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Disparities in the use of preventive health care among children with disabilities in Taiwan

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ABSTRACT

Children with disabilities face more barriers accessing preventive health services. Prior research has documented disparities in the receipt of these services. However, most are limited to specific types of disability or care. This study investigates disparities in the use of preventive health care among children with disabilities in Taiwan. Three nationwide databases from the Ministry of the Interior, Bureau of Health Promotion, and National Health Research Institutes were linked to gather related information between 2006 and 2008. A total of 8572 children with disabilities aged 1–7 years were included in this study. Multivariate logistic regression analysis was conducted to adjust for covariates. Nationally, only 37.58% of children with disabilities received preventive health care in 2008. Children with severe and very severe disabilities were less likely to use preventive care than those with mild severity. Children with disabilities from the lowest income family were less likely to have preventive care than other income groups. Urbanization was strongly associated with the receipt of preventive health care. However, surprisingly, urban children with disabilities were less likely to receive preventive care than all others. Under universal health insurance coverage, the overall usage of preventive health care is still low among children with disabilities. The study also identified several disparities in their usage. Potential factors affecting the lack of use deserve additional research. Policymakers should target low socioeconomic brackets and foster education about the importance of preventive care. Mobile health services should be continually provided in those areas in need. Capitation reimbursement and other incentives should be considered in improving the utilization among children with disabilities.

1. Introduction

Eliminating disparities in health care received by persons with disabilities is an overarching goal of Healthy People 2010 (Centers for Disease Control & Prevention, 2000). However, individuals with disabilities have been reported to have unmet health needs and experienced difficulty in accessing health care (Hagglund, Clark, Conforti, & Shigaki, 1999; Houtrow, Kim, Chen, & Newacheck, 2007; Lishner, Richardson, Levine, & Patrick, 1996) but still desire health promotion interventions (Warms, 1987). Lack of disease prevention and health promotion among people with disabilities is believed to increase the

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incidence of "medical, social, emotional, family, or community problems" among these disadvantaged individuals (Centers for Disease Control & Prevention, 2000). In addition, in debate over whether preventive health services represent an effective investment, recent empirical evidence suggested that greater use of clinical preventive services in the United States could avoid the loss of more than two million life-years annually (Maciosek, Coffield, Flottemesch, Edwards, & Solberg, 2010). Thus, preventive health services can be effective in reducing subsequent medical expenditures and promoting health for various age groups and diseases (Gandjour, 2009; Macnab, Rozmus, Benton, & Gagnon, 2008; Malach & Baumol, 2009; Vázquez, Garciflan, Rioboo, & Bratos, 2002). Preventive health care is the cornerstone of well-child care for both healthy children and children with special health care needs (Houtrow et al., 2007), yet past researchers have documented evident disparities in usage (US Department of Health & Human Services, 2000). Disparities in access to preventive health service reflect difference in family income, gender, race/ethnicity, urban/rural residence, level of disability, and parental education (Chan et al., 1999; Diab & Johnston, 2004; Iezzoni, McCarthy, Davis, & Siebens, 2000; Liu, Probst, Martin, Wang, & Salinas, 2007). Failure to receive preventive care was more common among children from low income family, of minority by race or residence, with higher level of disability, and whose parents receive less than college education (Asamoa et al., 2004).

The improvement of access to health care for children with disability has become a focus in preventive medicine. Due to physical and psychological barriers, children with disabilities might not be able to communicate their physical complaints accurately, which may, in turn, reduce their access to care and utilization of preventive services (Diab & Johnston, 2004; Lin, Yen, & Wu, 2005; Weng, Kung, Tsai, Chiang, & Chiu, 2011). Besides, care for these children are dynamic, and health care providers find their energies consumed by time-intensive disability-related issues (Ayyangar, 2002). Diminishing the barriers on both receivers and providers may lead to increased equality and utilization.

Previous studies regarding preventive health care among children with disabilities are limited to specific type of disability or care (Diab & Johnston, 2004; Liu et al., 2007; Weng et al., 2011). In order to effectively improve the health of children with disabilities, it is necessary to conduct a large-scaled investigation of the utilization of preventive services across all diseases and disabilities. Due to a dearth of national studies on such utilization, the present study was aimed at addressing disparities in the use of all preventive health care among Taiwanese children with disabilities and identify associated factors by using nationally representative data. Given that previous research pertains to either a specific kind of disability or health service, this study expects to add new understanding to the relative domains.

