



Changes in the neonatal and infant mortality rate and the causes of death in Korea

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Received: 26 October 2011, Accepted: 6 November 2011
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Neonatal mortality rate (NMR) or infant mortality rate (IMR) are the rate of deaths per 1,000 live births at which babies of either less than four weeks or of one year of age die, respectively. The NMR and IMR are commonly accepted as a measure of the general health and well-being of a population. Korea's NMR and IMR fell significantly between 1993 and 2009 from 6.6 and 9.9 to 1.7 and 3.2, respectively. Common causes of infantile death in 2008 had decreased compared with those in 1996 such as other disorders originating in the perinatal period, congenital malformation of the heart, bacterial sepsis of newborns, disorders related to length of gestation and fetal growth, intra-uterine hypoxia, birth asphyxia. However, some other causes are on the increase, such as respiratory distress of newborn, other respiratory conditions originating in the perinatal period, other congenital malformation, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism. In this study, we provide basic data about changes of NMR and IMR and the causes of neonatal and infantile death from 1983 to 2009 in Korea.

Key words: Epidemiology, Vital statistics, Neonatal mortality, Infant mortality, Causes of death, Korea

Introduction

Among many public health indexes, neonatal mortality rate (NMR) and infant mortality rate (IMR) are the two most important measures indicating the regional, national, and population status in various fields including health, demography, society, economy, biology, and culture. NMR and IMR are therefore very important indexes of a country's state and trends of health or development, and is a component of the physical quality of life index. A decrease in NMR and IMR results in the improvement of infant mortality and survival, which can positively influence the national public state of health.

In Korea, during the past 60 years there has been marked improvement in the management of maternity, pregnancy, delivery, birth, neonatal and infantile health care by a qualitative improvement in obstetric, perinatal, neonatal, and pediatric medical conditions. As a result, despite increasing trends of high-risk newborns including prematurity, neonatal survival rates are improving with the development of neonatal intensive care medicine. In addition, the development of infantile preventive medicine and treatment of infants had a big effect on the improvement of NMR and IMR in Korea, and has become a cornerstone in the development of national health.

Every year since 1993, there is an official announcement about

IMR. There is a need for systematic review analysis on the recent changes and trends of NMR and IMR over the past 60 years in Korea, which makes it important to review the differences in the causes of neonatal and infantile death and understand the current state. Therefore, in this review, we attempted to analyze the changes and trends of NMR and IMR in Korea by understanding the current state of improved public health and we also analyzed changes in the causes of death accompanying improved NMR and IMR. We also attempted to provide basic data for neonatal and infantile health promotion.

Definitions

The following terms based on International Statistical Classification of Diseases (ICD) and Related Health Problems 10th revision of World Health Organization (WHO)^{1,2)}.

Neonate: infants 0 to 27 days of life, under 28 days of life.

Early neonate: infants 0 to 6 days (under 7 days) of age.

Late neonate: infants 7 to 27 days (under 28 days) of age.

Neonatal mortality rate: [annual number of death of infants 0 to 27 days of life / the annual number of live births] × 1,000.

Early neonatal mortality rate: [annual number of death of infants 0 to 6 days of age / the annual number of live births] × 1,000.

Late neonatal mortality rate: [annual number of death of infants 7 to 27 days of age / the annual number of live births] × 1,000.

Infant mortality rate: [annual number of death of infants under 1 year / the annual number of live births] × 1,000.

Data collection

1. NMR and IMR in Korea

From 1993 the official IMR of investigation by Korea Ministry of Health and Welfare (KMHW)³⁾ has been published on a national scale. KMHW has enlisted the services of the Korea Institute for Health and Social Affairs (KIHASA) since 1993 and have been publishing data on Korean NMR and IMR⁴⁻⁷⁾. These data are reported to the United Nations, WHO, Organization for Economic Cooperation and Development (OECD) and are used as reference guides on Korean statistics. A large amount of personal data has accumulated prior to 1993⁸⁾. Therefore, we used data by KHMW from 1993 and used data by Statistics Korea from 2007. We also used data by Chang et al.⁸⁾ because they conducted organized analyses on Korean NMR and IMR in 2011.

2. Causes of neonatal and infant death in Korea

We classified the causes of neonatal and infant death in Korea from

1983 to 2009 into three categories by chapters and block categories based on the Korean Standard Classification of Diseases (KCD) (5th edition), classified by the Korean Medical Record Association based on the ICD and related health problems (10th edition) by WHO^{1,2)}. We used data on the cause of death based on Statistics Korea⁹⁾ from 1983 to 2009, and data on the ten major causes of neonatal and infant death based on KIHASA from 1996 to 2008¹⁰⁾.

Changes in the NMR and IMR in Korea

1. Changes of NMR in Korea (1993 to 2009)

Overall, Korean NMR shows a decline: 6.6 in 1993, 4.1 in 1996, 3.8 in 1999, 3.3 in 2002, 2.8 in 2005, 2.5 in 2006, 2.0 in 2007, 1.8 in 2008 and 1.7 in 2009 (Fig. 1). The change of early and late NMR is shown in Table 1, and also shows a decline. The proportion of early NMR is 79% in 1993, 69% in 1999, 70% in 2002, 69% in 2005, 68% in 2009, exhibiting a reducing trend. However, early NMR contributes to more than two-thirds the proportion of large numbers in NMR (Table 1).

2. Changes of IMR in Korea

1) IMR before 1993

Korean research on IMR targeted regional or nationwide data before 1993. Chang et al.⁸⁾ summarized data as follows in Table 2. We can recognize slowly reducing trends of IMR; 350 before 1920, 240 to 250 in the 1920s, 180 to 200 in the 1930s, 160 in the 1940s, 150 in the early 1940s, 160 in the late 1940s, 100 during the Korean War, 60 in the early 1960s, 50 in the late 1960s, 30 to 40 in the 1970s, and 15 in the late 1980s⁸⁾.

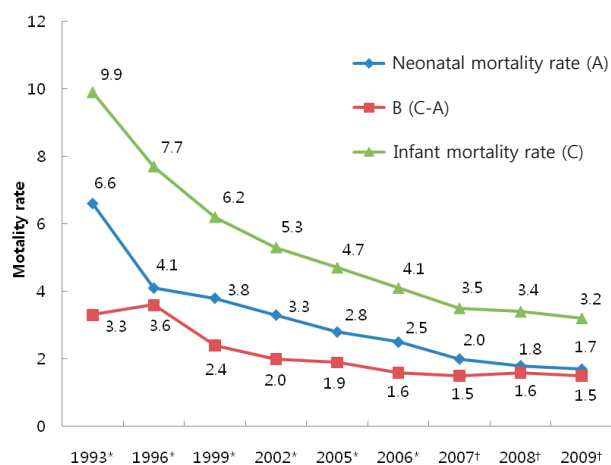


Fig. 1. Changes in infant and neonatal mortality rate in Korea from 1993 to 2009. Significant improvement in mortality rates was found. *Data from the Korea Ministry of Health and Welfare. †Data from Statistics Korea⁸⁾.

