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## ORIGINAL ARTICLE

# Field survey of dental manpower in Taiwan's hospitals

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survey

**Background/Purpose:** In Taiwan, dental manpower in hospitals plays an important role in dental education other than clinical service. Questionnaires, as well as a field survey, were conducted to understand the situation of dental manpower in 2007 and 2008.

**Methods:** During the period from 2007 to 2008, questionnaires about dental administration, clinical dental practice, dental education, dental manpower and dental facilities were mailed to the dental departments of 165 hospitals located around Taiwan; 134 completed the questionnaire and mailed it back. The field survey was also carried out by visiting hospitals, to collect and gather information at the local level. There were 102 hospitals within the 134 hospitals which accepted the field survey; the rate was 62.0%.

**Results:** In 2008, the number of dentists working in the hospitals was 1,421, which was approximately 13% of the number of total dentists in Taiwan (9672). Within the 1,421 dentists, 675 were attending staffs and 745 dentists were training residents. Within the 675 attending dentists, 510 (75.6%) had dental specialist certificates and 272 (40.3%) had teaching positions in dental schools. There were 382 dental interns (6<sup>th</sup> year undergraduate students) taking the training programs in hospitals, most of whom were trained in medical centers (342/382, 89.5%). Moreover, there were 888 dental assistants, 338 of whom were nurses and the other 550 were hospital self-trained personnel.

**Conclusion:** Comparing the dental manpower of different types of hospitals in Taiwan, the medical center was the best, followed by the regional hospital and the district hospital was last. When comparing 2008 with 2002, the numbers of both dentists and auxiliary personnel in Taiwan's hospitals increased with years. Although there were still only 13% dentists working

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in the hospital, they were responsible for teaching young dentists and doing research in hospitals. In other words, the quality of clinical service, teaching, and research in hospitals would influence the development of young dentists.

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## Introduction

The Department of Health began hospital accreditation in 1978.<sup>1</sup> Over 30 years, medical quality, manpower training, hospital management, teaching and research have been tremendously improved. Recently, the hospital accreditation concentrated on the patient-centered care and patient safety environment,<sup>1</sup> and has greatly changed the medical care system in Taiwan. The hospital accreditation includes not only all medical specialties, but also hospital management, nursing, pharmacy, radiology, medical rehabilitation, medical technology, etc. So far, dental medicine has been excluded in the hospital accreditation. Although three recognized dental specialties (i.e., maxillofacial surgery, oral pathology and orthodontics) have participated in the hospital accreditation, other dental specialties were excluded. Therefore, the qualification of dental care in the hospital is still not available.

In 2002, the Chinese Association of Hospital Dentistry (CAHD) completed questionnaires investigating human resources, dental care quality, teaching training, and research for all dental departments of hospitals<sup>2</sup> across Taiwan. The results revealed great variations in manpower and facilities among the dental departments in hospital. Even in the level of the teaching medical center, the dental department might vary from six dentists to 80 dentists depending on how the hospital administration runs the dental care. Recently, hospital accreditation has been changed from facility-orientated to outcome-orientated. In 2007, the CAHD, supported by the Department of Health, prepared to carry out the field survey for all dental departments in hospital, the final steps incorporating dental care into the hospital accreditation. The standards of field survey from 508 items of hospital accreditation criteria and 95 items of teaching hospital accreditation criteria, especially those related with dental care, were prepared. A total of 94 standards, including 30 items of administration, 36 items of clinical dentistry, and 28 items of dental teaching and training, had been selected as well as 23 items of basic information of each dental department. This paper focused on the analysis of basic information related to dental manpower, and compared with the results of the 2002 questionnaire survey.

## Materials and methods

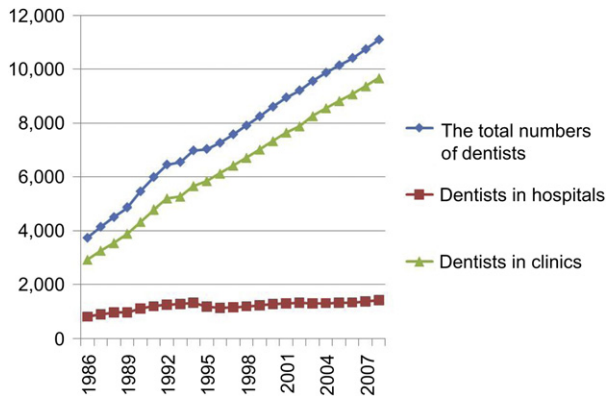
In order to reach the consensus of the standards for field survey, 25 representatives from different levels of hospitals across Taiwan formed the task force group in 2007. The members of the task force group met every month and tried to select and modify 508 items from the Concurrent Hospital Accreditation and 95 items from the Teaching Hospital Criteria. Ninety-four standards, including 30 standards in administration management, 36 standards in clinical dental

