図 2-3

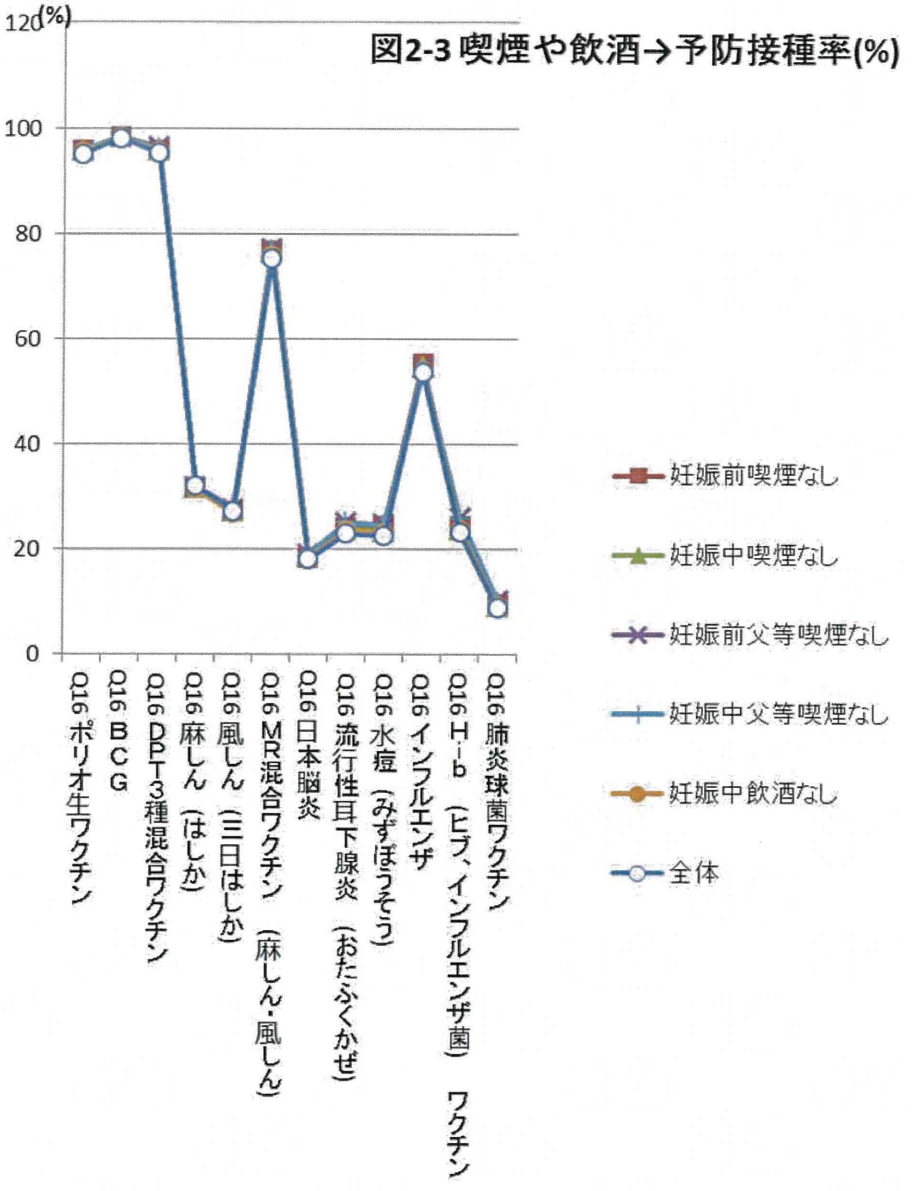
図2-3 喫煙や飲酒→予防接種率(%)
(%)
120
100
80
60
40
20
0
Q16 ポリオ生ワクチン
Q16 BCG
Q16 DPT3種混合ワクチン
Q16 麻しん（はしか）
Q16 風しん（三日はしか）
Q16 MR混合ワクチン（麻しん・風しん）
Q16 日本脳炎
Q16 流行性耳下腺炎（おたふくかぜ）
Q16 水痘（みずぼうそう）
Q16 インフルエンザ
Q16 Hib（ヒブ、インフルエンザ菌）ワクチン
Q16 肺炎球菌ワクチン
妊娠前喫煙なし
妊娠中喫煙なし
妊娠前父等喫煙なし
妊娠中父等喫煙なし
妊娠中飲酒なし
全体

図 2-4

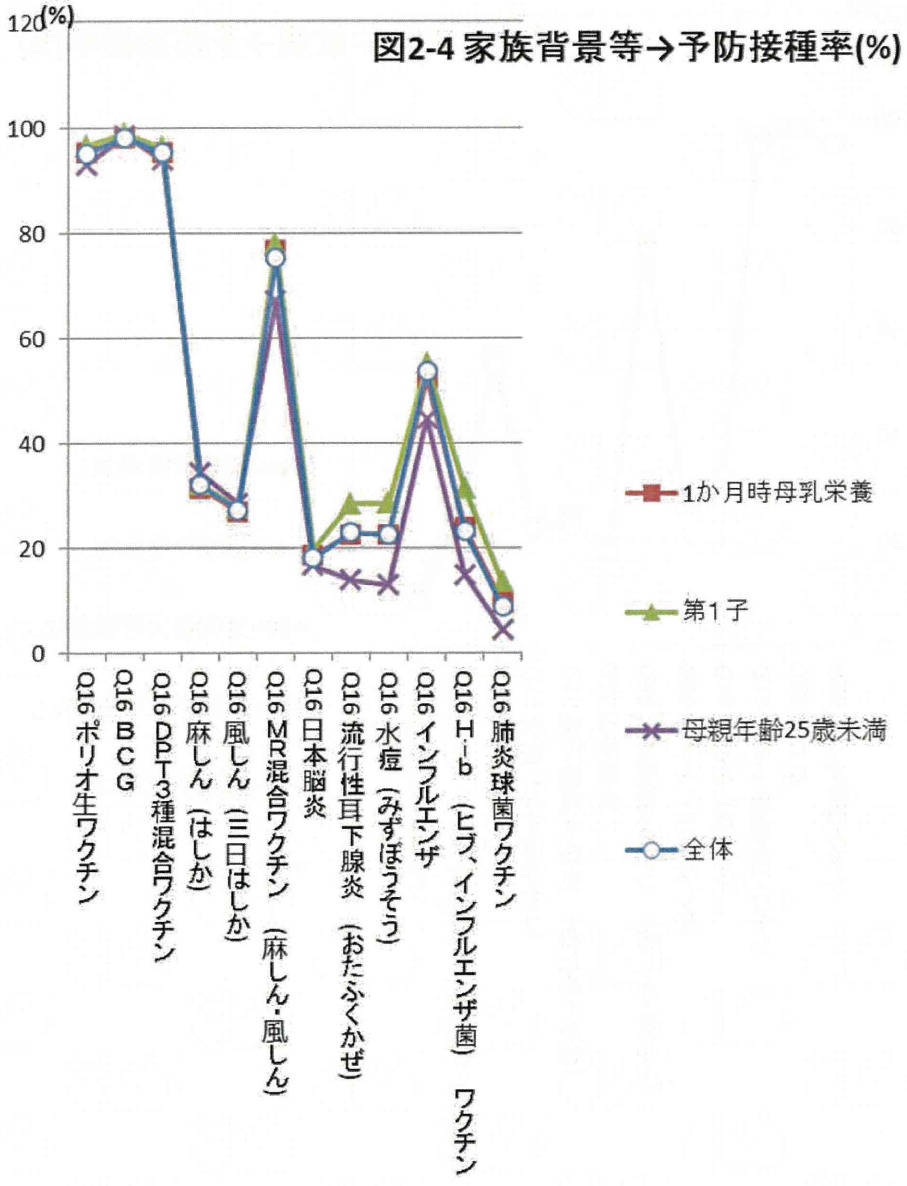
図2-4 家族背景等→予防接種率(%)
(%)
120
100
80
60
40
20
0
Q16 ポリオ生ワクチン
Q16 BCG
Q16 DPT3種混合ワクチン
Q16 麻しん（はしか）
Q16 風しん（三日はしか）
Q16 MR混合ワクチン（麻しん・風しん）
Q16 日本脳炎
Q16 流行性耳下腺炎（おたふくかぜ）
Q16 水痘（みずぼうそう）
Q16 インフルエンザ
Q16 Hib（ヒブ、インフルエンザ菌）ワクチン
Q16 肺炎球菌ワクチン
1か月時母乳栄養
第1子
母親年齢25歳未満
全体

