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Preface

I am honored to be able to publish the 1993 infant mortality survey report and I would like to share my pleasure and give my sincere thanks to those who have contributed to these very important statistics.

It is well known that infant deaths, rather than being caused by direct health problems after birth, is more likely to be because of risk factors inherited from the mother. When considering that a mother's health can show a nation's health level and socio-economic status, the compilation of this kind of basic statistic have great meaning for the development of maternal and child health policy.

Up-until now the Korean infant mortality rate has been based on registration data and produced by indirect estimations. However, reliability of these statistics could not be achieved because of under-reporting of neonatal deaths and also because reporting of the event was sometimes delayed.

This study used the fact that 99% of deliveries have taken place in medical facilities under the national medical insurance system. Therefore, new and alternative methods were used that involved medical insurance maternity benefit data and confirmation of medical charts.

I believe that the infant mortality rate and the characteristics and causes of infant deaths derived from this study will be essential in planning to enhance the quality of life and the population. Moreover, this report will contribute to the improved understanding and management of the maternal and child health in Korea.

In conclusion, I would like to thank the Korea Institute for Health and Social Affairs for making the research design and analysis, the Ministry of Home Affairs for their cooperation in providing the data, the Federation of Health Insurance and also the Korea Medical Insurance Corporation all for their support.

Moim Kim, Ph.D.
Minister, MOHW

Foreword

The infant mortality rate (IMR) is among one of the most important indices for measuring the health level of a population and for establishing and evaluating the health policy of a country. Since Korea's initiation into the OECD, the Korean government has been required to report the nation's IMR. Past IMRs received no recognition because a large proportion of neonatal deaths, nearly 70% of total infant deaths, are not registered as birth or death. This problem continues despite the many efforts made by the government to find a solution.

Under the Ministry of Health and Welfare, the Korea Institute for Health and Social Affairs conducted a research for developing a new method of estimating IMR in 1995. KIHASA was the first to develop a research strategy to produce IMR based on real data on population.

The Ministry of Health and Welfare conducted surveys at medical and health facilities in November of 1995. Our research was based on two alternative methods. The first method was to conduct surveys at medical and health facilities to identify infant deaths and trace deliveries at the facilities according to medical insurance data. The second method was to collect and sort all existing data containing information on infant death. In the course of these events we were not only able to secure extensive information on infant deaths but to identify a deficiency in the patterns of infant death registration and record maintenance.

This research was conducted under the responsibility of Youngja Han, senior researcher at KIHASA, in collaboration with the researchers at KIHASA and external experts:

Introduction (YJ Han, SW Lee)
Analysis of Infant Deaths (YJ Han)
Collecting and Analyzing Existing Data (SR Doh)
Survey at Medical Facilities (SR Doh)
Analysis of the Causes of Infant Death (HB Lee, MI Lee)
Life Table of Infants (SW Lee)
Conclusion (YJ Han)

Various organizations and related experts have made significant contributions in this research as well. We would like to extend our gratitude to the Ministry of Health and Welfare for their financial and administrative support and for their active participation in conducting surveys at medical facilities. In addition, we would like to thank the Federation of Health Insurance, Korea Medical Insurance Corporation, and Ministry of Home Affairs for supplying us with numerous data and the local governments, health centers, medical facilities, Korean Doctors Association, Korean Hospital Association, and Korean Medical Record Association for their support and advice. Also, special thanks to Dr. Jaegoog Jo and Youngsik Chang for their helpful comments.

Because this report deals with the estimation of IMR, causes of infant death and characteristics of infant death based on our new method, we recommend researchers and related experts in areas of population, health and health statistics and the related organizations and policy makers to take particular interest in this report. It is hoped that this paper will generate more research and studies of IMR in Korea.

Kyungbae Chung, Ph.D.
President, KIHASA

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Summary

Infant Mortality Rate (IMR) is among one of the most vital statistics used for measuring the health and welfare level of a population. The Korean Infant Mortality Rate, which was produced in the past, failed to be recognized nationally and internationally. It was considered unreliable on account of its indirect method of estimation. Therefore, this study aims to produce a new and a more efficient method for estimating infant deaths in Korea.

First, we collected information on real infant death cases by utilizing the medical insurance benefit data and by conducting surveys at medical facilities, which then allowed us to trace the fate of delivered births. Another strategy employed was gathering information on infant deaths from the various existing sources and integrating them into one set, after adjusting any overlap among data sets from the various sources.

The study subjects are a cohort of infants who were born during the period of Jan. 1~Dec. 31, 1993, and who died before their first birthday.

National infant mortality survey was conducted by both 'Ministry of Health and Welfare' and 'Korea Institute for Health and Social Affairs'. KIHASA took responsibility of planning research strategy, analyzing survey results and producing infant mortality indices. MOHW conducted the survey at medical and health facilities during December 15 to 21, 1995.

The estimated number of infant deaths of the 1993 birth

cohort was 7,088 and the proportion of neonatal deaths was 66.2% of all infant deaths. IMR was 9.9 per 1,000 live births in 1993, consisting 10.5 for male and 9.2, for female.

Infant mortality rate showed a notable difference according to the mother's age. The lowest rate was observed among infants delivered from the mothers of the 20~24 age group, and increased with age. The first major cause of infant death was 'Fetal Growth Disorder' (25.3%) and the second cause was 'Respiratory Distress of the Newborn' (16.4%). The third cause was 'Congenital Malformation of the Heart' (9.7%), which was also a prevalent cause of death with increased age at death.

Chapter 1. Introduction

1. Study Background

The significance of infant mortality rate (IMR) in measuring the overall health level of a population is comparable to the importance of GNP as an index for measuring the economic level of a country. As a participating OECD member country, the Korean government is required to report accurate statistics of the Korean infant mortality rate. Infant Mortality Rate, produced in the past could not receive recognition nationally and internationally, because of its measurement based on indirect estimation, in spite of the many efforts made by the government and related experts.

The only way for the National Statistical Office to produce IMR was to use indirect methods of estimation since few cases of neonatal death (death within 28 days after birth) are reported. Nealy 70% of all infant deaths are neonatal deaths, however such deaths are registered as neither birth nor death. There also appears to be no appropriate measures for reporting neonatal deaths. Studies on infant mortality based on either sample surveys or fertility surveys have been conducted, however, the results were unreliable because infant deaths are rare and only few cases of infant deaths were identified from the large sample population. Given the inadequacy of these studies as well as the shortcomings of the NSO's attempt to estimate the number of infant deaths, we concluded that neither registration nor survey is the appropriate method for producing IMR in Korea.

An alternative method for estimating IMR was used - one suitable to the Korean situation - by using the "Health Insurance Benefit Data" and "Registration Record of Beneficiaries." Since 99% of all deliveries had been undertaken at medical and health facilities due to universal coverage under the national health system from 1989, most births were identified and drawn from the maternity benefit data of health insurance records. For infants to obtain medical service, they must be placed on the "Registration Record of Beneficiaries." The fate of an infant can then be identified once he/she is registered as a beneficiary. In view of this fact, we developed a system of which the two sets of data are combined to match deliveries from the delivery benefit file with beneficiaries from the registration records of each infant.

The majority of deliveries that did not match with the registration record were assumed to be instances of infant death at a very early stage. The next procedure was to confirm this assumption at the medical and health facilities on a case by case basis. The value of this research was placed on obtaining ways to estimate the number of infant deaths based on real data from the whole population.

This research is aimed at developing a new and accurate method for estimating the number of infant deaths, particularly, one that conforms with the Korean situation. In addition, it aims to verify the reliability of data among the different sources related to infant death.

The study subjects are a cohort of infants who were born during the period of Jan. 1~Dec. 31, 1993, and who died before their first birthday.

The content of this project consists of three stages: the collection of existing data, surveys at medical facilities, and data integrating and adjusting process. The sources of data used in this project were health insurance data sets (maternity benefit data, health insurance record of beneficiaries, funeral grant) and the resident registration data. Health insurance data was the most

valuable source for this study. We requested National Federation of Medical Insurance and Korea Medical Insurance Corporation for necessary files and variables in standardized layout form.

National infant mortality survey was conducted by both 'Ministry of Health and Welfare' and 'Korea Institute for Health and Social Affairs". KIHASA took responsibility of planning research strategy, analyzing survey results and producing infant mortality indices. MOHW conducted the survey at medical and health facilities during December 15 to 21, 1995. The survey was conducted at medical facilities where deliveries were performed and infants were treated. The survey lasted over the duration of ten days from November 15 to 21, 1995 and was conducted by approximately 907 trained people at 6,766 medical and health facilities. The survey results were then computerized to match data sets, and any overlap among different data sets were filtered.

2. Definitions

Live Birth

Live birth is the complete expulsion or extraction from the mother's womb as a product of human conception, which shows any evidence of life. In this report, live birth defines 20 weeks or more of pregnancy or 500g or more of birth weight.