care and 28 standards in dental education, were chosen and posted on the CAHD website for 3 months to get comments and modification before becoming effective in 2007. In order to initiate all dental departments in hospitals into the field survey, 6 meetings were held separately in northern, central, and southern parts of Taiwan to convince them of the importance and necessity of the dental accreditation. The final version of the 94 standards could be downloaded from the CAHD website 3 months before the field survey. After completing the form, the original copy should be sent back to CAHD. One hundred and thirty-four hospitals sent back the evaluation forms, and the other 31 hospitals refused to fill in the forms, even after reminding by email and telephone. Inspection examiners recommended from different hospitals had completed one full-training course held both in Taipei and Kaohsiung. Among these 134 hospitals, 32 hospitals refused the field survey and 102 hospitals accepted it. The number of the field surveys was 76. According to the standard operation procedure of a survey, the field survey team visited every hospital for about 1.5 to 3 hours. The field survey team was composed of three to five examiners and it was divided into three groups: administration, clinical dental care, and dental education. Examiners would go through the 94 standards, ask questions relating to each standard, and reconfirm them with evidence provided. The hospital staff should answer the questions raised by the examiners. The basic information about the manpower and facility were provided by each dental department and would be checked by the CAHD secretary. If the hospital submitted the evaluation form without completing the field survey, the form would be excluded from the data to make sure the accuracy. All hospitals were classified into three groups: medical centers, regional hospitals, and district hospitals according to the 2007 accreditation. The whole area of Taiwan is divided into five parts: northern, central, southern, eastern and offshore islands. The northern part included Taipei county and city, Yilan county and city, Taoyuan county and city, and Hsinchu county and city; the central part included Miaoli County, Taichung County, Changhua County, Nantou County, and Yunlin County; the southern part included Chiayi County, Tainan County, Kaohsiung County, and Pingtung County; the eastern part included Taitung County and Hualien County; and the offshore islands included King-Meng and Peng-Hu. Full-time, but not part-time dentists registered their practices in hospitals. Specialist registration is limited in one main hospital.

## Results

### The change of the total number of dentists in hospitals (1986-2008)

The total number of dentists in Taiwan was 3,739 in 1986 and increased to 11,093 in 2008.<sup>3,4</sup> The increment per year

**Table 1** The total number of dentists from 1986 to 2008.

is about 300–400 (Table 1). Although the dentists in hospitals increased in number, the increasing rate was still less than that of the total dentists in Taiwan. Especially in 1995, when the National Insurance System first started, the number of dentists in hospitals had decreased by 133; when SARS happened in 2002, the number of the dentists in hospitals had decreased by 34. In 2005, the number of the dentists in hospitals finally increased back to it in 1994. The impact lasted for 11 years. In 1986, the number of dentists in hospitals was 22% of the total number of dentists nationwide; this proportion decreased to 13% in 2004, and remained stable until 2008.

### The change of hospital dentistry and the completion rate of survey (2002-2008)

In 2002, there were 163 hospitals with dental departments. These hospitals included 17 medical centers, 59 regional hospitals, and 87 district hospitals (Table 2). In 2008, there were 165 hospitals with dental departments, including 19 medical centers, 69 regional hospitals, and 77 district hospitals. In 2002, an airmail questionnaire survey was undertaken and the response rate was 40.5%. In 2008, a field survey was carried out, and the completion rates in 19 medical centers, 56 regional hospitals, and 27 district hospitals were 100%, 81.2%, and 35.1%, respectively. The total completion rate of the field survey was 61.8%.

