

Measurement of Cause-Specific Death Rate from Civil Registration in Korea: 1970-1974

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Mortality statistics, like all other demographic data, are used for a variety of purposes. These statistics are generally used for formulation, implementation, and evaluation of programs designed to promote economic and social development. Other specific uses of the data are for developing research in various fields such as population, public health, social welfare, nutrition, environmental sanitation, genetics, housing and social affairs.

The quality of mortality statistics compiled from vital registration is not uniform. It may be defective in respect of completeness or of accuracy. The defects of the latter kind are probably widespread in both developed and developing countries. Evaluation of completeness of mortality data, or at least of their representativeness, is very important for their uses.

In Korea, the recognition of the need for population statistics has been emphasized repeatedly in various fields since the establishment of the Republic of Korea in 1948. Therefore, the Korean Government has been making efforts to acquire demographic statistics, especially vital statistics needed for socio-economic development, formulation of population policy, health program and family planning

evaluation as well as for a variety of research projects.

Mortality statistics from civil registration provide various characteristics about the death event. However, in Korea, vital statistics have rarely been published because of incompleteness in the civil registration. Since the vital statistics are not available for use, the levels and causes of mortality are mainly estimated from the census data enumerated at five-year intervals.

The Bureau of Statistics, Economic Planning Board, Korea Government, which is responsible for compilation and analysis of civil registration has not published vital statistics since 1967. Therefore, no official assessment of the level of mortality or the cause of death from the vital statistics has been circulated to the public since 1967.

The Korean death registration form asks for much demographic information about the dead to be stated at the time of registration. These are: name, householder's address, year of birth, sex, marital status, date of death, place of death, cause of death, medical certification of the cause of death, and educational attainment. This is very necessary information in understanding and explaining levels of mortality.

Over the past ten to fifteen years there have

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been great advances in the techniques for extracting meaningful measurements from limited and defective statistics on population.

Most of these developments have depended upon the construction of models of demographic processes, but other concepts, such as internal checkings and robustness of relations, have brought us a larger knowledge and deeper understanding of demographic measurements, as for example, patterns of mortality, age specific rate, and how these change with time.

OBJECTIVE

The first objective of this study is to find plausible demographic models and to apply these models to the mortality statistics compiled from incompleting vital registration in order to estimate levels of mortality. The measures of mortality that are required by the use of these models are crude death rate per thousand population and years of life expectancy at birth for both sexes combined.

The second objective of this study is to estimate the levels of cause-specific death rate, and to determine if there have been any differences in these levels during the five-year period from 1970 to 1974.

DATA SOURCE AND DATA PROCESSING

The statistical information utilized in this study was obtained from the original death registration forms. The total number of forms, reported to Bureau of Statistics, Economic Planning Board by the civil registration during the five-year period, were 203,960 in 1970, 190,057 in 1971, 143,920 in 1972, 143,750 in 1973 and 131,700 in 1974. These forms have

not been published, so that all the information stated in the death registration forms has to be processed from scratch. To save time and money this was done by selecting samples.

In sampling, a systematic selection was applied to the total number of forms after listing all forms in a sequential order for each year. The sampling fraction was determined after considering a minimum error in estimating the parameter at a ninetyfive percent confidence interval, the result of which was that 10,198 deaths were selected as the sample size for 1970, 10,003 deaths for 1971, 10,280 deaths for 1972, 12,439 deaths for 1973 and 12,062 deaths for 1974. The tabulation of this sampling is summarized in table 1.

Two major difficulties were found in classifying the causes of death from the death registration forms. Often the person registering the death was not qualified to write accurately the cause of the death. Another difficulty was that the same disease has a different nomenclature in various regions, and that it is sometimes difficult to determine the specific cause for a death.

Owing to difficulties in detailing the classification of the cause of death, the diseases associated with the deaths were grouped in correspondence to the World Health Organization's B classification. The B list groups all diseases according to fifty causes. For deaths

Table 1. Total number of deaths registered, sampling fractions and size of samples, by year: 1970~1974

| Year | Total number of deaths | Sampling fraction | Size of sample |
|------|------------------------|-------------------|----------------|
| 1970 | 203,960 | 0.05 | 10,198 |
| 1971 | 190,057 | 0.05 | 10,003 |
| 1972 | 143,920 | 0.07 | 10,280 |
| 1973 | 143,750 | 0.08 | 12,439 |
| 1974 | 131,700 | 0.09 | 12,062 |

certified by medical professionals, the fifty classifications of causes of death were regrouped by the basic five-group classification of the World Health Organization¹⁾.

Coding work took one month by ten coders. Before joining the coding work, every coder received one week's training on the principles, rules and codes of the World Health Organization's B classification and the basic five-group classification with ample exercises. While the coding work was being carried on the chief investigator of this study also joined in the coding as supervisor.

The data processing required punching cards for all the codes of causes of death in addition to the other information about the death, and then these cards were processed by a computer for the tabulation of tables and statistical analyses.

DEMOGRAPHIC MODEL

The quality of vital statistics from civil registration for the countries in the ECAFE area has been classified by the United Nations, and the classifications are available in the annual issue of the United Nations Demographic Yearbook. According to the classification, the Korean vital statistics was classified as "U", that meant that the Korean registration system was nationwide but data compiled were unreliable because the coverage of civil registration was considered less than ninety

per cent. Another United Nations' study on mortality in the ECAFE region also pointed out that the percentage of completeness in death registration in Korea was only 71 per cent during the period from 1961 to 1965²⁾.