Infant Death

Infant death is the death of an infant which occurs before his or her first birthday. Infant deaths are divided into two categories according to age: neonatal deaths, which occur during the first 28 days of life and post-neonatal deaths, which occur between 29 days and one year of age.

Chapter 2. Data Collection

1. Gathering Existing Data

Since the majority of data sources on infant death were deficient, information on infant death was gathered from various sources and integrated into a single set of data. The foremost step in data collecting was to assess what sources are appropriate and to gather information on infant deaths from existing data. Table 1 shows the number of infant deaths from the selected sources that currently exist in Korea. The data set includes the record of health insurance beneficiaries, funeral grant, resident registration record and vital registration. It was assumed that all of these data are in some way inadequate and need to be supplemented by other data. The most seriously deficient among

Table 1. Number of Births and Infant Deaths from Existing Sources of Data

(Unit: person)

	Births	Infant deaths	Source of Data
Record of Beneficiaries	695,976	1,689	Federation of Health Insurance, Korea Medical Insurance Corp.
Funeral Grant	-	1,714	Federation of Health Insurance, Korea Medical Insurance Corp.
Resident Registration	710,786	2,057	Ministry of Home Affairs
Vital Registration	711,129	2,160	National Statistical Office

the existing data was the inadequate record of neonatal death since it is rarely ever reported. Therefore, one alternative was to conduct investigation at medical facilities to identify instances of neonatal death, which are generally omitted from all records, by tracking down the maternity benefit data.

2. The Sources of Existing Data

Health Insurance Record of Beneficiaries

Live births or new-born infants (registered as health insurance beneficiaries) born during the period of Jan. 1~Dec. 31, 1993 were selected. The health insurance registration files of beneficiaries from each health insurance association unit were collected and combined, regardless of whether they had lost qualification as of May, 1995. One loses his/her qualification upon transfer to another insurance unit or death.

Funeral Grant

Data on funeral grants, given to infants that were born in 1993 and died before their first birthday, were collected from each health insurance association unit.

Resident Registration

The data file of registered residents who were born between Jan. 1 and Dec. 31, 1993, including those who lost their qualification because of death, was collected. The Ministry of Home Affairs maintains this data file.

Report of Infant Deaths from the Medical and Health Facilities

Data on the death of infants born between Jan. 1 and Dec. 31, 1993 was collected from all medical and health facilities that

report infant death cases in accordance with the Maternal and Child Health Act.

Maternity Benefit Data

Maternity benefit events[1] were identified from the record of bills for medical fees. We selected the records of medical bills from the mother's initial date of medical examination between Dec. 25, 1992, and Dec. 31, 1993. The number of maternity benefit events recorded 826,731 cases and after being sorted by person, the total was 712,050 mothers.

Supplementary Data

Supplementary data was collected from adoption agencies.

3. Collection of Early Death Data

Our strategy for identifying early death, which is reported as neither birth nor death, was to trace the maternity benefit data. Each delivery was matched with the mother's child in the other data of the registration record of beneficiaries (See Figure 1). The mother and her child was matched by their household insurance card number or resident registration number (Every Korean has a unique number).

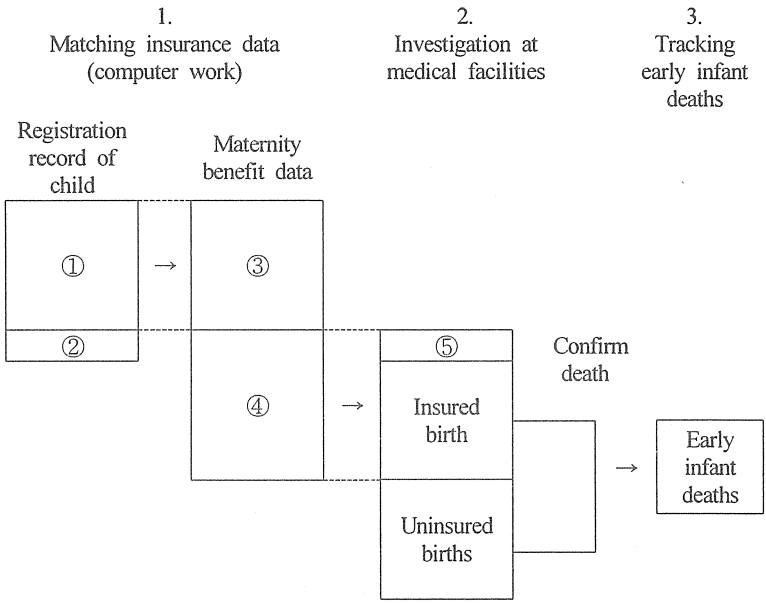
Among a total of 826,731 maternity benefit cases, 616,200 cases were matched with a child. The rest of the 210,531 cases were reviewed and among them, 77,036 cases were identified as unrelated with delivery and 133,495 cases were tracked down at the health and medical facilities where maternity benefits were requested. A follow-up investigation was necessary to determine

---

1) Codes of major and minor disease as 644, 650-669 in classification of cause of death in Korean standard of diseases which is based on international classification of diseases (ICD) 9.

whether the benefits were for the deliveries of livebirth or stillbirth, or for delivery-related treatments. The survival status of live births and the incidences of early infant deaths were questioned during investigation at medical facilities to confirm the result of deliveries. Cases of neonatal death was easily identified through the process of investigating medical records, such as delivery charts or maternity admission records at maternity wards.

Figure 1. Identifying Early Infant Deaths at the Health Facilities when Tracking the Result of Delivery



Note : ① Children matched with their mothers
② Children not matched with their mothers
③ Mothers matched with their children
④ Mothers not matched with their children
⑤ Maternity benefit was not for childbirth

Information on uninsured births was also necessary and found at the medical and health facilities when tracking maternity benefit data. Even under the national health insurance system,

there are a small number of women who have not fulfilled their insurance payment obligations and who are not covered by insurance. According to the population control policies effective at that time, the delivery of a woman's third child and on was not covered by health insurance.

The term 'early infant death' in this study defines the death of a child before the discharge of his or her mother from the hospital after delivery. Therefore, early infant death can be generally less than one week after birth. On this account, 1,490 neonatal deaths were identified by tracking down maternity benefit events and 145 cases of uninsured neonatal deaths were also discovered. As the result, 1,635 early infant deaths were identified at health facilities by this process.

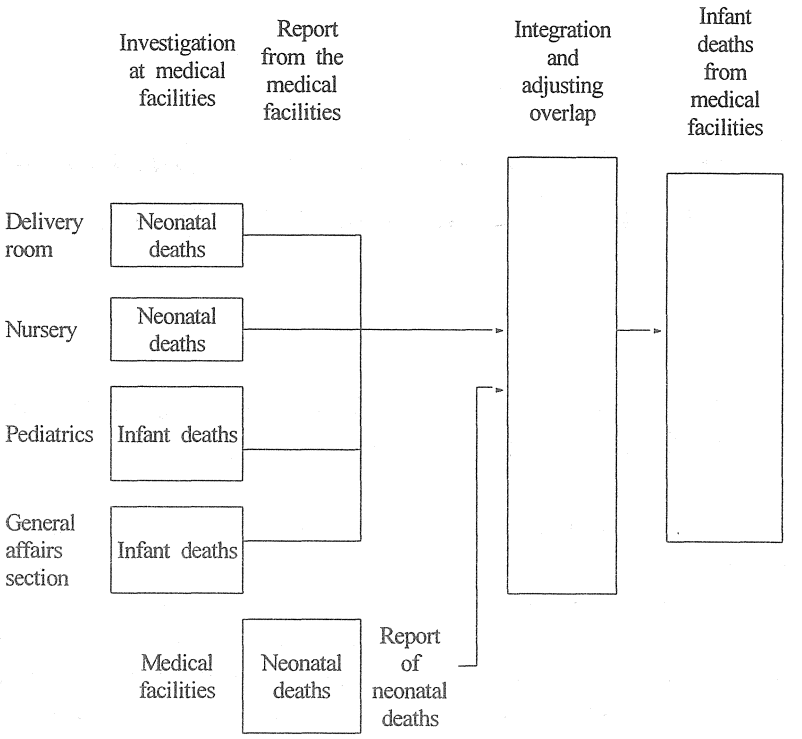
4. Collection of Data from the Various Sections of Medical Facilities

There are various sources of infant death data, however, all source of data have limitations. Our strategy for identifying infant death cases was to investigate all medical and health facilities where infant deaths might occur.

Investigating medical facilities was the reasonable approach because most infant deaths take place at hospitals. Information on causes of death was discovered from patient charts or medical certificates. Infant death data were dispersed throughout the maternity ward, nursery, pediatrics and the general affairs section of a hospital. Therefore, the process of gathering and compiling data from all those units was necessary (See Figure 2).

The total of 6,766 medical facilities were investigated to obtain the number of infant deaths and among them, 2,164 facilities requested maternity benefits. Through this process, 5,194 infant deaths, which consisted of 1,635 early infant deaths, were identified.

Figure 2. Infant Deaths from Medical Facilities



Note: Neonatal deaths at the delivery room include early infant deaths that were identified from the maternity benefit data.