図 3-1

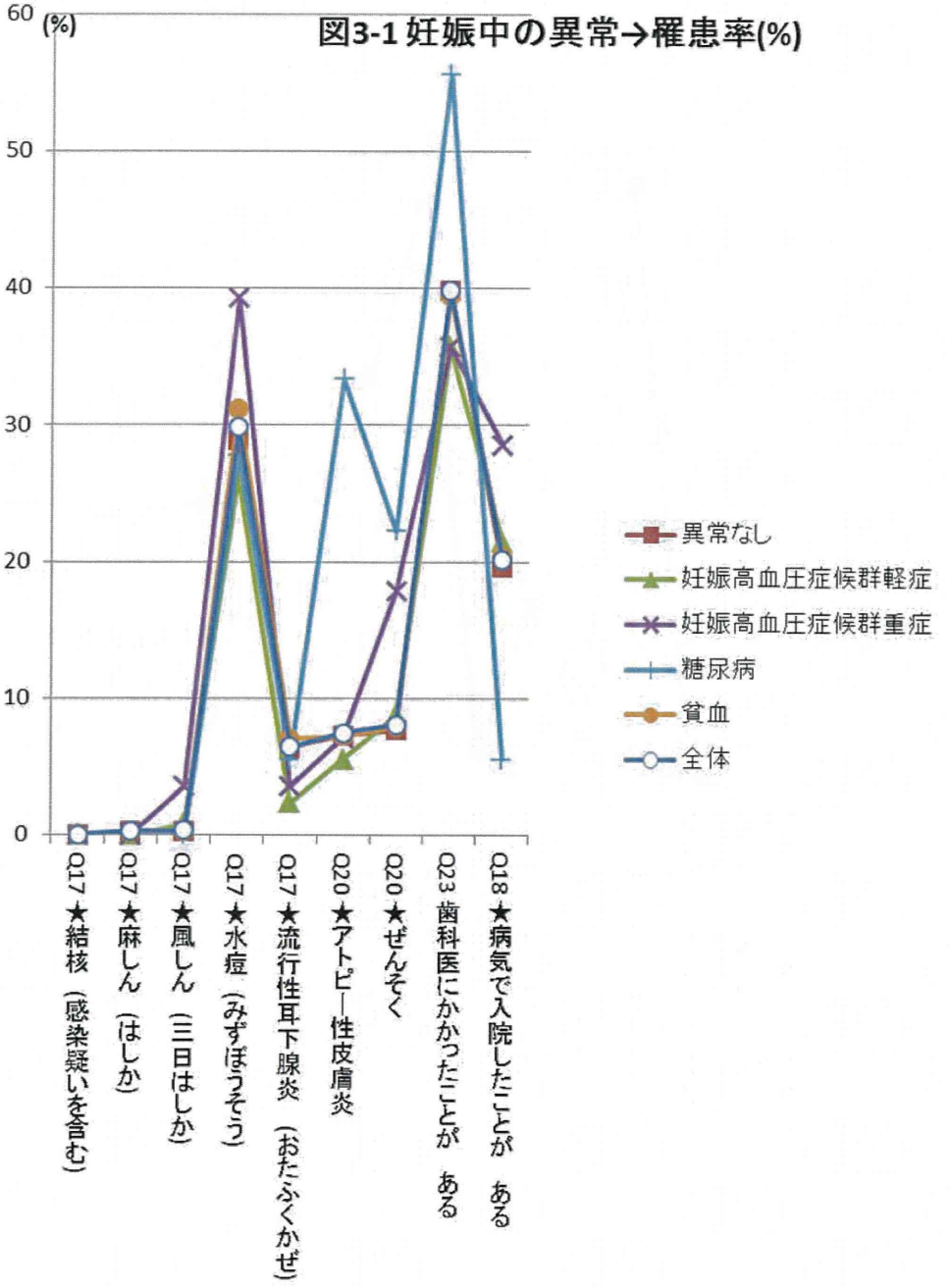
図3-1 妊娠中の異常→罹患率(%)
60
(%)
50
40
30
20
10
0
異常なし
妊娠高血圧症候群軽症
妊娠高血圧症候群重症
糖尿病
貧血
全体
Q17 ★結核（感染疑いを含む）
Q17 ★麻しん（はしか）
Q17 ★風しん（三日はしか）
Q17 ★水痘（みずぼうそう）
Q17 ★流行性耳下腺炎（おたふくかぜ）
Q20 ★アトピー性皮膚炎
Q20 ★ぜんそく
Q23 歯科医にかかったことがある
Q18 ★病気で入院したことがある

図 3-2

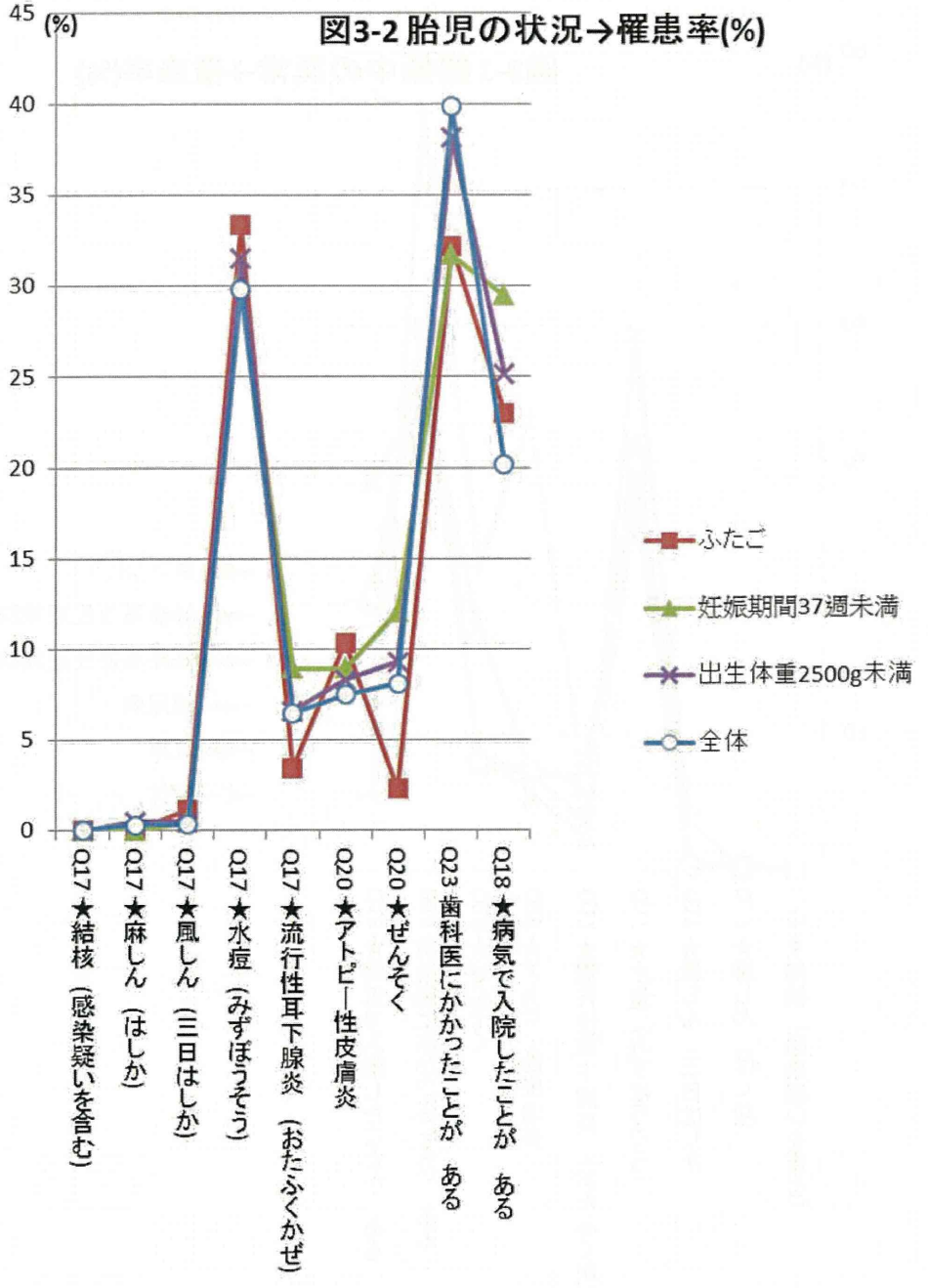
図3-2 胎児の状況→罹患率(%)
(%)
45
40
35
30
25
20
15
10
5
0
ふたご
妊娠期間37週未満
出生体重2500g未満
全体
Q17 ★結核（感染疑いを含む）
Q17 ★麻しん（はしか）
Q17 ★風しん（三日はしか）
Q17 ★水痘（みずぼうそう）
Q17 ★流行性耳下腺炎（おたふくかぜ）
Q20 ★アトピー性皮膚炎
Q20 ★ぜんそく
Q23 歯科医にかかったことがある
Q18 ★病気で入院したことがある