In those countries with "U" classification, direct measurement of mortality based on incompleting death registration would be misleading in the assessment of mortality. Therefore, in recent years various attempts have been made to study mortality for such countries by sampling surveys, or sample registration, or by the application of demographic techniques. Use of these demographic techniques for incompleting data have been increasingly elaborated recently, but it is also known that they have some limitations. To supplement these limitations one primary important method is to obtain vital data by sampling survey, and then match the results from the registered and surveyed data so that correction factors can be derived.

In this study, however, the method of measuring mortality levels is confined to the use of two demographic models, since the original design of obtaining vital data by a sampling field survey was discarded at the time of screening this study proposal.

The two demographic models used are the linear regression model and the exponential regression model. The linear regression model was used to estimate crude death rates per thousand population, and the exponential regression model was to estimate years of life expectancy at birth for both sexes combined.

The uses of these two models were only for

1) The basic five-group classification is a condensed classification of the WHO's classification of diseases, injuries and causes of death established in 1955. Group 1 includes deaths caused by infectious and parasitic diseases and respiratory causes, Group 2 includes deaths from cancer, group 3 includes diseases of the circulatory system, group 4 includes deaths by violence and group 5 includes all causes not included in the four preceding.

2) United Nations, Comparative study of mortality trends in ECAFE countries, Economic commission for Asia and the Far East, Bangkok, Thailand, December, 1973, Table 3, pp 11.

the purpose of obtaining rough estimates from the corresponding incomplete vital registration.

A linear regression model with a high negative correlation coefficient was established after examining a relationship between the extent of completeness of death registration and estimated crude death rates of corresponding population based on observations from twelve countries, including Korea, in the ECAFE region for the period from 1965 to 1970.

The formula was:

$$Y = 100.59663 - 2.6186X$$

$$r = -0.90969, p < 0.001$$

(Y: crude death rate per thousand population,

X: variable of correction for percent completeness in death registration)

An exponential regression model was established by the United Nations in 1973 after examining the relationship between years of life expectancy at birth for both sexes combined and crude death rate of corresponding population based on fortyseven observations from sixteen countries in ECAFE region³⁾.

The formula was:

$$Y = 81.059X^{0.967^x}$$

(Y: years of life expectancy at birth for both sexes combined.

X: crude death rate per thousand population)

MAJOR RESULTS

Crude death rate:

Use of the linear regression model in this study was the prime technique in estimating the crude death rate. By applying this model

to the data of death registration, two estimates were made: a rough level of crude death rate and a corrected level of crude death rate. The rough level of crude death rate resulted from direct calculation of the level by assigning percentage completeness of death registration to the variable of correction in the formula. The corrected level of crude death rate was calculated by dividing the number of deaths by the midyear population of the corresponding calendar year.

In the process of applying the model, first of all, percentage of completeness was estimated for each year of the five-year period from 1970 to 1974. These percentages of completeness were determined after examining an increasing trend in percent of completeness from 1966 to 1971, based on eleven observations of crude death rate from sample surveys or from estimates by applying demographic techniques to the census statistics (Table 2). Then, the percentage of completeness was used as a coefficient for the variable of correcting the crude death rate through the linear formula.

The expected number of deaths was calculated by inflating the total number of deaths registered with the corresponding percentage of completeness. And the mid-population was determined by interpolating 1970 census statistics and 1974 census statistics according to time period. These two calculations were the bases of the corrected death rate. The coefficient of correction, number of deaths estimated and registered are shown in table 3.

The corrected level of death rate by year from 1970 to 1974 was, 8.0 deaths per thousand population in 1970, 8.0 deaths per thousand population in 1971, 7.6 death per thousand population in 1972, 7.4 deaths per thousand population in 1973 and 7.3 deaths per

3) United Nations: op. cit.

Table 2. Crude death rates by year from various reports in Korea, 1966~1971

| Year | Kim & Lee ¹⁾ | Lim ²⁾ | SDS ³⁾ | BOS ⁴⁾ | BOS ⁵⁾ | BOS ⁶⁾ (Sample) | Cho ⁷⁾ | Brass ⁸⁾ Correction | KIFP ¹⁰⁾ |
|------|-------------------------|-------------------|----------------------|-------------------|-------------------|-------------------------------|-------------------|-----------------------------------|---------------------|
| 1966 | 11.9 | | 8.6 | 9.0 | 10.0 | | | | |
| 1967 | 11.9 | | (8.19) ⁸⁾ | | | 8.1 | | | |
| 1968 | | 7.6 | | | | | | | |
| 1969 | | | | | | | | | |
| 1970 | | | | | | | 7.5~8.0 | 9.11 | |
| 1971 | | | | | | | | | 8.0 |

1): Kim I.S. & Lee D.W.; Mortality changes in Korea, Korean Journal of Public Health, Vol. 2, No. 2, 1969

2): T.B. Lim; The Korean labour force and school population, 1965

3), 4): BOS; Analysis of the 1966 population census, 1970

5), 6): BOS; 1966 vital statistics, 1968

7), 8), 9): BOS; Population Projection(Mimeographed)

10): KIFP; Fertility and Family Planning, An Interim Report on 1971 Fertility-Abortion Survey, 1973

thousand population in 1974. The level of crude death rate from direct calculation was, 8.2 deaths per thousand population in 1970, 7.5 deaths per thousand population in 1971, 5.5 deaths per thousand population in 1972, 5.3 deaths per thousand population in 1973 and 4.7 deaths per thousand population in 1974. These rates are shown in Table 4.