Table 1. Neonatal (Early and Late) Mortality Rate in Korea (1993 to 2009)^{9,10)}

	Neonatal=(A)+(B)	%	Early neonatal* (A)	%	Late neonatal† (B)	%
1993	6.6	100	5.2	79	1.4	21
1996	4.1	100	3.0	73	1.1	27
1999	3.8	100	2.6	69	1.2	31
2002	3.3	100	2.3	70	1.0	30
2005	2.8	100	1.9	69	0.9	31
2007	2.0	100	1.3	65	0.7	35
2008	1.8	100	1.3	72	0.5	28
2009	1.7	100	1.2	68	0.5	22

*Death under 7 days after birth. †Death between 7 days and 27 days after birth.

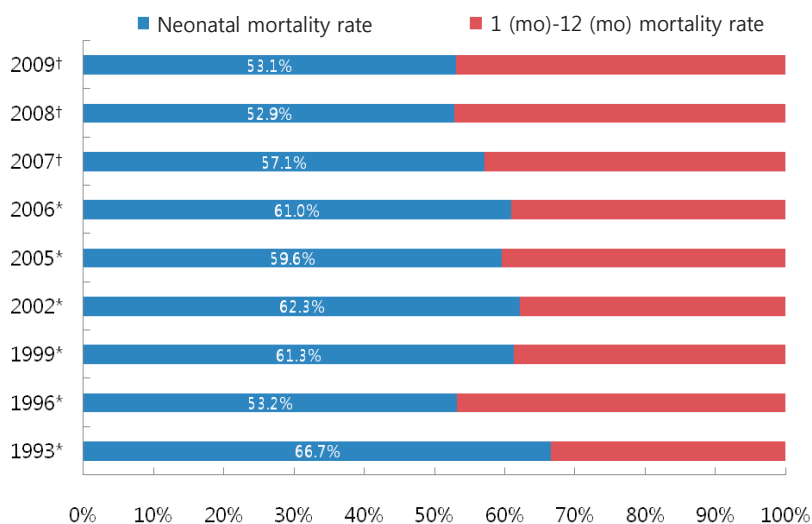


Fig. 2. The proportion of neonatal mortality rate in infant mortality rate in Korea from 1993 to 2009. Even though the ratio of neonatal mortality rate to infantile mortality rate has recently been decreasing, it still accounts for more than half infantile mortality rate. *Data from the Korea Ministry of Health and Welfare. †Data from Statistics Korea⁸⁾.

2) IMR after 1933

The IMR in Korea since 1993 are summarized in Fig. 1. A remarkable reduction in IMR was observed: 9.9 in 1993, 7.7 in 1996, 6.2 in 1999, 5.3 in 2002, 4.7 in 2005, 4.1 in 2006, 3.5 in 2007, 3.4 in 2008 and 3.2 in 2009⁸⁾.

3) Proportion of NMR of IMR

The ratio of NMR in IMR is shown in Fig. 2. The ratio has been decreasing slowly: 66.7% in 1993, 53.2% in 1996, 61.3% in 1999, 62.3% in 2002, 59.6% in 2005, 61.0% in 2006, 57.1% in 2007, 52.9% in 2008, and 53.1% in 2009. According to this data, the NMR still consists of approximately half the IMR, implicating the reduction in NMR could be one of the most important factors of improving IMR in Korea⁸⁾.

Changes in causes of neonatal and infant death in Korea

1. Causes of neonatal death (2005, 2009)

1) Classified by chapters of KCD: causes and numbers of neonatal death⁹⁾

The numbers of neonatal deaths decreased from 1025 in 2005 to 771 in 2009. The causes and number of neonatal deaths in Korea in 2005 and 2009 by KCD are shown in Table 3. Certain conditions originating in the perinatal period (P00-P96) in 2005 (67.7%) and 2009 (72.1%) were the highest, followed by congenital malformations, deformations and chromosomal abnormality (Q00-Q99) in 2005 (16.2%) and 2009 (15.3%), and symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified (NEC) (R00-R99) in 2005 (12.5%) and 2009 (6.6%). Certain conditions originating in the perinatal period and congenital malformations, deformations and chromosomal abnormalities are important causes, which means diseases in perinatal period and soon

Table 2. Reported Infant Mortality Rates in Korea (1921 to 1991)⁸⁾

Year	IMR	Investigator	Area
1921-25	254	Lee KC	Seoul
1926-30	234	Lee KC	Seoul
1926-30	242	Mizushima	Seoul
1931-34	183	Hironaka	Seoul
1931-35	203	Choe HY	Seoul
1938-42	118	Park CB	Urban area
1941-45	150	Kim NI (FS, 1971)	Nationwide
1944-48	166	Yun DJ	Rural area
1945-49	166	WFS, 1974	Nationwide
1946-50	132	Kim NI (FS, 1971)	Nationwide
1949-53	97	WFS, 1974	Nationwide
1950-54	109	WFS, 1974	Nationwide
1951-55	79	Kim NI (FS, 1971)	Nationwide
1954-59	83	Park HJ	Rural area
1955-59	60	WFS, 1974	Nationwide
1956-60	64	Kim NI (FS, 1971)	Nationwide
1962	82.9	Park HJ	Rural area
1960-64	59	WFS, 1974	Nationwide
1961-64	45	Kim KS	Rural area
1961-65	60	Kim NI (FS, 1971)	Nationwide
1961-65	60	Lee SJ	Rural area
1962-64	36	Kwon EH	Seoul
1968	32.2	Kwon EH	Seoul
1965-69	50	WFS, 1974	Nationwide
1966-70	50	Kim NI (FS, 1971)	Nationwide
1970-72	46	WFS, 1974	Nationwide
1971-76	32	Park KH	Rural area
1974	26	Kim JK	Nationwide
1974-75	28.4	Han SH	Nationwide
1984-85	13.9	Han SH	Nationwide
1986-87	15.4	Han SH	Nationwide
1986-87	14.7	Kim JK	Nationwide
1985-88	12.5	Park JH	Rural area
1986	12.5	Kim IH	Nationwide
1990	12.8	Statistics Korea	Nationwide
1991	10.0	Statistics Korea	Nationwide

IMR, infant mortality rate; FS, fertility survey; WFS, world fertility survey.

after of birth are the most frequent.