図 3-3

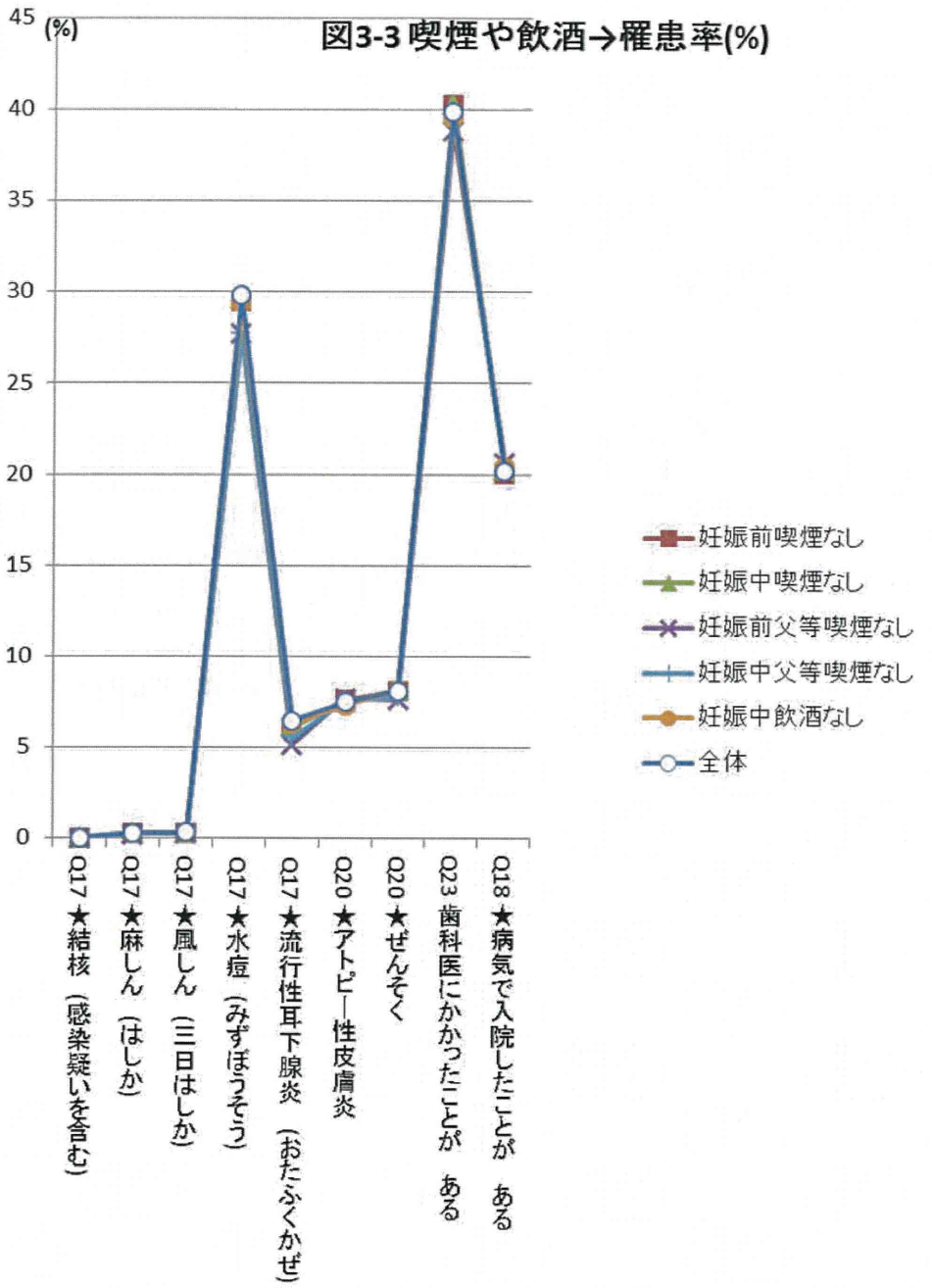
図3-3 喫煙や飲酒→罹患率(%)
(%)
45
40
35
30
25
20
15
10
5
0
Q17★結核（感染疑いを含む）
Q17★麻しん（はしか）
Q17★風しん（三日はしか）
Q17★水痘（みずぼうそう）
Q17★流行性耳下腺炎（おたふくかぜ）
Q20★アトピー性皮膚炎
Q20★ぜんそく
Q23 歯科医にかかったことがある
Q18★病気で入院したことがある
妊娠前喫煙なし
妊娠中喫煙なし
妊娠前父等喫煙なし
妊娠中父等喫煙なし
妊娠中飲酒なし
全体

図 3-4

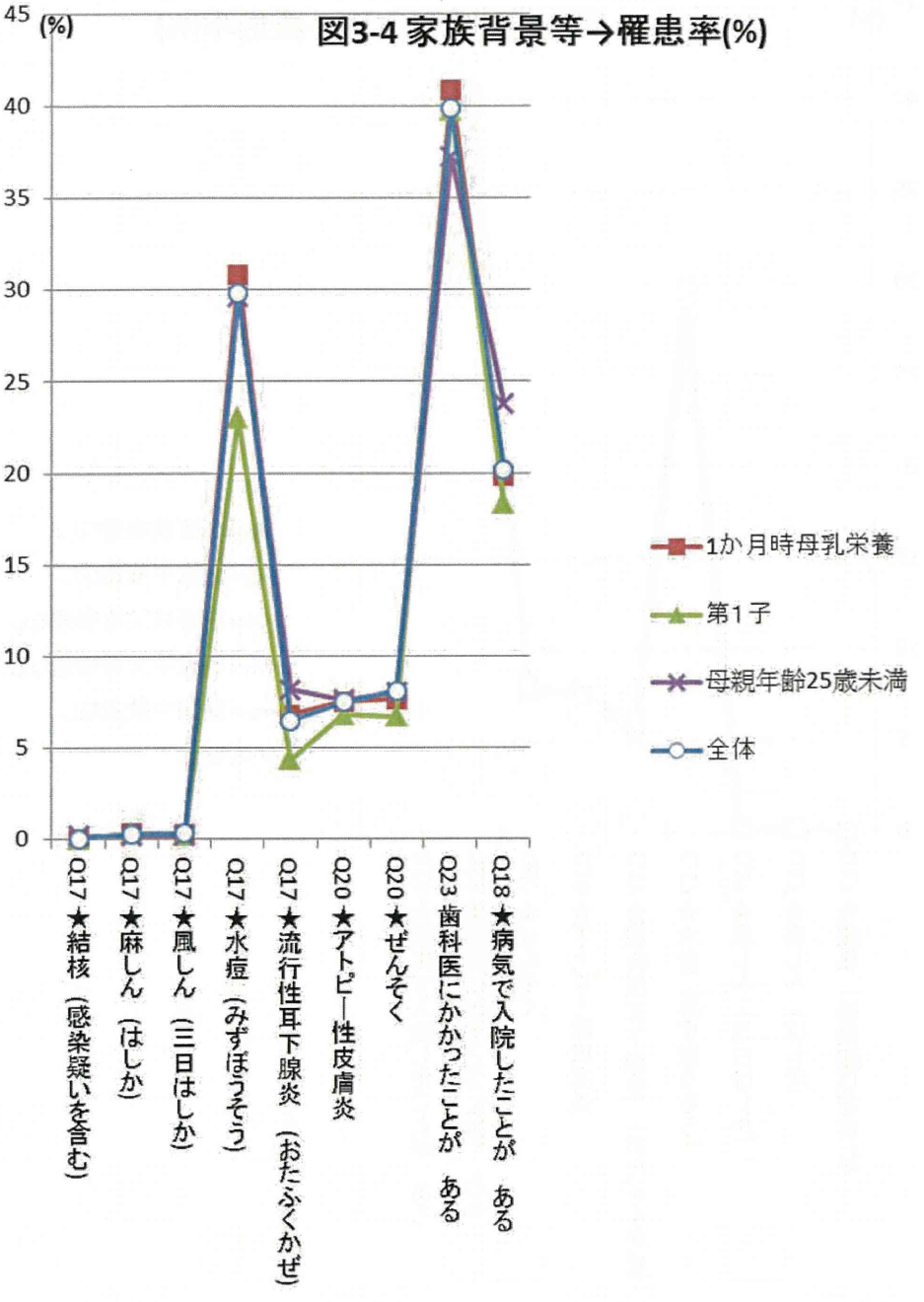
図3-4 家族背景等→罹患率(%)
45
(%)
40
35
30
25
20
15
10
5
0
Q17 ★結核 (感染疑いを含む)
Q17 ★麻しん (はしか)
Q17 ★風しん (三日はしか)
Q17 ★水痘 (みずぼうそう)
Q17 ★流行性耳下腺炎 (おたふくかぜ)
Q20 ★アトピー性皮膚炎
Q20 ★ぜんそく
Q23 歯科医にかかったことが ある
Q18 ★病気で入院したことが ある
1か月時母乳栄養
第1子
母親年齢25歳未満
全体