YEARS OF LIFE EXPECTANCY AT BIRTH

Two levels of annual life expectancy at birth, for both sexes combined, were estimated by use of the exponential regression model from the levels of crude death rate. As the crude death rate was calculated for two levels, years of life expectancy at birth were also estimated for two levels: a crude level from the rough estimate of crude death rate and a corrected level from the corrected estimate of crude death rate.

The corrected years of life expectancy at birth, for both sexes combined, was 63.37 years in 1970, 63.37 years in 1971, 64.48 years in 1972, 64.47 years in 1973 and 64.85 years in 1974. The years of life expectancy

Table 3. Number of Estimated Deaths: 1970~1974

| Number of death | 1970 | 1971 | 1972 | 1973 | 1974 |
|---------------------------------|-------|-------|-------|-------|-------|
| Correction factor | 79.6 | 79.6 | 80.6 | 81.1 | 81.6 |
| No. of deaths estimated(1,000) | 256.2 | 238.8 | 178.6 | 177.3 | 161.4 |
| No. of deaths Registered(1,000) | 204 | 190 | 144 | 144 | 132 |

Table 4. Estimated Crude Death Rate per 1,000: 1970~1974

| Year | Population (mid-year, 1,000) | No. of deaths (1,000) | CDR (%) | Corrected CDR(‰) |
|------|------------------------------|-----------------------|---------|------------------|
| 1970 | 31,435 | 256.2 | 8.15 | 8.0 |
| 1971 | 32,062 | 238.8 | 7.45 | 8.0 |
| 1972 | 32,702 | 178.6 | 5.46 | 7.64 |
| 1973 | 33,355 | 177.3 | 5.32 | 7.44 |
| 1974 | 34,021 | 161.4 | 4.74 | 7.25 |

1): BOS, 1970 Population Census Report

2): Estimate by Lee-Jay Cho.

3)~6): Estimated by the formula, $P_t = P_0(1+r)^t$, from 1970 and 1975 census reports.

from the direct calculation of crude death rate was 63.38 years in 1970, 64.45 years in 1971, 68.52 years in 1972, 68.52 years in 1973 and 70.06 years in 1974. These two levels are shown in table 5.

CAUSE-SPECIFIC DEATH RATE

The cause-specific death rate was calculated for each cause of death in two levels, a high estimate and a low estimate, after classifying all the deaths observed from the samples by the World Health Organization's B list. The process of determining the rate was, that the number of deaths classified by cause was adjusted by the percentage of completeness which was used in the calculation of the level of crude death rate, corrected level or rough level, and then the resulting number of deaths was inflated by the sampling fraction of the corresponding year, which was the number of

deaths turned into a cause-specific death rate per 1,000,000 population.

As table 6 indicates, the most frequent causes of death throughout the five-year period were tuberculosis of the respiratory system (B 5), malignant neoplasms, including neo-

Table 5. Estimated Life Expectancy in Korea; 1970~1974

| Year | CDR | e ₀ | CDR | e ₀ |
|------|------|----------------|------|----------------|
| 1970 | 8.15 | 63.08 | 8.0 | 63.37 |
| 1971 | 7.45 | 64.45 | 8.0 | 63.37 |
| 1972 | 5.46 | 68.52 | 7.64 | 64.08 |
| 1973 | 5.32 | 68.82 | 7.44 | 64.47 |
| 1974 | 4.74 | 70.06 | 7.25 | 64.85 |

Table 6. Estimates of Cause-specific Death Rates Per 1,000,000 by Year, 1970~1974

| Disease | Digit of code | 1970 | | 1971 | | 1972 | | 1973 | | 1974 | |
|--|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | Low | High |
| B 1 Cholera | 000 | 0.24 | 0.24 | 0.08 | 0.08 | — | — | 0.17 | 0.24 | 0.04 | 0.06 |
| B 2 Typhoid fever | 001 | 2.50 | 2.56 | 2.45 | 2.64 | 0.74 | 1.04 | 0.51 | 0.72 | 1.26 | 1.92 |
| B 3 Bacillary dysentery and amoebiasis | 004,006 | — | — | — | — | — | — | 3.42 | 4.78 | 0.04 | 0.06 |
| B 4 Enteritis and other diarrhoeal diseases | 008,009 | 1.18 | 1.20 | 1.12 | 1.20 | 1.16 | 1.64 | 0.47 | 0.66 | 0.39 | 0.60 |
| B 5 Tuberculosis of respiratory system | 010-012 | 33.96 | 34.52 | 29.49 | 31.67 | 24.60 | 34.41 | 15.51 | 21.68 | 14.36 | 21.89 |
| B 6 Other tuberculosis, including late effects | 013-019 | 2.12 | 2.16 | 1.05 | 1.12 | 0.95 | 1.34 | 4.23 | 5.92 | 1.62 | 2.43 |
| B 7 Plague | 020 | — | — | — | — | — | — | — | — | — | — |
| B 8 Diphtheria | 032 | 0.16 | 0.16 | 0.15 | 0.15 | 0.21 | 0.29 | 0.13 | 0.17 | 0.04 | 0.06 |
| B 9 Whooping cough | 033 | 1.34 | 1.36 | 0.38 | 0.40 | 0.42 | 0.59 | 0.13 | 0.17 | 0.32 | 0.48 |
| B 10 Streptococcal sore throat and scarlet fever | 034 | 0.32 | 0.32 | 0.08 | 0.08 | 0.11 | 0.15 | 0.05 | 0.06 | — | — |
| B 11 Meningococcal infection | 036 | — | — | — | — | — | — | — | — | 0.08 | 0.12 |
| B 12 Acute poliomyelitis | 040-043 | 3.84 | 3.92 | 2.24 | 2.39 | 1.69 | 2.38 | 1.79 | 2.51 | 1.22 | 1.86 |
| B 13 Smallpox | 050 | — | — | 0.23 | 0.25 | — | — | 0.17 | 0.24 | 0.15 | 0.24 |
| B 14 Measles | 055 | 5.64 | 5.76 | 5.36 | 5.76 | 4.35 | 6.09 | 2.05 | 2.87 | 2.12 | 3.24 |
| B 15 Typhus and other rickettsioses | 080-083 | — | — | — | — | — | — | — | — | 0.08 | 0.12 |
| B 16 Malaria | 084 | — | — | — | — | — | — | — | — | — | — |
| B 17 Syphilis and its sequelae | 090-097 | 0.08 | 0.08 | 0.08 | 0.08 | 0.06 | 0.07 | 0.05 | 0.06 | — | — |
| B 18 All other infective and parasitic | 000-136 | 2.66 | 2.72 | 2.53 | 2.72 | 1.12 | 1.55 | 2.87 | 4.00 | 4.25 | 6.47 |
| B 19 Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissue | 140-209 | 39.62 | 40.36 | 41.40 | 44.50 | 35.59 | 49.80 | 32.81 | 45.88 | 28.52 | 43.49 |