2. Materials and methods

2.1. Data source and processing

The present research was conducted based on the nationally administrative database from the Ministry of the Interior, Taiwan, 2008, coupled with information gathered between 2006 and 2008 on preventive health care and health insurance medical claims from the Bureau of Health Promotion and the National Health Research Institutes, respectively. The variables include: (1) demographic characteristics: gender, age, aboriginal status; (2) health and disability status: catastrophic illness/injury, relevant chronic illnesses (including cancer and 14 comprehensive categories of diseases); (3) classification of disability: type of disability, severity of disability; (4) the utilization of children's preventive health services. Being pivotal in influencing the children's health care utilization, parental variables including sex, age, residence, premium-based monthly salary, and low-income household status were also acquired.

2.2. Subjects

According to the 'Disability Rights Protection Acts' of Taiwan, disability can be classified into 18 categories, namely mental retardation, multiple disabilities, physical disability, autism, major organ malfunction, hearing impairment, sound or speech impairment, chromosomal abnormalities, visual impairment, congenital defects, metabolic abnormalities, refractory epilepsy, facial injury, balance impairment, persistent vegetative state, dementia, other chronic mental illness, and other disabilities caused by rare diseases recognized by the health authorities. Among all categories of disability, persistent vegetative state, dementia, and chronic mental illness were excluded from the present analysis due to very small sample sizes and constantly no utilization. Severity of disability is classified into 4 groups: mild, moderate, severe, and very severe. A total of 8572 children with disabilities under the age of 7 were included, and that is the exact number of this vulnerable population nationwide.

The free preventive health services consist of physical examinations and health educations. All children aged under 7 years are eligible for the services, with limitations on the yearly frequency of use varying by age: 4 times for children aged under one year, 2 times for the age of 1–2, and one time for those aged between 2 and 7 years.

2.3. Statistical analysis

All data were analyzed with the SAS version 9.2. This study firstly included a descriptive analysis of the identified variables. Percentages of each variable and mean difference in their frequency of use were examined for statistical significance using the t-test, one-way ANOVA, and χ^2 test. Lastly, bivariate and multivariate logistic regression analyses were conducted to examine factors associated with disparities in the utilization of preventive health services.

Table 1
Chi-square analysis of the use of preventive health services in children with disabilities during 2006–2008.

Variables	$N = 8572$	%	Use		Non-use		χ^2
			$n_1 = 3221$	%	$n_2 = 5351$	%	p-Value
Total percent				37.58		62.42	
Gender							0.559
Female	3190	37.21	1186	37.18	2004	62.82	
Male	5382	62.79	2035	37.81	3347	62.19	
Age							<.001*
<1 years	515	6.01	280	54.37	235	45.63	
1–2 years	905	10.56	535	59.12	370	40.88	
2–3 years	1472	17.17	573	38.93	899	61.07	
3–4 years	2038	23.78	461	22.62	1577	77.38	
4–7 years	3642	42.49	1372	37.67	2270	62.33	
Aboriginal status							0.169
Aboriginal	132	1.54	42	31.82	90	68.18	
Non-aboriginal	8440	98.46	3179	37.67	5261	62.33	
Catastrophic illness/injury							<.001*
Yes	3217	37.53	1120	34.82	2097	65.18	
No	5355	62.47	2101	39.23	3254	60.77	
Relevant chronic illnesses							
Cancer							0.036*
Yes	48	0.56	11	22.92	37	77.08	
No	8524	99.44	3210	37.66	5314	62.34	
Endocrine and metabolic disorder							0.898
Yes	584	6.81	218	37.33	366	62.67	
No	7988	93.19	3003	37.59	4985	62.41	
Mental disorder							0.257
Yes	4182	48.79	1546	36.97	2636	63.03	
No	4390	51.21	1675	38.15	2715	61.85	
Diseases of the nervous system							0.002*
Yes	2193	25.58	764	34.84	1429	65.16	
No	6379	74.42	2457	38.52	3922	61.48	
Diseases of the circulatory system							<.001*
Yes	495	5.77	146	29.49	349	70.51	
No	8077	94.23	3075	38.07	5002	61.93	
Diseases of the respiratory system							0.171
Yes	2700	31.50	986	36.52	1714	63.48	
No	5872	68.50	2235	38.06	3637	61.94	
Diseases of the digestive system							0.049*
Yes	2051	23.93	733	35.74	1318	64.26	
No	6521	76.07	2488	38.15	4033	61.85	
Diseases of the genitourinary system							0.578
Yes	92	1.07	32	34.78	60	65.22	
No	8480	98.93	3189	37.61	5291	62.39	
Diseases of the musculoskeletal system and connective tissue						0.369	
Yes	447	5.21	159	35.57	288	64.43	
No	8125	94.79	3062	37.69	5063	62.31	
Disorders of the eye and adnexa							0.561
Yes	521	6.08	202	38.77	319	61.23	
No	8051	93.92	3019	37.50	5032	62.50	
Infectious disease							0.873
Yes	79	0.92	29	36.71	50	63.29	
No	8493	99.08	3192	37.58	5301	62.42	
Congenital anomalies							0.664
Yes	2964	34.58	1123	37.89	1841	62.11	
No	5608	65.42	2098	37.41	3510	62.59	
Diseases of skin and subcutaneous tissue							0.760
Yes	1344	15.68	510	37.95	834	62.05	
No	7228	84.32	2711	37.51	4517	62.49	
Diseases of blood and blood-forming organs							0.408
Yes	355	4.14	126	35.49	229	64.51	
No	8217	95.86	3095	37.67	5122	62.33	
Diseases of the ear and mastoid process							0.672
Yes	730	8.52	269	36.85	461	63.15	
No	7842	91.48	2952	37.64	4890	62.36	
Type of disability							<.001*
Mental retardation	2049	23.90	756	36.90	1293	63.10	
Multiple disabilities	1613	18.82	508	31.49	1105	68.51	
Physical disability	1156	13.49	495	42.82	661	57.18	
Autism	1155	13.47	421	36.45	734	63.55	

