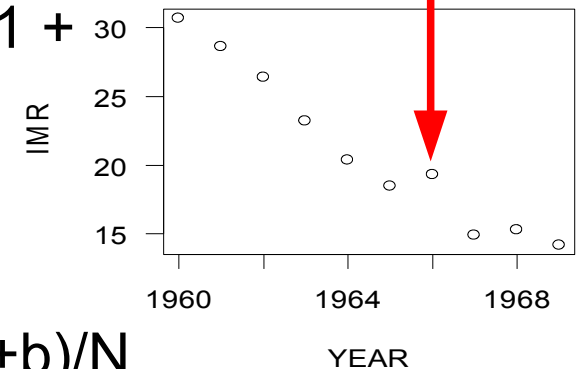- **IMR = (No. of death under age 1) / (1000 live births)**
- **Note: IMR in year x is given by the following equation**
  - Death under age 1 in year x
    = (a) Death in year x under age 1 born in year x-1 +
    (b) Death in year x under age 1 born in year x
  - Live births in year x (N)
    = (b) + (c) Survival until age 1 +
    (d) Death in year x+1 under age 1
  - IMR in year x should be (b+d)/N, but given by (a+b)/N assuming (a) nearly equals (d) in a large population.
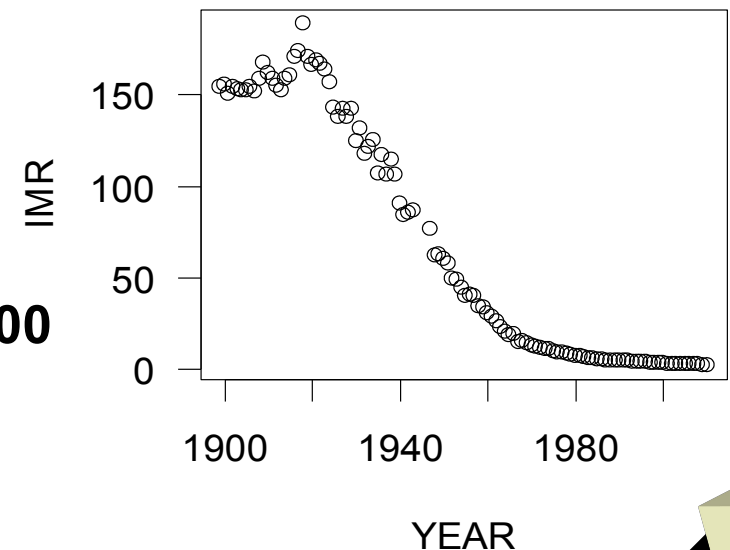 - A hump in hinoe-uma is mainly caused by (d)<(a).
- **Reflecting sanitary condition and living standards**
- **International comparison**
  - Japan: 2.4, one of the lowest countries
    ```
    library(fmsb)
    plot(IMR ~ YEAR, data=Jvital)
    ```
  - Very high in Sub-Sahel African countries
    → **Siella-Leone, Angola, Niger, Liberia: >200**
- **Top share cause of IM in Japan**
  - Injury at delivery during 1979-1984
 - Congenital abnormalities since 1985