| | | | | | | | | | | | | |
|-------|---|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| B 20 | Benign neoplasms and neoplasms of unspecified nature | 210-239 | — | — | — | — | 0.06 | 0.07 | 0.86 | 1.19 | 1.62 | 2.46 |
| B 21 | Diabetes mellitus | 250 | 1.10 | 1.12 | 1.79 | 1.92 | 1.54 | 2.16 | 1.46 | 2.03 | 1.26 | 1.92 |
| B 22 | Avitaminoses and other nutritional deficiency | 260-269 | 4.24 | 4.32 | 3.50 | 3.76 | 2.70 | 3.79 | 1.58 | 2.21 | 1.73 | 2.64 |
| B 23 | Anaemias | 280-285 | 1.34 | 1.36 | 2.24 | 2.39 | 1.27 | 1.78 | 0.25 | 0.36 | 0.47 | 0.72 |
| B 24 | Meningitis | 320 | 6.52 | 6.64 | 6.25 | 6.73 | 5.10 | 7.14 | 3.07 | 4.30 | 2.87 | 4.38 |
| B 25 | Active rheumatic fever | 390-392 | 0.16 | 0.16 | — | — | 0.11 | 0.15 | — | — | — | — |
| B 26 | Chronic rheumatic heart disease | 393-398 | — | — | — | — | 0.06 | 0.07 | 0.05 | 0.06 | 0.12 | 0.17 |
| B 27 | Hypertensive disease | 400-404 | 20.94 | 21.34 | 23.83 | 25.59 | 25.65 | 31.50 | 29.56 | 41.34 | 25.33 | 38.63 |
| B 28 | Ischaemic heart disease | 410-414 | 0.24 | 0.24 | — | — | — | — | 0.47 | 0.66 | 0.24 | 0.36 |
| B 29 | Other forms of heart disease | 420-429 | 18.04 | 18.38 | 17.04 | 18.32 | 12.59 | 17.61 | 10.00 | 13.98 | 10.50 | 16.02 |
| B 30 | Cerebrovascular disease | 430-438 | 41.58 | 42.36 | 43.85 | 47.10 | 35.48 | 49.64 | 33.36 | 46.65 | 26.43 | 40.31 |
| B 31 | Influenza | 470-474 | 11.06 | 11.26 | 9.98 | 10.72 | 5.04 | 7.06 | 2.82 | 3.94 | 2.24 | 3.42 |
| B 32 | Pneumonia | 480-486 | 33.10 | 33.72 | 27.99 | 30.08 | 15.13 | 21.18 | 15.08 | 21.09 | 11.37 | 17.01 |
| B 33 | Bronchitis, emphysema and asthma | 490-493 | 22.44 | 22.86 | 17.94 | 19.27 | 13.44 | 18.80 | 13.62 | 19.06 | 13.09 | 19.98 |
| B 34 | Peptic ulcer | 531-533 | 6.20 | 6.32 | 5.66 | 6.08 | 4.30 | 6.02 | 2.57 | 3.58 | 2.80 | 4.26 |
| B 35 | Appendicitis | 540-543 | 5.96 | 6.08 | 5.59 | 6.00 | 3.67 | 5.12 | 2.65 | 3.70 | 2.52 | 3.84 |
| B 36 | Intestinal obstruction and hernia | 550-553, 560 | 0.24 | 0.24 | 0.23 | 0.25 | 0.32 | 0.45 | 0.38 | 0.53 | 0.24 | 0.36 |
| B 37 | Cirrhosis of liver | 571 | 6.04 | 6.16 | 6.25 | 6.73 | 5.00 | 6.99 | 8.54 | 11.95 | 8.10 | 12.36 |
| B 38 | Nephritis and nephrosis | 580-584 | 5.18 | 5.28 | 5.05 | 5.43 | 4.14 | 5.80 | 4.44 | 6.22 | 4.13 | 6.30 |
| B 39 | Hyperplasia of prostate | 600 | — | — | — | — | — | — | — | — | — | — |
| B 40 | Abortion | 640-645 | 0.24 | 0.24 | 0.15 | 0.16 | 0.21 | 0.29 | — | — | — | — |
| B 41 | Other complications of pregnancy, childbirth and the puerperium, delivery without mention of complication | 630-639 650-678 | 2.82 | 2.88 | 2.09 | 2.24 | 1.39 | 1.93 | 1.06 | 1.49 | 1.10 | 1.68 |
| B 42 | Congenital anomalies | 740-759 | — | — | — | — | — | — | 0.15 | 0.17 | 0.24 | 0.36 |
| B 43 | Birth injury, difficult labour and other anoxic and hypoxic conditions | 764-768 772, 776 | 0.08 | 0.08 | 0.15 | 0.16 | 0.06 | 0.07 | 0.08 | 0.12 | 0.08 | 0.12 |
| B 44 | Other causes of perinatal mortality | 760-763 769-771 773-775 777-779 | 0.08 | 0.08 | 0.67 | 0.72 | 0.11 | 0.15 | 0.08 | 0.12 | — | — |
| B 45 | Symptoms and ill-defined conditions | 780-796 | 302.50 | 308.20 | 312.84 | 336.05 | 223.30 | 312.47 | 243.67 | 340.72 | 218.72 | 333.60 |
| B 46 | All other diseases | 135.88 | 138.44 | 121.87 | 130.91 | 80.57 | 112.76 | 27.13 | 37.94 | 17.15 | 26.16 | |
| BE 47 | Motor vehicle accidents | E 081-E 823 | 5.02 | 5.12 | 5.81 | 6.23 | 4.51 | 6.31 | 3.17 | 4.41 | 3.34 | 5.10 |
| BE 48 | All other accidents | E 800-E 807 E 825-E 949 | 21.34 | 21.74 | 21.43 | 23.03 | 23.48 | 32.86 | 24.05 | 33.63 | 21.05 | 32.11 |
| BE 49 | Suicide and self-inflicted injuries | E 950-E 959 | 4.40 | 4.48 | 3.50 | 3.76 | 3.35 | 4.68 | 2.01 | 2.81 | 2.24 | 3.42 |
| BE 50 | All other external causes | E 960-E 999 | 3.46 | 3.52 | 3.34 | 3.59 | 3.14 | 4.38 | 1.46 | 2.03 | 2.56 | 3.90 |