2) Classified by block categories of KCD: causes and numbers of neonatal death⁹⁾

The block categories of KCD are shown in Table 4. In 2005, the following conditions originated in the perinatal period (P00-P96) in order of frequency, respiratory distress of newborns (P22), disorders related to length of gestation and fetal growth (P05-P08), other respiratory conditions originating in the perinatal period (P28), bacterial sepsis of newborns (P36), other disorders originating in

the perinatal period (P00-P96), haemorrhagic and haematological disorders of fetuses and newborns (P50-P61), intrauterine hypoxia, birth asphyxia (P20, P21), congenital pneumonia (P23), and birth trauma (P10-P15). With regards to congenital malformations, the following conditions were observed in order of frequency: deformations and chromosomal abnormalities (Q00-Q99), other congenital malformations (Q10-Q89), congenital malformations of the heart (Q20-Q24), congenital malformations of the circulatory system (Q20-28), Down's syndrome, other chromosome abnormalities (Q90-Q99), congenital malformations of the nervous system (Q00-Q07), congenital hydrocephalus, and spina bifida (Q03, Q05).

With regards to symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99), they are symptoms, signs and abnormal clinical and laboratory findings, other (R00-R99), sudden infant death syndrome (R95). Neonatal death according to early and late neonatal periods is shown in Table 4. The number of deaths decreased to 694 in the early neonatal period in 2005, and 523 in the late neonatal period. The ratio of deaths in the early neonatal period to total death was 69% in 2005 and 68% in 2009.

3) Changes in the ten major causes of neonatal death (1996 to 2008)¹⁰⁾

Changes in the ten major causes of neonatal death in 1996, 1999, 2002, 2005, 2006, 2007, and 2008 in Korea by Choi's study¹⁰⁾ of KIHASA are shown in Table 5. The respiratory distress of newborns, diseases of the blood and blood-forming organs as well as certain disorders involving the immune mechanism, symptoms, signs and abnormal clinical and laboratory findings, NEC, Other congenital malformation, and others increased in ratio. In contrast, other respiratory conditions originating in the perinatal period, bacterial sepsis of newborns, disorders related to length of gestation and fetal growth, other respiratory conditions originating in the perinatal period, congenital malformation of heart, intrauterine hypoxia, birth asphyxia were decreased in trend.

2. Causes of infant death (1983 to 2009)

1) Classified by chapters of KCD: causes and numbers of infant death⁹⁾

The causes and numbers of infant death by the classification of chapters of KCD in Korea from 1983 to 2009 are shown in Table 6. In order of frequency in 1983, they included symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99) 33.1%, diseases of the respiratory system (J00-J98) 20.6%, congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) 11.9%, certain infectious and parasitic diseases

Table 3. Causes of Neonatal Death by Chapters, KSCD* in Korea (2005, 2009)⁹⁾

Group by ICD	2005 (yr)	2009 (yr)
Certain infectious and parasitic diseases (A00-B99)	6 (0.6)	2 (0.3)
Neoplasms (C00-D48)	5 (0.5)	4 (0.5)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	0 (0.0)	1 (0.1)
Endocrine, nutritional and metabolic disease (E00-E88)	6 (0.6)	6 (0.8)
Diseases of the nervous system (G00-G98)	3 (0.3)	3 (0.4)
Diseases of the circulatory system (I00-I99)	5 (0.5)	6 (0.8)
Diseases of the respiratory system (J00-J98)	1 (0.1)	1 (0.1)
Diseases of the digestive system (K00-K92)	0 (0.0)	1 (0.1)
Diseases of the genitourinary system (N00-N98)	0 (0.0)	1 (0.1)
Certain conditions originating in the perinatal period (P00-P96)	694 (67.7)	556 (72.1)
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	166 (16.2)	118 (15.3)
Symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99)	128 (12.5)	51 (6.6)
External causes of morbidity and mortality (V01-Y89)	11 (1.1)	21 (2.7)
Total	1,025 (100.0)	771 (100.0)

Values are presented as number (%).

ICD, International Statistical Classification of Diseases; NEC, not elsewhere classified.

*Korean Standard Classification of Diseases, 5th ed., 2007.

Table 4. Causes of Early and Late Neonatal Death by Chapters and Block Categories, KSCD* in Korea (2005, 2009)⁹⁾

	2005				2009			
	END	LND	Total	%	END	LND	Total	%
Certain infectious and parasitic diseases (A00-B99)								
Other intestinal Infectious Diseases (A00- A09)	0	1	1		0	0	0	
Sepsis (A40-A41)	2	2	4		0	0	0	
Other viral diseases (B25-B34)	0	1	1		0	1	1	
Other certain infectious and parasitic diseases (A00-B99)	0	0	0		0	1	1	
Subtotal	2	4	6	0.6	0	2	2	0.3
Neoplasms (C00-D48)								
Leukemia (C91-C95)	3	2	5		0	1	1	
Other malignant neoplasm (C00-C97)	0	0	0		2	0	2	
Other neoplasm (D00-D48)	0	0	0		1	0	1	
Subtotal	3	2	5	0.5	3	1	4	0.5
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)								
Other disorders involving the immune mechanism, NEC (D50-D89)	0	0	0		0	1	1	
Subtotal	0	0	0	0.0	0	1	1	0.1
Endocrine, nutritional and metabolic disease (E00-E88)								
Other endocrine, nutritional and metabolic disease (E00-88)	3	3	6		1	5	6	
Subtotal	3	3	6	0.6	1	5	6	0.8
Diseases of the nervous system (G00-G98)								
Other diseases of the nervous system (G00-G98)	3	0	3		1	2	3	
Subtotal	3	0	3	0.3	1	2	3	0.4
Diseases of the circulatory system (I00-I99)	1	4	5	0.5	3	3	6	0.8
Diseases of the respiratory system (J00-J98)	0	1	1	0.1	1	0	1	0.1
Pneumonia (J12-J18)	0	1	1		1	0	1	
Subtotal	0	1	1	0.1	1	0	1	0.1
Diseases of the digestive system (K00-K92)	0	0	0	0.0	1	0	1	0.1
Diseases of the genitourinary system (N00-N98)	0	0	0	0.0	0	1	1	0.1

Table 4. Causes of Early and Late Neonatal Death by Chapters and Block Categories, KSCD* in Korea (2005, 2009) (Continued)