図 4-1

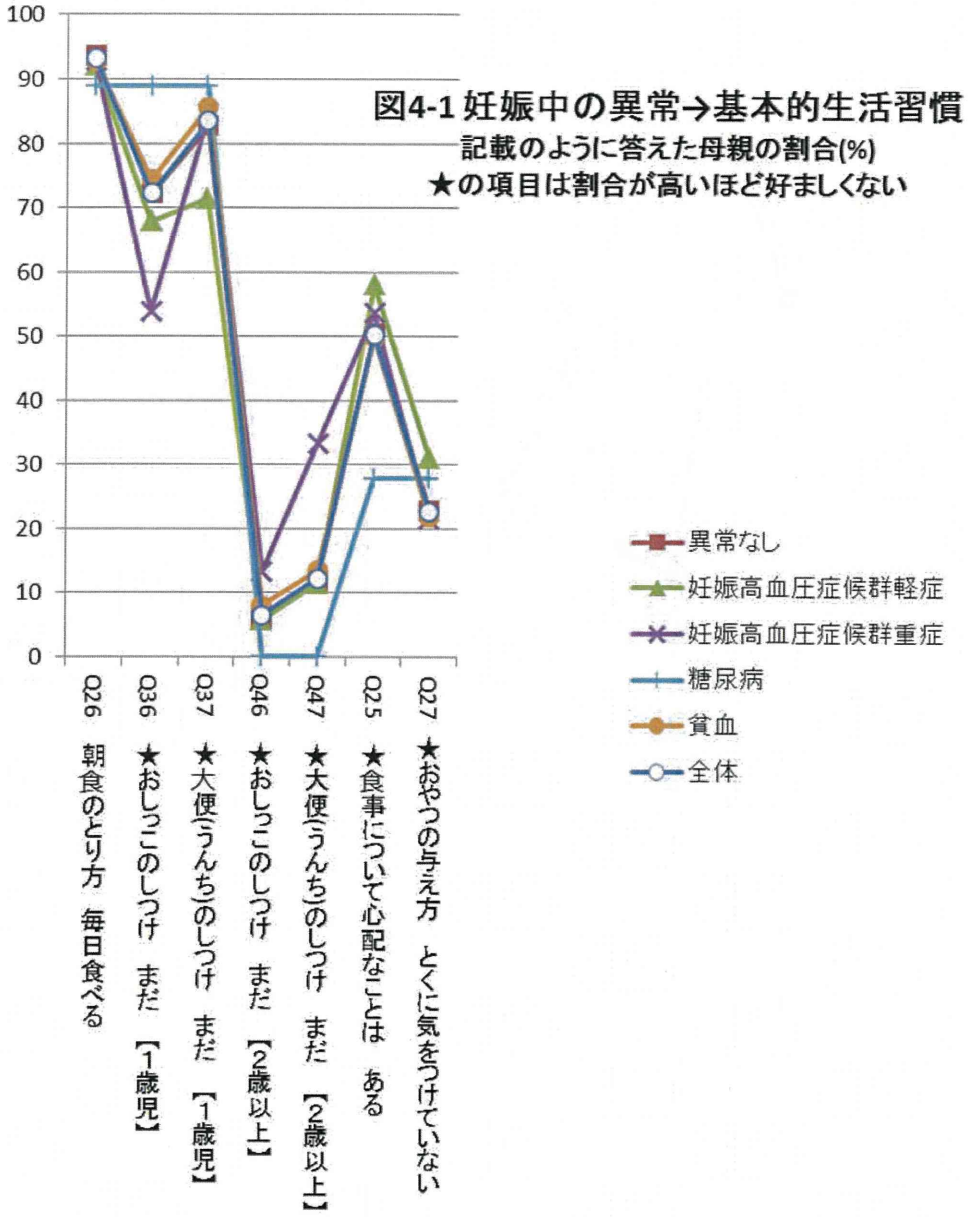
図4-1 妊娠中の異常→基本的生活習慣
記載のように答えた母親の割合(%)
★の項目は割合が高いほど好ましくない
100
90
80
70
60
50
40
30
20
10
0
Q26 朝食のとり方 毎日食べる
Q36 ★おしっこのしつけ まだ 【1歳児】
Q37 ★大便(うんち)のしつけ まだ 【1歳児】
Q46 ★おしっこのしつけ まだ 【2歳以上】
Q47 ★大便(うんち)のしつけ まだ 【2歳以上】
Q25 ★食事について心配なことは ある
Q27 ★おやつの与え方 とくに気をつけていない
異常なし
妊娠高血圧症候群軽症
妊娠高血圧症候群重症
糖尿病
貧血
全体

図 4-2

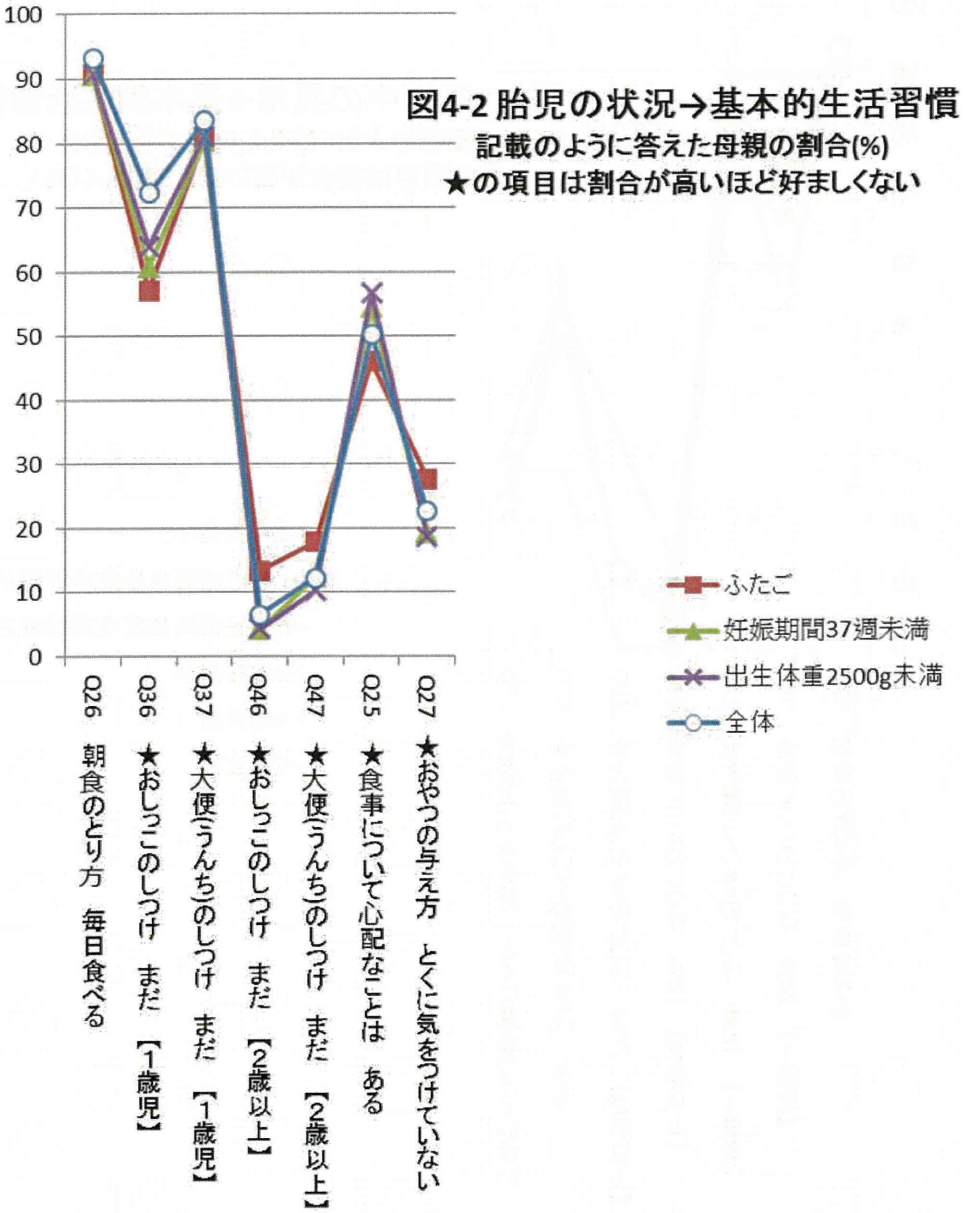
図4-2 胎児の状況→基本的生活習慣
記載のように答えた母親の割合(%)
★の項目は割合が高いほど好ましくない
100
90
80
70
60
50
40
30
20
10
0
Q26 朝食のとり方 毎日食べる
Q36 ★おしっこのしつけ まだ【1歳児】
Q37 ★大便(うんち)のしつけ まだ【1歳児】
Q46 ★おしっこのしつけ まだ【2歳以上】
Q47 ★大便(うんち)のしつけ まだ【2歳以上】
Q25 ★食事について心配なことは ある
Q27 ★おやつの与え方 とくに気をつけていない
ふたご
妊娠期間37週未満
出生体重2500g未満
全体

