Demography (1) 7th April 2022 Minato Nakazawa <minato-nakazawa@people.kobe-u.ac.jp>
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<Introduction>
Two kinds of demographic research
    1.   Formal demography
    2.   Population studies

This lecture will focus on formal demography. Fundamentally descriptive/analytic rather than explanatory. Concerned with demographic phenomena themselves, not with their interaction with economic, social and other (biological, environmental, ...) phenomena.

The textbook (Newell C: "Methods and models in demography", Guilford Press, NY, 1988) is composed of 2 parts.
    1.   The topics conventionally found in introductory textbooks of demographic methods (Chapter 1 to 9): Basic measures used in the analysis of fertility, mortality, nuptiality and migration.
    2.   Less written topics than previous part except Chapter 11 (Stable population) and Chapter 15 (projections, using cohort component method like Lee-Carter model).

Further references are:
* Preston SH, et al. (2001) Demography: Measuring and Modeling Population Processes. Blackwell Publishing.
* Rowland DT (2003) Demographic methods and concepts. Oxford Univ. Press.
* Burch TK (2018) Model-based demography: Essays on integrating data, technique and theory. Springer Open
[https://link.springer.com/book/10.1007%2F978-3-319-65433-1]
* Bengtsson T, Keilman N (2019) Old and new perspectives on mortality forecasting. Springer Open
[https://link.springer.com/book/10.1007/978-3-030-05075-7]
* Maier H et al. (2021) Exceptional Lifespan, Springer Open [https://link.springer.com/book/10.1007/978-3-030-49970-9]

Historical background to formal demography
Until late 19C, development of formal demography essentially occurred as **life table** analysis to analyze mortality. Until 20C, fertility, nuptiality, migration and age structure were rarely studied except Euler's invention of "stable population" in 1760. 150 years later, Lotka invented stable population theory.
- Development of life table: Graunt's "bills of mortality" of London in 1662 was the first. Halley (1693) first calculated the first life table based on actual numbers of deaths by age. Milne (1815) formalized the conventional calculation and presentation of the present style life table. Then Farr started the decennial series of English life tables by 1841.
- Lotka largely developed formal demography: under the fixed schedules of age-specific mortality and fertility, a closed population tends to develop along predictable path to a final, fixed age-structure, with "intrinsic rate of natural increase".
- Total fertility rate (TFR) and net reproduction rate (NRR) were developed by German demographers and became widely used by the work of Kuczynski (1935).
- Singulate mean age at marriage (SMAM) was developed after the WWII (Hajnal, 1953).
- Except Lotka's stable population, the first widely used demographic model was model life table by UN (1955, 1956), followed by Coale and Demeny (1966). Then, Coale and his colleagues developed model fertility and nuptiality schedules. Relational models were developed by Brass et al.
- Rogers (1975) developed multi-regional demographic modeling.

Some of the very basic concepts and measures used in formal demography
- Demographic data are mostly frequencies. The statistics used to manipulate such data are rates, ratios and proportions: Ratio = (number) / (other number) [eg. sex ratio = number of males / number of females x 100], Proportion = (number of specific components) / (total number) [Note: It can range from 0 to 1], Rate = (number of events) / (person-years of population at risk) [Note: the term "rate" is somewhat loosely used for other concepts, which sometimes causes confusion. "Literacy rate" is not a rate, but a proportion.]
- Basic demographic equation $P_{t+1} = P_t + B - D + IN - OUT$. In other expression,
  "Population change" = "Natural increase" + "Net migration"
- Using mid-year population (MYP), the equation can be expanded to rates as follows
  $$\frac{P_{t+1} - P_t}{\text{MYP}} = \frac{B}{\text{MYP}} - \frac{D}{\text{MYP}} + \frac{IN}{\text{MYP}} - \frac{OUT}{\text{MYP}}.$$ In other expression,
  "Growth rate" = "Rate of natural increase" + "Net migration rate".
- In addition to such crude rates, there are many kinds of adjusted rates.
- Types of demographic data: census (records of all individual data at one time), survey (specially collecting data of [usually a part of] population) and registration systems (records of events within particular period).
- The definition of "population": "Number of people in a given area" is a normal concept but vague. At least, "*de facto*" and "*de jure*" must be distinguished.
- Demographic transition theory (not included in "formal demography" but in "population studies"): Notestien (1945) and others developed the basic idea "There are a series of stages during which a population moves from a situation where both mortality and fertility are high, to a position where both mortality and fertility are low." There were many modifications and criticism for this idea, with related ideas like Zelinsky's "mobility transition" (1971, 1979) for global population movement.