	2005				2009			
	END	LND	Total	%	END	LND	Total	%
Certain conditions originating in the perinatal period (P00-P96)								
Disorders related to length of gestation and fetal growth (P05-P08)	120	31	151		36	3	39	
Birth trauma (P10-P15)	0	1	1		0	0	0	
Intrauterine hypoxia, birth asphyxia (P20, P21)	45	9	54		40	5	45	
Respiratory distress of newborn (P22)	144	37	181		144	54	198	
Congenital pneumonia (P23)	3	2	5		2	2	4	
Other respiratory conditions originating in the perinatal period (P28)	69	18	87		57	7	64	
Bacterial sepsis of newborn (P36)	30	45	75		21	34	55	
Haemorrhagic and haematological disorders of fetus and newborn (P50-P61)	34	31	65		29	22	51	
Other disorders originating in the perinatal period (P00-P96)	42	33	75		58	42	100	
Subtotal	487	207	694	67.7	387	169	556	72.1
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)								
Congenital hydrocephalus, spina bifida (Q03, Q05)	2	1	3		2	0	2	
Congenital malformations of the nervous system (Q00-Q07)	3	2	5		4	1	5	
Congenital malformations of heart (Q20-Q24)	13	36	49		12	26	38	
Congenital malformations of circulatory system (Q20-28)	27	9	36		15	10	25	
Down's syndrome, other chromosome abnormalities (Q90-Q99)	6	7	13		2	6	8	
Other congenital malformations (Q10-Q89)	51	9	60		33	7	40	
Subtotal	102	64	166	16.2	68	50	118	15.3
Symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99)								
Sudden infant death syndrome (R95)	5	9	14		2	4	6	
Symptoms, signs and abnormal clinical and laboratory findings, other (R00-R99)	86	28	114		40	5	45	
Subtotal	91	37	128	12.5	42	9	51	6.6
External causes of morbidity and mortality (V01-Y89)								
Transport accident (V01-V99)	0	0	0		0	1	1	
Other accidental threats to breathing(W75-W84)	1	4	5		2	2	4	
Assault (X85-Y09)	0	1	1		12	1	13	
Other external causes (V01-Y89)	1	4	5		2	1	3	
Subtotal	2	9	11	1.1	16	5	21	2.7
Total	694	331	1,025	100.0	523	248	771	100.0

END, early neonatal death (death within 6 days after birth); LND, late neonatal death (death in 7 -27 days after birth); NEC, not elsewhere classified.

*Korean Standard Classification of Diseases, 5th ed., 2007.

(A00-B99) 9.6%, diseases of the nervous system (G00-G98) 6.6%, diseases of the circulatory system (I00-I99) 5.5%, external causes of morbidity and mortality (V01-Y89) 4.9%, certain conditions originating in the perinatal period (P00-P96) 2.3%, diseases of the digestive system (K00-K92) 2.2%, neoplasms (C00-D48) 1.2%, endocrine, nutritional and metabolic diseases (E00-E88) 1.0%, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89) 0.6%, diseases of the genito-urinary system (N00-N98) 0.1%, diseases of the skin and subcutaneous tissue (L00-L98) 0.1% and diseases of the musculo-skeletal system and connective tissue (M00-M99) 0.1%. On the other hand, in order of frequency in 2009, the causes included certain conditions originating in the perinatal period (P00-P96)

50.0%, congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) 18.4%, symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99) 13.8%, external causes of morbidity and mortality (V01-Y89) 5.6%, diseases of the circulatory system (I00-I99) 2.8%, diseases of the nervous system (G00-G98) 2.3%, diseases of the respiratory system (J00-J98) 2.0%, certain infectious and parasitic diseases (A00-B99) 1.7%, neoplasms (C00-D48) 1.4%, endocrine, nutritional and metabolic diseases (E00-E88) 1.0%, diseases of the digestive system (K00-K92) 0.7%, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89) 0.2% and diseases of the genito-urinary system (N00-N98) 0.1%.

Table 5. Changes in the Ten Major Causes of Neonatal Death in Korea (1996-2008)

Order	Group by ICD	1996 (n=2,856)	1999 (n=2,332)	2002 (n=1,637)	2005 (n=1,246)	2006 (n=1,113)	2007 (n=1,036)	2008 (n=914)
1	Respiratory distress of newborn	14.6	17.2	18.1	17.6	19.4	27.2	31.5
2	Other respiratory conditions originating in the perinatal period	19.1	14.2	11.9	8.4	10.5	9.7	9.1
3	Bacterial sepsis of newborn	12.6	8.1	8.6	9.1	8.8	4.8	8.4
4	Disorders related to length of gestation and fetal growth	13.3	14	12.5	12.8	11.8	8.6	8.3
5	Other respiratory conditions originating in the perinatal period	9.3	8.7	9.2	10.0	11.0	10.0	6.5
6	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	4.4	3.9	5.6	5.6	6.7	4.2	6.3
7	Symptoms, signs and abnormal clinical and laboratory findings, NEC	2.9	4.6	8.0	12.8	8.4	5.0	5.6
8	Other congenital malformation	4.5	5.5	7.9	5.1	5.8	7.1	5.3
9	Congenital malformation of heart	5.3	7.7	7.0	5.0	5.4	5.5	4.7
10	Intrauterine hypoxia, birth asphyxia	6.0	5.7	3.2	3.7	3.3	6.8	3.2
	Others	8.0	10.6	8.0	9.9	8.8	11.0	11.2
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Values are presented as (%).

ICD, International Statistical Classification of Diseases; NEC, not elsewhere classified.

Table 6. Causes of Infant Death by Chapters, KSCD* in Korea (1983-2009)