### The distribution of attending doctors, residents, and interns (2002-2008)

In 2008, according to the field survey, 1,322 dentists registered their practice license in hospitals among 1,421

dentists registered in the Department of Health; 93% of the dentists working in hospitals participated in the field survey. Eight hundred and sixty-five full-time dentists in hospitals completed the questionnaire survey in 2002. The number of dentists registered in the Department of Health in 2002 was 1326; 65.2% of the dentists participated in the questionnaire survey. In 2008, the numbers of full-time attending dentists in medical centers, regional hospitals, and district hospitals were 359 (53.2%), 248 (36.7%), and 68 (10.1%), respectively. The total number of full-time attending dentists was 675. The average numbers of full-time attending dentists in each medical center, regional hospital, and district hospital were 18.9, 4.4, and 2.5, respectively (Table 3). In comparison with 2002, the increasing numbers of attending dentists in medical centers and regional hospitals were 84 and 155, respectively, while the number of attending dentists in district hospitals did not change significantly. The total number of part-time attending dentists increased from 304 in 2002 to 626 in 2008. The ratio of part-time attending dentists to full-time attending dentists increased from 0.7 to 0.9. The great increase in part-time attending dentists mostly occurred in regional hospitals, which increased from 52 to 227. The number of part-time attending dentists in medical centers increased from 218 to 332. The average part-time attending dentists increased from 12.8 in 2002 to 17.5 in 2008 in medical centers, from 2.2 in 2002 to 4.1 in 2008 in regional hospitals, and from 1.4 in 2002 to 2.5 in 2008 in district hospitals. Generally, part-time attending dentists increased from 4.6 in 2002 to 6.1 in 2008.

In 2008, most of the residents worked full-time with a total number of 647, which including 464 working in medical centers, 167 working in regional hospitals, and 16 working in district hospitals. The number of full-time residents working in district hospitals was less than that in 2002.

The average number of full-time residents was 17.8 in 2008. In the case of full-time residents in regional hospitals, the average number decreased from 4 in 2002 to 3 in 2008; in the case of full-time residents in district hospitals, the average number decreased from 1.3 in 2002 to 0.6 in 2008. The average number of total full-time residents decreased from 6.5 in 2002 to 6.3 in 2008.

The total number of dental interns in 2008 was 382. In comparison with the 336 interns in 2002, the number increased by 46 persons and most of them practiced in medical centers (89.5%). There were 342, 35, and 5 interns in medical centers, regional hospitals, and district hospitals, respectively. The average number of interns decreased by 1.4 when comparing 2008 with 2002; the number of interns decreased from 18.1 in 2002 to 18 in 2008

**Table 2** The completion rate of field survey in hospital dentistry between 2002 and 2008.

	Medical center		Regional hospital		District hospital		Total	
	2002	2008	2002	2008	2002	2008	2002	2008
Total hospital numbers	17	19	59	69	87	77	163	165
Field survey hospital numbers	17	19	24	56	25	27	66	102
Teaching hospital numbers	17	19	18	54	8	11	43	84
Response rate	100%	100%	40.7%	81.2%	28.7%	35.1%	40.5%	61.8%

**Table 3** The total attending dentists, residents, and interns in 2002 and 2008.

		Full-time attending dentists		Part-time attending dentists		Full-time residents		Part-time residents	Full-time interns	
		2002	2008	2002	2008	2002	2008	2008	2002	2008
Medical center	Total	275	359	218	332	303	464	10	307	342
	Average	16.2	18.9	12.8	17.5	17.8	24.4	0.5	18.1	18.0
Regional hospital	Total	93	248	52	227	96	167	52	29	35
	Average	3.9	4.4	2.2	4.1	4	3	0.9	1.2	0.6
District hospital	Total	66	68	34	67	32	16	8	0	5
	Average	2.6	2.5	1.4	2.5	1.3	0.6	0.3	0	0.2
Total	Total	434	675	304	626	431	647	70	336	382
	Average	6.6	6.6	4.6	6.1	6.5	6.3	0.7	5.1	3.7

in medical centers, decreased from 1.2 to 0.6 in regional hospitals, and increased from 0 to 0.2 in district hospitals.

### The distribution of auxiliary personnel in hospital dentistry

The auxiliary personnel in hospital dentistry included clinical assistants with nurse licenses, clinical assistants without licenses, radiologists, dental technicians, administrators, and office employees. The total number of dental auxiliary personnel was 1,258 in 2008, which was 732 more than that in 2002 (Table 4). The number of dental clinical assistants with nurse licenses grew from 225 to 338 and 200 worked in medical centers. The number of dental clinical assistants without nurse licenses grew from 329 to 550 and most of them worked in regional hospitals. The average number of dental assistants with nurse licenses decreased from 3.4 to 3.3; the number increased from 8.7 to 10.5 in medical centers, increased from 2 to 2.1 in regional hospitals, and decreased from 1.2 persons in 2002 to 0.8 in 2008 in district hospitals. The average number of dental assistants without nurse licenses increased from 5 in 2002 to 5.4 in 2008; the number decreased from 9.6 to 9.3 in medical centers, increased from 4 to 5.3 in regional hospitals, and did not change significantly in district hospitals (Table 4).