図 4-3

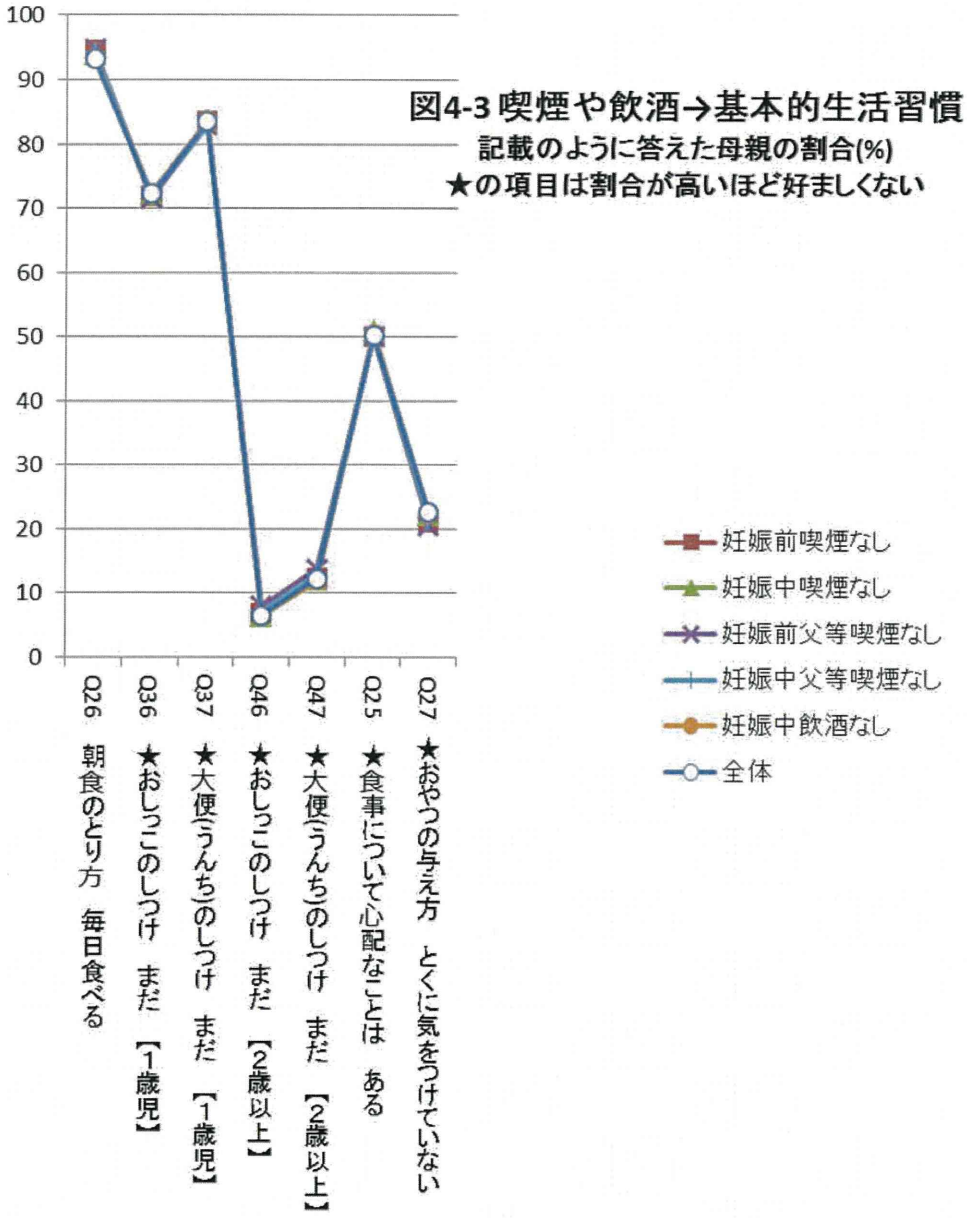
図4-3 喫煙や飲酒→基本的生活習慣
記載のように答えた母親の割合(%)
★の項目は割合が高いほど好ましくない
100
90
80
70
60
50
40
30
20
10
0
Q26 朝食のとり方 毎日食べる
Q36 ★おしっこのしつけ まだ【1歳児】
Q37 ★大便(うんち)のしつけ まだ【1歳児】
Q46 ★おしっこのしつけ まだ【2歳以上】
Q47 ★大便(うんち)のしつけ まだ【2歳以上】
Q25 ★食事について心配なことは ある
Q27 ★おやつの与え方 とくに気をつけていない
妊娠前喫煙なし
妊娠中喫煙なし
妊娠前父等喫煙なし
妊娠中父等喫煙なし
妊娠中飲酒なし
全体

図 4-4

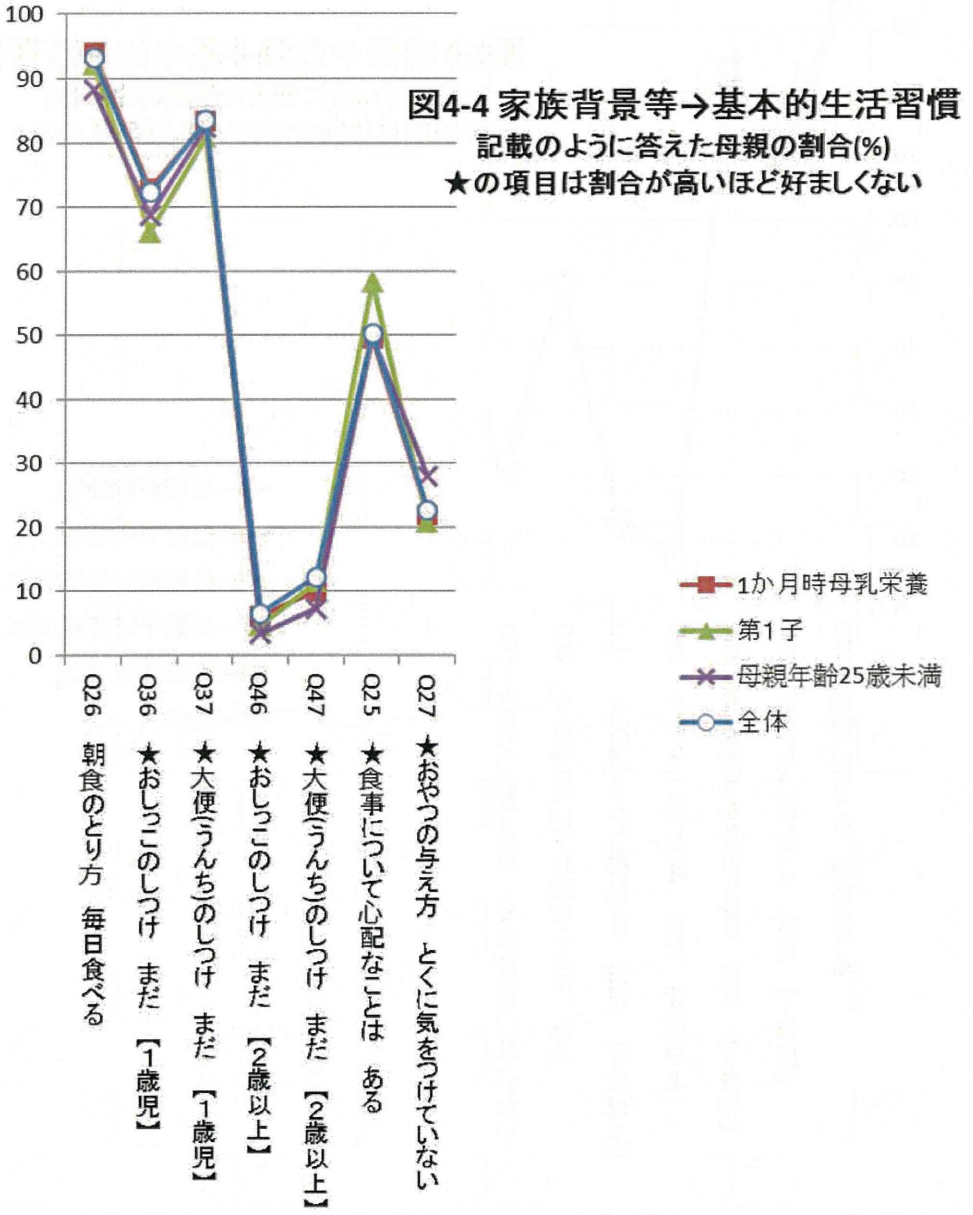
図4-4 家族背景等→基本的生活習慣
記載のように答えた母親の割合(%)
★の項目は割合が高いほど好ましくない
100
90
80
70
60
50
40
30
20
10
0
Q26 朝食のとり方 毎日食べる
Q36 ★おしっこのしつけ まだ 【1歳児】
Q37 ★大便(うんち)のしつけ まだ 【1歳児】
Q46 ★おしっこのしつけ まだ 【2歳以上】
Q47 ★大便(うんち)のしつけ まだ 【2歳以上】
Q25 ★食事について心配なことは ある
Q27 ★おやつの与え方 とくに気をつけていない
1か月時母乳栄養
第1子
母親年齢25歳未満
全体

Technical report for Japanese National Growth Survey for infants and children in 2010

March 31, 2012.

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[1] Area on community health system research, National Institute of Public Health

[2] Department of health promotion, National Institute of Public Health

1. Growth reference of Japanese infants and children

As major international child growth standards, those issued by the WHO in 2006 (http://www.who.int/childgrowth/en/) and those announced by the CDC of the United States in 2000 (http://www.cdc.gov/growthcharts/) are well known. The latter were a revision of the 1977 edition.

A notable characteristic of the growth reference of Japanese infants and children is that they have been monitored at 10-year intervals over more than half a century. Following the standards called Kuriyama/Yoshinaga reference (University of Tokyo Department of Pediatrics Values) reported on the basis of an investigation in healthy children in the suburbs of Tokyo in 1930 , and those compiled primarily by the National Institute of Public Health on the basis of surveys funded by the Ministry of Education and conducted in 1940 and 1950 (called Saito/Shimizu reference and Saito/Funakawa reference, respectively), governmental surveys were carried out every 10 years since 1960 until the 6th survey in 2010. Since the surveys provided data collected over a period of 1 month, there are limitations including the smallness of the data size, but the values collected by the surveys in and after 1980 show internationally unrivaled details of the state of growth in the neonatal period, including physiologic postnatal body weight loss.

The growth survey of infants and children in 2010 was conducted by the Equal Employment, Children and Families Bureau, Ministry of Health, Labour and Welfare with the cooperation of academic experts. For the planning and evaluation of the survey, the Research Group for the Planning and Evaluation of Child Physical Development Survey was established in the Equal Employment, Children and Families Bureau, and cooperation by the Research on the Methods of Statistical Analysis of Child Physical Development Surveys and Uses of the Results (Principal Investigator: Tetsuji Yokoyama) funded by a Health and Labour Sciences Research Grant 2011 was obtained.

As the results of the survey were disclosed in October 2011 (http://www.mhlw.go.jp/stf/houdou/2r9852000001t3so.html in Japanese), part of them are presented with commentaries.

2. Survey methods

The survey consisted of general and hospital surveys.

The subjects of the general survey were infants and children aged 14 days or above and less than 2 years on the day of the survey in 3,000 areas sampled at random by stratification from the census areas in 2005 and children aged 2 years or above and less than the elementary school age in 900 areas selected from the above 3,000 areas. The survey was performed between September 1 and 30, 2010 in a mass health screening for infants and children, in principle, and data were obtained from 7,652 children.

In the hospital survey, infants who were born at 150 of the hospitals all over Japan with an obstetric department and beds for inpatients were selected from the Basic File of Medical Facilities, 2010 and underwent the 1-month health check in September 2010. Data on 4,774 infants were obtained from 146 hospitals.