Chapter 3. Determining the Number of Infant Deaths and Live Births

1. The Process of Integrating and Adjusting the Overlap of Infant Death Cases

We secured the total number of infant deaths by collecting the maximum number of infant deaths from all sources, then compiled and adjusted to fix overlap of identical children according to their resident registration number. The number of infant deaths obtained by the above process is probably the most realistic data we could hope to provide. The steps used for determining the number of infant deaths are as follows.

First, the existing information on infant deaths from various data sources were integrated and any overlap among sources were checked to find whether the same infant appears among different sources. Through this process, the total number of registered deaths was estimated. The lack of data on infant death in a particular source was supplemented by other data sets. The sources of registered deaths were the record of beneficiaries, funeral grants, and resident registration file.

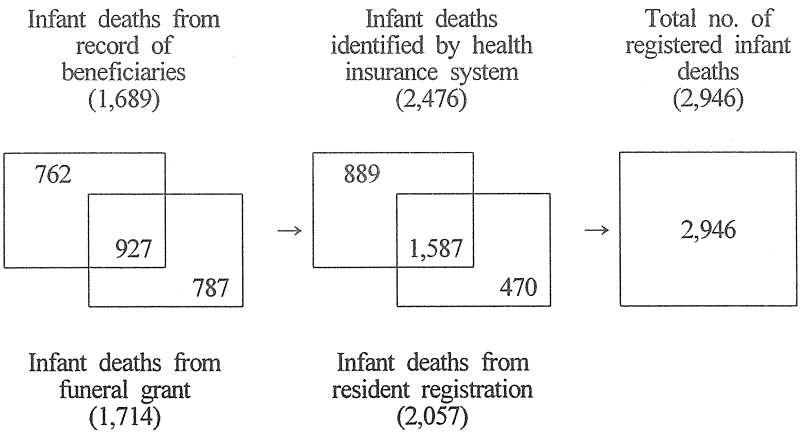
The matching process was first made between the record of beneficiaries and funeral grants and secondly, between the result of the first process and resident registration.

The key to matching infants among the data were:

- Resident registration number and name of an infant;
- Resident registration number and name of the mother;
- Resident registration number and name of the father;
- Resident registration number and name of the head of the household.

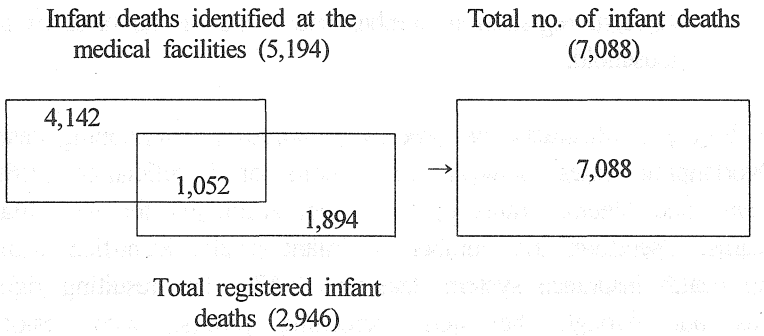
Figure 3 illustrates the process of adjusting overlapping cases. Overlapping cases between the record of beneficiaries (1,689 cases) and funeral grants (1,714 cases) accounted for 927 infant deaths. Therefore, the number of infant deaths identified within the health insurance system data was 2,476. The resulting figure was put through the same screening process with resident registration (2,057 cases), among which 1,587 overlapping cases were identified. After adjusting the overlapping cases, the total number of registered infant deaths was 2,946.

Figure 3. Process of Adjusting Overlapping Cases among the Sets of Registered Infant Deaths



The next process was matching registered infant deaths with deaths identified at medical facilities (5,194 cases). Results revealed 1,052 overlapping cases, which makes the final total number of infant deaths as 7,088 (See Figure 4).

Figure 4. Process of Adjusting Overlapping Cases between the Registered Data and the Data from Medical Facilities



The results from the matching process among data sources are shown in Table 2. It is noticeable that the matching portions among sources are very limited. Only 252 cases appeared in all four data sets and the number of non-matching cases combined was 4,873: medical facilities survey, 4,142; funeral grant, 228; record of beneficiaries, 171; and resident registration, 332. This suggests that there is, in reality, a small number of overlapping cases or the matching process was inaccurate due to the inconsistency or deficiency in the information used to identify infants. Nonetheless, we recognize that the small number of overlapping cases represent the real situation from further analysis. The completeness of coverage by survival time period is different according to the source of data (See Chapter 4, Table 30).

Table 2. Results from Matching Infant Deaths among Data Sources

(Unit: person)

Results of Matching		Medical Facilities Survey (MFS)	Funeral Grant (FG)	Record of Beneficiaries (RB)	Resident Registration (RR)
No matches	XXXX	4,142	228	171	332
RB+RR	XXOO	-	-	356	356
FG+RR	XOXO	-	250	-	250
FG+RB	XOOX	-	117	117	-
FG+RB+RR	XOOO	-	440	440	440
MFS+RR	OXXO	138	-	-	138
MFS+RB	OXOX	70	-	70	-
MFS+RB+RR	OXOO	165	-	165	165
MFS+FG	OOXX	185	185	-	-
MFS+FG+RR	OOXO	124	124	-	124
MFS+FG+RB	OOOX	118	118	118	-
Matched all	OOOO	252	252	252	252
Total		5,194	1,714	1,689	2,057

Note: O; Matches, X; No matches

2. Process of Estimating Total Number of Live Births

The sources collected to acquire data on live births (born between Jan. 1, 1993 and Dec. 31, 1993) were Population Census, Vital Registration Record, Resident Registration Record and Health Insurance Beneficiaries Record.

Although the number of births (695,976) recorded in the health insurance beneficiaries data of 1993 reflects 98% of births in the resident registration data, it contains no record of uninsured infants. When comparing the number of registered births in 1993 and the '95 Census and Resident Registration, the difference was about 8,000 or 9,000.

The Resident Registration data, thereby seemed reliable considering that differences may be due to the death of a child

during that period or the underestimated number of infants by the Census.

In such cases like the above, the event should be registered in both the vital statistics and resident registration data. The data of both sources must be identical. Unfortunately, however, differences between the two data sets have been observed (Table 3). One of the reasons may be due to the fact that the two data sets are managed by different organizations; the vital registration is managed by the National Statistical Office and the resident registration by the Ministry of Home Affairs.

Vital registration recorded 343 more live births than the resident registration, and it was difficult to decide on which data set was more reliable. Conclusively, the resident registration data was selected to be used as the main source for estimating the total number of live births in this project for two reasons. First, the resident registration data was easily accessible and second, the data was surmised more reliable based on its record of personal identification which is frequently used in the practical and bureaucratic affairs of people's daily lives. The number of live births according to different sources of data is shown in Table 3.

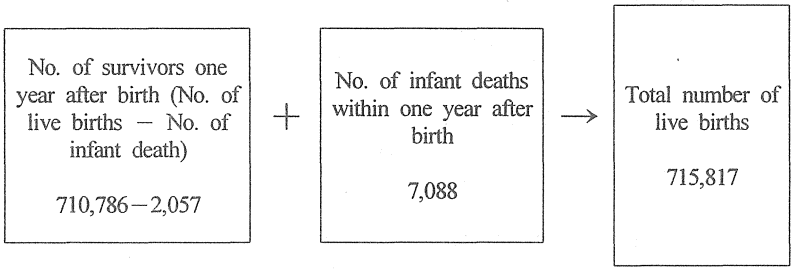
In order to estimate the number of live births in 1993, the number of infant deaths and the number of children still alive after their first birthday, both from the 1993 birth cohort, were combined. Although the infant death data was derived from various sources, the data on surviving children were taken only from the resident registration record. If a child survives until his or her first birthday, that child will most certainly show up in the resident registration record. Figure 5 illustrates the process of estimating the number of live births in 1993.

Table 3. Number of Live Births by Source of Data in 1993

(Unit: person)

	'95 population census	Resident registration	Vital registration	Estimated total no. of live births of 1993
Total	701,931	710,786	711,129	715,817
Male	377,402	380,676	381,170	383,561
Female	324,529	330,110	329,959	332,256
Sex ratio	116.3	115.3	115.5	115.5

Figure 5. Process of Estimating Total Live Births



Note: 1) No. of survivors is taken from resident registration data.
2) Infant deaths include resident registered infant deaths; therefore, infant deaths should be excluded from the resident registered infant. Otherwise, resident registered infant deaths will be counted twice.

