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# Overview of the medical benefit for the pulp capping under the National Health Insurance of Taiwan from 2011 to 2022

## KEYWORDS

Pulp capping;  
National health  
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Medical benefit;  
Vital pulp therapy

The pulp capping is a repair technology used to prevent bacteria from continuing to invade tooth and cause tooth decay after the dental pulp is exposed, leading to inflammation of the pulp tissue and subsequent root canal treatment. The pulp can be exposed through carious dentin removal or cavity preparation. If pulp vitality and function can be preserved, inflammation of the superficial layers of pulp is more likely to be restricted. Although a vital, well-vascularized, functioning pulp is capable of healing, the pulp can be exposed and infected due to microleakage and subsequent bacterial contamination.<sup>1</sup> Therefore, the direct pulp capping is considered as an effective and conservative treatment option to reduce the risk of infection and further damage. During this procedure, after the caries has been excavated, a dental biomaterial is placed directly over the exposed pulp to provide a biological seal and to prevent bacterial leakage.<sup>2,3</sup>

The National Health Insurance (NHI) of Taiwan, which was implemented in March 1995, has provided a medical benefit for the pulp capping since its inception. This medical benefit provides 140 NHI points for the medical expenses of the pulp capping, includes temporary fillings for the treated teeth, and is limited to the permanent teeth. Each tooth can only be applied for once every six months. Due to the cost, dentists usually use calcium hydroxide as the standard material for the pulp capping in practice. In this article, we used secondary data analysis to understand

the status of the medical benefit for the pulp capping from 2011 to 2022.

We collected the number of declarations of the medical benefit for the pulp capping under the NHI from 2011 to 2022 from the public information of the Ministry of Health and Welfare. Then, we also collected the number of dentists and other NHI parameters or indicators during the same period. Further calculations were performed on various ratios related to the pulp capping. The results are shown in Table 1. The number of the pulp capping procedures performed under the NHI gradually decreased and fluctuated from 237,587 in 2011 to 181,268 in 2022. The annual decrease and decrease rate were 5120 and 2.15 %, respectively, while their total decrease and decrease rate were 56,319 and 23.70 %, respectively. Female patients received the pulp capping treatments more often than male patients. However, the ratio of the number of the pulp capping procedures for females to that for males gradually and steadily decreased from 1.35 in 2011 to 1.22 in 2022, showing that the gender gap in patients receiving the pulp capping treatments has steadily decreased. In addition, the medical expenses for the pulp capping gradually decreased and fluctuated from 19,095 thousands of NHI points in 2011 to 13,950 thousands of NHI points in 2022. It should be noted that there was a relatively obvious decline in the medical expenses for the pulp capping from 2019 to 2022. Furthermore, based on the number of dentists, the average

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**Table 1** The number of the pulp capping procedures and their medical expenses by gender under the National Health Insurance (NHI) of Taiwan from 2011 to 2022.<sup>a</sup>**A. Number of the pulp capping procedures, their medical expenses, and average number of pulp capping procedures per dentist**

Year	Number of the pulp capping procedures				Medical expenses for the pulp capping <sup>b</sup>			Number of dentists	Average number of the pulp capping procedures per dentist
	Male	Female	Total	Ratio of female to male	Male	Female	Total		
2011	101,196	136,391	237,587	1.35	33,262	14,167	19,095	11,992	19.81
2012	99,425	133,481	232,906	1.34	32,607	13,920	18,687	12,391	18.80
2013	100,456	133,415	233,871	1.33	32,742	14,064	18,678	12,794	18.28
2014	102,848	133,686	236,534	1.30	33,115	14,399	18,716	13,178	17.95
2015	101,072	131,115	232,187	1.30	32,506	14,150	18,356	13,502	17.20
2016	101,444	131,360	232,804	1.29	32,593	14,202	18,390	13,912	16.73
2017	102,879	132,731	235,610	1.29	32,985	14,403	18,582	14,379	16.39
2018	100,675	128,962	229,637	1.28	32,149	14,095	18,055	14,717	15.60
2019	96,865	122,755	219,620	1.27	30,747	13,561	17,186	15,127	14.52
2020	90,024	113,192	203,216	1.26	28,450	12,603	15,847	15,429	13.17
2021	82,472	102,649	185,121	1.24	25,917	11,546	14,371	15,741	11.76
2022	81,624	99,644	181,268	1.22	25,378	11,427	13,950	15,996	11.33

**B. Numbers of all dental patients, all dental outpatient visits, and all dental medical expenses**

Year	Number of all dental patients			Number of all dental outpatient visits			All dental medical expenses <sup>b</sup>		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2011	4,617,220	5,202,732	9,819,952	15,019,862	17,212,083	32,231,945	15,812,362	18,197,388	34,009,750
2012	4,749,646	5,359,368	10,109,014	15,568,716	17,888,179	33,456,895	16,527,669	19,021,736	35,549,404
2013	4,904,373	5,522,761	10,427,134	16,128,138	18,506,141	34,634,279	17,207,175	19,757,259	36,964,434
2014	4,988,630	5,616,832	10,605,462	16,483,855	18,903,154	35,387,009	17,654,955	20,247,333	37,902,287
2015	5,045,706	5,707,392	10,753,098	16,572,952	19,158,762	35,731,714	17,830,661	20,592,407	38,423,069
2016	5,066,509	5,703,738	10,770,247	17,952,864	20,532,040	38,484,904	18,870,493	21,532,553	40,403,046
2017	5,207,862	5,874,541	11,082,403	18,734,829	21,505,055	40,239,884	20,077,910	22,965,330	43,043,240
2018	5,268,514	5,953,323	11,221,837	19,169,674	22,026,863	41,196,537	20,681,983	23,660,324	44,342,307
2019	5,343,235	6,056,168	11,399,403	19,662,282	22,608,732	42,271,014	21,165,607	24,196,703	45,362,310
2020	5,195,896	5,883,165	11,079,061	19,357,200	22,159,697	41,516,897	21,396,792	24,349,814	45,746,606
2021	4,990,687	5,666,258	10,656,945	18,233,552	20,897,337	39,130,889	20,382,961	23,169,879	43,552,840
2022	5,151,400	5,837,749	10,989,149	18,972,511	21,748,018	40,720,529	21,304,208	24,245,962	45,550,170