The instruments and methods employed for physical measurements of infants and children were in conformity with the Guidelines for the Survey of Physical Growth of Children distributed at the survey. Physical measurements

were performed in the supine position in those aged less than 2 years and in the standing position in those aged 2 years or above. The head girth was measured along the line passing the glabella and external occipital protuberance, and the chest girth was measured in the plane passing the bilateral nipples and perpendicular to the body axis.

3. Preparation of growth curves

The data were summarized at the Equal Employment, Children and Families Bureau, Ministry of Health, Labour and Welfare. The values considered to be abnormal were checked with the individual cards, and those confirmed to be abnormal were excluded. Since accidental variation was noted due to the limitation of the number of subjects, the values included in the 0.01% on the top and bottom of the distribution were excluded, the remaining values were smoothed by the LMS method (Cole TJ. The LMS method for constructing normalized growth standards. Eur J Clin Nutr 1990;44(1):45-60.) , and percentile curves were created.

The percentile method used to express growth values is a method to statistically present a given percentile value as a point in the distribution up from the lowest. The 3, 10, 25, 50, 75, 90, and 97 percentile values of each measured item are indicated separately for boys and girls, and these values correspond to the values at 3, 10, 25, 50, 75, 90, and 97% from the lowest.

By the LMS method, the distribution is expressed by the following 3 parameters:

L: The parameter showing the skewness of distribution. The distribution is symmetric when L=1, trails long to smaller values when L>1, and trails long to larger values when L<1.

M: Represents the median value of distribution.

S: The parameter showing the variation of the distribution.

In calculating growth values, the values of L, M, and S were calculated for various age levels, which were set at 5-day intervals until 2 months after birth, 1-month intervals until 2 years after birth, and 6-month intervals after the age of 2 years.

The values of L, M, and S calculated for each age level were smoothed using a cubic spline function. The cubic spline function, which smoothly connects several cubic equations horizontally at junctions, is one of the most frequently used methods for smoothing. At each junction, the linear and quadratic differential coefficients are equal between the two cubic functions.

From the values of L, S, and M smoothed by the cubic equation, a given percentile value can be calculated using the following equation:

$M(1-ZLS)^{1/L}$,

where Z is the corresponding percent point in the standard normal distribution. The growth values thus prepared make a smooth curve.

For example, in the 3 percentile curve of the body weight (g) of children aged 5 days to 6 months in which x is for age, L, M, and S are

$L=0.991051x^3-2.39516x^2+0.331977x+1.31741$

$M=15570.73x^3-28353.3x^2+20734.37x+2612.62$

$S=-0.04499x^3+0.139317x^2-0.14798x+0.150307$

and M(1-1.88049LS)1/L, which combines them, represents the curve. The value -1.88049 is Z corresponding to 3% in the standard normal distribution.

Concerning the body weight, daily values are calculated according to the data collected at the hospitals until 5

days after birth to reflect the body weight loss shortly after birth. The daily values are presented until 5 days after birth, because neonates are discharged most frequently 5 days after birth, and body weight changes of normal neonates are considered to be observed during this period.

4. Publicized growth references

The growth values of body weight, stature, chest circumference, and head circumference are shown in Figures 1-1 to 4-2 separately for boys and girls (Shown in the Manual for the Evaluation of Physical Development of Infants and Children http://www.niph.go.jp/soshiki/07shougai/hatsuiku/ in Japanese).

The body weight, stature and chest circumference decreased slightly in both boys and girls since the survey in 2000, but the head circumference showed little difference, compared with the values of the previous survey.

In the subjects of this survey, the body weight and height at birth also decreased slightly compared with the data in 2000. Since the items evaluated in this survey were limited, sufficient validation was impossible, but the analysis of factors that possibly affected the data suggested the effects of the duration of pregnancy, maternal age, number of fetuses, and maternal smoking. Multivariate analysis using related items showed that shortening of the duration of pregnancy contributed to about half of the decrease in the birth weight and that the effects of other factors were small.

Figures 5-1 and 5-2 show the height-weight- for –stature curve prepared for obesity evaluation (obeseness and leanness). This curve was obtained by expressing the body weight as a second degree equation of the height (Body weight = $a \times height^2 + b \times height + c$). a, b, and c were determined to minimize the square of the difference between the true weight of each child and the value calculated from the height by the second-degree equation. For example, a 30% obesity level is a result of multiplication of the value of the standard curve calculated as above by 1.3.

New growth values have been described above, but the Japanese Association for Human Auxology and the Japanese Society for Pediatric Endocrinology are jointly advocating that the values in 2000 should be used as standards of Japanese children. The interrelations between these values and the latest growth values are organized in the Manual for the Evaluation of Physical Development of Infants and Children (http://www.niph.go.jp/soshiki/07shougai/hatsuiku/ in Japanese) issued by the Ministry of Health, Labour and Welfare in March 2012.

Figure 1-1 Length and weight for male infants (2010)

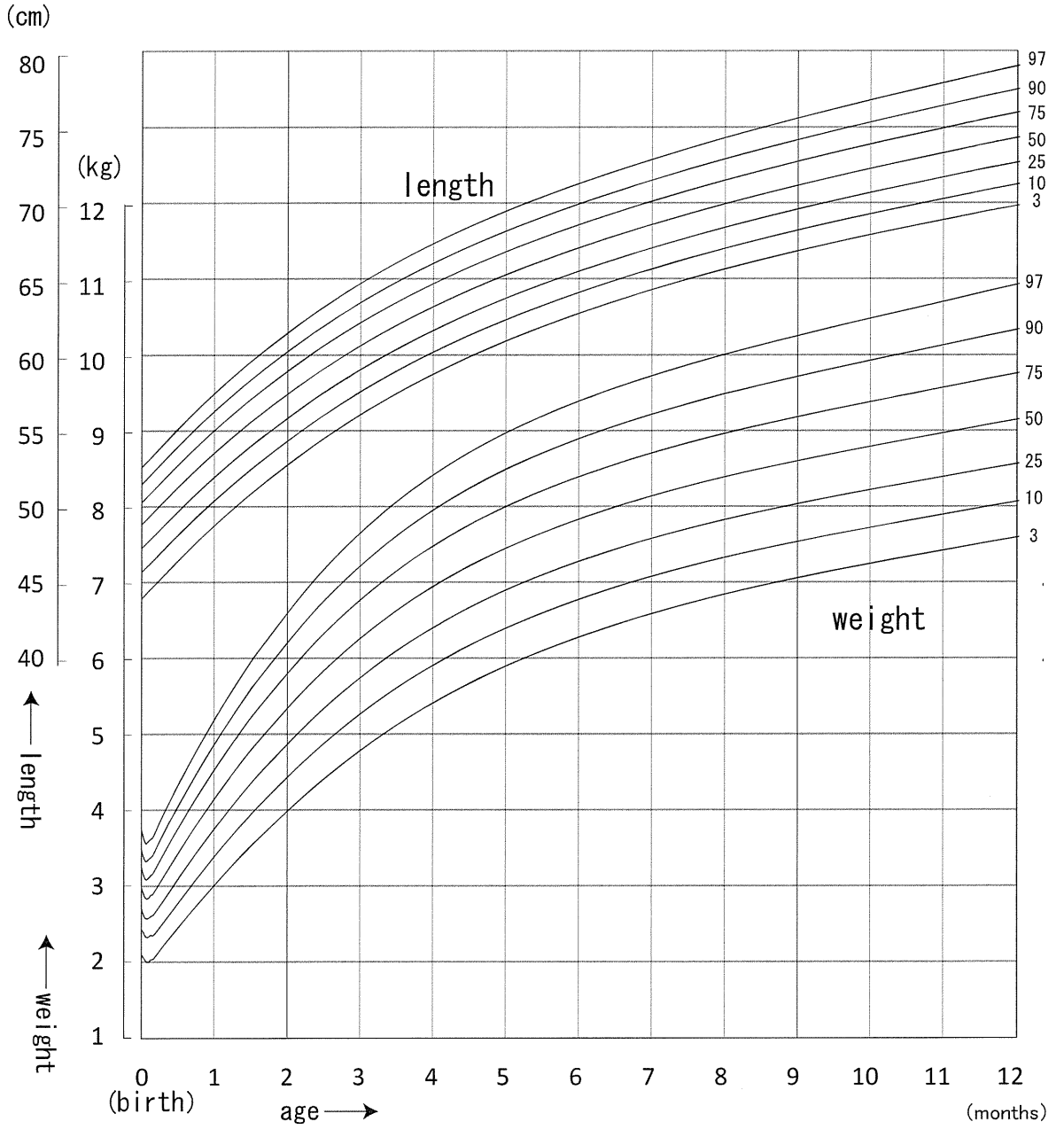

Figure 1-2 Stature and weight for male children (2010)

