

Why did Japan advance so rapidly? A comparative analysis of newly reconstructed series of deaths by cause

Yui Ohtsu¹, Svitlana Poniakina², France Meslé²

¹ Saitama University, Japan

² Institut National d'Études Démographiques, France

Theoretical focus

Statistics on the causes of death are frequently disrupted by revisions of the International Classification of Diseases (ICD), which makes it difficult to accurately track long-term mortality trends. Similarly, Japan's official statistics on the cause of death have been disrupted by the application of ICD revisions. Notably, at the time of the introduction of the ICD-10 in 1995, a significant disconnection occurred because of the simultaneous death certificate revision.

The death certificate revision, regarding avoiding the inclusion of only "heart failure" or "renal failure," announced even before the revision, resulted in a notable decline in the number of cases of heart failure and renal failure between 1993 and 1995, and 1994 and 1995, respectively. Conversely, the number of deaths due to other causes increased (Fig. 1).

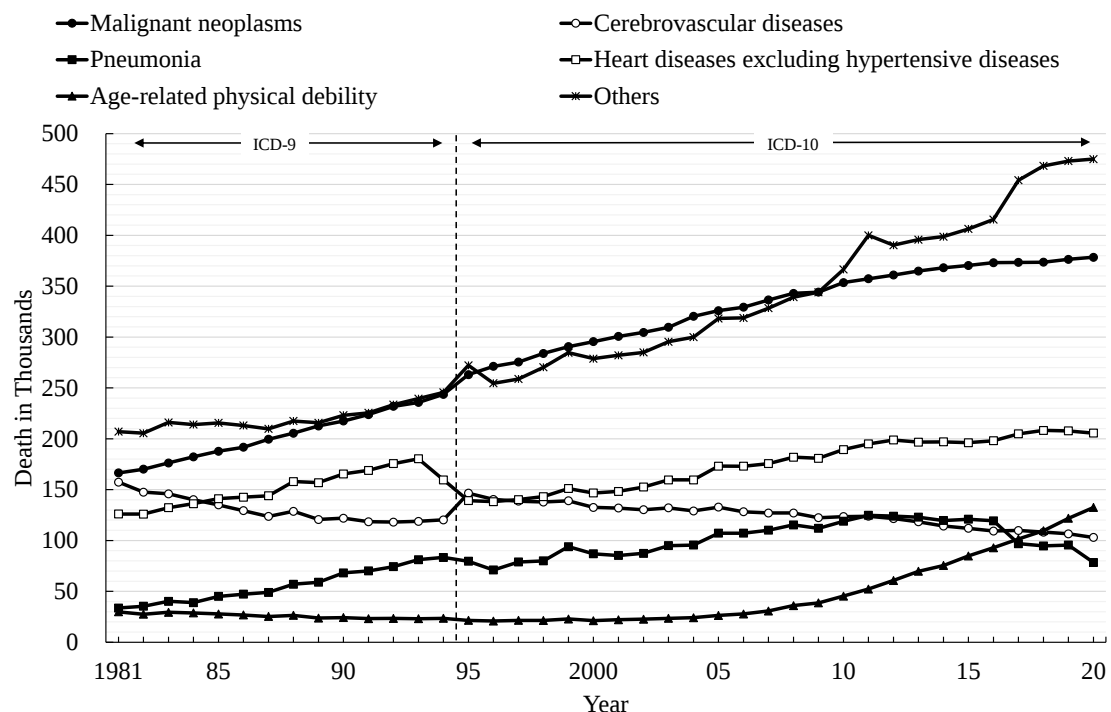


Fig. 1. Annual Trends in Number of Deaths by Cause in Japan

Note: The codes for the causes of death shown in this figure are as follows: Malignant neoplasms: 140-208 (ICD-9), C00-C97 (ICD-10). Cerebrovascular diseases: 430-438 (ICD-9), I60-I69 (ICD-10). Pneumonia: 480-486 (ICD-9), J12-

J18 (ICD-10). Heart diseases excluding hypertensive diseases: 393-398, 410-429 (ICD-9), I01-I02.0, I05-I09, I20-I25, I27 and I30-I51 (ICD-10). Age-related physical debility: 797 (ICD-9), R54 (ICD-10).
Source: “Vital Statistics” of Japan’s Ministry of Health, Labour and Welfare.

