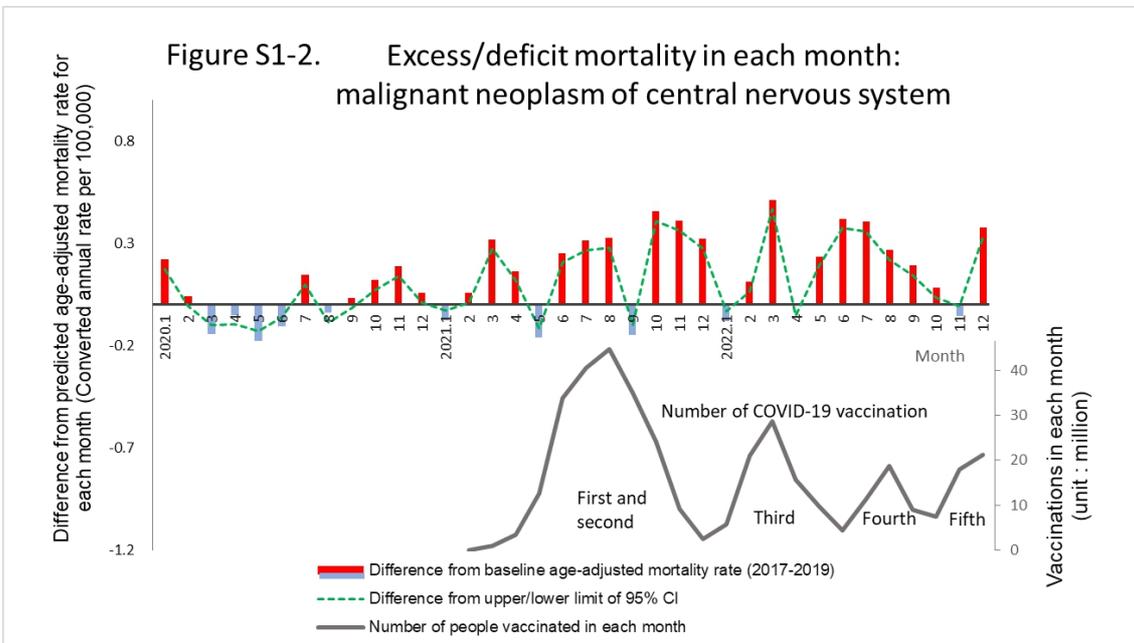

Figure S1-2. Excess/deficit mortality in each month: malignant neoplasms of the central nervous system

The excess in monthly mortality rates became more apparent after the start of vaccination (2021).
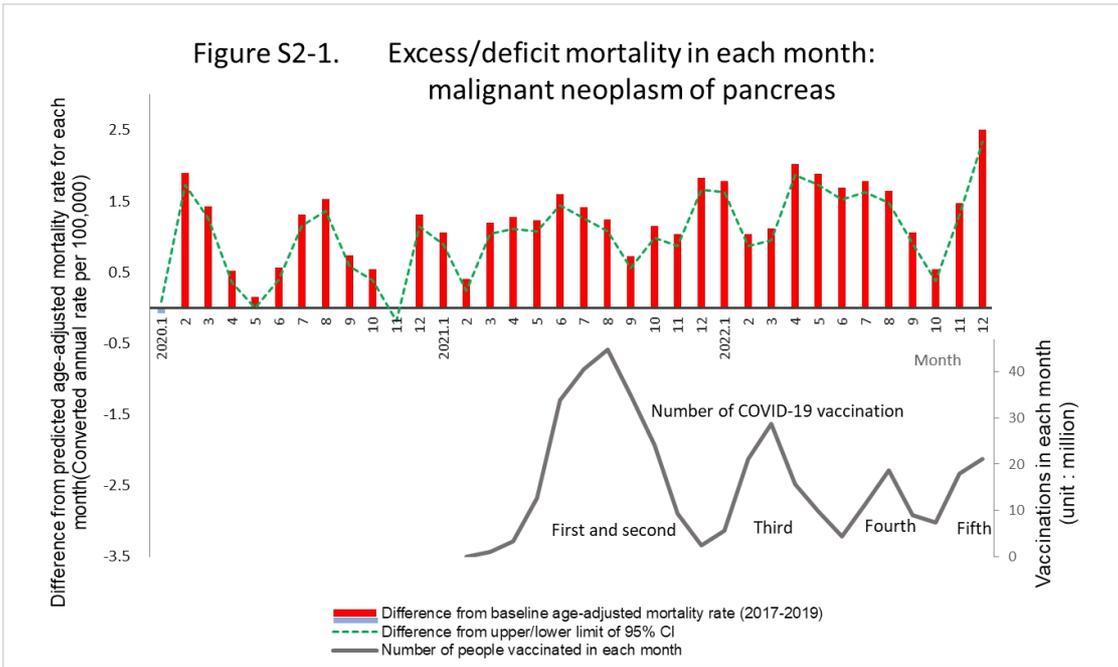
Figure S2-1. Excess/deficit mortality in each month: malignant neoplasms of the pancreas