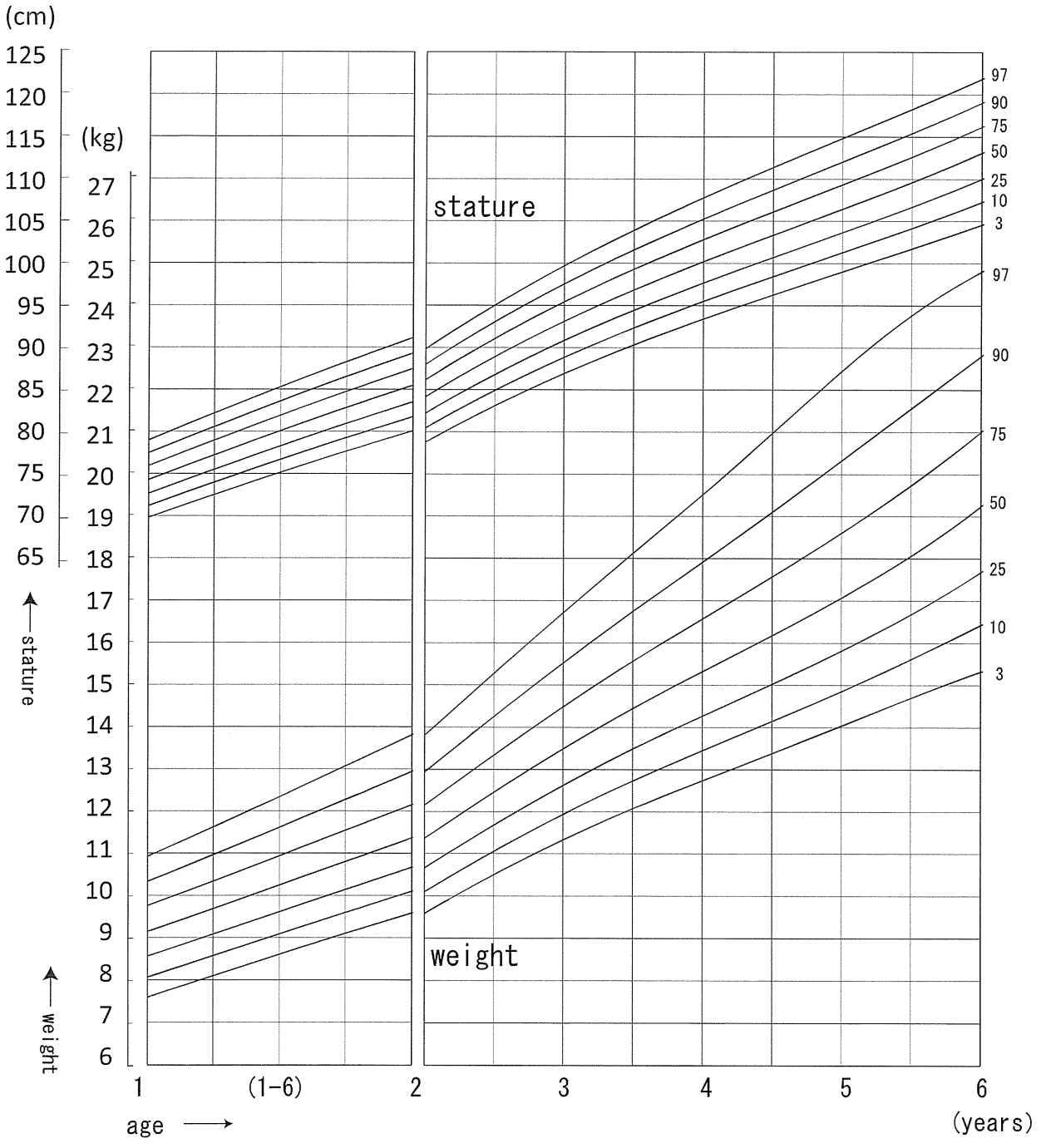

Figure 2－1　Length and weight for female infants (2010)

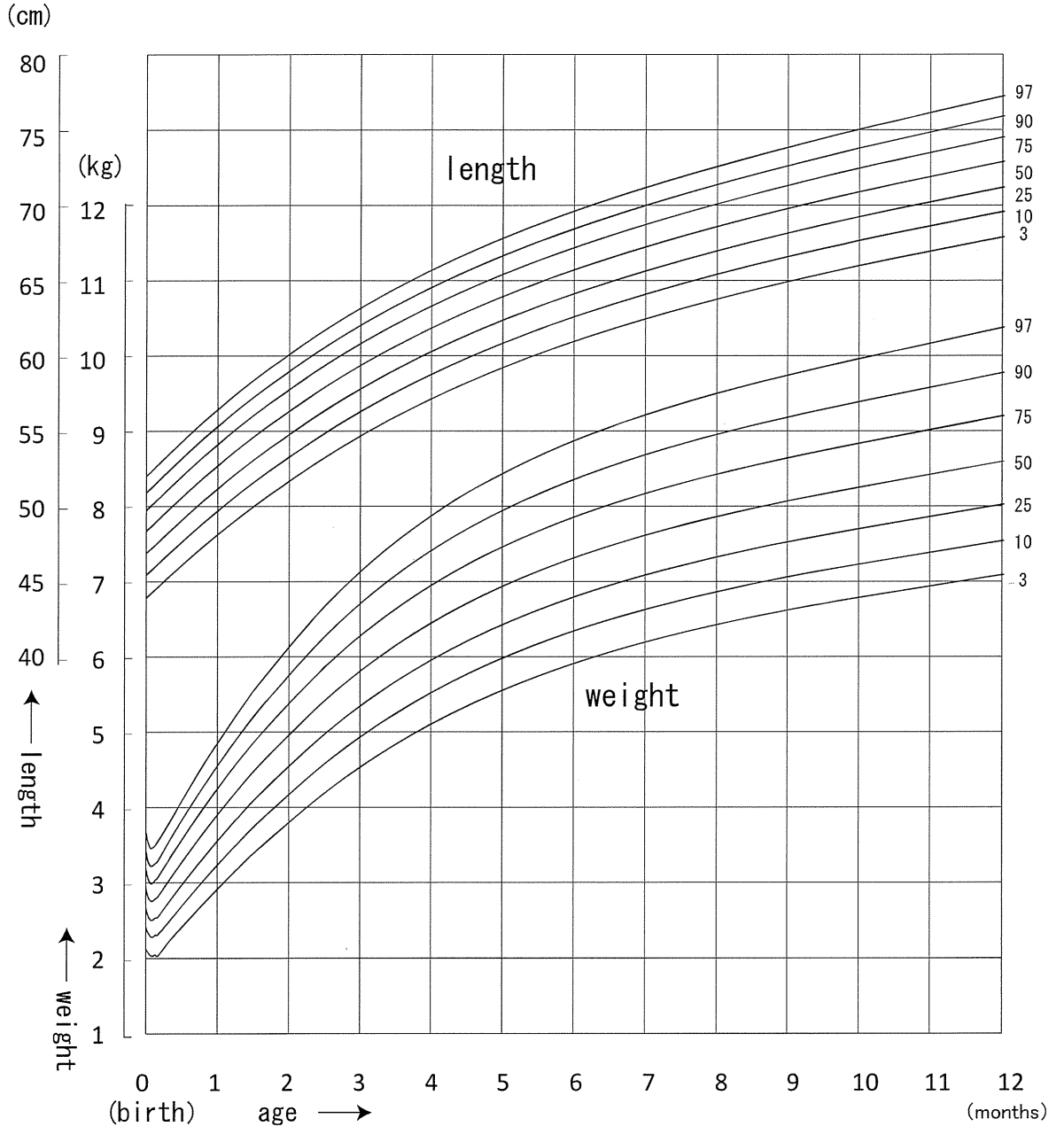

Figure 2-2 Stature and weight for female children (2010)