A hump in hinoe-uma

- **NMR = (No. of deaths under 4 wks) / (1000 live births)**
  - Neonatal death = Deaths under 4 wks (28 days, roughly 1 mo.)
- **The same problem as IMR occurs, but trivial because 4 wks are much shorter than 1 year.**
- **NMR consists of Early NMR (ENMR) and Late NMR.**
  - ENMR = (No. of deaths under 1wk) / (1000 live births)
  - Late NMR is not popular compared with ENMR.
- **NMR is largely affected by maternal health status and medical (especially obstetrics and gynecology [OB-GYN] including the NICU facility) level.**
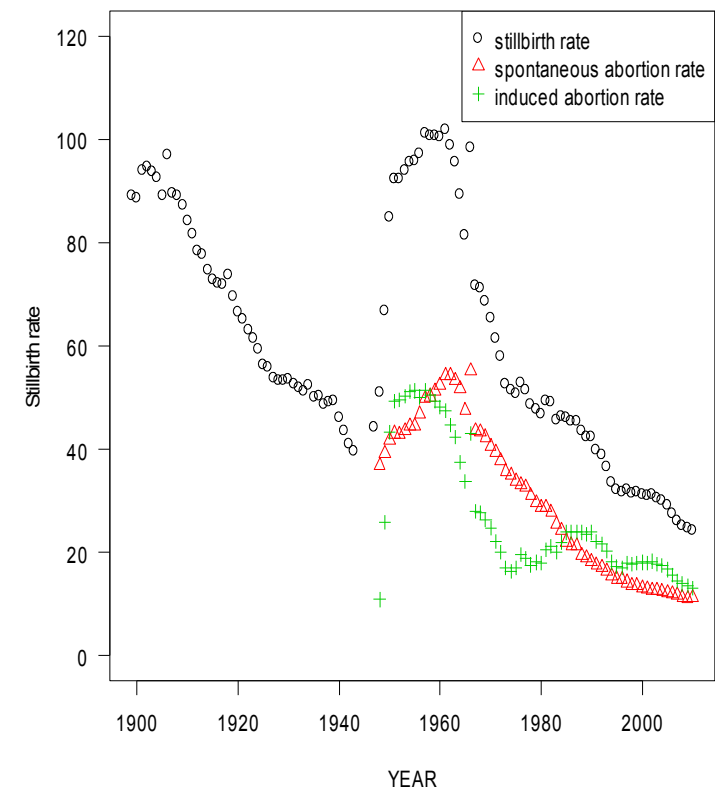- **Rapid decline in Japan.**

```
library(fmsb)
plot(NMR ~ YEAR, data=Jvital)
```
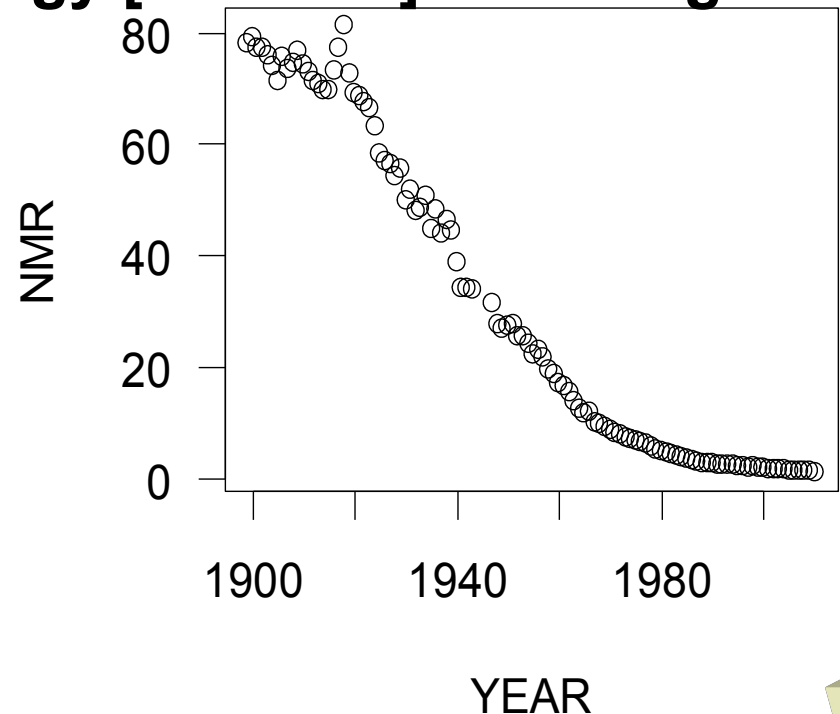
Stillbirth Rate (SBR)

- **In the Newell's textbook, the term "Late Foetal Death Rate" is used as its synonym.**
- **Fetal deaths (the criteria are different by time/region)**
  - Early fetal death (miscarriage): before 20 wks
  - Intermediate fetal death: 20-28 wks
  - Late fetal death (stillbirth): after 28wks
  - WHO's recommendation in 1995: stillbirth is fetal death with body weight>500g and/or after 22wks of gestation (with no vital sign after delivery).
  - Japan's criteria: 28wks until 1994, 22wks since 1995 (adopted ICD-10). Stillbirths after 12wks of gestation must be registered.
    - **When you see the changes of SBR in Japan, you must pay attention to this change of criteria and the progresses of OB-GYN (eg. NICU) and the change of delivery place from home to medical facilities (very drastic after WWII).**
- **SBR = (No. stillbirths) / {(No. stillbirths)+(No. live births)} x 1000**
- **In Japanese statistics, the stillbirth rates for total stillbirth (incl. induced abortion since 1948) and the stillbirth rates for the late fetal death (after 22wks of gestation since 1995, after 28 wks of gestation until 1994) are separately provided.**