Causes of infant death	1983	1985	1990	1995	2000	2005	2009
Certain infectious and parasitic diseases (A00-B99)	321 (9.6)	211 (8.2)	115 (5.8)	78 (3.9)	51 (1.8)	30 (1.6)	24 (1.7)
Neoplasms (C00-D48)	40 (1.2)	43 (1.7)	52 (2.6)	38 (1.9)	36 (1.2)	25 (1.4)	20 (1.4)
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)	20 (0.6)	7 (0.3)	11 (0.6)	18 (0.9)	14 (0.5)	12 (0.7)	3 (0.2)
Endocrine, nutritional and metabolic disease (E00-E88)	32 (1.0)	22 (0.9)	16 (0.8)	15 (0.8)	30 (1.0)	13 (0.7)	14 (1.0)
Mental and behavioural disorders (F01-F99)	1 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Diseases of the nervous system (G00-G98)	221 (6.6)	162 (6.3)	138 (7.0)	112 (5.6)	82 (2.8)	29 (1.6)	32 (2.3)
Diseases of the eye and adnexa (H00-H57)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Diseases of the ear and mastoid process (H60-H93)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Diseases of the circulatory system (I00-I99)	184 (5.5)	161 (6.3)	19 (1.0)	83 (4.2)	80 (2.8)	34 (1.9)	39 (2.8)
Diseases of the respiratory system (J00-J98)	688 (20.6)	494 (19.3)	229 (11.6)	125 (6.3)	93 (3.2)	26 (1.4)	29 (2.0)
Diseases of the digestive system (K00-K92)	74 (2.2)	51 (2.0)	41 (2.1)	46 (2.3)	22 (0.8)	9 (0.5)	10 (0.7)
Diseases of the skin and subcutaneous tissue (L00-L98)	4 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)
Diseases of the musculo-skeletal system and connective tissue (M00-M99)	4 (0.1)	2 (0.1)	0 (0.0)	1 (0.1)	2 (0.1)	2 (0.1)	0 (0.0)
Diseases of the genitourinary system (N00-N98)	5 (0.1)	4 (0.2)	16 (0.8)	4 (0.2)	2 (0.1)	1 (0.1)	2 (0.1)
Pregnancy, childbirth and the puerperium (O00-O99)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Certain conditions originating in the perinatal period (P00-P96)	76 (2.3)	81 (3.2)	124 (6.3)	254 (12.7)	1,300 (45.1)	900 (49.5)	707 (50.0)
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)	398 (11.9)	461 (18.0)	531 (26.8)	575 (28.8)	685 (23.8)	356 (19.6)	261 (18.4)
Symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99)	1,103 (33.1)	716 (27.9)	472 (23.8)	322 (16.1)	371 (12.9)	287 (15.8)	195 (13.8)
External causes of morbidity and mortality (V01-Y89)	163 (4.9)	148 (5.8)	217 (10.9)	326 (16.3)	114 (4.0)	96 (5.3)	79 (5.6)
Total	3,334 (100.0)	2,563 (100.0)	1,982 (100.0)	1,998 (100.0)	2,882 (100.0)	1,820 (100.0)	1,415 (100.0)

Values are presented as number (%).

*KSCD: Korean Standard Classification of Diseases, 5th ed., 2007.

Table 7. Causes of Infant Death by Chapters and Block Categories, KSCD* in Korea (1983-2009)

Cause of death	1983	1985	1990	1995	2000	2005	2009
	No. of infant deaths						
Certain infectious and parasitic diseases (A00-B99)							
Intestinal Infectious Diseases (A00-A09)	92	51	31	26	18	5	9
Cholera (A00)	2	1	0	0	0	0	0
Typhoid and paratyphoid fevers (A01)	3	0	0	0	0	0	0
Other salmonella infections and bacterial foodborne intoxications (A02, A05)	6	2	0	5	3	4	1
Other intestinal Infectious Diseases (Re. A00- A09)	81	48	31	21	15	1	8
Tuberculosis (A15-A19)	56	45	7	7	0	1	0
Respiratory tuberculosis (A15-A16)	40	33	5	4	0	0	0
Other tuberculosis (A17-A19)	16	12	2	3	0	1	0
Tetanus (A33-A35)	21	24	0	0	1	0	0
Diphtheria (A36)	1	0	0	0	0	0	0
Whooping cough (A37)	20	9	0	0	0	0	0
Scarlet fever (A38)	3	0	0	0	0	0	0
Sepsis (A40-A41)	48	36	49	28	17	14	7
Infections with a predominantly sexual mode of transmission (A50-A64)	0	0	0	0	1	0	1
Measles (B05)	43	28	18	3	4	0	0
Viral hepatitis (B15-B19)	1	1	6	6	4	1	1
Human immunodeficiency virus [HIV] disease (B20-B24)	0	1	2	1	1	1	1
Other infectious and parasitic diseases (Re.A00- B99)	36	16	2	7	5	8	5
Subtotal	321	211	115	78	51	30	24
Neoplasms (C00-D48)							
Malignant neoplasm (C00-C97)	33	32	51	35	25	20	14
Malignant neoplasms of digestive organs (C15-C26)	3	4	0	4	1	2	3
Malignant neoplasm of stomach (C16)	0	1	0	0	0	0	0
Malignant neoplasm of other and unspecified parts of biliary tract (C22.0, C22.2-C22.9)	2	3	0	3	0	2	3
Malignant neoplasm of pancreas (C25)	0	0	0	1	0	0	0
Malignant neoplasm of other and ill-defined digestive organs (C26)	1	0	0	0	0	0	0
Malignant neoplasms of respiratory and intrathoracic organs (C30-C39)	0	1	0	2	1	0	1
Malignant neoplasm of bronchus and lung (C34)	0	1	0	2	1	0	0
Melanoma and other malignant neoplasms of skin (C43-C44)	2	0	0	0	0	0	0
Malignant neoplasms of mesothelial and soft tissue (C45-C49)	1	1	2	0	0	1	0
Malignant neoplasm of male genital organs (C60-C63)	0	0	0	0	0	0	1
Malignant neoplasm of other and unspecified male genital organs (Re. C60- C63)	0	0	0	0	0	0	1
Malignant neoplasms of urinary tract (C64-C68)	1	1	2	0	3	0	0
Malignant neoplasm of kidney, except renal pelvis (C64)	0	1	2	0	3	0	0
Malignant neoplasm of bladder (C67)	1	0	0	0	0	0	0
Malignant neoplasms of Eye, brain and other parts of central nervous system (C69-C72)	4	2	8	8	7	1	1
Malignant neoplasm of brain (C71)	2	2	8	7	6	1	1
Malignant neoplasm of spinal cord, cranial nerves and other parts of central nervous system (Re. C69- C72)	2	0	0	1	1	0	0
Malignant neoplasm of thyroid and other endocrine gland (C74-C75)	2	1	2	2	1	1	2
Malignant neoplasm of ill-defined, secondary and unspecified sites (C76-C80)	2	1	16	1	0	0	0
Malignant neoplasms of lymphoid, hematopoietic and related tissue (C81-C96)	18	21	21	17	12	14	4
Non-Hodgkin lymphoma (C82-C85)	0	1	1	1	0	0	0
Leukaemia (C91-C95)	17	19	18	14	11	13	4
Other and unspecified malignant neoplasms of lymphoid, haematopoietic and related tissue (Re. C81-C96)	1	1	2	2	1	1	0

Table 7. Causes of Infant Death by Chapters and Block Categories, KSCD* in Korea (1983-2009) (Continued)