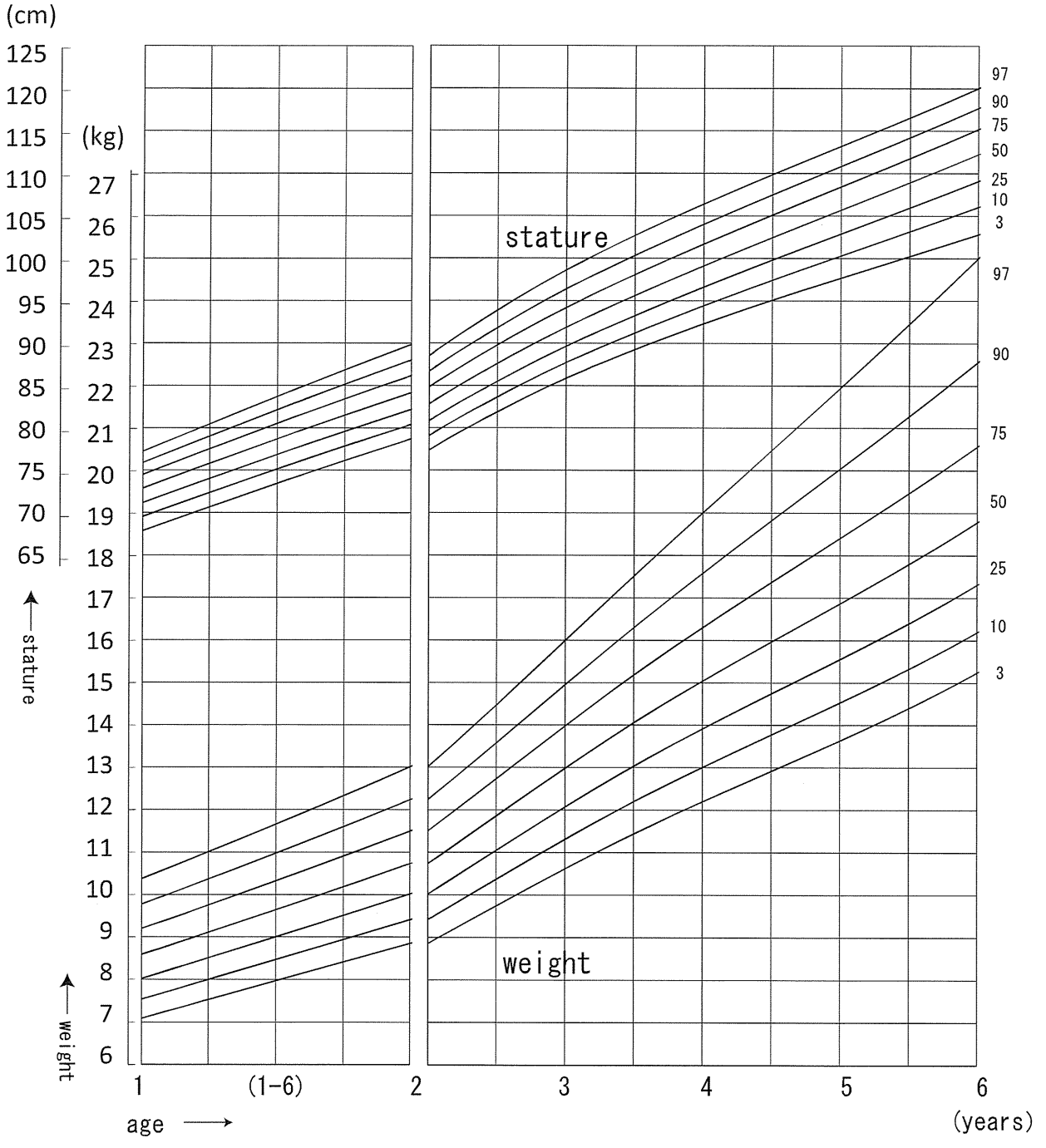

Figure 3－1　Chest circumference for male infants and dhildren (2010)

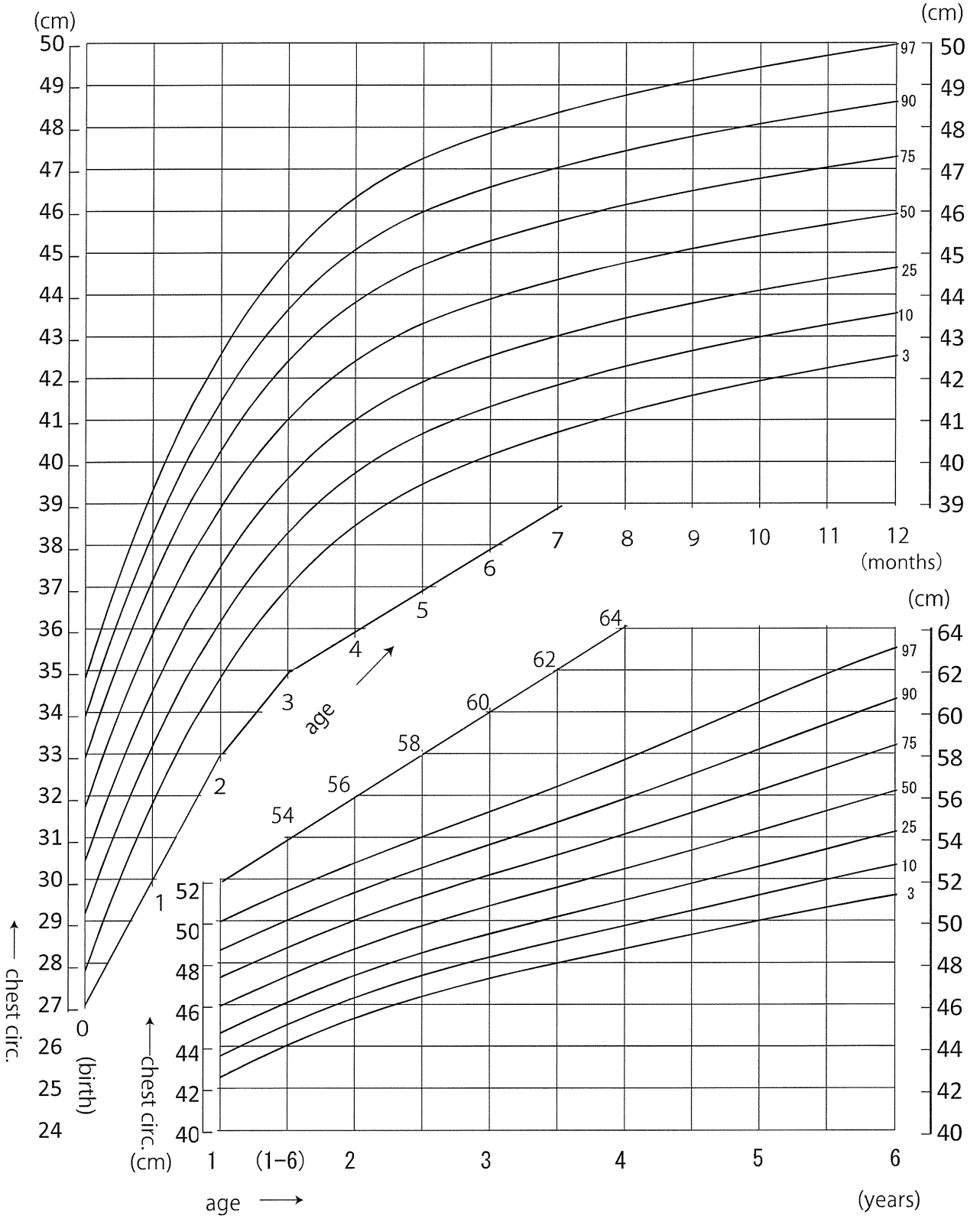

Figure３－２　Chest circumference for female infants and children (2010)

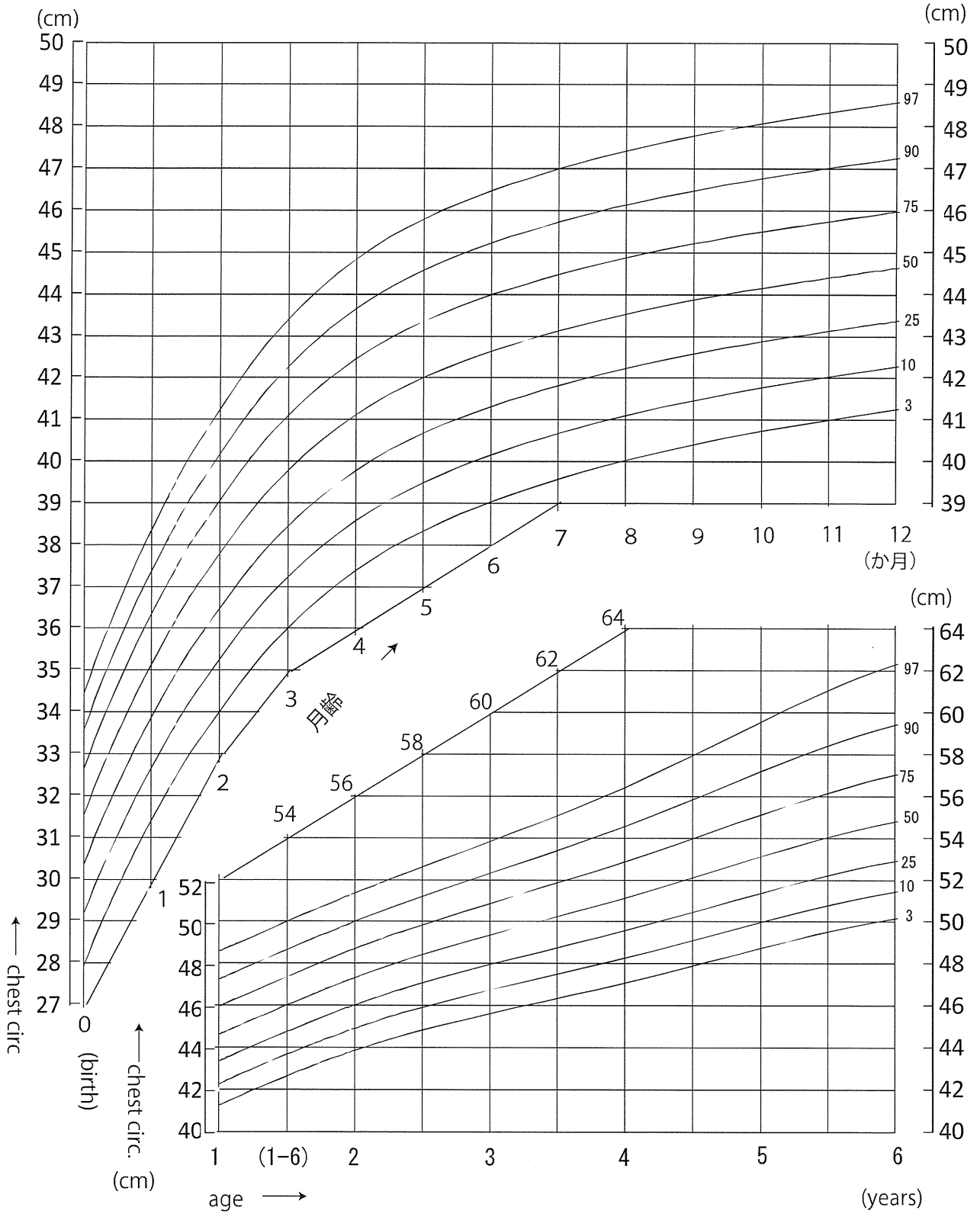

Figure 4－1　Head circumference for male infants and children