From 2020 to 2022, monthly mortality rates exceeded the zero-line and increased further after the start of vaccination.
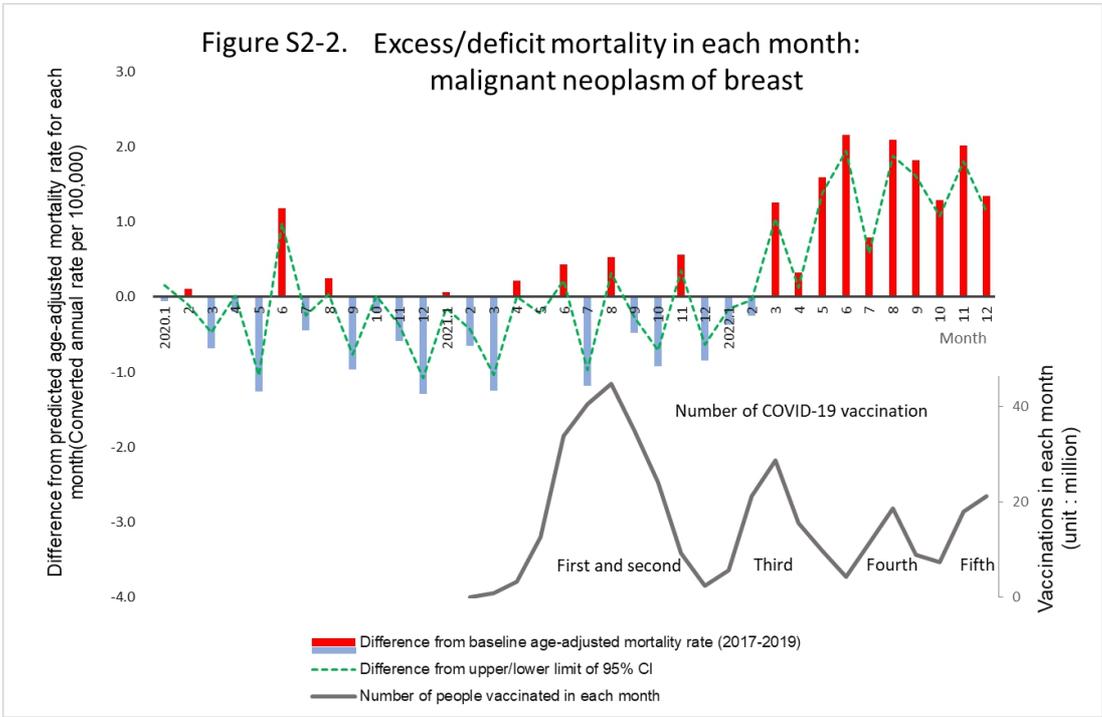

Figure S2-2. Excess/deficit mortality in each month: breast cancer

The excess in monthly mortality rates became prominent starting in March 2022 after mass booster vaccination.
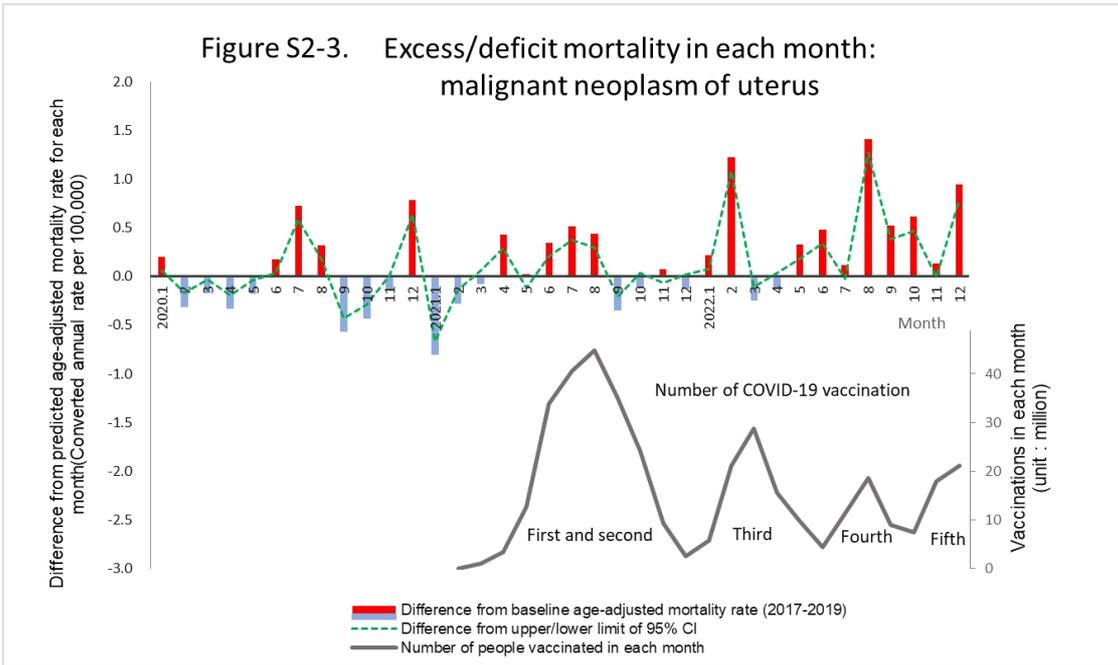
Figure S2-3. Excess/deficit mortality in each month: uterine cancer