plasms of lymphatic and haematopoietic tissue (B 19), hypertensive disease (B 27), cerebrovascular disease (B 30), pneumonia (B 32), bronchitis, emphysema and asthma (B 33), all accident (B 48), symptoms and ill-defined conditions (B 45) and all other diseases (B 46).

The less frequent causes of death were diphtheria (B 8), syphilis and its sequelae (B 17), active rheumatic fever (B 25), ischemic heart disease (B 29), intestinal obstruction and hernia (B 36), abortion (B 40), birth injury, difficult labour and other anoxic and hypoxic conditions (B 43) and other causes of perinatal mortality (B 44).

The least frequent causes of death were cholera (B 1), bacillary dysentery and amoebiasis (B 3), plague (B 7), meningococcal infection (B 11), typhus and other rickettsioses (B 15), malaria (B 16), chronic rheumatic heart disease (B 26), hyperplasia of prostate (B 39) and congenital anomalies (B 42).

Although there were several problems in the classification of the cause of death-incompleteness in death registration, use of different nomenclature and non-medical professionals' certification of the deaths it was noticeable that the shape of the distribution consisting of the cause-specific rates within each year were quite similar to each other during the five-year period, and the patterns of change in the levels by cause of death during the five-year period were consistent and reasonable. For example, those specific rates for tuberculosis of respiratory system, pneumonia, bronchitis, emphysema and asthma showed that the levels have steadily decreased, while the levels of cause-specific rates for malignant neoplasms including neoplasms of lymphatic and haematopoietic tissue, and hypertensive disease have slightly increased over the same

time period.

NUMBER OF MEDICALLY CERTIFIED DEATHS

Often the person registering the death was not qualified to state the cause of death. In this situation, one of the first steps towards improved reporting on and analysis of cause of death is the separate tabulation of medically certified deaths. Therefore, in this study the medically certified deaths were selected again and tabulated separately.

The total number of medically certified deaths by year was 2,591 (26.9%) in 1970, 2,795 (28.29%), 3,617 (35.29%), 4,868 (42.01%) and 4,878 (43.31%) (Table 7).

The rest of the deaths were certified either by a local herb doctor's certificate (5.24%~7.05%) or by a non-medical professional's statement of cause (49.55%~67.43%).

As it was known that availability of medical facilities in large cities like Seoul, the capital, or Pusan city was much easier than in the provinces the medically certified deaths were reported by provincial jurisdiction to determine if there were any differences in the proportion of medically certified deaths by area.

The proportions of medically certified deaths in the two cities were quite high, as it was expected. In Seoul, for example, the annual proportion during the five-year period was in a range of 72%~80%, and in Pusan, the rate was in a range of 71%~82%.

However, the proportion of medically certified deaths in every province was less than fifty per cent except only that three provinces for selected years were chosen.