Chapter 4. Results

1. Infant Mortality Rate

Mortality rates were calculated as follows.

$$\text{IMR (Infant mortality rate)} = \frac{\text{No. of infant deaths}^{1)}}{\text{No. of live births in 1993}} \times 1,000$$

$$\text{NMR (Neonatal mortality rate)} = \frac{\text{No. of neonatal deaths}^{2)}}{\text{No. of live births in 1993}} \times 1,000$$

$$\text{PNMR (Postneonatal mortality rate)} = \frac{\text{No. of post}-\text{neonatal deaths}^{3)}}{\text{No. of live births in 1993}} \times 1,000$$

Note: 1) The number of infant deaths before their first birthday from the 1993 birth cohort. Death occurred between Jan. 1, 1993 and Dec. 30, 1994.
2) The number of deaths within 28 days after their birth date from the 1993 birth cohort. Death occurred between Jan. 1, 1993 and Jan. 27, 1994.
3) The number of deaths between 29 days and 365 days after their birth from the 1993 birth cohort. Death occurred between Jan. 1, 1993 and Dec. 30, 1994.

The estimated result of IMR (infant mortality rate) was 9.9 per 1,000 live births of the 1993 birth cohort (See Table 4). Usually, IMR is estimated on a periodical basis, however, the

cohort of 1993 births was traced in this project and infant deaths of the 1993 birth cohort occurred during the two-year period of 1993～1994. The neonatal mortality rate was 6.6 per 1,000 live births, and the post-neonatal mortality rate was 3.3 per 1,000 live births of the 1993 birth cohort.

Table 4. IMR of the 1993 Birth Cohort

	Male	Female	Total
Neonatal	7.0	6.1	6.6
Post-neonatal	3.6	3.1	3.3
Infant	10.5	9.2	9.9

2. Infant Deaths by Socio-demographic Characteristics

Table 5 shows the distribution of infant deaths by sex. Neonatal deaths comprised 66.2% of all infant deaths for both males and females.

Table 5. Infant Deaths by Sex

(Unit: person, %)

	Male		Female		Total	
Neonatal	2,667	66.2	2,025	66.2	4,692	66.2
Post-neonatal	1,362	33.8	1,034	33.8	2,396	33.8
Infant	4,029	100.0	3,059	100.0	7,088	100.0

Table 6 shows the infant deaths by sex and age at death. Among infant deaths, 66.2% occurred during the neonatal period and about a half of the infant deaths occurred within one week after birth. There was very little difference in age at death by sex.

Table 6. Infant Deaths by Sex and Age at Death

(Unit: person, %)

Age at Death	Male	Female	Total
Total	100.0 (4,029)	100.0 (3,059)	100.0 (7,088)
Neonatal	66.2	66.2	66.2
Post-neonatal	33.8	33.8	33.8
1 Week	52.9	51.5	52.3
2 Weeks	7.2	7.3	7.3
3 Weeks	4.0	4.0	4.0
4 Weeks	2.1	3.4	2.7
5 Weeks~3 Months	15.3	14.2	14.8
4~6 Months	9.6	10.8	10.1
7~9 Months	5.0	5.1	5.1
10~12 Months	3.8	3.8	3.8

About a half of infant deaths (49.0%) occurred among mothers of 25~29 year age group (See Table 7). This indicates that the large proportion of births occur among that particular age group of mothers.

Table 7. Infant Deaths by Age of Mother

Age of Mother	Neonatal	Post-neonatal	Infant
Total	100.0 (3,544)	100.0 (1,637)	100.0 (5,181)
14~19	1.0	0.7	0.9
20~24	17.4	19.4	18.0
25~29	48.2	50.9	49.0
30~34	25.4	21.9	24.3
35~39	6.9	5.4	6.5
40 and over	1.1	1.6	1.3

Note: Exclude deaths of infants whose mother's age is unknown. 1,907 infant deaths out of 7,088 total infant deaths (1,148 neonatal deaths, 759 post-neonatal deaths) were excluded.

More than a half of live births occurred among the 25~29 year age group of mothers (See Table 8). This shows that births among teenagers and women over the age of 35 are rare.

Table 8. Live Births by Age of Mother

(Unit: person, %)

Age of Mother	Live births	%
14~19	8,307	1.2
20~24	163,063	22.9
25~29	373,260	52.6
30~34	139,554	19.6
35~39	23,605	3.3
40 and over	2,602	0.4
Total	710,391	100.0

Source: Report on the Annual Vital Statistics, NSO, 1993.

The lowest IMR was observed among mothers of the 20~24 year age group at 7.2 (See Table 9). IMR increases with the age of mother and shows a steep increase after 35 years of age. It is possible that most infant deaths whose mothers' age is unknown (1,907 cases) belong to teenage mothers. Therefore, it was assumed that IMR of the 14~19 age group of mothers is much higher than the 7.4 shown in Table 9.

Table 9. IMR by Age of Mother

Age of Mother	Neonatal Mortality Rate	Post-neonatal Mortality Rate	IMR
14~19	5.5	1.9	7.4
20~24	4.7	2.5	7.2
25~29	5.7	2.9	8.6
30~34	8.0	3.3	11.3
35~39	12.9	4.9	17.8
40 and over	19.5	15.6	34.8
Total	6.6	3.3	9.9

Table 10 records the distribution of infant deaths from the 1993 birth cohort. Infants in this table are those born in 1993 and died within one year after birth.

Table 10. Infant Deaths by Year and Month

Year / Month		Male	Female	Total
1993	1	207	156	363
	2	238	202	440
	3	303	215	518
	4	321	218	539
	5	311	244	555
	6	307	232	539
	7	283	190	473
	8	303	219	522
	9	299	237	536
	10	292	243	535
	11	327	253	580
	12	351	279	630
1994	1	137	111	248
	2	93	61	154
	3	73	46	119
	4	50	41	91
	5	35	31	66
	6	31	26	57
	7	28	16	44
	8	16	16	32
	9	7	12	19
	10	11	2	13
	11	3	8	11
	12	3	1	4

Among the total infant deaths at the medical facilities, 87.7% of them occurred at general hospitals (See Table 11). It suggests that the infant at risk might have been transfered to a general hospital, because of the increased accessibility to medical facilities since the introduction of the national medical insurance system in 1989.

Table 11. Infant Deaths by Type of Medical Facilities

(Unit: %, person)

Medical Facilities	Infant Deaths
General Hospital	87.7
Hospital	5.9
Clinic	5.1
Midwifery Clinic	0.1
Health Facilities	1.2
Total	100.0 (5,194)

Note: Number of infant deaths based on the medical facilities survey.

There are regional differences in infant deaths by the type of medical facilities. More than 90% of infant deaths occurred at general hospitals in the six metropolitan areas and two other provinces, whereas the rate was less than 90% (60.0~86.0%) in provinces (See Table 12).

Table 12. Infant Deaths by Region and Medical Facilities

(Unit: %, Person)

	General Hospital	Hospital	Clinic	Midwifery Clinic	Health Facilities	Total
Total	87.7	5.9	5.1	0.1	1.2	100.0(5,194)
Metropolitan areas						
Seoul	90.8	3.3	5.8	0.1	-	100.0(1,540)
Pusan	92.1	6.5	1.4	-	-	100.0(571)
Taegu	92.7	4.7	2.6	-	-	100.0(386)
Inchon	97.3	-	2.7	-	-	100.0(259)
Kwangju	94.6	4.7	0.7	-	-	100.0(296)
Taejon	97.1	-	2.9	-	-	100.0(239)
Provinces						
Kyonggi	83.1	7.2	9.1	-	0.6	100.0(528)
Kangwon	95.6	1.3	3.1	-	-	100.0(160)
Chungbuk	84.3	0.8	13.4	-	1.6	100.0(127)
Chungnam	74.4	3.1	6.2	-	16.3	100.0(129)
Chonbuk	86.0	1.9	7.6	-	4.5	100.0(157)
Chonnam	60.0	27.0	7.8	-	5.2	100.0(115)
Kyongbuk	82.2	4.3	1.6	0.5	11.4	100.0(185)
Kyongnam	68.3	21.9	8.4	1.1	0.2	100.0(439)
Cheju	90.5	9.5	-	-	-	100.0(63)

Note: Number of infant deaths based on the medical facilities survey.

3. Stillbirths

Information on stillbirth was also included in the infant death survey at medical facilities and the result was 4,281 stillbirths. This figure might be a part of the total number of stillbirths because the survey was concentrated on collecting infant death data. However, this information may be worthwhile for understanding the characteristics of stillbirths. Results showed 40.4% of stillbirths with the body weight of 500~900g. In comparison with the body weight of stillbirths by sex, more females than males belonged to the lower weight bracket (See Table 13).

Table 13. Stillbirths by Body Weight

(Unit: %, Person)

Body Weight	Male	Female	Total
500~ 900g	38.8	42.3	40.4
1,000~1,400g	18.1	17.8	18.0
1,500~1,900g	13.7	11.5	12.7
2,000~2,400g	9.1	8.5	8.8
2,500~2,900g	7.3	8.7	7.9
3,000~3,400g	7.3	6.3	6.9
3,500g and over	5.7	4.9	5.3
Total	100.0 (1,485)	100.0 (1,339)	100.0 (2,824)

Note: The body weight and sex of 1,457 cases out of 4,281 were unknown and excluded from the analysis.