- **Perinatal death= late fetal death after 28 wks of gestation + early neonatal death under 1 wk**
  - ◆ Largely affected by maternal health status
  - ◆ Early neonatal death is sometimes misclassified as stillbirth in developing countries
- **Definition in Japanese statistics**
  - ◆ (Perinatal death) =
    (late fetal death after 22 wks
    [28 wks until 1994] of gestation)+
    (early neonatal death under 1 wk)
  - ◆ (Perinatal MR)=
    (No. perinatal death) /
    {(No. stillbirth after 22 wks of gestation)
    + (No. live births)} * 1000
    * The denominator of Perinatal MR
        was No. live births until 1994.
- **Trends in recent Japan**

```
library(fmsb)
par(mar=c(2,4,3,2), las=1, cex=1.2)
matplot(Jvital$YEAR, cbind(Jvital$PNMPB, Jvital$PNMPLB),
 pch=1:2, col=1:2, ylab="Perinatal Mortality Rates")
legend("topright", pch=1:2, col=1:2,
 legend=c("definition since 1995", "definition until 1994"))
```


4
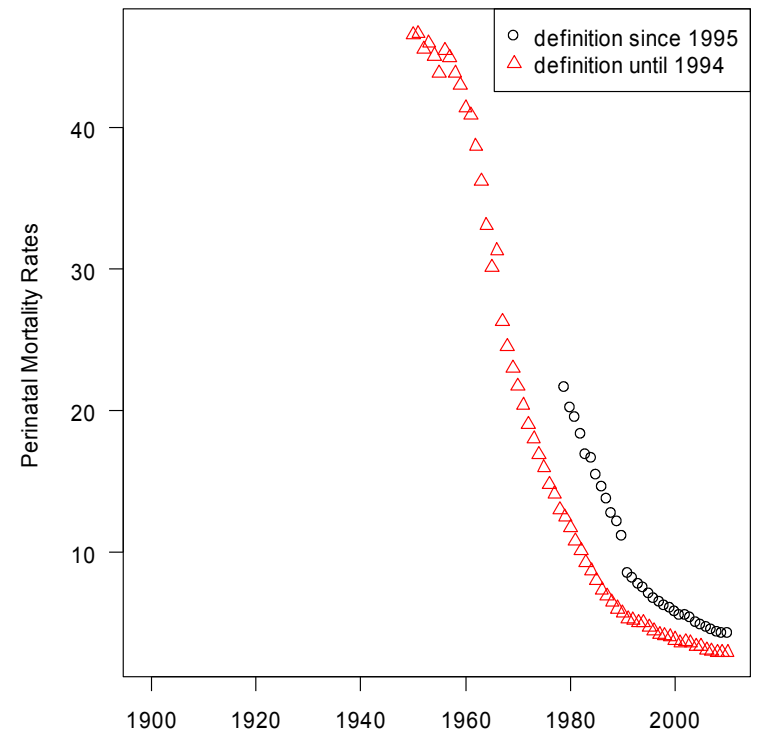
Toddler and Under-five Mortality Rates

- **Definition of toddler death: children's death at ages 1-4**
- **Toddler MR = (No. death with age 1-4) / (Mid-year population of ages 1-4) * 100000**
    - Data in Japan
        - **33 in 1999 -> 25.4 in 2005 -> 22.3 in 2008**
    - Major causes in Japan
        - **Accidental death (esp. by drowning, much more than other developed countries: due to bath?)**
        - **Congenital abnormalities**
- **Under-five MR: integrates IMR and Toddler MR but different**
    - Very famous indicator of child health and overall development
    - WHO's definition: Probability of a child born in a specific year or period dying before reaching the age of five, if subject to age-specific mortality rates of that period.
    - Practical estimation: A probability of death before reaching age 5 _derived from a life table_ and expressed as rate per 1,000 live births.

- **Maternal death**
  - Concept: woman's death caused by the diseases or abnormalities directly related to pregnancy, delivery or puerperia
  - WHO's definition: the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes
- **Maternal Mortality <u>Ratio</u> (because denominator does not include numerator) = No. Maternal death / 100000 live births (or 100000 total births)**
  - In Japan, the term "Maternal Mortality Rate" is used = No. Maternal death / (No. live births + No. stillbirths after 22 wks) * 100000
- **International comparison**
  - Some countries in Sub-Sahara or South Asia, several hundreds
  - Japan and West Europe since 1990, less than 10
  - USA: <10 in 1980s-1990s, 13.3 in 2003, 17.0 in 2004, 18.4 in 2005
- **Trend and major causes in Japan**
  - Rapid decline: 130.6 (in 1960), 52.1 (in 1970), 20.5 (in 1980), 8.6 (in 1990), 6.1 (in 1999), 4.8 (in 2006), 3.1 (in 2007), 3.5 (in 2008), 4.8 (in 2009), 4.1 (in 2010), 3.8 (in 2011)
  - Major causes: Haemorrhage, Pregnancy Induced Hypertension (PIH; recently declined in Japan), Obstetric Venous Thromboembolism (VTE; slowly declined, thus the share is increasing in Japan)