These were Gyeongnam in 1973 (52.5%), in 1974 (52.5%), Gyeonggi in 1974 (51.3%), and

Table 7. Number of deaths by death diagnostician: 1970~1974

| Diagnostician | 1970 | | 1971 | | 1972 | | 1973 | | 1974 | |
|---------------|-------|--------|-------|-------|--------|--------|--------|-------|--------|-------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| Doctor | 2,591 | 26.96 | 2,795 | 28.29 | 3,617 | 35.29 | 4,868 | 42.01 | 4,878 | 43.31 |
| Herb doctor | 539 | 5.61 | 544 | 5.51 | 537 | 5.24 | 817 | 7.05 | 612 | 5.43 |
| Others | 6,479 | 67.43 | 6,542 | 66.21 | 6,094 | 59.47 | 5,718 | 49.35 | 5,581 | 49.55 |
| Unknown | — | — | — | — | — | — | 183 | 1.57 | 191 | 1.69 |
| Total | 9,609 | 100.00 | 9,881 | 100.1 | 10,248 | 100.00 | 11,586 | 99.93 | 11,262 | 99.98 |

Table 8. Types of place where death occurred: 1970~1974

| Year | Individual house | | Hospital or clinic | | Others | | Not known | | Total | |
|------|------------------|---------|--------------------|--------|--------|--------|-----------|--------|--------|---------|
| | No. | % | No. | % | No. | % | No. | % | No. | % |
| 1970 | 8,890 | (92.52) | 345 | (3.59) | 374 | (3.89) | — | (—) | 9,609 | (100.0) |
| 1971 | 9,041 | (91.50) | 433 | (4.38) | 407 | (4.12) | — | (—) | 9,881 | (100.0) |
| 1972 | 9,137 | (89.16) | 544 | (5.31) | 567 | (5.53) | — | (—) | 10,248 | (100.0) |
| 1973 | 9,990 | (86.24) | 789 | (6.81) | 660 | (5.69) | 147 | (1.26) | 11,586 | (100.0) |
| 1974 | 9,705 | (86.18) | 732 | (6.49) | 711 | (6.32) | 114 | (1.01) | 11,262 | (100.0) |

Chungnam in 1974 (76.0%).

PLACE OF DEATH OCCURRED

Additionally, the proportion of deaths occurring at a hospital or a medical clinic was observed for each year of the five-year period from 1970 to 1974.

These proportions, as shown in table 8, indicates that the proportion was remarkably small in number. In 1970, the rate was only 3.6 per cent. The highest proportion was 7.1 per cent.

Considering the high rates in the proportion of medically certified deaths in large cities, seen in the previous section, the validity and the reliability of the small rate for the deaths occurring at a hospital or medical clinic remains doubtful.

MEDICALLY CERTIFIED CAUSE OF DEATH

In 1968 a special meeting was held in

Copenhagen by the United Nations devoted to the discussion of the problems of accurate reporting of causes of death within the currently existing system. After the meeting, it was recommended that medically certified deaths only should be used in assessing the cause of death in Asian countries where vital registration data were incomplete⁴⁾.

In Korea, however, since most of the medically certified deaths are of urban residents and relatively recent deaths during the five-year period, assessment of the cause of death from this data does not necessarily represent the true aspect of the specific structure of the cause of death in the total population of registered deaths.

Nevertheless, these data are still considered to be worthy in analysing the urban type of

4) United Nations, Report of the seminar on civil registration and vital statistics for Asia and Far East, Copenhagen, Denmark, 1968, Statistical paper M, No. 50.

Table 9. Proportion of the deaths classified by the WHO's B list from medically certified deaths only: 1970~1974