Therefore, it is not feasible to ascertain mortality trends before and after the implementation of the ICD-10. To address this issue, we reconstructed long-term time series statistics on the cause of death by converting the statistics over the ICD-9 period (1981-1994) to ICD-10 at the most detailed 4-digit level.

Data

We used data from "Deaths by sex, 5-year age groups and causes of death" published in the "Vital Statistics" of Japan's Ministry of Health, Labour and Welfare.

Research methods

The discontinuity in Japan's cause-of-death statistics was addressed with the introduction of the ICD-10 following the procedure outlined below (Table 1). The procedure consists of two main steps. The first step, which addresses the discontinuities caused by the death certificate revision, was thoroughly detailed by Ohtsu et al. (2018). The second step involves the methodology used to convert ICD-9 to ICD-10, as adopted by the Human Cause-of-Death Database (HCD) project. The HCD is an international initiative that provides a reconstructed data series based on the ICD-10 at the 4-digit level, following the methodology developed by Vallin and Meslé (1988, 1998), Meslé and Vallin (1996), and Pechholdova et al. (2017).

Table 1. Summary of Procedure for Reconstructing Japan’s Cause-of-Death Statistics

<u>1) Addressing Discontinuities Due to Death Certificate Revision</u> 1-1. Adjusting for Discontinuity in Heart Failure (1993-1994) ● The number of deaths in 1993 and earlier due to causes for which the numbers of deaths were discontinuously increased in the opposite direction to “Heart failure, unspecified” (ICD-9 code: 428.9) was adjusted to match the 1994 level. Any additional deaths resulting from this adjustment were subtracted from the annual total of deaths attributed to “heart failure, unspecified.” ● The number of deaths in 1993 was replaced by the number of deaths in 1994 in cases where the number of deaths from “heart failure, unspecified” in 1993 exceeded the 1994 value by sex and age group. The number of deaths in earlier years were adjusted in accordance with the ratio of this replacement. The number of deaths that were not accounted for was distributed proportionately to all causes except “heart failure, unspecified” and “injury and poisoning” (ICD-9 codes: 800-999). 1-2. Adjusting for Discontinuity in Heart Failure and Renal Failure (1994-1995) ● Deaths classified as “heart failure, unspecified” (ICD-9 code: 428.9) in 1994 and earlier were

redistributed to other relevant causes in order to address the discontinuity observed from 1994 to 1995.

- Similarly, deaths classified as “renal failure, unspecified” (ICD-9 code: 586) in 1994 and earlier were redistributed to other relevant causes for individuals aged 30 years and older.

2) Conversion of ICD-9 to ICD-10 using HCD methodology

2-1. Creation of a Correspondence Table

- A correspondence table was constructed for the purpose of identifying the associations between ICD-9 and ICD-10 items at the 4-digit classification level.

2-2. Definition of Fundamental Associations of Items

- The smallest entities bringing together ICD-9 and ICD-10 items gathering the same medical diagnoses from the two classifications and ensuring statistical continuity between them.

2-3. Computation of Transition Coefficients

- A transition coefficient was set to 1 for 1:1 matches or when multiple ICD-9 items were corresponding to a single ICD-10 item.
- When an ICD-9 code corresponded with multiple ICD-10 items, the transition coefficient was calculated as the ratio of the number of deaths in 1995 between the corresponding ICD-10 codes.
- **When several ICD-9 items were corresponding with several ICD-10 items, a more complex process was necessary within each association.**
- In cases where significant discrepancies were found between the transition coefficients across age groups, the coefficients were adjusted in accordance with an established set of rules.

2-3. Conversion of ICD-9 to ICD-10 using the transition coefficients

- The number of deaths for each code in ICD-10 was calculated by multiplying the number of deaths for each code in ICD-9 by the transition coefficients.

Note: Ad hoc modifications are being made to address statistical disconnections that remain unresolved even after the above procedure. Details are available on the HCD website (<http://www.causesofdeath.org>).

Expected findings

Figure 2 shows the reconstructed annual trends in the number of deaths by cause in Japan (1981-2020) for large groups of causes of death. The discontinuity observed in the original statistics have been corrected. This study offers a detailed analysis of Japanese cause-of-death trends since 1981, comparing them with trends observed in other low-mortality countries (France, Spain, and the USA) for which consistent cause-specific death series are available for the same period in the HCD. Because the reconstruction was carried out at a very detailed level (using 3 or 4-digit codes), it is possible to provide an accurate picture of the main conditions driving progress and those hindering it in these countries.