Table 1 (*Continued*)

Variables	$N = 8572$	%	Use		Non-use		χ^2
			$n_1 = 3221$	%	$n_2 = 5351$	%	p-Value
Major organ malfunction	642	7.49	222	34.58	420	65.42	
Hearing impairment	599	6.99	274	45.74	325	54.26	
Sound or speech impairment	439	5.12	186	42.37	253	57.63	
Chromosomal abnormalities	353	4.12	146	41.36	207	58.64	
Rare diseases	216	2.52	74	34.26	142	65.74	
Visual impairment	143	1.67	55	38.46	88	61.54	
Congenital defects	72	0.84	33	45.83	39	54.17	
Metabolic abnormalities	42	0.49	17	40.48	25	59.52	
Refractory epilepsy	42	0.49	16	38.10	26	61.90	
Facial injury	38	0.44	12	31.58	26	68.42	
Balance impairment	13	0.15	6	46.15	7	53.85	
Severity of disability							<.001*
Mild	3290	38.38	1303	39.60	1987	60.40	
Moderate	2834	33.06	1096	38.67	1738	61.33	
Severe	1764	20.58	667	37.81	1097	62.19	
Very severe	684	7.98	155	22.66	529	77.34	
Parents' characteristics							
Sex							0.249
Female	3411	39.79	1307	38.32	2104	61.68	
Male	5161	60.21	1914	37.09	3247	62.91	
Age							0.004*
≦30 years	2119	24.72	829	39.12	1290	60.88	
31–40 years	4739	55.28	1806	38.11	2933	61.89	
≧41 years	1714	20.00	586	34.19	1128	65.81	
Urbanization level							<.001*
Highest: Level 1	1054	12.30	296	28.08	758	71.92	
Level 2	2182	25.45	807	36.98	1375	63.02	
Level 3	1420	16.57	538	37.89	882	62.11	
Level 4	828	9.66	314	37.92	514	62.08	
Level 5	1209	14.10	500	41.36	709	58.64	
Level 6	817	9.53	339	41.49	478	58.51	
Level 7	734	8.56	291	39.65	443	60.35	
Lowest: Level 8	328	3.83	136	41.46	192	58.54	
Premium-based monthly salary (NT$)							<.001*
<15,840	1869	21.80	627	33.55	1242	66.45	
16,500–22,800	3488	40.69	1390	39.85	2098	60.15	
24,000–28,800	670	7.82	246	36.72	424	63.28	
30,300–36,300	734	8.56	297	40.46	437	59.54	
38,200–45,800	812	9.47	309	38.05	503	61.95	
48,200–57,800	570	6.65	209	36.67	361	63.33	
60,800–72,800	266	3.10	92	34.59	174	65.41	
76,500–87,600	163	1.90	51	31.29	112	68.71	
Low-income household							0.002*
Yes	412	4.81	125	30.34	287	69.66	
No	8160	95.19	3096	37.94	5064	62.06	

* $p < 0.05$.