| Disease | Digit of code | 1970 | | 1971 | | 1972 | | 1973 | | 1974 | |
|--|---------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | MD | Other |
| B 1 Cholera | 000 | 0.04 | 0.03 | — | 0.02 | — | — | 0.06 | 0.01 | 0.02 | — |
| B 2 Typhoid fever | 001 | 0.19 | 0.42 | 0.32 | 0.37 | 0.06 | 0.18 | 0.04 | 0.17 | 0.04 | 0.48 |
| B 3 Bacillary dysentery and amoebiasis | 004,006 | — | — | — | — | — | — | 0.04 | 0.10 | — | 0.01 |
| B 4 Enteritis and other diarrhoeal diseases | 008,009 | 0.08 | 0.20 | 0.14 | 0.17 | 0.17 | 0.26 | 0.08 | 0.10 | 0.16 | 0.01 |
| B 5 Tuberculosis of respiratory system | 010-012 | 5.21 | 4.26 | 4.47 | 3.79 | 5.00 | 4.28 | 3.94 | 2.41 | 3.81 | 2.79 |
| B 6 Other tuberculosis, including late effects | 013-019 | 0.73 | 0.09 | 0.43 | 0.02 | 0.41 | 0.03 | 0.98 | 0.76 | 0.61 | 0.16 |
| B 7 Plague | 020 | — | — | — | — | — | — | 0.02 | — | — | — |
| B 8 Diphtheria | 032 | 0.08 | — | 0.04 | 0.02 | 0.08 | 0.02 | 0.04 | — | 0.02 | — |
| B 9 Whooping cough | 033 | 0.04 | 0.22 | — | 0.08 | — | 0.13 | — | 0.03 | — | 0.14 |
| B 10 Streptococcal sore throat and scarlet fever | 034 | — | 0.06 | — | 0.02 | — | 0.03 | — | 0.01 | — | — |
| B 11 Meningococcal infection | 036 | — | — | — | — | — | — | — | — | 0.04 | — |
| B 12 Acute poliomyelitis | 040-043 | 0.23 | 0.66 | 0.07 | 0.40 | 0.11 | 0.46 | 0.08 | 0.61 | 0.06 | 0.48 |
| B 13 Smallpox | 050 | — | — | — | 0.05 | — | — | — | 0.03 | — | 0.07 |
| B 14 Measles | 055 | 0.35 | 0.96 | 0.14 | 1.01 | 0.11 | 1.28 | 0.08 | 0.73 | 0.04 | 0.91 |
| B 15 Typhus and other rickettsioses | 080-083 | — | — | — | — | — | — | — | — | 0.04 | — |
| B 16 Malaria | 084 | — | — | — | — | — | 0.02 | — | — | — | — |
| B 17 Syphilis and its sequelae | 090-097 | 0.04 | — | 0.04 | — | — | — | 0.02 | — | — | — |
| B 18 All other infective and parasitic | 000-136 | 0.50 | 0.31 | 0.68 | 0.21 | 0.44 | 0.07 | 0.41 | 0.66 | 0.38 | 1.57 |
| B 19 Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissue | 140-209 | 8.03 | 4.01 | 7.76 | 4.71 | 8.79 | 5.12 | 9.32 | 4.03 | 9.04 | 3.87 |
| B 20 Benign neoplasms and neoplasms of unspecified nature | 210-239 | — | — | — | — | 0.03 | — | 0.32 | 0.05 | 0.57 | 0.16 |
| B 21 Diabetes mellitus | 250 | 0.31 | 0.05 | 0.39 | 0.14 | 0.50 | 0.10 | 0.43 | 0.10 | 0.45 | 0.16 |
| B 22 Avitaminoses and other nutritional deficiency | 260-269 | 0.81 | 0.48 | 0.50 | 0.47 | 0.53 | 0.46 | 0.43 | 0.17 | 0.59 | 0.25 |
| B 23 Anaemias | 280-285 | 0.23 | 0.15 | 0.47 | 0.24 | 0.25 | 0.23 | 0.08 | 0.01 | 0.12 | 0.10 |
| B 24 Meningitis | 320 | 1.47 | 0.54 | 1.04 | 0.67 | 1.22 | 0.67 | 0.61 | 0.61 | 0.71 | 0.57 |
| B 25 Active rheumatic fever | 390-392 | 0.04 | 0.02 | — | — | 0.06 | — | — | — | — | — |
| B 26 Chronic rheumatic heart disease | 393-398 | — | — | — | — | 0.03 | — | 0.02 | — | 0.06 | — |
| B 27 Hypertensive disease | 400-404 | 4.25 | 2.15 | 4.65 | 2.54 | 5.53 | 3.40 | 7.35 | 4.49 | 7.42 | 3.99 |
| B 28 Ischaemic heart disease | 410-414 | 0.08 | — | — | — | — | — | 0.20 | — | 0.12 | — |
| B 29 Other forms of heart disease | 420-429 | 2.78 | 2.15 | 3.33 | 1.88 | 2.82 | 1.97 | 2.89 | 1.22 | 3.77 | 1.16 |
| B 30 Cerebrovascular disease | 430-438 | 10.96 | 3.13 | 11.16 | 3.53 | 11.20 | 3.63 | 10.55 | 3.28 | 10.55 | 1.91 |
| B 31 Influenza | 470-474 | 0.77 | 1.74 | 0.39 | 1.74 | 0.17 | 1.38 | 0.04 | 1.06 | 0.10 | 0.87 |
| B 32 Pneumonia | 480-486 | 3.86 | 4.65 | 3.18 | 4.11 | 2.05 | 3.28 | 2.67 | 3.46 | 2.43 | 2.92 |
| B 33 Bronchitis, emphysema and asthma | 490-498 | 3.16 | 2.67 | 2.47 | 2.05 | 2.41 | 2.22 | 2.42 | 2.62 | 2.50 | 3.38 |

| | | | | | | | | | | | |
|--|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| B 34 Peptic ulcer | 531-533 | 0.96 | 0.69 | 0.57 | 0.78 | 1.00 | 0.62 | 0.59 | 0.43 | 0.59 | 0.57 |
| B 35 Appendicitis | 540-543 | 0.15 | 1.11 | 0.25 | 1.01 | 0.06 | 1.08 | 0.10 | 0.96 | 0.04 | 1.09 |
| B 36 Intestinal obstruction and hernia | 550-533, 560 | 0.08 | — | 0.11 | — | 0.14 | — | 0.08 | 0.08 | 0.08 | 0.01 |
| B 37 Cirrhosis of liver | 571 | 1.78 | 0.39 | 2.11 | 0.34 | 1.91 | 0.30 | 2.87 | 0.64 | 3.09 | 0.64 |
| B 38 Nephritis and nephrosis | 580-584 | 0.62 | 0.68 | 1.11 | 0.43 | 0.72 | 0.71 | 0.76 | 0.68 | 0.88 | 0.69 |
| B ₂ 39 Hyperplasia of prostate | 600 | — | — | — | — | — | — | — | — | — | — |
| B 40 Abortion | 640-645 | 0.04 | 0.02 | 0.07 | — | 0.06 | 0.02 | — | — | — | — |
| B 41 Other complications of pregnancy, childbirth and the puerperium, delivery without mention of complication | 630-639 650-678 | 0.66 | 0.28 | 0.29 | 0.28 | 0.28 | 0.20 | 0.14 | 0.29 | 0.16 | 0.26 |
| B 42 Congenital anomalies | 740-759 | — | — | — | — | — | — | — | 0.03 | 0.08 | 0.01 |
| B 43 Birth injury, difficult labour and other ranoxic and hypoxic conditions | 764-768 772, 776 | 0.04 | — | 0.07 | — | 0.03 | — | — | — | 0.02 | 0.01 |
| B 44 Other causes of perinatal mortality | 760-763 769-771 773-775 777-779 | — | 0.02 | 0.07 | 0.11 | — | 0.02 | — | 0.01 | — | — |
| B 45 Symptoms and ill-defined conditions | 780-796 | 28.37 | 45.82 | 29.91 | 48.87 | 29.83 | 48.57 | 33.98 | 61.59 | 34.88 | 61.64 |
| B ₂ 46 All other diseases | | 11.39 | 20.06 | 12.67 | 17.75 | 10.59 | 16.69 | 4.34 | 3.86 | 4.95 | 5.76 |
| BE 47 Motor vehicle accidents | E810-E823 | 1.62 | 0.34 | 2.08 | 0.31 | 1.80 | 0.30 | 1.21 | 0.24 | 1.41 | 0.2 |
| BE 48 All other accidents | E800-E807 E825-E949 | 8.03 | 0.93 | 7.66 | 1.10 | 9.95 | 1.31 | 8.53 | 2.22 | 8.34 | 2.01 |
| BE 49 Suicide and self-inflicted injuries | E950-E959 | 1.66 | 0.20 | 1.07 | 0.26 | 1.27 | 0.28 | 0.80 | 0.10 | 1.06 | 0.24 |
| BE 50 All other external causes | E960-E999 | 0.39 | 0.52 | 0.29 | 0.57 | 0.44 | 0.71 | 0.34 | 0.29 | 0.59 | 0.62 |