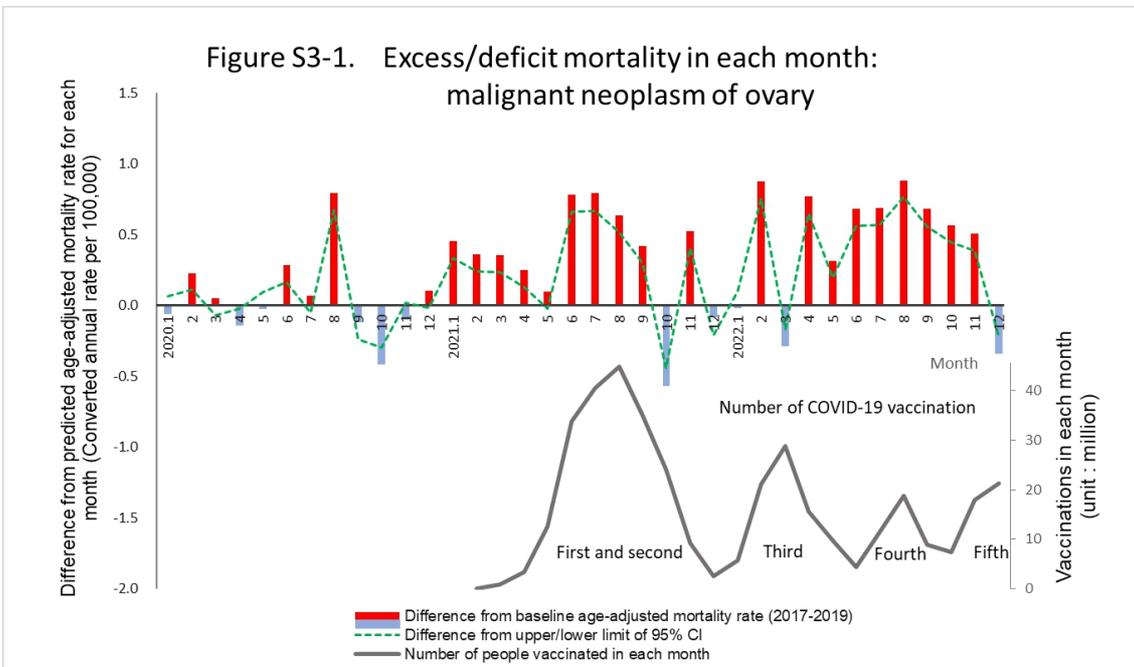The excess in monthly mortality rates increased or decreased in tandem with the number of COVID-19 vaccinations.