3. Results

Only slightly over one third of disabled children were recorded as having used preventive health care (37.58%, Table 1) in the past one year. The use of preventive health care was the lowest among children aged between 3 and 4 (22.62%), and the percentage of use nearly decreased with age. The percentage of use among those with catastrophic illness was 34.82%, which is significantly lower than those without (39.23%). Among the relevant chronic illnesses significantly associated with use, children with cancer showed the lowest usage (22.92%). Among all different types of disability, children with multiple disabilities reported the lowest usage (31.49%) while balance impairment was the highest (46.15%). Those with very severe disabilities exhibited the lowest usage (22.66%) compared to other levels of disability, which displayed a negative relationship between severity of disability and usage. Among the parent characteristics, the use of preventive care was lowest in children whose parents were aged ≧41 years (34.19%) compared to other age groups. Those residing in areas graded the highest level 1, of urbanization reported the lowest usage (28.08%). Also, those parents with premium-based monthly salary of NT$76,500–87,600 (New Taiwan Dollar, NT$) showed the lowest utilization (31.29%), followed by those parents with premium-based monthly salary of <NT$15,840 (33.55%).

In terms of the mean frequency in use of preventive health care, children with disability aged between 3 and 4 years was significantly lower than other age groups ($p < 0.001$, Table 2), showing almost negative correlation between age and frequency of use. The average frequency of use among children with catastrophic illnesses (0.39) was significantly lower

Table 2
Mean difference in the use of preventive health services among children with disabilities during 2006–2008.

Variables	*N* = 8572	Mean	SD	*p*-Value (*t*-test or *F*-test)
Gender				0.371
Female	3190	0.45	0.66	
Male	5382	0.43	0.62	
Age				<.001*
<1 years	515	1.12	1.26	
1–2 years	905	0.85	0.80	
2–3 years	1472	0.39	0.49	
3–4 years	2038	0.23	0.42	
4–7 years	3642	0.38	0.48	
Aboriginal status				0.065
Aboriginal	132	0.35	0.55	
Non-aboriginal	8440	0.44	0.64	
Catastrophic illness/injury				<.001*
Yes	3217	0.39	0.59	
No	5355	0.47	0.66	
Relevant chronic illnesses				
Cancer				0.010*
Yes	48	0.25	0.48	
No	8524	0.44	0.64	
Endocrine and metabolic disorder				0.870
Yes	584	0.43	0.62	
No	7988	0.44	0.64	
Mental disorder				<.001*
Yes	4182	0.40	0.57	
No	4390	0.47	0.69	
Diseases of the nervous system				0.008*
Yes	2193	0.41	0.62	
No	6379	0.45	0.64	
Diseases of the circulatory system				<.001*
Yes	495	0.35	0.59	
No	8077	0.44	0.64	
Diseases of the respiratory system				<.001*
Yes	2700	0.39	0.55	
No	5872	0.46	0.67	
Diseases of the digestive system				0.015*
Yes	2051	0.41	0.61	
No	6521	0.45	0.64	
Diseases of the genitourinary system				0.712
Yes	92	0.41	0.63	
No	8480	0.44	0.63	
Diseases of the musculoskeletal system and connective tissue				0.085
Yes	447	0.39	0.57	
No	8125	0.44	0.64	
Disorders of the eye and adnexa				0.155
Yes	521	0.48	0.71	
No	8051	0.43	0.63	
Infectious disease				0.321
Yes	79	0.38	0.51	
No	8493	0.44	0.64	
Congenital anomalies				0.007*
Yes	2964	0.46	0.68	
No	5608	0.42	0.61	
Diseases of skin and subcutaneous tissue				0.477
Yes	1344	0.45	0.65	
No	7228	0.44	0.63	
Diseases of blood and blood-forming organs				0.593
Yes	355	0.42	0.64	
No	8217	0.44	0.63	
Diseases of the ear and mastoid process				0.074
Yes	730	0.40	0.56	
No	7842	0.44	0.64	
Type of disability				<.001*
Mental retardation	2049	0.38	0.51	
Multiple disabilities	1613	0.36	0.58	
Physical disability	1156	0.57	0.79	
Autism	1155	0.39	0.54	
Major organ malfunction	642	0.40	0.64	
Hearing impairment	599	0.60	0.79	
Sound or speech impairment	439	0.44	0.54	
Chromosomal abnormalities	353	0.57	0.78	

Table 2 (*Continued*)