The number of dental radiologists increased from 31 in 2002 to 66 in 2008. The average number increased from 0.5 in 2002 to 0.6 in 2008. The average number in regional hospitals had the greatest increase; from 0.2 in 2002 to 0.6 in 2008 (Table 4). The total number of dental technologists increased from 77 in 2002 to 98 in 2008 while the average number decreased from 1.2 to 1. The total number in medical centers decreased from 61 to 56 persons while the average number decreased from 0.4 to 0.2. The total number in regional hospitals increased from 6 to 36 while the average number increased from 0.3 to 0.6. The number of office employees increased from 16 in 2002 to 135 in 2008, of which the number in medical centers increased the most (from 11 to 93). The average number of the office employees increased from 0.6 in 2002 to 4.9 in 2008.

The number of administrators increased from 54 in 2002 to 71 in 2008. The increase occurred mainly in the medical centers with an increase in total number from 23 to 28 and average number from 1.4 to 2.

### Situation of dental classification in hospital dentistry

The dental specialty may be classified into nine sections: oral maxillofacial surgery, oral pathology, orthodontics, periodontics, operative dentistry, prosthodontics, pedodontics, endodontics, and general dentistry/family dentistry. Extremely detailed classification caused inconvenience and the classification varied in different hospitals. There were 32 hospitals (31.4%) which had no classification in dental specialty; among them, 14 were regional hospitals and 18 were district hospitals (Table 5). Of the hospitals, 23.5%, most of which were medical centers (9) and regional hospitals (14), had six to seven specialties in their classification, covering general dentistry/family dentistry, prosthodontics, periodontics, oral maxillofacial surgery, endodontics, orthodontics, and pedodontics. Of the hospitals, 15.6%, which consisted of 12 regional hospitals and 4 district hospitals, had two to three specialties in their classification, covering general dentistry, oral surgery, and orthodontics. The lowest number of sections in medical center is 6.

### Management style of hospital dentistry

Hospital dentistry was managed by the hospital in most occasions. The percentage decreased from 84.1% in 2002 to 82.4% in 2008. The change of outsourcing rate was not significant. There were four hospitals managed by Build-Operate-Transfer (BOT) in 2008 (Table 6).

### The specialists in hospital dentistry

Only three dental specialties have the definite qualification accredited by the Department of Health. Therefore, when doing the field survey, dentists of the other six dental specialties may submit specialty certificates issued by related dental specialty associations to acquire the accreditation.

There were 463 dental specialists in hospitals dentistry in 2002; this number increased to 510 in 2008, which was 32.2% of the total dentist population (510/1,586). The number of specialists increased the most in the oral surgery specialty, which was 111 (Table 7). The top five of the nine

**Table 4** The dental auxiliary personnel in different levels of hospitals in 2002 and 2008.

Classification of hospitals	Hospital numbers	Clinic assistant (with nurse license)		Clinic assistant (without nurse license)		Radiologist		Dental technician		Office employee		Administrator		Total	
		2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008
Medical center		17	19	17	19	17	19	17	19	17	19	17	19	17	19
Total		148	200	164	177	24	31	61	56	11	93	23	38	431	595
Average		8.7	10.5	9.6	9.3	1.4	1.6	3.6	2.9	0.6	4.9	1.4	2.0	25.4	31.3
Regional hospital		24	56	24	56	24	56	24	56	24	56	24	56	24	56
Total		48	117	95	298	4	34	6	36	5	34	21	29	179	548
Average		2.0	2.1	4.0	5.3	0.2	0.6	0.3	0.6	0.2	0.6	0.9	0.5	7.5	9.8
District hospital		25	27	25	27	25	27	25	27	25	27	25	27	25	27
Total		29	21	70	75	3	1	10	6	0	8	10	4	122	115
Average		1.2	0.8	2.8	2.8	0.1	0.0	0.4	0.2	0.0	0.3	0.4	0.1	4.9	4.3
Hospital numbers		66	102	66	102	66	102	66	102	66	102	66	102	66	102
Total		225	338	329	550	31	66	77	98	16	135	54	71	732	1258
Average		3.4	3.3	5.0	5.4	0.5	0.6	1.2	1.0	0.2	1.3	0.8	0.7	11.1	12.3