cause-specific structure, and possibly the comparison of cause-specific rates from the data with non-medically certified cause-specific rates would raise many questions in studying mortality based on vital registration.

Unique analysis of these medically certified deaths in this study was confined to calculating the proportions of cause of death, since the data were selective, so that the denominator of the cause-specific death rate was not possible to determine.

The proportion of each cause of death from the medically certified deaths is shown in table 9 along with the proportion of non-medically certified causes of death. As table

9 indicates, the frequent causes of death were tuberculosis of respiratory system (B 5) (5.2% in 1970, 4.5% in 1971, 5.0% in 1972, 3.9% in 1973 and 3.8% in 1974), malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissue (B 19) (8.0% in 1970, 7.7% in 1971, 8.8% in 1972, 9.3% in 1973 and 9.0% in 1974), hypertensive disease (B 27) (4.3% in 1970, 4.7% in 1971, 5.5% in 1972, 7.3% in 1973 and 7.4% in 1974), cerebrovascular disease (B 30) (11.0% in 1970, 11.2% in 1971, 11.2% in 1972, 10.6% in 1973 and 10.6% in 1974), all other accidents (B 46) (8.0% in 1970, 7.7% in 1971, 10.0% in 1972, 8.5% in 1973 and 8.3% in 1974), symptoms

and ill-defined conditions (B 45) (28.4% in 1970, 29.9% in 1971, 29.8% in 1972, 34.0% in 1973 and 34.9% in 1974) and all other diseases (B 46) (11.4% in 1970, 12.7% in 1971, 10.6% in 1972, 4.3% in 1973 and 5.0% in 1974).

The frequency of the causes of death from the medically certified deaths are the same as the frequency of the causes of death from all the deaths registered.

The medically certified deaths were reclassified again by the World Health Organization's basic five-group of cause of death (Table 10). The proportion of Group 1 diseases, consisting of infectious and parasitic diseases and respiratory diseases has decreased steadily over the five-year study period. The proportion of Group 2 diseases, consisting of deaths from cancer, remained unchanged during the same time period, but the proportion of Group 3, consisting of diseases of the circulatory system, has increased slightly during the study period. The proportion of Group 4 diseases and the proportion of Group 5 diseases remained practically unchanged during the five-year period. If these changing patterns in the basic five-group cause of death are

Table 10. Proportion of the causes of death by the WHO basic five-group classification: medically certified deaths only, 1970~1974

| Group | 1970 (%) | 1971 (%) | 1972 (%) | 1973 (%) | 1974 (%) |
|------------------|----------|----------|----------|----------|----------|
| 1 | 21.87 | 19.84 | 18.97 | 18.19 | 17.49 |
| 2 | 0.50 | 0.68 | 0.44 | 0.41 | 0.38 |
| 3 | 9.28 | 9.60 | 9.99 | 11.62 | 12.62 |
| 4 | 11.70 | 11.06 | 13.46 | 10.90 | 11.24 |
| 5 | 56.63 | 58.82 | 57.13 | 58.88 | 58.27 |
| Total | 99.98 | 100.00 | 99.99 | 100.00 | 100.00 |
| Number of deaths | (2,591) | (2,795) | (3,617) | (4,868) | (4,878) |

5) United Nations, op. cit.

compared to the study on mortality, done by the United Nations⁵⁾, that "the distinguished three general phases in the pattern of mortality by cause were, when life expectancy at birth increased to between 40 to 60 years, the proportion of deaths due to Group 1 diseases declined, and the proportion of deaths due to Group 2 diseases and Group 3 diseases increased, and the proportion of deaths due to Group 4 diseases increased slightly. When life expectancy at birth increased to between 60 and 70 years the proportion of Group 1 diseases continues to decline, and that of Group 2 and Group 3 continued to increase, but the increase was more rapid. The proportion of Group 4 diseases remained practically unchanged, "the years of life expectancy for urban population seem to be in a trend of increase.

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