Variables	*N* = 8572	Mean	SD	*p*-Value (*t*-test or *F*-test)
Rare diseases	216	0.44	0.69	
Visual impairment	143	0.48	0.73	
Congenital defects	72	0.57	0.69	
Metabolic abnormalities	42	0.48	0.63	
Refractory epilepsy	42	0.45	0.63	
Facial injury	38	0.37	0.59	
Balance impairment	13	0.46	0.52	
Severity of disability				<.001*
Mild	3290	0.45	0.62	
Moderate	2834	0.45	0.63	
Severe	1764	0.47	0.69	
Very severe	684	0.26	0.52	
Parents' characteristics				
Sex				0.381
Female	3411	0.44	0.63	
Male	5161	0.43	0.63	
Age				<.001*
≦30 years	2119	0.47	0.67	
31–40 years	4739	0.45	0.65	
≧41 years	1714	0.36	0.53	
Urbanization level				<.001*
Highest: Level 1	1054	0.35	0.64	
Level 2	2182	0.42	0.62	
Level 3	1420	0.44	0.63	
Level 4	828	0.45	0.66	
Level 5	1209	0.47	0.63	
Level 6	817	0.50	0.70	
Level 7	734	0.45	0.60	
Lowest: Level 8	328	0.47	0.62	
Premium-based monthly salary (NT$)				<.001*
<15,840	1869	0.37	0.56	
16,500–22,800	3488	0.47	0.65	
24,000–28,800	670	0.44	0.67	
30,300–36,300	734	0.48	0.65	
38,200–45,800	812	0.46	0.67	
48,200–57,800	570	0.43	0.64	
60,800–72,800	266	0.39	0.61	
76,500–87,600	163	0.36	0.60	
Low-income household				<.001*
Yes	412	0.31	0.48	
No	8160	0.44	0.64	

* $p < 0.05$.

than those without such illnesses ($p < 0.001$). The use of preventive health care was lower among those with cancer, mental disorders, nervous system diseases, circulatory system diseases, respiratory system diseases, digestive system diseases, and congenital anomalies (all $p_s < 0.05$). Among the different types of disability, children with multiple disabilities showed the lowest mean frequency of use (0.36), while hearing impairment reported the highest (0.60). The average usage of those with severe disability (0.47) was significantly higher than other severity groups ($p < 0.001$) while the mean usage of the 'very severe' group was ranked the lowest (0.26). Utilization was significantly lower ($p < 0.001$) among children whose parents are aged ≧41 years (0.36). Residents in areas of level 1 urbanization had a significantly lower mean frequency of use (0.35) than residents of other levels ($p < 0.001$). The average frequency of use among those parents who had the premium-based monthly salary of NT$76,500–87,600 was as low as 0.36.

With all other variables held equal, adjusted logistic regression analysis yielded to a result that the odds of use decreased with age in a manner paralleling the findings shown in Tables 1 and 2. Higher odds of receipt of preventive health care were significantly associated with children with mental disorder, hearing impairment, and sound or speech impairment (OR = 1.20, 1,27, 1,33, respectively, Table 3), while lowers odds were associated with those with circulatory system diseases and rare diseases (OR = 0.69, 0.71, respectively). Differences in odds were found significant among the severity of disability, in which 'very severe' had the lowest odds of use (OR = 0.43; 95% CI: 0.34–0.54), which echoes with the results in the previous levels of analysis. The odds of use among children whose parents were aged ≧41 years were markedly lower (OR = 0.84; 95% CI: 0.72–0.99) than those whose parents were aged ≦30 years. The disparities were exacerbated among the urbanization levels of residence; compared with the highest urbanization level, children residing in areas of all other lower urbanization levels were significantly more likely to use preventive health care (all ORs > 1). As might not be anticipated, the odds of use increased almost linearly with the decrease of urbanization level ($p < .001$). A marked difference was also present across levels of income; those with premium-based monthly salary of NT$16,500–22,800 and NT$30,300–36,300 showed significantly higher odds of use (OR = 1.22, 1.28, respectively), demonstrating a strong link between parental income and use of preventive care in children with disability.

Table 3
Logistic regression models for the use of preventive health services in children with disabilities during 2006–2008.