Figure S3-1. Excess/deficit mortality in each month: ovarian cancer

The monthly mortality rates increased more significantly after the start of COVID-19 vaccination (2021).
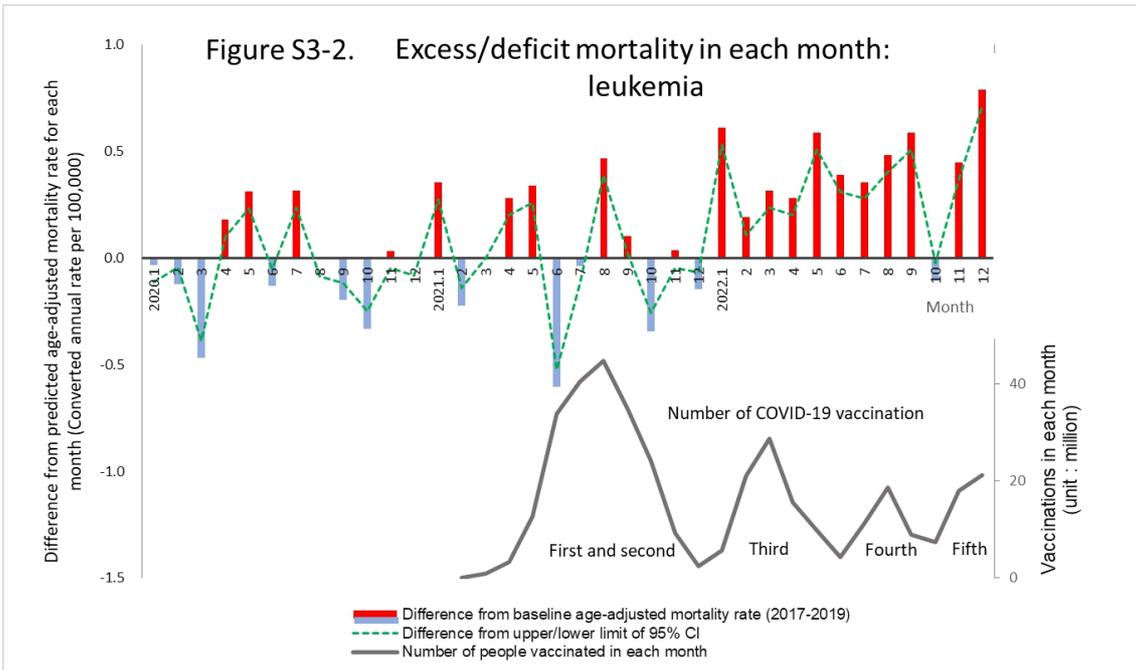
Figure S3-2. Excess/deficit mortality in each month: leukemia

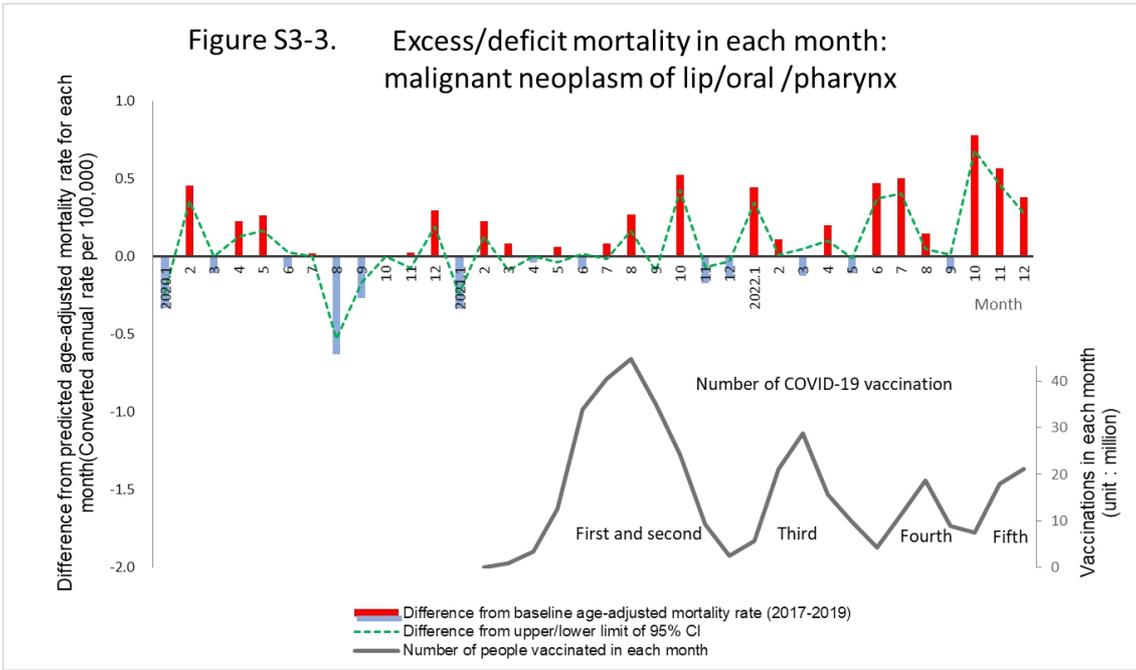The excess in monthly mortality rates became prominent after January 2022 after the third vaccination.

Figure S3-3. Excess/deficit mortality in each month: malignant neoplasms of the lip/mouth/pharynx

The excess in monthly mortality rates increased more clearly after the start of COVID-19 vaccination (2021).