行政院國家科學委員會專題研究計畫　成果報告

低體重嬰兒之全民健保醫療費用分析

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INTRODUCTION

Rapid economic developments over recent decades and the resultant changes in social structures have dramatically brought down the birth rate in the developing world. However, the incidence and improved survival chances of low birthweight infants has increased, which is attributed primarily to recent medical advances in perinatal practices, ranging from assisted ventilation to surfactant therapy.[1-2] From 1992 through 2002 in Taiwan, the birth rates dropped 29 per cent from 15.5 to 11.0 per 1000 women.[3] In the same period, the percentage of live born babies weighing 2500 mg and less increased 45 per cent from 4.99% to 7.23%. The reported incidence of very-low-birth-weight (VLBW) and extremely-low-birth-weight (ELBW) babies have increased at an even faster rate. The percentage of live born babies weighing less than 1500 g in Taiwan increased 51 per cent from 0.31% in 1992 to 0.47% in 2002 and that of live born babies weighting less than 1000 g increased by 2.6 times from 0.07% to 0.25%.[4]

The increasing incidence and improved survival chances of infants of low birthweight, combined with the diffusion of new technologies, have increased the demand for and expenditure of care provided to these children in the infancy and beyond and consumed a significantly portion of the finite health care resources. Most of the studies in the scientific literature have focused on assessing treatment costs

consumed by low birth weight infants in the neonatal intensive care unit (NICU),[5-12] relatively few studies have documented the longer-term costs of low birthweight infants following their discharge from the neonatal unit. Some investigators reported that low birthweight children have significantly more health service costs than do normal birth weight in the first year of life[13-16]. In contrast, other studies followed up the increase use and cost of health care services consumed by low birth weight infants into early childhood[17-21] and even up to later childhood of age 8-9 years.[22-23]

Among all the aforementioned studies dealt with health care costs for low birthweight, most of the studies focused on very-low-birth-weight (VLBW)[5-6, 8-10, 13-16, 19-22] or extremely-low-birth-weight (ELBW).[7,14,17,18,22] Less has been reported about the costs of moderately-low-birth-weight (MLBW) infants.[13,15,22] In addition, very few studies provided detailed and disaggregated information on the access to and utilization of each type of health services.[14,16,18] Furthermore, most of the findings in the prior studies were based upon a sampling frame or confined in a limited setting when examining the effects of low birthweight on health care use, and the cost estimates cannot be extrapolated and generalized.[5-18,20]

The purpose of this study is to fill the gap in the literature by conducting a comprehensive economic assessment of low birthweight infants' resource use and costs associated with outpatient services and inpatient services in the first year of life

after birth.

METHODS

Data and Study Population

All infants born in Taiwan during January 1, 2000 and December 31, 2000 were first identified from the birth certificate data (n= 305,720). Second, random samping scheme was employed to retrieve one tenth of the population as our study sample. The incidence rate of low birthweight babies were 5.74% for MLBW infants, 0.43% for VLBW and 0.26% for ELBW. The birth certificate dataset comprises of variables indicating maternal and paternal age and education, infant birth weight, sex, gestation period (in weeks), and the mother's gravidity, marital status and county of residence.

ID numbers and date of birth were then used to match the National Health Insurance enrollment history and the death file. Those who were not continuously covered in the NHI plan for at least 1 year after birth or who died within one year after birth were excluded (n= 154). Cases of missing birthweight information were further deleted (n=23). The resulting number of records available for analysis was 30,328 infants.

ID numbers were also used to match NHI-paid claims history files to extract

records of all outpatient and inpatient services received by each infant following the infant's initial discharge from the neonatal unit and before turning age 2. The beginning date of service on each NHI claim was compared to the infant's date of birth to determine if the specific claim falls into the first year of life. The initial neonatal hospitalization was also included.

Statistical Methods and Analysis

For the purpose of analysis, 4 dummy variables were initially created to stratify all infants into 5 subgroups according to the infants' birthweight: <1,000 grams (extremely-low-birth-weight; ELBW); 1000 to 1499 grams (very-low-birth-weight; VLBW); 1,500 to 2,499 grams (moderately-low-birth-weight; MLBW); 2,500 to 4,499 grams (normal-birth-weight; NBW), or ≥4,500 grams (large for gestational age, LGA), with NBW infants as the reference group. However, the pooled comparison of LGA and NBW versus ELBW, VLBW or MLBW did not differ in resource use and medical costs. Therefore, when the analyses were performed, NBW and LGA infants were pooled together as one group.

The analyses were descriptive in nature, including mean, standard deviation (SD), and percentages for categorical variables. Costs, outpatient visits, admissions, and hospital day were tabulated on a per-case basis for one year after birth. All statistical

analyses were undertaken using SAS/Stats program (SAS software program package, version 8.02, SAS Institute, Cary, NC).