Variables	Bivariate model				Multivariate model			
	Crude OR	95% CI		*p*-Value	Adjusted OR	95% CI		*p*-Value
Gender								
Female	–	–	–	–	–	–	–	–
Male	1.03	0.94	1.13	0.559	1.04	0.95	1.15	0.384
Age								
<1 years	–	–	–	–	–	–	–	–
1–2 years	1.21	0.98	1.51	0.082	1.16	0.93	1.46	0.188
2–3 years	0.54	0.44	0.66	<.001*	0.47	0.38	0.59	<.001*
3–4 years	0.25	0.20	0.30	<.001*	0.20	0.16	0.25	<.001*
4–7 years	0.51	0.42	0.61	<.001*	0.43	0.34	0.53	<.001*
Aboriginal status								
Non-aboriginal	–	–	–	–	–	–	–	–
Aboriginal	0.77	0.53	1.12	0.170	0.74	0.50	1.10	0.131
Catastrophic illness/injury								
No	–	–	–	–	–	–	–	–
Yes	0.83	0.76	0.91	<.001*	1.09	0.96	1.23	0.184
Relevant chronic illnesses								
Cancer	0.49	0.25	0.97	0.040*	0.58	0.29	1.19	0.139
Endocrine and metabolic disorder	0.99	0.83	1.18	0.899	1.10	0.91	1.33	0.324
Mental disorder	0.95	0.87	1.04	0.257	1.20	1.08	1.34	0.001*
Diseases of the nervous system	0.85	0.77	0.94	0.002*	0.97	0.86	1.11	0.690
Diseases of the circulatory system	0.68	0.56	0.83	<.001*	0.69	0.56	0.86	0.001*
Diseases of the respiratory system	0.94	0.85	1.03	0.172	1.08	0.97	1.20	0.148
Diseases of the digestive system	0.90	0.81	1.00	0.049*	0.99	0.89	1.12	0.922
Diseases of the genitourinary system	0.89	0.58	1.36	0.578	0.98	0.62	1.55	0.937
Diseases of the musculoskeletal system and connective tissue	0.91	0.75	1.11	0.369	1.04	0.84	1.28	0.741
Disorders of the eye and adnexa	1.06	0.88	1.27	0.559	1.20	0.98	1.47	0.071
Infectious disease	0.96	0.61	1.53	0.874	1.05	0.64	1.71	0.852
Congenital anomalies	1.02	0.93	1.12	0.664	1.04	0.92	1.17	0.514
Diseases of skin and subcutaneous tissue	1.02	0.90	1.15	0.760	1.05	0.92	1.20	0.443
Diseases of blood and blood-forming organs	0.91	0.73	1.14	0.408	1.01	0.79	1.28	0.938
Diseases of the ear and mastoid process	0.97	0.83	1.13	0.673	1.08	0.91	1.28	0.398
Type of disability								
Physical disability	–	–	–	–	–	–	–	–
Visual impairment	0.84	0.58	1.19	0.320	1.04	0.71	1.54	0.837
Hearing impairment	1.13	0.92	1.37	0.242	1.27	1.01	1.59	0.043*
Sound or speech impairment	0.98	0.79	1.23	0.871	1.33	1.04	1.70	0.023*
Mental retardation	0.78	0.67	0.90	0.001*	1.01	0.85	1.21	0.878
Multiple disabilities	0.61	0.53	0.72	<.001*	0.91	0.76	1.09	0.304
Major organ malfunction	0.71	0.58	0.86	0.001*	0.80	0.63	1.02	0.066
Facial injury	0.62	0.31	1.23	0.172	0.69	0.33	1.44	0.323
Autism	0.77	0.65	0.91	0.002*	1.05	0.85	1.28	0.674
Chromosomal abnormalities	0.94	0.74	1.20	0.627	1.01	0.76	1.33	0.971
Metabolic abnormalities	0.91	0.49	1.70	0.763	1.08	0.56	2.09	0.821
Congenital defects	1.13	0.70	1.82	0.617	1.25	0.75	2.09	0.394
Balance impairment	1.15	0.38	3.43	0.809	1.96	0.60	6.44	0.269
Refractory epilepsy	0.82	0.44	1.55	0.544	0.85	0.44	1.67	0.644
Rare diseases	0.70	0.51	0.94	0.020*	0.71	0.51	0.98	0.040*
Severity of disability								
Mild	–	–	–	–	–	–	–	–
Moderate	0.96	0.87	1.07	0.457	0.97	0.87	1.09	0.591
Severe	0.93	0.82	1.04	0.213	0.82	0.71	0.95	0.009*
Very severe	0.45	0.37	0.54	<.001*	0.43	0.34	0.54	<.001*
Parents' characteristics								
Sex								
Female	–	–	–	–	–	–	–	–
Male	0.95	0.87	1.04	0.249	0.97	0.88	1.07	0.596
Age								
≦30 years	–	–	–	–	–	–	–	–
31–40 years	0.96	0.86	1.06	0.426	0.93	0.82	1.05	0.230
≧41 years	0.81	0.71	0.92	0.002*	0.84	0.72	0.99	0.032*
Urbanization level								
Highest: Level 1	–	–	–	–	–	–	–	–
Level 2	1.50	1.28	1.76	<.001*	1.58	1.33	1.87	<.001*
Level 3	1.56	1.32	1.86	<.001*	1.62	1.35	1.95	<.001*
Level 4	1.56	1.29	1.90	<.001*	1.64	1.33	2.01	<.001*
Level 5	1.81	1.51	2.15	<.001*	1.90	1.57	2.31	<.001*
Level 6	1.82	1.50	2.20	<.001*	1.96	1.59	2.41	<.001*