**C. Ratios of the pulp capping procedures to all dental patients and to all dental outpatient visits, and ratio of medical expenses for the pulp capping to all dental medical expenses**

Year	Ratio of the pulp capping procedures to all dental patients (%)			Ratio of the pulp capping procedures to all dental outpatient visits (%)			Ratio of medical expenses for the pulp capping to all dental medical expenses (%)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
2011	2.19	2.62	2.42	0.67	0.79	0.74	0.09	0.10	0.10

2012	2.09	2.49	2.30	0.64	0.75	0.70	0.08	0.10	0.09
2013	2.05	2.42	2.24	0.62	0.72	0.68	0.08	0.09	0.09
2014	2.06	2.38	2.23	0.62	0.71	0.67	0.08	0.09	0.09
2015	2.00	2.30	2.16	0.61	0.68	0.65	0.08	0.09	0.08
2016	2.00	2.30	2.16	0.57	0.64	0.60	0.08	0.09	0.08
2017	1.98	2.26	2.13	0.55	0.62	0.59	0.07	0.08	0.08
2018	1.91	2.17	2.05	0.53	0.59	0.56	0.07	0.08	0.07
2019	1.81	2.03	1.93	0.49	0.54	0.52	0.06	0.07	0.07
2020	1.73	1.92	1.83	0.47	0.51	0.49	0.06	0.07	0.06
2021	1.65	1.81	1.74	0.45	0.49	0.47	0.06	0.06	0.06
2022	1.58	1.71	1.65	0.43	0.46	0.45	0.05	0.06	0.06

<sup>a</sup> The data in the table are the numbers of patients and outpatient visits diagnosed as having diseases of teeth and supporting structures. From 2011 to 2015, the statistics are a total of medical, dental and traditional Chinese medicine outpatient clinics including emergency visits. However, from 2016 to 2022, the statistics are the numbers of dental patients and dental outpatient visits excluding emergency visits.

<sup>b</sup> The unit of medical expenses is thousands of NHI points, while the value of one NHI point is settled quarterly, and one NHI point fluctuates from NT\$ 0.8 to NT\$ 1.2.

number of the pulp capping procedures performed by each dentist gradually and steadily decreased from 19.81 in 2011 to 11.33 in 2022. The annual decrease and decrease rate were 0.77 and 3.89 %, respectively, while their total decrease and decrease rate were 8.48 and 42.81 %, respectively (Table 1).

Based on other NHI parameters or indicators in overall, the ratios between parameters related to the pulp capping and all dental patients, all dental outpatient visits, or all dental medical expenses were calculated. The ratio of the pulp capping procedures to all dental patients gradually and steadily decreased from 2.42 % in 2011 to 1.65 % in 2022. The ratio of the pulp capping procedures to all dental outpatient visits also decreased from 0.74 % in 2011 to 0.45 % in 2022. In addition, the ratio of the medical expenses for the pulp capping to all dental medical expenses also decreased from 0.10 % in 2011 to 0.06 % in 2022. Furthermore, the above ratios of females were higher than those of males (Table 1).

From the long-term trend, the number of declarations for the medical benefit for the pulp capping of the NHI is indeed decreasing, especially after the COVID-19 pandemic. There are many factors that may cause this phenomenon. The low payment for the pulp capping or the greater pain suffered by the patients after the pulp capping failure makes the dentists hesitate to perform the pulp capping procedures under the NHI. Over the long term, due to the effectiveness of the NHI system and oral health policy implementation, the dental caries rate and dental caries severity among the public have been improved, thereby reducing the possibility of needs for the pulp capping.<sup>4,5</sup> The COVID-19 pandemic is also one of the reasons resulting in the reduction of overall dental outpatient visits. On the other hand, with the improvements in the vital pulp therapy (VPT) techniques and increasing awareness of conservative dentistry among public, people may be willing to choose self-paid VPT instead of the NHI pulp capping.<sup>1,2</sup> We found that females are obviously more willing to seek the pulp capping under the NHI than males, which means that there are gender differences in oral hygiene awareness and oral treatment decision-making. However, in any case, improving people's oral health and reducing serious dental caries and other oral problems are the direction that requires the long-term efforts.

## Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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## References

1. Marques MS, Wesselink P, Shemesh H. Outcome of direct pulp capping with mineral trioxide aggregate: prospective study. *J Endod* 2015;41:1026–31.

2. Peskersoy C, Lukarcanin J, Turkun M. Efficacy of different calcium silicate materials as pulp-capping agents: randomized clinical trial. *J Dent Sci* 2021;16:723–31.
3. Okamoto M, Takahashi Y, Komichi S, et al. Novel evaluation method of dentin repair by direct pulp capping using high-resolution micro-computed tomography. *Clin Oral Invest* 2018;22:2879–87.
4. Cheng FC, Chiang CP. Dental use and medical expenses for endodontic diseases under the National health Insurance system in Taiwan from 1998 to 2020. *J Dent Sci* 2023;18:272–81.
5. Cheng FC, Chiang CP. Profile of dental use for diseases of pulp and periapical tissues under the National Health Insurance system in Taiwan in 2020. *J Dent Sci* 2022;17:1744–50.

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