RESULTS

Table1 presents the socio-demographic characteristics of infants and their parents varied according to birthweight. The incidence of low birthweight was higher for unmarried couples and multiple births. The incidence of VLBW and ELBW were also higher among preterm babies. Mean of parents' age were younger among the three low birthweight groups versus NBW group. Parents with senior high-school education were the most common among the all birthweight groups.

Table 2 shows the mortality rate of infants within one year after birth. The neonatal death rate rises as the birth weight reduces. The infant mortality rate was 0.23% for NBW infants, 1.72% for MLBW infants, 14.39% for VLBW and 50.00% for ELBW. Death of the ELBW and VLBW groups occurred more often within 7 days after birth (37.50%, 9.85%).

Table 3 shows the mean, standard error, median, minimum and maximum of resource one year after infants' birth according to birthweight group. Outpatient utilization was similar across birthweight groups.

There exists significant differences in inpatient care across birthweight groups.

Mean number of admissions for the ELBW and VLBW were 1.93 and 1.74, which were much higher than those of MLBW (0.81) and NBW (0.34). Number of hospital days also increases as with reduced birthweight. Mean number of hospital days for ELBW and VLBW during the first year of life were 82.53 and 60.58 days, which were significantly higher than those of MLBW (9.44) and NBW (1.74).

Table 4 shows medical costs of infants one year after birth. Mean costs of ELBW and VLBW were 49 and 28 times higher, respectively, than those of the NBW group. Similarly, median costs of ELBW and VLBW were 97 and 46 times higher than those of the NBW group.

Table 4 also displays the distribution of costs by types of care, category of costs, and time points when costs incurred. For ELBW and VLBW groups, costs were mostly concentrated on inpatient care. Inpatient costs consists 91.06% and 95.42% of total medical costs for ELBW and VLBW infants, respectively. Conversely, only 40.51% and 14.23% of total costs were spent in inpatient care for MLBW and NBW infants, respectively.

Percentage of copayment reduced as birthweight increased. Ward fees took up the largest proportion of costs for ELBW and VLBW group (45.30% and 53.49%, respectively). Conversely, diagnosis fees and drugs fees took up 51.19% and 69.07% of total costs for MLBW and NBW group, respectively. With regarding to the

distribution of costs across four quarters of the year, costs occurred within the 1st quarter took up about 74.25% and 91.52% of total costs for ELBW and VLBW infants; whereas costs for MLBW and NBW infants were much more spreading out into the 2nd, 3rd and 4th quarters.

DISCUSSION

This study used NHI claims data in Taiwan to provide estimates of medical treatment costs during the infant's first year of life on low birthweight infants versus normal birthweight infants.

A search of the publication in the literature revealed that relatively few studies have estimated the medical treatment costs after discharge from the initial hospitalization following birth. Neither had much publication dealt with medical treatment costs of low birthweight other than hospital services costs. Moreover, very few of the cost estimates of the low birthweight in the existing literature came from the developing world. As the incidence of low birthweight infants has been increasing in a faster rate during these years in the developing countries due to technology advance in medical practices, economic burden on low birthweight infants will become more and more substantial.

The major strengths of this study are that it was based on the random sampling of a population-based linked datasets which included a comprehensive and validated

record of demographic background as well as health service data. The availability of linked data enabled us to relate birthweight at birth to 1-year follow-up on outpatient and emergency visits and admissions and to sum each infant's successive visits, admissions and expenditures to calculate their total volume of services and expenditures prior to turning age 2. The study cost accounting was comprehensive and included all significant outpatient, emergency and inpatient cost items. This provided a reliable basis for estimating the economic implications of low birthweight.

This study was limited in that it has adopted a narrow perspective of view. A small number of studies have shown that survivors of low birthweight consume significantly greater education services and social requirements than infants born at normal birthweight. [23] In addition, a wider costs to society, such as productivity loss of the parents of low birthweight infants, was evidenced to be substantial.[24-25] Moreover, the effect of low birthweight has showed to persist into late childhood.[22,23] Consequently, a broader and longer-term term impacts are required to provide a complete economic evaluation.

The second limitation is that in this study costs were estimated based on the NHI claims data. The reimbursement rates may include elements arising from the financial decision of the Bureau of NHI and therefore be poor proxies for the real resources-based costs of caring for low birthweight infants.

Despite the limitations of our study, the results have important clinical and policy implications. Given the recent evidence of an increasing incidence of low birthweight, it is crucial for clinical decision-makers and health authorities concerned to recognize the overall economic impact of low birthweight and to devise the cost-effectiveness strategies of preventing and treating low birthweight infants.