Table 3 (*Continued*)

Variables	Bivariate model				Multivariate model			
	Crude OR	95% CI		*p*-Value	Adjusted OR	95% CI		*p*-Value
Level 7	1.68	1.38	2.05	<.001*	1.83	1.48	2.27	<.001*
Lowest: Level 8	1.81	1.40	2.35	<.001*	2.13	1.61	2.82	<.001*
Premium-based monthly salary (NT$)								
<15,840	–	–	–	–	–	–	–	–
16,500–22,800	1.31	1.17	1.48	<.001*	1.22	1.07	1.39	0.004*
24,000–28,800	1.15	0.96	1.38	0.139	1.06	0.86	1.29	0.600
30,300–36,300	1.35	1.13	1.61	0.001*	1.28	1.05	1.55	0.013*
38,200–45,800	1.22	1.03	1.44	0.025*	1.18	0.98	1.43	0.087
48,200–57,800	1.15	0.94	1.40	0.170	1.13	0.91	1.40	0.270
60,800–72,800	1.05	0.80	1.37	0.737	1.11	0.83	1.49	0.469
76,500–87,600	0.90	0.64	1.27	0.558	1.07	0.74	1.55	0.731
Low-income household								
No	–	–	–	–	–	–	–	–
Yes	0.71	0.58	0.88	0.002*	0.83	0.64	1.08	0.170

* $p < 0.05$.

Across all levels and types of analysis, the following variables showed robust differences of use among children with disabilities: age, relevant chronic illness, type and severity of disability, parental age, urbanization level, and family income.

4. Discussion

Despite the fact that since 1995, the Department of Health in Taiwan has provided free preventive care to children with disabilities, 37.58% of utilization rate remains notably low compared with 87.5% of children with and 73.1% of children without special health care needs receiving health screening, which was reported in previous study (Houtrow et al., 2007), as well as with 78.64% of the general children in Taiwan (Tsai & Kung, 2010). Lack of preventive care among children with disabilities indicates a tremendous need to improve the usage in Taiwan.

Consistent with most but not all prior research, this study found disparities, although not very extensive, in the use of preventive health care among Taiwanese disabled children by children's age, health status, type and severity of disabilities, parents' age, urbanization level, and income. Among children characteristics, children with higher age, with diseases of the circulatory system and rare diseases, and with greater severity of disability were less likely to take advantage of preventive health care. Some of these findings mirror previous studies in the relevant fields (Chi, Momany, Kuthy, Chalmers, & Damiano, 2010; Diab & Johnston, 2004; Liu et al., 2007; Weng et al., 2011).

This study demonstrates that gender, aboriginal status, and catastrophic illness are not closely associated with the utilization of preventive health care among children with disabilities. Given that children with disabilities encompass greater functional limitation and require more diverse health care compared to children without disabilities (Jeng, Wang, Cher, Lin, & Jeng, 2009), these factors still are not strongly associated with differences in the receipt of care. Nevertheless, severity of disability is an important predictor to preventive health care utilization, which is consistent with the findings among American children with disabilities by Diab and Johnston (2004). The health status and medical needs among children with disabilities inevitably lead to challenges in accessing preventive health services. As health is worsened by increased severity of disability, the need for therapeutic medical care becomes demanding. Such need for care mainly revolves around the recovery of daily function, thus, lacking the urgency for preventive health services. This phenomenon of attitudinal obstacle by severity of disability might be exacerbated by provision obstacles and transportation and mobility barriers (Diab & Johnston, 2004; Probst, Laditka, Wang, & Johnson, 2007; Weng et al., 2011), discouraging their willingness to use preventive health services. Therefore, the planning of preventive health services should focus on the usage promotion among children with disability of higher severity. In order to increase the willingness of dentist to provide oral care for people with severe disability, the global budget reimbursement was employed to promote oral health for those with 'severe' and 'very severe' disability in Taiwan (Tsai, Kung, Chiang, & Chang, 2007). Hence, as a financial incentive, the increased subsidy of primary care for children with disability should be implemented and could equally encourage the use of preventive health services among the vulnerable population.