Cause of death	1983	1985	1990	1995	2000	2005	2009
	No. of infant deaths						
Neoplasms of uncertain or unknown behaviour (D00-D48)	7	11	1	3	11	5	6
Neoplasm of uncertain or unknown behavior of brain and central nervous system (D43)	5	8	0	3	6	0	4
Neoplasm of uncertain or unknown behaviour of other and unspecified sites (Re. D00- D48)	2	3	1	0	5	5	2
Subtotal	40	43	52	38	36	25	20
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism (D50-D89)							
Aplastic anemia (D60,D61)	3	0	0	2	1	0	0
Other anemias (D50-D59, D62-D64)	9	3	1	1	2	1	0
Other disorders of blood and blood-forming organs in diseases classified elsewhere (Re. D50- D89)	8	4	10	15	11	11	3
Subtotal	20	7	11	18	14	12	3
Endocrine, nutritional and metabolic disease (E00-E88)							
Disorders of thyroid (E00-E07)	1	1	1	0	0	1	0
Diabetes mellitus (E10-E14)	1	1	0	2	0	0	0
Sequelae of malnutrition and other nutritional deficiencies (E40-E64)	6	4	1	0	2	1	0
Metabolic disorders (E70-E88)	22	15	13	11	28	11	13
Endocrine, nutritional and metabolic disorders in diseases classified elsewhere (Re. E00- E88)	2	1	1	2	0	0	1
Subtotal	32	22	16	15	30	13	14
Mental and behavioural disorders (F01-F99)							
Unspecified organic or symptomatic mental disorder (F04-F09)	1	0	0	0	0	0	0
Subtotal	1	0	0	0	0	0	0
Diseases of the nervous system (G00-G98)							
Inflammatory diseases of the central nervous system (G00-G09)	92	64	49	29	35	5	8
Encephalitis, myelitis and encephalomyelitis (G00, G03, G04)	91	63	49	28	35	5	8
Encephalitis, myelitis and encephalomyelitis in diseases classified elsewhere (RE.G00- G09)	1	1	0	1	0	0	0
Epilepsy (G40-G41)	7	2	5	18	12	5	6
Cerebral palsy and other paralytic syndromes (G80-G83)	33	25	25	20	7	3	2
Cerebral palsy (G80)	33	25	25	20	7	3	2
Other disorders of the nervous system (Re. G00-G98)	89	71	59	45	28	16	16
Subtotal	221	162	138	112	82	29	32
Diseases of the eye and adnexa (H00-H57)							
	0	0	0	0	0	0	0
Diseases of the ear and mastoid process (H60-H93)							
	0	0	0	0	0	0	0
Diseases of the circulatory system (I00-I99)							
Acute rheumatic fever and chronic rheumatic heart diseases (I00-I09)	0	0	0	1	0	0	0
Pulmonary heart disease and diseases of pulmonary circulation (I26-I28)	0	0	0	3	11	0	1
Acute and subacute endocarditis and heart valve disorders (I33-I38)	0	1	1	5	7	3	1
Conduction disorders and cardiac arrhythmias (I44-I49)	110	97	1	23	14	4	8
Heart failure (I50)	2	11	0	7	8	2	2
Other forms of heart disease (I30-I31, I40,I42, I51)	38	37	0	20	21	20	18
Cerebrovascular diseases (I60-I69)	34	15	16	24	18	4	8
Subarachnoid hemorrhage (I60)	1	0	0	2	1	0	0
Intracerebral hemorrhage and other nontraumatic intracranial hemorrhage (I61,I62)	18	13	12	18	6	2	8
Cerebral infarction (I63)	1	0	4	3	3	2	0
Stroke, not specified as hemorrhage or infarction (I64)	7	1	0	0	2	0	0
Other cerebrovascular diseases (I67)	7	1	0	1	6	0	0
Aortic aneurysm and dissection (I71)	0	0	1	0	1	1	0
Subtotal	184	161	19	83	80	34	39

Table 7. Causes of Infant Death by Chapters and Block Categories, KSCD* in Korea (1983-2009) (Continued)

Cause of death	1983	1985	1990	1995	2000	2005	2009
	No. of infant deaths						
Disease of the respiratory system (J00-J98)							
Influenza (J09-J11)	28	20	2	25	4	0	2
Pneumonia (J12-J18)	513	391	162	58	21	6	8
Chronic lower respiratory diseases (J40-J47)	49	18	5	13	8	5	0
Chronic bronchitis and not specified as acute or chronic (J40-J42)	42	11	5	10	1	1	0
Other chronic obstructive pulmonary disease (J44)	0	0	0	0	2	0	0
Asthma (J45-J46)	7	7	0	3	5	4	0
Pneumonitis due to solids and liquids (J69)	15	11	20	12	12	4	3
Pulmonary edema (J81)	0	1	1	1	0	1	0
Other respiratory disorders (Re. J00- J98)	83	53	38	16	48	10	16
Subtotal	688	494	229	125	93	26	29
Diseases of the digestive system (K00-K92)							
Diseases of oesophagus, stomach and duodenum (K20-K31)	15	12	0	4	3	1	1
Gastric and duodenal ulcer (K25-K27)	0	0	0	0	1	0	0
Gastritis and duodenitis (K29)	3	2	0	1	1	0	0
Other diseases of stomach and duodenum (Re. K20-K31)	12	10	0	3	1	1	1
Noninfective enteritis and colitis (K50-K52)	0	4	4	12	0	0	0
Paralytic ileus and intestinal obstruction without hernia (K56)	12	16	11	11	7	2	1
Peritonitis (K65)	3	5	0	1	0	0	0
Diseases of liver (K70-K76)	33	5	17	7	6	3	5
Hepatic failure, NEC (K72)	11	5	1	0	1	2	4
Chronic hepatitis, NEC (K73)	0	0	0	0	0	0	0
Fibrosis and cirrhosis of liver (K74)	0	0	0	6	3	1	0
Other diseases of liver (Re. K70- K76)	22	0	16	1	2	0	1
Cholelithiasis (K80)	0	0	0	0	0	0	0
Acute pancreatitis and other diseases of pancreas (K85-K86)	0	0	0	1	0	0	0
Other diseases of digestive system (Re. K00- K92)	11	9	9	10	6	3	3
Subtotal	74	51	41	46	22	9	10
Diseases of the skin and subcutaneous tissue (L00-L98)							
Other diseases of the skin and subcutaneous tissue (Re. L00- L98)	4	0	1	1	0	0	0
Subtotal	4	0	1	1	0	0	0
Diseases of the musculo-skeletal system and connective tissue (M00-M99)							
Other inflammatory polyarthropathies (M08-M13)	1	0	0	0	0	0	0
Systemic connective tissue disorder (M30-M35)	0	0	0	0	0	1	0
Soft tissue disorders (M60-M79)	1	0	0	1	1	0	0
Disorders of bone density and structure (M80-M85)	0	1	0	0	0	0	0
Other disorders of bone density and structure (M83-M85)	0	1	0	0	0	0	0
Osteomyelitis (M86)	1	1	0	0	0	0	0
Other disorders of the musculoskeletal system and connective tissue (Re. M00- M99)	1	0	0	0	1	1	0
Subtotal	4	2	0	1	2	2	0
Diseases of the genitorurinary system (N00-N98)							
Glomerular diseases (N00-N07)	0	2	4	1	0	0	0
Renal failure (N17-N19)	2	1	9	2	2	1	2
Acute renal failure (N17)	1	1	7	1	0	0	1
Chronic renal failure (N18)	0	0	0	1	1	1	1
Unspecified renal failure (N19)	1	0	2	0	1	0	0
Other diseases of urinary system (Re. N00- N98)	3	1	3	1	0	0	0
Subtotal	5	4	16	4	2	1	2