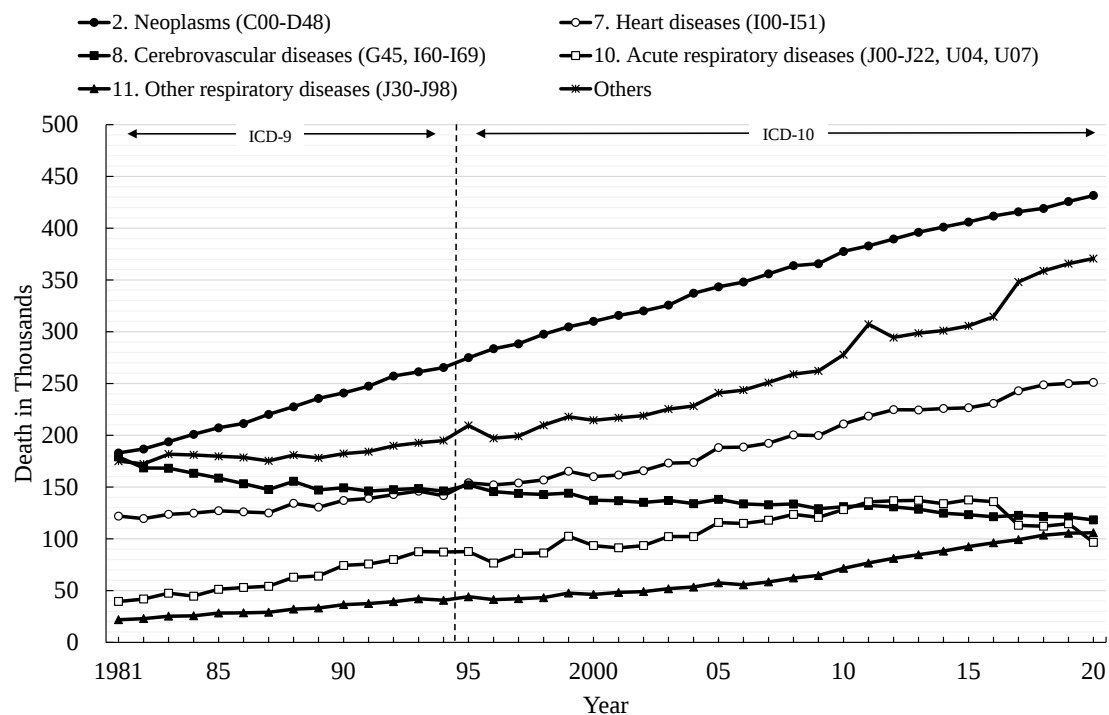


Fig. 2: Annual Trends in Number of Deaths by Cause in Japan, Reconstructed

Source: Human Cause-of-Death Database (<https://www.mortality.org/Data/HCD>).

References

1. Meslé, F., & Vallin, J. (1996). Reconstructing long-term series of causes of death. *Historical Methods*, 29 (2), 72–87.
2. Ohtsu Y., Korekawa Y., Ishii F., Pechholdová M., Meslé F., & Vallin J. (2018) *Towards the Reconstruction of Long-term Time Series Statistics on Causes of Death in Japan: How to Remove the Influence of a New Death Certificate in 1995*. *Journal of population problems*, 74(2), pp. 99-117. [in Japanese]
3. Pechholdova M., C., Meslé F., and Vallin J. (2017), Reconstructing Long-Term Coherent Cause-of-Death Series, a Necessary Step for Analyzing Trends, *European Journal of Population*, 33(5), 629-650.
4. Vallin, J., & Meslé, F. (1988). Les causes de décès en France de 1925 à 1978 (Travaux et Documents, No.115, 608 p.). Paris: INED/PUF.
5. Vallin, J., & Meslé, F. (1998). Comment suivre l'évolution de la mortalité par cause malgré les discontinuités de la statistique. Le cas de la France de 1925 à 1993. In G. Pavillon (Eds.), *Enjeux des classifications internationales en santé (Questions en santé publique*, pp. 113–156, 220 p.). Paris: Éditions INSERM.