specialties in hospital dentistry were oral surgery (111 persons), general dentistry (78 persons), periodontics (66 persons), orthodontics (66 persons), and prosthodontics (58 persons). However, the number of specialists in hospital dentistry in 2008 was less than that in 2002. Four specialties exhibited a decrease in the number of specialists: operative dentistry (34 persons less), pedodontic (18 persons less), endodontics (11 persons less), and prosthodontics (2 persons less). There were 78 specialists of general dentistry/family dentistry, occupying 31.1% of the family dentistry specialists in Taiwan. Among them, 24 worked in medical centers, 40 worked in regional hospitals, and 14 worked in district hospitals. Comparatively, oral pathology specialists all practiced in hospitals. There were 176 periodontists in Taiwan and 37.5% of them practiced in hospitals. There were 66 orthodontists practicing in hospitals, which accounted for 37.5% of the total population of orthodontists. There were 58 prosthodontists practicing in hospitals, which was 52.3% of the total population of the prosthodontists. Most of the specialists in pedodontics, endodontics, and operative dentistry practiced their specialties in local clinics; the percentage of their practices in hospital dentistry was 24.5%, 39.2%, and 41.1%, respectively.

### The specialty and teaching qualification for attending staff

Not all full-time attending staff in the hospitals had specialist certificates. Among the 675 full-time attending staff, only 510 (75.6%) acquired specialty certificates (Table 8).

Only the number of specialists in oral surgery and oral pathology had exceeded the number of attending dentists. The number of attending dentists in the other dental sections without specialty identification were 69 in general dentistry/family dentistry, 50 in prosthodontics, 23 in periodontics, 11 in endodontics, 11 in pedodontics, and 4 in orthodontics.

Among the 675 attending dentists in Taiwan, 272 (40.3%) had teaching qualifications issued by the Ministry of Education. The attending dentists in oral pathology with teaching qualification took up 71.4% of its population, followed by operative dentistry (65.2%), periodontics (50.6%), oral surgery (47.7%), prosthodontics (47.2%), pedodontics (46%), orthodontics (45.7%), and endodontics (34.5%); whereas only 12.9% of the attending dentists in general dentistry/family dentistry were qualified to teach. Of the attending dentists in medical centers, 52.1% were qualified to teach, followed by 27.8% in regional hospitals and 23.5% in district hospitals.

### The distribution of dental residents

There were 230 1<sup>st</sup> year dental residents trained in hospital dentistry (Table 9). However, there were only 147 2<sup>nd</sup> year dental residents trained in hospital dentistry. The number of the 3<sup>rd</sup> year and above dental residents mainly for specialist training was 271 (average 90 persons/year). Regarding the geographic environment distribution of human resources in hospital dentistry, half of the dentists

**Table 5** The total classification of hospital dental departments in 2008.

Classification	Hospital numbers	Medical center	Regional hospital	District hospital	Percentage
9 sections	9	6	3	0	8.8%
8 sections	7	4	2	1	6.9%
7 sections	11	4	7	0	10.8%
6 sections	13	5	7	1	12.7%
5 sections	9	0	8	1	8.8%
4 sections	5	0	3	2	4.9%
3 sections	8	0	6	2	7.8%
2 sections	8	0	6	2	7.8%
1 sections	32	0	14	18	31.4%
Total	102	19	56	27	100%

populated in the north area consisted of 53.5% of the full-time attending dentists, 67.6% of the part-time attending dentists, 54.6% of the residents, and 50.5% of the interns (Table 10).