Table 14 shows stilbirths by gestation period. About half (49.1%) of stillbirths occurred during the gestation period of 20~27 weeks. There was very little difference in gestation period by sex of stillbirths.

Table 14. Stillbirths by Gestation Period

(Unit: %, Person)

	Male	Female	Total
20~27 weeks	48.9	49.3	49.1
28~36 weeks	32.2	34.0	33.1
37 weeks and over	18.9	16.7	17.8
Total	100.0 (1,851)	100.0 (1,715)	100.0 (3,566)

Note: Gestational period and sex of 715 cases out of 4,281 were unknown and excluded from the analysis.

4. Early Infant Deaths Identified by the Medical Facilities Survey

A part of infant death survey includes identifying early infant deaths during the confirming result of delivery. Information on birth weight and gestation period of early infant deaths (1,646) were obtained. 89.9% of the early infant death occurred within one week after birth (See Table 15).

Table 15. Early Infant Deaths by Age at Death

(Unit: %, Person)

Days	Male	Female	Total
0~ 7	89.0	91.1	89.9
8~14	5.6	4.7	5.2
15~21	2.0	2.3	2.1
22~28	0.7	0.4	0.6
29 and over	2.7	1.5	2.2
Total	100.0 (907)	100.0 (707)	100.0 (1,614)

Note: Data is based on infant deaths identified during the confirming result of delivery. Gestational period and sex of 32 cases out of 1,646 were unknown and excluded from the analysis.

Table 16. Live Births by Birth Weight

(Unit: %, Person)

Birth weight	Male	Female	Total
Under 1,400g	0.1	0.1	0.1
1,500~1,900g	0.4	0.5	0.5
2,000~2,400g	1.8	2.3	2.0
2,500~2,900g	12.4	17.7	14.9
3,000~3,400g	44.4	48.6	46.4
3,500g and over	40.9	30.8	36.1
Total	100.0 (370,897)	100.0 (320,658)	100.0 (691,555)

Source: NSO, *Report on the Annual Vital Statistics*, 1993.

Table 16 shows the distribution of birth weight of live births from the vital registration data. This table was incorporated into this study to compare the birth weight of infant deaths. Only 2.6% of live births had a low birth weight of less than 2,500g.

Table 17. Infant Deaths by Sex and Birth Weight

(Unit: %, Person)

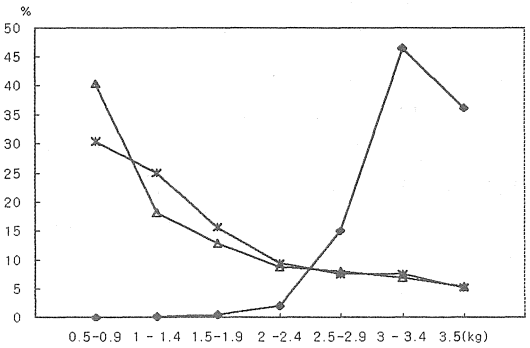
Birth Weight	Male	Female	Total
500~ 900g	28.1	33.2	30.3
1,000~1,400g	25.4	24.3	24.9
1,500~1,900g	16.4	14.4	15.5
2,000~2,400g	9.1	9.8	9.4
2,500~2,900g	7.4	7.3	7.4
3,000~3,400g	8.4	6.1	7.4
3,500g and over	5.2	4.9	5.1
Total	100.0 (824)	100.0 (654)	100.0 (1,478)

Note: Data is based on the infant deaths identified during the confirming result of delivery. Birth weight and sex of 168 cases out of 1,646 were unknown and excluded from the analysis.

Information on birth weight of early infant deaths is recorded during the confirming result of delivery. 30.3% of them had the

birth weight of 500~900g and 24.9% of them had the birth weight of 1,000~1,400g (See Table 17). Figure 6 shows that while the birth weight distribution between stillbirth and early infant death is little, there is a large difference in birth weight between live birth and early infant death.

Figure 6. Live Births · Stillbirths · Early Infant Deaths by Birth Weight



Notes: -△- Stillbirth -×- Early Infant Death -◇- Live Birth

34% of early infant deaths fell into the bracket of 20~27 weeks of gestation period (See Table 18). Here, live birth is defined as the duration of 20 weeks or more of pregnancy period and at least 500g or more of body weight at birth.

Table 18. Infant Death by Gestation Period

(Unit: %, Person)

	Male	Female	Total
20~27 weeks	32.8	35.4	34.0
28~36 weeks	44.8	41.5	43.3
37 weeks and over	22.4	23.1	22.7
Total	100.0 (896)	100.0 (703)	100.0 (1,599)

Note: Data is based on the infant deaths identified during the confirming result of delivery. Gestational period and sex of 47 cases out of 1,646 were unknown and excluded from the analysis.

5. Causes of Infant Death

The causes of infant deaths were analyzed by ICD-10 (International Classification of Diseases 10). Information on the causes of death of 5,176 out of 7,088 infant deaths was obtained. Infant death cases were collected from various sources, however, information on the causes of death was obtained only from the medical facilities survey, periodic record of infant deaths from the medical facilities and funeral grant data.

Among the ten major causes of infant death, the first was 'Fetal Growth Disorder', constituting 25.3% of infant deaths and the second was 'Respiratory Distress of the Newborn', constituting 16.4% of infant deaths (See Table 19). The third was 'Cogenital Malformation of the Heart', also an important cause of death as the age at death increased.

Table 19. 10 Major Causes of Infant Death

(Unit: Person, %)

	10 Major Causes	1	2	3	4	5	6	7	8	9	10
Total 5,176 (100.0)	4,187 (80.9)	Fetal Growth Disorder (25.3)	Respirat. Distress newborn (16.4)	Cong. Malform Heart (9.7)	Other Congeni. Malform (6.2)	Birth Asphyxia (5.8)	Neonatal Respiratory Disease (4.8)	Sepsis of Newborn (4.8)	Other Perinatal Disease (3.2)	Neonatal Hemorrha disease (2.5)	Maternal Factors (2.2)
Male 3,009 (100.0)	2,451 (81.8)	Fetal Growth Disorder (25.7)	Respirat. Distress newborn (16.9)	Cong. Malform Heart (9.8)	Other Congeni. Malform (6.8)	Birth Asphyxia (5.3)	Sepsis of Newborn (4.7)	Neonatal Respiratory Disease (4.7)	Other Perinatal Disease (3.1)	Neonatal Hemorrha disease (2.8)	Sepsis (2.1)
Female 2,167 (100.0)	1,736 (80.1)	Fetal Growth Disorder (24.6)	Respirat. Distress newborn (15.9)	Cong. Malform Heart (9.5)	Birth Asphyxia (6.5)	Other Congeni. Malform (5.3)	Neonatal Respiratory Disease (4.9)	Sepsis of Newborn (4.8)	Other Perinatal Disease (3.5)	Maternal Factors (2.8)	Neonatal Hemorrha disease (2.2)

The first cause of neo-natal death was 'Fetal Growth Disorders', constituting 31.6% of neo-natal deaths (See Table 20). The second cause of neo-natal death was 'Respiratory Distress of the Newborn', consistuting 20.5% of neo-natal deaths.

Table 20. 10 Major Causes of Neo-natal Death

(Unit: Person, %)

	10 major causes	1	2	3	4	5	6	7	8	9	10
Total 3,820 (100.0)	3,563 (93.0)	Fetal Growth Disorder (31.6)	Respirat. Distress newborn (20.5)	Birth Asphyxia (7.4)	Other Congeni. Malform (6.7)	Sepsis of Newborn (6.0)	Neonatal Respirator Disease (5.9)	Cong. Malform Heart (5.4)	Other Perinatal Disease (4.0)	Neonatal Hemorrha disease (2.9)	Maternal Factors (2.7)
Male 2,216 (100.0)	2,070 (93.4)	Fetal Growth Disorder (32.3)	Respirat. Distress newborn (20.6)	Other Congeni. Malform (7.2)	Birth Asphyxia14 (6.8)	Sepsis of Newborn (5.9)	Neonatal Respirator Disease (5.8)	Cong. Malform Heart (5.8)	Other Perinatal Disease (3.7)	Neonatal Hemorrha disease (3.3)	Maternal Factors (2.1)
Female 1,604 (100.0)	1,482 (92.4)	Fetal Growth Disorder (30.7)	Respirat. Distress newborn (20.3)	Birth Asphyxia (8.3)	Neonatal Respiratory Disease (6.1)	Sepsis of Newborn (6.1)	Other Congeni. Malform (5.9)	Cong. Malform Heart (4.9)	Other Perinatal Disease (4.3)	Maternal Factors (3.4)	Neonatal Hemorrha disease (2.3)

'Congenital Malformation of the Heart' comprised 24.3% of post-neonatal deaths, being the primary cause of post-neonatal death (See Table 21). The next important cause of the post-neonatal death was 'Sepsis' followed by 'Pneumonia'.