In regard to parental characteristics, this study did not find gender differences in the use of preventive health care among parents of children with disabilities. However, parental age was found significant. The fact of a majority of the parents aged between 30 and 40 years is supported by a previous work reporting the average age 36.3 of primary caregivers of preschool children with disabilities (Lin et al., 2005). Among all the associated factors, urbanization level exhibited manifest disparities in the service utilization. The noteworthy finding that children residing in urban areas (levels 1) tended to not use may be contrary to several existing documents that suggest low utilization in rural areas could be attributable to poor access to care (Chi et al., 2010; Liu et al., 2007; Torres, Bellinger, Probst, Harun, & Johnson, 2007). However, this somewhat surprising finding might actually revealed the desirable effects of improved access to care by the implementation of the National Health Insurance and by mobile health services of which travelling vehicles for screening and vaccinating funded by the Plan of Medical Network have directly penetrated the remote areas (Department of Health, 2009). Nevertheless, under-invested

medical resources, barriers to transportation, insufficient use of health information might still compound access problems among the disabled children in rural areas (Probst et al., 2007; Wang, Probst, Stoskopf, Sanders, & McTigue, 2011; Weng et al., 2011). Thus, home and community visits should be continually given to families of children with severe disabilities and with transportation barriers, even not in rural areas. The related authorities should continue to address and endeavor to eliminate this disparity by resource reallocation through channeling the potentially surplus investment to those in need. More of effective incentives in motivating medical professionals to serve in remote areas, including increased financial payment and doubled seniority (Department of Health, 2010), should be further strengthened in area in need. Besides, continuing education on the necessity of health services for disease prevention targeted to 'urban' residents with disabilities and their family should also be listed in the public policy agenda. The level of premium-based monthly salary indicative of household income demonstrated the disparity in the utilization. Families with good financial and socioeconomic status tend to emphasize on preventive health, presenting greater ability in ensuring the health of disabled children (Inkelas, Raghavan, Larson, Kuo, & Ortega, 2007; Lin et al., 2005). However, the current analysis only indicated fewer use in children from lowest income families and did not support higher use from top level income. A possible explanation is that the basically free of charge preventive care might not offer to richest children whose parents may be inclined to choose their children out-of-packet preventive services not provided by the National Health Insurance. Therefore, to promote the use, disparity in use by family income requires preventive services planners to communicate closely with the insured across different levels of income and merits further research on need assessment in a culturally fit way.

Time and physical constraints are commonly cited by primary caregivers as the major factors affecting the actual use of preventive health care. Adequate knowledge among primary caregivers positively impact on children's health and development (Hudson et al., 2003). On the contrary, inadequate knowledge on preventive care may lead to limited use, so effective parental supports and education aimed at lower socioeconomic groups should be formulated by health policymakers in the attempt to increase its use.

This study adds to the existing literature in several substantive ways. In addition to the utilization rate and mean frequency described, the results highlight an overall deficit in the receipt of preventive care nationwide and also identified some disparities within the population of children with disabilities. Furthermore, this study speculates a protective effect for the geographically vulnerable groups with respect to the national health insurance coverage and health system measures (Department of Health, 2010; Liu et al., 2007). Aiming at shortening discrepancy between rural/urban medical resource allocations, the authorities have launched different stages of the Plan of Medical Network since 1985. Based on the current analysis, increases in use of preventive services remain promising specifically in the remote areas. Regardless of other associated factors, eliminating economic and geographical disparities in preventive care requires additional efforts in removing both financial and cultural barriers to its delivery and utilization.

Limitations of the present study stem from the administrative databases used and the study nature. First, the databases did not incorporate information regarding level of education and knowledge on preventive care among the subjects' parents. Failure to include the related factors could attenuate the results. Second, although this study observed the subjects at least one year, the analysis could not ascertain a causal effect. Instead, only the associations can be inferred.

5. Conclusion

Taiwan has implemented the National Health Insurance since 1995. Under the universal coverage, however, disparities in the use of preventive health care among children with disability were still found by children and parental demographics, health status, type and severity of disability. Of all the associated factors, urbanization level is most evident. With much room for improving the utilization, older, poorer children with disability and older parents should be targeted. Future research would benefit from finely adjusting for the reimbursement and health system variables in evaluating disparities in receipt of preventive care. Limited medical resource on preventive care justifies the necessity of its effective investment in especially those in need. The authorities should tackle the disparities using a strategic framework, which involves special health and support needed assessments in culturally appropriate ways, a differential subsidy set for different severity of disability, redirecting medical resources to under served areas through mobile health services and incentives, and educating low income groups, to increase the accessibility and use. Since the authorities have partially launched the System of Family Physician reimbursed by capitation in the selected clinics or hospitals (Department of Health, 2011), the disability-specific scheme of capitation reimbursement by age and by severity might be also considered in the timely pursuit of an extensive use of preventive health services among children with disability.

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