## Discussion

### The total number change of dentists in hospital dentistry

From 1986 to 2008, the number of dentists in hospital dentistry kept increasing slowly, from 809 to 1,421. Since the National Health Insurance carried out on March 1, 1995, the income of dental clinic increased while the number of dentists decreased from 1,316 in 1994 to 1,136 in 1996,<sup>5</sup> and afterwards the number of dentists kept increasing slowly. However, when SARS suddenly happened in 2002, the number of dentists in hospital dentistry decreased by 34 and the number remained as the same in 1994 until 2005. The National Health Insurance and SARS had a great impact on the number of dentists in hospital dentistry, and the effect lasted for 11 years. From 2005 until now, the number of dentists has increased by 35 persons per year. The number of dentists in hospital dentistry was 22% of the total dentists in Taiwan in 1986, which decreased to 13% in 2008; while the ratio of dentists in clinic to national dentists increased from 78% in 1986 to 87% in 2008.

In comparison to data overseas, there were 10% dentists working in hospitals and schools in Sweden in 2008 and 90% dentists working in clinics.<sup>6,7</sup> There were 23% dentists working in public institutions and 77% working as private

practitioners in the United Kingdom in 2008.<sup>6,8</sup> In Japan, there were 15% dentists working in public institutions and schools and 85% working as private practitioners<sup>9</sup> in 2004. Moreover, there were 18% working in public institutions and schools and 82% working as private practitioners in 2000.<sup>10</sup>

### Hospital survey in 2002 and in 2008

In 2002, a questionnaire was mailed to hospitals, and the response rate was 40.5%. Although all 17 medical centers mailed back, the response rates in regional hospitals and district hospitals were not good. The number of dentists in hospitals was 865 in total, which was 65.2% of the total dentists (1,326) in hospitals.

In 2008, professional interview visits to hospitals were carried out. Although the hospital visits were not regulated by law, yet under the influence of the Association of Hospital Dentistry, all the hospitals attending the association completed the interview visits. There were 76 times of interview visits. All 19 medical centers completed the interview while only 56/69 regional hospitals (81.2%) and 27/77 district hospitals (35.1%) completed the interview. A total of 1,322 dentists (full-time attending dentists and full-time residents) were included in the interview.

The total number of dentists was 1,421 in 2008 according to the statistics of the Department of Health,<sup>4</sup> which implied that the dentists included in the interview visits was 93% of the total dentist population in hospital dentistry nationwide. This research is focused mainly on the analysis of the human resources in hospital dentistry, and may reflect the real situation.

**Table 6** The management style of hospital dental departments in 2002 and 2008.

	Classification						
	Managed by Hospital		Outsourcing		BOT	Total	
	2002	2008	2002	2008	2008	2002	2008
Medical center	16	17	1	0	2	17	19
Regional hospital	18	45	6	10	1	24	56
District hospital	19	22	3	4	1	22	27
Total	53	84	10	14	4	63	102
Rate	84.1%	82.4%	15.9%	13.7%	3.9%	100%	100%

**Table 7** The numbers of dental specialists in hospital dentistry in 2002 and 2008.

Hospital classification	Oral maxillofacial surgery		Oral pathology/Oral diagnosis		General dentistry/Family dentistry		Endodontics		Prosthodontics		Operative dentistry		Periodontics		Pedodontics		Orthodontics		Total		Average	
	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008
Medical center	—	69	19	—	24	30	—	45	—	18	—	38	—	31	—	50	—	324	—	17.1	—	—
Regional hospital	—	41	3	—	40	16	—	10	—	1	—	24	—	7	—	14	—	156	—	2.8	—	—
District hospital	—	1	0	—	14	1	—	3	—	4	—	4	—	1	—	2	—	30	—	1.1	—	—
Whole nation	57	111	22	—	58	47	60	58	57	23	59	66	39	57	66	463	510	7.0	5.0	—	—	—

### The change of the distribution of attending dentists, residents and interns

In 2008 and 2009, the constitution in hospital dentistry mainly consisted of attending dentists, whereas the number of attending dentists was more than that of the full-time residents. During this period, the full-time attending dentists increased by 241 persons and the full-time residents increased by 216 persons. The attending dentists in medical centers increased by 84 persons, the regional hospitals increased by 155 persons and the district hospitals only increased by 2 persons. The main reason may be due to the increase of the number of medical centers (3 hospitals) and regional hospitals (32 hospitals) during the period of interview visits. The number of full-time attending dentists in medical centers and regional hospitals were comparable in 2008 and in 2002. As the average number of full-time attending dentists changed from 16.2 to 18.9 in medical centers, from 3.9 to 4.4 in regional hospitals, and from 2.6 to 2.5 in district hospitals, the amount of increase was not obvious.