Table 21. 10 Major Causes of Post-neonatal Death

(Unit: Person, %)

	10 major cause	1	2	3	4	5	6	7	8	9	10
Total 1,356 (100.0)	983 (72.5)	Cong. Malform Heart (24.3)	Sepsis (8.3)	Pneumonia (6.9)	Other Nervous D's (6.5)	Digestive D's (5.6)	Circulatory D's (5.5)	Other Congeni. Malform (4.1)	Other Respiratory D's (4.0)	Fetal Growth Disorder (3.7)	SIDS (3.6)
Male 795 (100.0)	581 (73.1)	Cong. Malform Heart (23.7)	Sepsis (9.0)	Other Nervous D's (6.7)	Digestive D's (6.4)	Other Congeni. Malform (5.5)	Pneumonia (5.5)	Respirator Distress Newborn (4.4)	Circulatory D's (4.4)	Other Respiratory D's (3.9)	Fetal Growth Disorder (3.8)
Female 561 (100.0)	401 (71.7)	Cong. Malform Heart (25.2)	Sepsis (7.3)	Pneumonia (7.3)	Circulatory D's (6.7)	Digestive D's (5.8)	Other Nervous D's (5.6)	Other Respirator D's (3.7)	Fetal Growth Disorder (3.4)	Other Congeni. Malform (3.4)	SIDS (3.2)

Classified by group of diseases, 1,205 out of 1,432 cases (84.1%) of death on the day of birth was caused by 'Certain conditions originating in the perinatal period' and 206 cases (14.4%) by 'Congenital malformation' (See Table 22). The causes of death during the neonatal period were similar to those on the

first day of birth. The characteristics of the cause of death during the post-neonatal period revealed different distribution from the neonatal period. A total of 380 cases (28.1%) were 'Congenital malformation', which was the first cause of death, and 235 cases (17.4%) were 'Symptoms, signs and ill-defined conditions', which was the second cause of death.

Table 22. Infant Deaths by Group of Diseases and by Age at Death

(Unit: Person)

	First Day	Neonatal	Post Neonatal	Infant
Total	1,432	3,824	1,352	5,176[1)]
Infectious and parasitic D's	2	11	121	132
Neoplasms	3	9	34	43
Endocr./nutritio./metabol./immune	2	13	15	28
D's of blood & blood form. organ	1	3	17	20
D's of the nervous system	0	11	91	102
D's of the circulatory system	1	7	60	67
D's of the respiratory system	2	10	130	140
D's of the digestive system	1	12	69	81
D's of the genito-urinary system	1	15	14	29
D's of the skin/ subcut. system	0	1	0	1
D's of musc/skeletal syst./connect	0	1	6	7
Congenital malformation	206	589	380	969
Certain condit. in perinatal period	1,205	3,120	137	3,257
Other symptoms and signs	6	20	235	255
Injuries and accidental poisoning	2	2	43	45

Note: 1) 1,912 out of 7,088 cases with unknown diseases were excluded from the analysis.

Comparing the group of disease by sex in the neonatal death and the infant death, table 23 and 24 indicate little difference in the cause of death by sex.

Table 23. Infant Deaths by Group of Diseases and by Age at Death (male)

(Unit: person)

	First Day	Neonatal	Post Neonatal	Infant
Total	825	2,215	788	3,003
Infectious and parasitic D's	1	7	73	80
Neoplasms	2	5	14	19
Endocr./nutritio./metabol./immune	0	5	8	13
D's of blood & blood form. organ	0	2	10	12
D's of the nervous system	0	5	55	60
D's of the circulatory system	1	1	29	30
D's of the respiratory system	2	7	71	78
D's of the digestive system	1	7	42	49
D's of the genito-urinary system	1	8	8	16
D's of the skin/ subcut. system	0	1	0	1
D's of musc/skeletal syst./connect	0	1	6	7
Congenital malformation	122	358	227	585
Certain condit. in perinatal period	693	1,799	87	1,886
Other symptoms and signs	2	9	132	141
Injuries and accidental poisoning	0	0	26	26

Table 24. Infant Deaths by Group of Diseases and by Age at Death (female)

(Unit: person)

	First Day	Neonatal	Post Neonatal	Infant
Total	627	1,609	564	2,173
Infectious and parasitic D's	1	4	48	52
Neoplasms	1	4	20	24
Endocr./nutritio./metabol./immune	2	8	7	15
D's of blood & blood form. organ	1	1	7	8
D's of the nervous system	0	6	36	42
D's of the circulatory system	0	6	31	37
D's of the respiratory system	0	3	59	62
D's of the digestive system	0	5	27	32
D's of the genito-urinary system	0	7	6	13
D's of the skin/ subcut. system	0	0	0	0
D's of musc/skeletal syst./connect	0	0	0	0
Congenital malformation	84	231	153	384
Certain condit. in perinatal period	512	1,321	50	1,371
Other symptoms and signs	4	11	103	114
Injuries and accidental poisoning	2	2	17	19

The following illustrates a more detailed classification of the causes of death that originate during perinatal period. The proportion of 'Disorders relating to length of gestation and fetal growth' was 38.5% and the second major cause was 'Respiratory distress of the newborn', 24.9% (See Table 25). This data also revealed little difference in the distribution of the cause of death between sex.

Table 25. Certain Conditions Originating in the Perinatal Period

(Unit: %, person)

	Male	Female	Total
Total	100.0 (1,886)	100.0 (1,371)	100.0 (3,257)
Fetus and newborn affected by maternal factors and by compli. of preg. labour. del.	2.4	4.0	3.1
Disorders relating to length of gestation and fetal growth	39.5	37.2	38.5
Birth trauma	0.3	0.5	0.4
Intrauterine hypoxia and birth asphyxia	8.3	10.0	9.0
Respiratory distress of newborn	25.2	24.5	24.9
Congenital pneumonia	1.0	0.9	1.0
Other respiratory conditions of newborn	7.3	7.5	7.4
Bacterial sepsis of newborn	7.3	7.3	7.3
Hemorrhagic and hematological disorders of fetus and newborn	3.9	2.8	3.4
Remainder of perinatal condition	4.8	5.3	5.0

The major cause of death among the congenital malformation was the 'Congenital malformation of the heart'. It occupied 49.2% of 'Congenital malformation' and very little difference was observed between male and female (See Table 26).

Table 26. Congenital Malformations

(Unit: %, person)

	Male	Female	Total
Total	100.0 (585)	100.0 (384)	100.0 (969)
Conge. hydrocephal. and spina bifida	3.5	5.6	4.3
Conge. malform. of nervous system	4.9	4.0	4.5
Conge. malform. of heart	49.0	49.4	49.2
Conge. malform. of circulatory system	4.0	6.6	5.1
Down's synd. and chromosomal abnorm.	4.9	6.3	5.5
Other congenital malformations	33.7	28.1	31.4

6. Life Tables of the Infant Period

A detailed information on age at death of every infant death case was obtained from the survey and the existing data. Thereby, a life table of infant from the data was produced. It would be useful for understanding the course of infant death. Table 27 and 28 show that the probability of dying is the greatest during the first week after birth. About a half of infant deaths occur during this period.

When comparing the probability of death between sex by the weekly period, the probability was higher for male than for female.

Table 27. Life Table of the Infant (Male, 1993)

Week	Dx	Px	Mx	Qx	lx	Lx	Tx	Ex
1	2130	383561	0.00555322	0.005523	100000.0	1881.582	6766000.866	67.66001
2	290	381431	0.00076029	0.000760	99447.74	1875.660	6764119.284	68.01682
3	163	381141	0.00042766	0.000427	99372.19	1874.546	6762243.624	68.04966
4	84	380978	0.00022049	0.000220	99329.71	1873.939	6760369.078	68.05989
5	110	380894	0.00028879	0.000289	99307.82	1873.462	6758495.139	68.05602
6	105	380784	0.00027575	0.000276	99279.15	1872.933	6756621.677	68.05681
7	74	380679	0.00019439	0.000194	99251.78	1872.493	6754748.744	68.05670
8	60	380605	0.00015764	0.000158	99232.49	1872.164	6752876.251	68.05106
9	62	380545	0.00016292	0.000163	99216.85	1871.863	6751004.087	68.04292
10	64	380483	0.00016821	0.000168	99200.68	1871.554	6749132.224	68.03514
11	53	380419	0.00013932	0.000139	99184.00	1871.266	6747260.670	68.02771
12	46	380366	0.00012094	0.000121	99170.18	1871.022	6745389.404	68.01832
13	43	380320	0.00011306	0.000113	99158.19	1870.804	6743518.382	68.00768
14	45	380277	0.00011833	0.000118	99146.98	1870.587	6741647.578	67.99650
15	29	380232	0.00007627	0.000076	99135.25	1870.405	6739776.991	67.98567
16	33	380203	0.00008680	0.000087	99127.69	1870.253	6737906.586	67.97199
17	37	380170	0.00009733	0.000097	99119.09	1870.080	6736036.333	67.95902
18	38	380133	0.00009996	0.000100	99109.44	1869.896	6734166.253	67.94677
19	36	380095	0.00009471	0.000095	99099.54	1869.714	6732296.357	67.93469
20	27	380059	0.00007104	0.000071	99090.15	1869.559	6730426.643	67.92226
21	30	380032	0.00007894	0.000079	99083.11	1869.419	6728557.084	67.90821
22	18	380002	0.00004737	0.000047	99075.29	1869.301	6726687.665	67.89471
23	23	379984	0.00006053	0.000061	99070.60	1869.200	6724818.364	67.87905
24	28	379961	0.00007369	0.000074	99064.60	1869.075	6722949.164	67.86429
25	16	379933	0.00004211	0.000042	99057.30	1868.966	6721080.089	67.85043