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Table 1 Infant's characteristics according to birth weight group

	Birth weight group							
	<1000g (N=40)		1001-1499g (N=113)		1500-2499g (N=1,719)		≧2500g (N=28,456)	
Characteristics	N	%	N	%	N	%	N	%
Baby sex								
male	22	55	61	54	781	45	14,971	53
female	18	45	52	46	938	55	13,485	47
Married								
yes	38	95	104	92	1,623	94	27,587	97
no	2	5	9	8	96	6	869	3
Multiple birth								
yes	6	15	23	20	391	23	313	1
no	34	85	90	80	1,328	77	28,143	99
Gestational week								
<=31	31	78	75	66	61	4	51	0
32-35	1	3	32	28	594	35	289	1
>=36	8	20	6	5	1,064	62	28,116	99
Nulliparous								
yes	15	38	62	55	831	48	13,326	47
no	25	63	51	45	888	52	15,130	53
Father's age								
<=29	7	18	42	37	577	34	9,590	34
30-34	25	63	37	33	657	38	10,828	38
>=35	8	20	34	30	485	28	8,038	28
mean(s.d)	31.63	(4.17)	31.72	(5.91)	31.69	(5.72)	31.81	(5.35)
Mother's age								
<=29	26	65	66	58	1,064	62	17,334	61
30-34	10	25	33	29	464	27	8,312	29
>=35	4	10	14	12	191	11	2,810	10
mean(s.d)	27.63	(5.49)	27.88	(5.50)	28.04	(5.28)	28.20	(4.87)
Father's education								
Elementary and below	3	8	7	6	65	4	872	3
Junior high school	11	28	25	22	458	27	6,914	24
Senior high school	18	45	56	50	699	41	11,916	42
College	3	8	11	10	298	17	5,089	18
University and above	5	13	14	12	195	11	3,642	13

Mother's education								
Elementary and below	0	0	6	5	69	4	842	3
Junior high school	8	20	28	25	414	24	6,366	22
Senior high school	26	65	53	47	818	48	13,368	47
College	3	8	14	12	260	15	5,131	18
University and above	3	8	11	10	155	9	2,728	10

Table 2 Infant's mortality rate according to birth weight group

	Birth weight group							
	<1000g (N=80)		**1001-1499g (N=132)**		**1500-2499g (N=1,749)**		**>=2500g (N=28,521)**	
Dead day	N	%	N	%	N	%	N	%
0	12	15.00%	4	3.03%	7	0.40%	5	0.02%
1-7	18	22.50%	9	6.82%	6	0.34%	12	0.04%
8-30	3	3.75%	4	3.03%	6	0.34%	11	0.04%
31-365	7	8.75%	2	1.52%	11	0.63%	37	0.13%
Total	**40**	**50.00%**	**19**	**14.39%**	**30**	**1.72%**	**65**	**0.23%**

Table 3 Health care resource use one year after birth according to birth weight group

Utilization	Birth weight group			
	<1000g (N=40)	**1000-1499g (N=113)**	**1500-2499g (N=1,719)**	**≧2500g (N=28,456)**
Number of outpatient				
Mean	23.68	26.35	23.91	22.93
S.D.	11.67	11.86	13.69	13.22
Median	23	26	22	21
Minimum	0	0	0	0
Maximum	49	55	92	160
Hospital admissions				
Mean	1.93	1.74	0.81	0.34
S.D.	1.31	1.22	1.03	0.73
Median	1	1	1	0
Minimum	1	1	0	0
Maximum	7	8	10	10
Hospital days				
Mean	82.53	60.58	9.44	1.74
S.D.	51.49	31.00	18.49	6.40
Median	83	54	3	0
Minimum	3	4	0	0
Maximum	237	211	319	365

Table 4 Medical costs one year after birth according to birth weight group

	Birth weight group			
	<1000g (N=40)	**1000-1499g (N=113)**	**1500-2499g (N=1,719)**	**≧2500g (N=28,456)**
Total costs				
Number	40	113	1,719	28,456
Mean	732,330	417,807	52,218	14,871
S.D.	482,117	299,261	122,679	51,028
Median	753,383	352,970	16,597	7,734
Minimum	11,775	27,966	0	0
Maximum	1,934,504	1,718,781	2,068,223	3,111,669
Inpatient costs (%)	91.06	95.42	40.51	14.23
Outpatient costs (%)	8.94	4.58	58.50	84.51
Co payment fee (%)	3.77	6.25	13.44	15.39
Apply fee (%)	96.23	93.75	85.56	83.35
Diagnosis fee (%)	11.35	9.15	35.77	47.68
Drug fee (%)	7.42	5.98	15.42	21.39
Ward fee (%)	45.30	53.49	20.28	5.63
Sugary fee (%)	2.15	0.57	0.80	0.42
Other fee (%)	33.78	30.82	26.73	23.60
1st:0-90 day (%)	74.25	91.52	44.96	21.83
2ed:91-180 day (%)	17.47	4.53	14.28	19.35
3rd:181-270 day (%)	2.73	1.82	18.70	26.95
4th:271-365 day (%)	5.55	2.12	21.06	30.62