### Dental auxiliary personnel

The number of dental auxiliary personnel in 2008 was 1,258 and the number of dental manpower was 1,322. The ratio of dental auxiliary personnel to dentists was 0.95 (1,258/1,322), which was lower than in the United States (2.1),<sup>7,11</sup> in the United Kingdom (1.3),<sup>6,12,13</sup> or in Japan (1.1)<sup>14</sup> in 2008. In 2002, the ratio of dental auxiliary personnel to dentists was only 0.8 (732/865). This result also reflected that when dentists increased in hospital, the dental auxiliary personnel did not increase. The clinical assistants in medical centers, regional hospitals, and district hospitals may be divided into those with nurse licenses and those without nurse licenses. All assistants need further training in clinical dental assistance regardless of their original training background. Since the clinical assistants with nurse licenses are paid higher salaries, many hospitals also employ dental assistants without nurse licenses. In 2002, the ratio of the clinic assistants without nurse licenses compared to those with nurse licenses was 1.1 (164/148) in medical centers. This ratio decreased to 0.9 (177/200) in 2008. In 2002, this ratio in the regional hospitals was 1.98 (95/48), which increased to 2.5 (298/117) in 2008. This ratio in district hospitals was 2.4 (70/29) in 2002, which increased to 3.6 (75/21) in 2008. The number of clinical dental assistants with nurse licenses gradually increased in medical centers, but decreased in regional hospitals and district hospitals.

The number of office employees had increased the most in medical centers (from 0.6 to 4.9) while the number of dental technicians decreased from 3.6 to 2.9. The average number of radiologists, dental technicians, office employees, or administrators was < 1.

The research in Kaohsiung County, Kaohsiung City, Pingtung County, and Penghu County showed that each dentist employed 1.44 dental assistants in average.<sup>15,16</sup> The research focused on the dental clinics and institutions in Taipei by Wang et al<sup>16</sup> indicated that the ideal ratio of dentists to dental assistants was 1:2 to 1:1. In case of the full-time dental assistants, the most common case was 1

**Table 8** The total numbers of qualified teachers, dental specialists, and full-time attending dentists in different levels of hospitals.

Hospital classification	Specialist classification	Specialist numbers	Persons of full-time attending dentists	Numbers of qualified teachers
Medical center	Oral maxillofacial surgery	69	66	37
	Oral pathology/Oral diagnosis	19	17	14
	General dentistry/Family dentistry	24	28	13
	Endodontics	30	33	17
	Prosthodontics	45	69	34
	Operative dentistry	18	17	13
	Periodontics	38	50	29
	Pedodontics	31	34	14
	Orthodontics	50	45	16
	Total	324	359	187
Regional hospital	Oral maxillofacial surgery	41	42	12
	Oral pathology/Oral diagnosis	3	4	1
	General dentistry/Family dentistry	40	77	5
	Endodontics	16	23	3
	Prosthodontics	10	31	13
	Operative dentistry	1	3	2
	Periodontics	24	31	14
	Pedodontics	7	15	4
	Orthodontics	14	22	15
	Total	156	248	69
District hospital	Oral maxillofacial surgery	1	1	3
	Oral pathology/Oral diagnosis	0	0	0
	General dentistry/Family dentistry	14	42	1
	Endodontics	1	2	0
	Prosthodontics	3	8	4
	Operative dentistry	4	3	0
	Periodontics	4	8	2
	Pedodontics	1	1	5
	Orthodontics	2	3	1
	Total	30	68	16
Whole nation	Total	510	675	272

person in a hospital (33.2%), and the second common case was 2 persons in a hospital (25.2%).

A study conducted overseas in 1998 showed that the ratio of dental hygienists to dentists<sup>17</sup> was 0.83 in Canada, 0.71 in Japan, and 0.91 in the United States. This ratio did not include other auxiliary personnel such as dental assistants and dental nurses.

An investigation in Australia in 2004 indicated that in the western rural area, there were 2 dental assistants and 1 dental nurse in each dental clinic. The data in the United States also demonstrated an increasing number in auxiliary personnel.<sup>18</sup>

### The necessity of dental classification

Dental classification is mainly necessary for clinic medicine and teaching, and is not patient-centered comprehensive dental care. From the aspect of a patient, it would be more convenient if a single doctor could solve all his/her health problems.