Table 27. continued

Week	Dx	Px	Mx	Qx	lx	Lx	Tx	Ex
26	27	379917	0.00007107	0.000071	99053.13	1868.861	6719211.123	67.83441
27	13	379890	0.00003422	0.000034	99046.09	1868.762	6717342.262	67.82037
28	17	379877	0.00004475	0.000045	99042.70	1868.688	6715473.500	67.80382
29	20	379860	0.00005265	0.000053	99038.27	1868.597	6713604.812	67.78799
30	20	379840	0.00005265	0.000053	99033.06	1868.499	6711736.214	67.77269
31	26	379820	0.00006845	0.000068	99027.84	1868.386	6709867.715	67.75739
32	15	379794	0.00003950	0.000040	99021.06	1868.285	6707999.329	67.74316
33	15	379779	0.00003950	0.000040	99017.15	1868.211	6706131.044	67.72696
34	15	379764	0.00003950	0.000040	99013.24	1868.137	6704262.833	67.71077
35	15	379749	0.00003950	0.000040	99009.33	1868.064	6702394.696	67.69458
36	6	379734	0.00001580	0.000016	99005.42	1868.012	6700526.632	67.67838
37	16	379728	0.00004214	0.000042	99003.86	1867.958	6698658.620	67.66058
38	12	379712	0.00003160	0.000032	98999.68	1867.889	6696790.662	67.64457
39	13	379700	0.00003424	0.000034	98996.56	1867.828	6694922.773	67.62784
40	13	379687	0.00003424	0.000034	98993.17	1867.764	6693054.945	67.61128
41	21	379674	0.00005531	0.000055	98989.78	1867.680	6691187.182	67.59473
42	14	379653	0.00003688	0.000037	98984.30	1867.594	6689319.502	67.57960
43	13	379639	0.00003424	0.000034	98980.65	1867.528	6687451.908	67.56322
44	14	379626	0.00003688	0.000037	98977.26	1867.461	6685584.380	67.54667
45	9	379612	0.00002371	0.000024	98973.61	1867.405	6683716.919	67.53029
46	11	379603	0.00002898	0.000029	98971.27	1867.355	6681849.515	67.51302
47	8	379592	0.00002108	0.000021	98968.40	1867.309	6679982.159	67.49611
48	11	379584	0.00002880	0.000029	98966.31	1867.262	6678114.851	67.47867
49	10	379573	0.00002635	0.000026	98963.45	1867.210	6676247.589	67.46175
50	10	379563	0.00002635	0.000026	98960.84	1867.161	6674380.379	67.44466
51	9	379553	0.00002371	0.000024	98958.23	1867.114	6672513.217	67.42757
52	11	379544	0.00002898	0.000029	98955.88	1867.065	6670646.103	67.41030
53	1	379533	0.00000263	0.000003	98953.02	1867.038	6668779.038	67.39339

Table 28. Life Table of the Infant (Female, 1993)

Week	Dx	Px	Mx	Qx	lx	Lx	Tx	Ex
1	1575	332256	0.00474032	0.004718	100000.0	1882.342	7566701.013	75.66701
2	224	330681	0.00067739	0.000677	99528.20	1877.255	7564818.672	76.00678
3	122	330457	0.00036919	0.000369	99460.83	1876.273	7562941.417	76.03940
4	104	330335	0.00031483	0.000315	99424.12	1875.632	7561065.144	76.04860
5	68	330231	0.00020592	0.000206	99392.83	1875.143	7559189.512	76.05367
6	62	330163	0.00018779	0.000188	99372.37	1874.774	7557314.369	76.05046
7	51	330101	0.00015450	0.000154	99353.71	1874.454	7555439.594	76.04587
8	44	330050	0.00013331	0.000133	99338.37	1874.184	7553565.141	76.03875
9	57	330006	0.00017272	0.000173	99325.12	1873.897	7551690.957	76.03002
10	42	329949	0.00012729	0.000127	99307.97	1873.616	7549817.060	76.02428

Table 28. continued

Week	Dx	Px	Mx	Qx	lx	Lx	Tx	Ex
11	27	329907	0.00008184	0.000082	99295.33	1873.420	7547943.444	76.01509
12	37	329880	0.00011216	0.000112	99287.21	1873.238	7546070.023	76.00244
13	46	329843	0.00013946	0.000139	99276.07	1873.003	7544196.785	75.99210
14	33	329797	0.00010006	0.000100	99262.23	1872.779	7542323.782	75.98383
15	22	329764	0.00006671	0.000067	99252.30	1872.622	7540451.004	75.97256
16	46	329742	0.00013950	0.000139	99245.68	1872.429	7538578.381	75.95876
17	34	329696	0.00010313	0.000103	99231.83	1872.202	7536705.952	75.95049
18	28	329662	0.00008493	0.000085	99221.60	1872.026	7534833.750	75.93945
19	26	329634	0.00007887	0.000080	99213.17	1871.873	7532961.724	75.92703
20	27	329608	0.00008191	0.000082	99205.35	1871.722	7531089.851	75.91415
21	14	329581	0.00004247	0.000043	99197.22	1871.606	7529218.128	75.90150
22	27	329567	0.00008192	0.000082	99193.01	1871.490	7527346.522	75.88586
23	23	329540	0.00006979	0.000070	99184.88	1871.348	7525475.033	75.87321
24	16	329517	0.00004855	0.000049	99177.96	1871.237	7523603.685	75.85963
25	16	329501	0.00004855	0.000049	99173.15	1871.146	7521732.448	75.84445
26	18	329485	0.00005463	0.000055	99168.33	1871.049	7519861.302	75.82926
27	15	329467	0.00004552	0.000046	99162.91	1870.956	7517990.253	75.81454
28	9	329452	0.00002731	0.000027	99158.40	1870.888	7516119.297	75.79912
29	13	329443	0.00003946	0.000040	99155.69	1870.825	7514248.410	75.78232
30	17	329430	0.00005160	0.000052	99151.78	1870.740	7512377.584	75.76644
31	12	329413	0.00003642	0.000036	99146.66	1870.658	7510506.844	75.75149
32	12	329401	0.00003642	0.000036	99143.05	1870.589	7508636.187	75.73538
33	11	329389	0.00003339	0.000033	99139.44	1870.524	7506765.597	75.71927
34	12	329378	0.00003643	0.000036	99136.13	1870.459	7504895.073	75.70293
35	6	329366	0.00001821	0.000018	99132.52	1870.408	7503024.614	75.68682
36	16	329360	0.00004857	0.000050	99130.71	1870.345	7501154.206	75.66933
37	10	329344	0.00003036	0.000030	99125.89	1870.271	7499283.861	75.65414
38	7	329334	0.00002125	0.000021	99122.88	1870.223	7497413.590	75.63757
39	15	329327	0.00004554	0.000046	99120.78	1870.161	7495543.366	75.62030
40	17	329312	0.00005162	0.000052	99116.26	1870.070	7493673.206	75.60488
41	12	329295	0.00003644	0.000036	99111.15	1869.988	7491803.136	75.58992
42	11	329283	0.00003340	0.000033	99107.53	1869.922	7489933.148	75.57380
43	12	329272	0.00003644	0.000036	99104.22	1869.857	7488063.226	75.55746
44	7	329260	0.00002120	0.000021	99100.61	1869.803	7486193.369	75.54134
45	5	329253	0.00001518	0.000015	99098.51	1869.769	7484323.566	75.52408
46	5	329248	0.00001518	0.000015	99097.00	1869.741	7482453.797	75.50636
47	5	329243	0.00001518	0.000015	99095.50	1869.712	7480584.057	75.48864
48	9	329238	0.00002733	0.000027	99093.99	1869.672	7478714.344	75.47092
49	7	329229	0.00002126	0.000021	99091.28	1869.627	7476844.672	75.45411
50	11	329222	0.00003341	0.000033	99089.18	1869.576	7474975.045	75.43685
51	8	329211	0.00002430	0.000024	99085.86	1869.522	7473105.469	75.42050
52	6	329203	0.00001822	0.000018	99083.46	1869.482	7471235.947	75.40346
53	0	329197	0.00000000	0.000000	99081.65	1869.465	7469366.465	75.38597

Table 29 shows the difference in the probability of dying by sex and age. A considerable difference between sex was observed during the first week and the difference lessened as age increased.