Table 7. Causes of Infant Death by Chapters and Block Categories, KSCD* in Korea (1983-2009) (Continued)

Cause of death	1983	1985	1990	1995	2000	2005	2009
	No. of infant deaths						
Pregnancy, childbirth and the puerperium (O00-O99)	0	0	0	0	0	0	0
Certain conditions originating in the perinatal period (P00-P96)							
Disorders related to length of gestation and fetal growth (P05-P08)	26	28	36	103	159	175	41
Intrauterine hypoxia, birth asphyxia, and respiratory distress of newborn (P20-P22)	3	3	7	24	429	284	281
Other conditions originating in the perinatal period (Re. P00- P96)	47	50	81	127	712	441	385
Subtotal	76	81	124	254	1,300	900	707
Congenital malformations, deformations and chromosomal abnormalities (Q00-Q99)							
Congenital malformations of the nervous system (Q00-Q07)	25	42	34	24	50	30	12
Congenital malformations of the circulatory system (Q20-Q28)	302	334	409	412	361	191	147
Congenital malformations of heart (Q20-Q24)	299	331	385	392	301	130	95
Other congenital malformations of circulatory system (Q25-Q28)	3	3	24	20	60	61	52
Other congenital malformations and chromosome abnormalities (Re. Q00-Q99)	71	85	88	139	274	135	102
Subtotal	398	461	531	575	685	356	261
Symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99)							
Senility (R54)	1	0	1	0	0	0	0
Sudden infant death syndrome (R95)	491	191	8	124	103	75	84
Other sudden death, cause unknown (R96)	1	0	0	4	9	5	2
Others (Re. R00- R99)	610	525	463	194	259	207	109
Subtotal	1,103	716	472	322	371	287	195
External causes of morbidity and mortality (V01-Y89)							
Transport accident (V01-V99)	15	17	42	73	23	6	6
Vehicle accident (V01-V89)	15	17	42	73	23	6	6
Falls (W00-W19)	14	12	5	13	10	5	3
Exposure to inanimate mechanical forces (W20-W49)	0	1	4	4	2	2	2
Explosion (W35-W40)	0	0	0	0	1	0	0
Other exposure to inanimate mechanical forces (Re. W20- W49)	0	1	4	4	1	2	2
Accidental drowning and submersion (W65-W74)	10	6	4	7	2	0	0
Other accidental threats to breathing (W75-W84)	52	67	121	179	49	54	35
Exposure to smoke, fire and flames (X00-X09)	31	14	3	2	3	0	0
Exposure to forces of nature (X30-X39)	0	0	0	0	0	1	1
Exposure to excessive natural cold (X31)	0	0	0	0	0	1	1
Accidental poisoning by and exposure to noxious substances (X40-X49)	22	18	10	2	2	0	0
Accidental poisoning by and exposure to drugs, medicaments and biological substances (X40-X44)	1	0	0	0	1	0	0
Accidental poisoning by and exposure to chemicals and noxious substances (X45-X49)	21	18	10	2	1	0	0
Accidental exposure to other and unspecified factors (X59)	13	10	20	31	8	3	1
Assault (X85-Y09)	5	2	5	9	7	12	24
Assault by hanging, strangulation and suffocation (X91)	1	1	1	4	4	3	8
Others (Re. X85- Y09)	4	1	4	5	3	9	16
Event of undetermined intent (Y10-Y34)	1	0	0	4	2	9	6
Sequelae of external causes of morbidity and mortality (Y85-Y89)	0	1	0	0	0	0	0
Othewr sequelae of external causes of morbidity and mortality (Y86-Y89)	0	1	0	0	0	0	0
Others (Re. V01- Y89)	0	0	2	2	6	4	1
Subtotal	163	148	217	326	114	96	79
Total	3,334	2,563	1,982	1,998	2,882	1,820	1,415

*Korean Standard Classification of Diseases, 5th ed., 2007.

Table 8. Changes in the Ten Major Causes of Infant Death in Korea (1996-2006)¹⁰⁾

Order	Group by ICD	1996 (n=5,371)	1999 (n=3,834)	2002 (n=2,631)	2005 (n=2,062)	2006 (n=1,856)	2007 (n=1,788)	2008 (n=1,652)
1	Respiratory distress of newborn	8.3	10.9	12.1	11.4	12.9	17.6	19.6
2	Symptoms, signs and abnormal clinical and laboratory findings, NEC	7.2	7	10.9	14.3	11.6	6.8	7.7
3	Other disorders originating in the perinatal period	22	7.3	10.7	7.6	8.9	8.5	7.3
4	Congenital malformation of heart	9.1	0	8.4	6.5	6.6	8.0	7.1
5	Other respiratory conditions originating in the perinatal period	5.6	8.9	9.1	8.7	9.6	7.8	6.7
6	Sudden infant death syndrome	-	3.7	3.8	-	-	4.5	6.6
7	Bacterial sepsis of newborn	8.4	8.2	9.4	8.1	8.2	4.6	5.9
8	Other congenital malformation	3.8	5	7.4	5.7	5.4	8.1	5.7
9	Disorders related to length of gestation and fetal growth	8.0	9	8.3	8.7	7.4	5.1	4.8
10	Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	3.2	-	4.4	4.3	4.8	-	3.8
	Intrauterine hypoxia, birth asphyxia	3.5	3.9	-	-	-	4.1	-
	Congenital malformation of circulatory system	-	-	-	3.4	2.9	-	-
	Others	20.9	19.0	15.4	21.5	21.6	24.9	24.7
	Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Values are presented as (%).