The hospitals with nine dental sections were teaching hospitals affiliated to school dental departments. All medical centers had at least five sections in dental

departments, and most of those had six to seven sections. Most of the regional hospitals had only one section (general dentistry) in their dental departments, and some of them were further divided into two sections, namely general dentistry and oral surgery. District hospitals are less divided into three sections above.

In the United States, the number of dental specialists has increased during the past 30 years; in 1970, < 10% of the dentists were specialists, but 22% of the dentists were specialists in 2009. It is predicted that the number will increase to 27% in 2022, with most specialists are in the urban area.<sup>18</sup>

Only 40.3% of the attending dentists acquired a teaching qualification. Half of the attending dentists did not apply for the identification of the teacher qualification set by the Ministry of Education. This may be due to dentistry not being included in hospital accreditation.

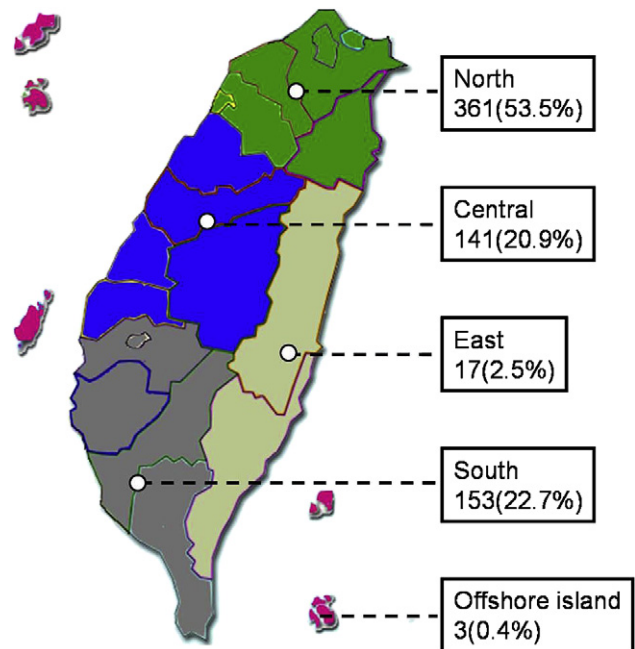
An average of 90 dentists entered the 3<sup>rd</sup> year resident training program each year. The 3<sup>rd</sup> year residency is mainly for specialty training. Approximately 350 to 400 persons graduated from dental schools each year. The initial statistics show that about 1/4 dentists choose further specialty training; the period is 2–3 years.



**Table 9** The numbers of full-time residents and training residents in hospitals in 2008.

Hospital classification	Numbers of full-time residents					Numbers of training residents					Total				
	R1	R2	R3	R4	Total	R1	R2	R3	R4	Total	R1	R2	R3	R4	Total
Medical center (19)	130	70	55	53	370	39	31	17	7	95	169	101	72	60	465
Average	6.8	3.7	2.9	2.8	19.5	2.1	1.6	0.9	0.4	5.0	8.9	5.3	3.8	3.2	24.5
Regional hospital (56)	50	39	27	18	152	6	5	3	0	15	56	44	30	18	167
Average	0.89	0.7	0.48	0.32	2.71	0.11	0.09	0.05	0	0.27	1	0.79	0.54	0.32	1.62
District hospital (27)	5	2	2	4	15	0	0	0	0	1	5	2	2	4	16
Average	0.19	0.07	0.07	0.15	0.56	0	0	0	0	0.04	0.19	0.07	0.07	0.15	0.16
Total (102)	185	111	84	75	537	45	36	20	7	111	230	147	104	82	648
Average	1.8	1.1	0.8	0.7	5.3	0.4	0.4	0.2	0.1	1.1	2.3	1.4	1.0	0.8	6.4

**Table 10** The distribution of full-time attending dentists in Taiwan in 2008.



Approximately half of the dental manpower resources in hospitals concentrated in north part. There were about 20% resources in the south and 20% in the central area. The eastern part and offshore lands had very few resources. How to balance the dental manpower resources in each part of Taiwan will be a vital issue in the future.

**Conclusion**

In hospital dentistry, among human resources in different levels, the best is in medical centers, followed by regional hospitals and lastly district hospitals. In comparison with the year 2002, the dentist manpower and auxiliary personnel in hospital dentistry showed little improvement in 2008. Although there are only 13% dentists working in hospitals, the hospital dentistry is still responsible for teaching and research, which is vital for the cultivation and development of young dentists.

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