Table 29. Difference in Probability of Dying by Sex and Age

Week	QxM	QxF	QxM - QxF
1	0.005523	0.004718	0.000805
2	0.000760	0.000677	0.000083
3	0.000427	0.000369	0.000058
4	0.000220	0.000315	-0.000095
5	0.000289	0.000206	0.000083
6	0.000276	0.000188	0.000088
7	0.000194	0.000154	0.000040
8	0.000158	0.000133	0.000025
9	0.000163	0.000173	-0.000010
10	0.000168	0.000127	0.000041
11	0.000139	0.000082	0.000057
12	0.000121	0.000112	0.000009
13	0.000113	0.000139	-0.000026
14	0.000118	0.000100	0.000018
15	0.000076	0.000067	0.000009
16	0.000087	0.000139	-0.000052
17	0.000097	0.000103	-0.000006
18	0.000100	0.000085	0.000015
19	0.000095	0.000080	0.000015
20	0.000071	0.000082	-0.000011
21	0.000079	0.000043	0.000036
22	0.000047	0.000082	-0.000035
23	0.000061	0.000070	-0.000009
24	0.000074	0.000049	0.000025
25	0.000042	0.000049	-0.000007
26	0.000071	0.000055	0.000016
27	0.000034	0.000046	-0.000012
28	0.000045	0.000027	0.000018
29	0.000053	0.000040	0.000013
30	0.000053	0.000052	0.000001
31	0.000068	0.000036	0.000032
32	0.000040	0.000036	0.000004
33	0.000040	0.000033	0.000007
34	0.000040	0.000036	0.000004
35	0.000040	0.000018	0.000022
36	0.000016	0.000050	-0.000034
37	0.000042	0.000030	0.000012
38	0.000032	0.000021	0.000011
39	0.000034	0.000046	-0.000012
40	0.000034	0.000052	-0.000018
41	0.000055	0.000036	0.000019
42	0.000037	0.000033	0.000004
43	0.000034	0.000036	-0.000002
44	0.000037	0.000021	0.000016
45	0.000024	0.000015	0.000009
46	0.000029	0.000015	0.000014
47	0.000021	0.000015	0.000006
48	0.000029	0.000027	0.000002
49	0.000026	0.000021	0.000005
50	0.000026	0.000033	-0.000007
51	0.000024	0.000024	0.000000
52	0.000029	0.000018	0.000011
53	0.000003	0.000000	0.000003

7. Infant Deaths by Source of Data

The numbers of infant deaths vary by the source of data (See Table 30). The largest number of infant deaths was obtained from the medical facilities survey data (5,194) and the second largest was from the health facilities report (2,341). The funeral grant data revealed 1,714 infant deaths, which was similar to the 1,689 cases from the record of beneficiaries.

The differences in infant deaths among the various sources of data are shown not only by numbers, but also by distribution of deaths by age. The proportion of neonatal deaths (1~28 days) was 81.5% in the medical facilities survey data, whereas it was only 7.0% for the resident registration. This reflects that each source of data covers only a part of the total number and varies by age.

Table 30. Infant Deaths by Age (days) and Source of Data

(Unit: person, %)

Surviving duration	Medical facilities survey	Health facilities report	Funeral grant	Record of beneficiaries	Resident registration
Total	100.0 (5,194)	100.0 (2,341)	100.0 (1,714)	100.0 (1,689)	100.0 (2,057)
1~ 28 days	81.5	92.3	34.0	24.3	7.0
29~365 days	18.9	7.7	66.0	75.7	93.0
1 week	66.7	73.7	21.2	14.0	0.7
2 weeks	8.1	9.8	5.7	4.1	1.3
3 weeks	4.3	6.5	4.4	3.5	2.3
4 weeks	2.3	2.3	2.7	2.6	2.8
5 wks.~3 mon.	9.4	2.5	27.8	28.3	36.6
4~ 6 months	5.3	4.6	21.8	23.0	29.8
7~ 9 months	2.5	0.3	9.6	13.6	14.9
10~12 months	1.7	0.3	6.8	10.8	11.7

8. Coverage Rates of Infant Deaths

Table 31 shows the completeness of data from each source to the total number of infant deaths that was produced in this project. Medical facilities survey data represents neonatal deaths quite well indicating 90.2% of all neonatal deaths, however, only 41.0% of post-neonatal deaths period are covered. The resident registration data covers only 3.1% of the total number of neonatal deaths, but the data for the post-neonatal period was somewhat tolerable at a coverage of 79.8%.

Table 31. Coverage Rate (completeness) of Infant Deaths to the Estimated Infant Death by Source of Data

(Unit: person, %)

Duration of survival	Estimated infant deaths	Medical facilities survey	Medical facilities report	Funeral grant	Record benefi.	Resident regist.
Total	100.0 (7,088)	73.3	33.0	24.2	23.8	29.0
1~ 28 days	100.0 (4,692)	90.2	46.1	12.4	8.7	3.1
29~365 days	100.0 (2,396)	41.0	7.5	47.2	53.4	79.8
1 week	100.0 (3,705)	93.5	46.6	9.8	6.4	0.4
2 weeks	100.0 (514)	82.1	44.6	19.1	13.6	5.1
3 weeks	100.0 (285)	78.6	53.7	26.3	20.7	16.5
4 weeks	100.0 (188)	63.8	29.3	24.5	23.4	30.9
5 wks.~3 mon.	100.0 (1,051)	46.2	5.5	45.4	45.5	71.2
4~ 6 months	100.0 (717)	38.6	15.1	52.0	54.1	85.6
7~ 9 months	100.0 (358)	36.0	2.0	45.8	64.2	85.5
10~12months	100.0 (270)	33.3	2.2	43.3	67.8	88.9

Note: Due to overlapping of infant deaths among the data, the total added % of each source of data can be more than 100.

Chapter 5. Conclusion

This study was conducted for the purpose of developing of a new and efficient method for estimating the Korean Infant Mortality Rate, which is perceived inadequate due to its indirect method of estimation.

We used an alternative method of which the existing data on infant deaths were collected from various sources, and integrated after adjusting any overlap among the sources. Extreme lack of information on neonatal deaths was noticed during the process of health facility investigation to track down the maternal benefit data on health insurance.

The following summarizes the overall investigation.

Among children born between Jan. 1, 1993 and Dec. 31, 1993, a total of 7,088 infant deaths were identified. Our estimation of IMR, according to live births as the duration of 20 weeks or more of pregnancy and 500g or more of body weight at birth, was 9.9 per 1,000 live births for the 1993 birth cohort. The neonatal mortality rate was 6.6 and the post-neonatal mortality rate was 3.3 per 1,000 live births.

Infant mortality rate showed a significant amount of difference according to the mother's age. The lowest rate was observed among infants born to the 20~24 age group of mothers and it increased with mother's age.

Among ten major causes of infant death, the first cause was

'Fetal Growth Disorder' (25.3%) and the second cause was 'Respiratory Distress of the Newborn' (16.4%). The third cause was 'Congenital Malformation of the Heart' (9.7%), which was primary cause of death as the age at death increased.

Through the comprehensive process of gathering data on infant deaths from the various sources and comparing them, results showed that all existing sets of data and even thorough investigations into health facilities have pitfalls. Therefore, our next step must be to further review the current situation by identifying problems and developing systems to improve the quality of data.

The medical facilities survey covered only 73.3% of the total number of infant deaths despite the tedious and complicated process involved. The funeral grant covered 24.2%, while the record of beneficiaries covered 23.8% and resident registration covered 29.0%. However, if we compare the data specified by age at death, then we can obtain more accurate information. The completeness of health facility survey on neonatal death was 90.2%, while that of resident registration data on post-neonatal death was 79.8%.

Although vital registration has substantially improved recently and births and deaths statistics need to be secured within the vital registration system, infant deaths statistics will need complementary measures for some time in the future. If the reporting format was revised specifically in the areas of information management system and computerization within every sector of the health system, and the health and medical personnel were educated on the importance of accurate recording, the quality of the death statistics will be greatly improved.

The following suggests ways to improve the quality of infant deaths statistics.

The usefulness of health insurance benefit data will be increased if one column of codes was added to the maternity benefit data for live birth, still birth, abortion, and death soon after live birth. Deaths will also be easily identified if one

column was added for coding deaths or a number was given for death to the classification of diseases on requesting health benefit grant.

Moreover, the reliability of medical insurance data will be secured if it is somehow integrated and managed in coherence with the resident registration data.

In order to use the funeral grant data, the government and the medical insurance corporation and the federation of health insurance should encourage the clients to request funeral grant. The accurate recording of the cause of deaths and contact address of the beneficiaries must also be required.

Periodical infant and maternal death reports from medical and health facilities are indispensable. Therefore, proper maintenance and improvement of the reporting system is vital. Infant deaths that occur, apart from obstetrics and pediatrics, are now rarely reported. A network of reporting system should be developed to avoid under reporting. It is also necessary to secure information of the parent, such as their ID numbers (resident registration number) and address.

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