2) Classified by block categories of KCD: causes and numbers of infant death⁹⁾

The causes and numbers of infant death classified by block categories of KCD are shown in Table 7. In order of frequency, they are symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99) 33.1%, diseases of the respiratory system (J00-J98) 20.6%, congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) 11.9%, certain infectious and parasitic diseases (A00-B99) 9.6%, diseases of the nervous system (G00-G98) 6.6%, diseases of the circulatory system (I00-I99) 5.5%, external causes of morbidity and mortality (V01-Y89) 4.9%, certain conditions originating in the perinatal period (P00-P96) 2.3%, diseases of the digestive system (K00-K92) 2.2%, neoplasms (C00-D48) 1.2%, and endocrine, nutritional and metabolic diseases (E00-E88) 1.0%. On the other hand, a change was observed in 2009. In order of frequency, the causes were conditions originating in the perinatal period (P00-P96) 50.0%, congenital malformations, deformations and chromosomal abnormalities (Q00-Q99) 18.4%, symptoms, signs and abnormal clinical and laboratory findings, NEC (R00-R99) 13.8%, external causes of morbidity and mortality (V01-Y89) 5.6%, diseases of the circulatory system (I00-I99) 2.8%, diseases of the nervous system (G00-G98) 2.3%, diseases of the respiratory system (J00-J98) 2.0%, certain infectious and parasitic diseases (A00-B99) 1.7%, neoplasms (C00-D48) 1.4%, endocrine, nutritional and metabolic diseases (E00-E88) 1.0%, and diseases of the digestive system (K00-K92) 1.0%.

3) Changes in the ten major causes of infant death (1996-2008)¹⁰⁾

The changes in the ten major causes of infant death in 1996, 1999, 2002, 2005, 2006, 2007, and 2008 in Korea by Choi's study¹⁰⁾ of KIHASA are shown in Table 8. Common causes of infantile death in 2008 had decreased compared with those in 1996 such as other disorders originating in the perinatal period, congenital malformation of the heart, bacterial sepsis of newborns, disorders related to length of gestation and fetal growth, intra-uterine hypoxia, birth asphyxia. However, some other causes are on the increase, such as respiratory distress of newborn, symptoms, other respiratory conditions originating in the perinatal period, other congenital malformation, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism.

Discussion

The NMR of Korea decreased from 6.6 in 1993 to 4.1 in 1996, 3.8 in 1999, 3.3 in 2002, 2.8 in 2005, 2.5 in 2006, 2.0 in 2007, 1.8 in 2008 and 1.7 in 2009, showing a remarkably decreasing trend. Despite the recent high risk of neonatal morbidity due to increasing premature birth rates, the remarkable advances in NMR were partly influenced by highly advanced neonatal intensive care technique during the last 30 years¹¹⁾. In addition, the reduced perinatal mortality rate during the last 20 years (6.0 in 1996, 5.2 in 1999, 4.6 in 2002, 4.2 in 2005, 3.6 in 2006, 3.7 in 2007, 3.6 in 2008, and 3.4 in 2009) influenced the lowered NMR as well¹²⁾. With decreasing NMR, the proportion of early NMR was 79% in 1993 and 68% in 2009, but the proportion

was still over two-thirds the entire NMR, emphasizing the importance of early period neonatal management.

In addition, IMR has shown a decreasing pattern (9.9 in 1993, 7.7 in 1996, 6.2 in 1999, 5.3 in 2002, 4.7 in 2005, 4.1 in 2006, 3.5 in 2007, 3.4 in 2008 and 3.2 in 2009). In comparison with Korea, Japan and USA, the IMR of Japan and USA were 4.6 and 9.0 in 1990, 3.1 and 8.0 in 2000, 2.8 and 6.4 in 2005, and 2.8 and 6.3 in 2009, respectively, which means the IMR of Korea is higher than that of Japan but lower than that of USA. Japan has the lowest IMR in the world, which allows us to speculate on the reason why it is lower than Korea. Reasons include operating perinatal health care centers and localization of neonatal care networks which are not yet established in Korea. On the other hand, the IMR of USA is higher than that of Korea, most likely because of different ethnicities in USA, difficulty accessing medical services, increased high risk pregnancy such as teenage or old age pregnancy, multiple gestation, and increased preterm birth⁸⁾.

When we compare Korean IMR with other OECD nations, the IMR of Korea and the mean of OECD are as follows: 7.7 and 8.1 in 1996, 6.2 and 7.1 in 1999, 5.3 and 6.5 in 2002, 4.1 and 4.9 in 2006 and 3.4 and 4.7 in 2008 showing the encouraging fact that Korea has a lower IMR than OECD countries over the last 20 years. Korea ranked 13th position in 2008 among all the OECD countries⁸⁾.

The ratio of NMR in IMR was 66.7% in 1993 and dropped to 53.1% in 2009, but NMR still consists of approximately half of IMR, which shows that neonatal mortality has an important place in IMR in Korea, and neonatal period management is much more important.

In changes in the ten major causes of neonatal death from 1996 to 2008 in Korea, respiratory distress of newborns, diseases of the blood and blood-forming organs as well as certain disorders involving the immune mechanism, symptoms, signs and abnormal clinical and laboratory findings, NEC, other congenital malformation, and others increased in ratio. In contrast, other respiratory conditions originating in the perinatal period, bacterial sepsis of newborns, disorders related to length of gestation and fetal growth, other respiratory conditions originating in the perinatal period, congenital malformation of heart, intrauterine hypoxia, birth asphyxia were decreased in trend.

Common causes of infantile death in 2008 had decreased compared with those in 1996 such as other disorders originating in the perinatal period, congenital malformation of the heart, bacterial sepsis of newborns, disorders related to length of gestation and fetal growth, intra-uterine hypoxia, birth asphyxia. However, some other causes are on the increase, such as respiratory distress of newborn, symptoms, other respiratory conditions originating in the perinatal period, other congenital malformation, diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism. Therefore, establishing solutions against these problems is important¹⁰⁾.

Conclusions

The authors reviewed improvements in IMR over the last 60 years and NMR during last 20 years in Korea, finding remarkably encouraging advances. Although Korean IMR is higher than that of Japan, it is much lower than that of the USA and other OECD nations. Changes in the neonatal and infantile causes of death related to improved NMR and IMR were also analyzed. Our analysis may further improve the NMR and IMR in the future in Korea.

Changes in the neonatal and infantile causes of death related to improved NMR and IMR were also analyzed. Our analysis may further improve the NMR and IMR in the future in Korea.

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