



ORIGINAL ARTICLE

Impact of Knowledge and Behavior of Medical Personnel Towards Speech Therapy for Tracheostomized Patients

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Background: Tracheostomized patients suffer from communication difficulty, physical pain, swallowing difficulty, and decreased quality of life. In this study, we investigated the current status of communication and swallowing difficulties in tracheostomized patients in Taiwan, and the knowledge of medical personnel about tracheostomized patients and the perceived benefits of referring them to speech therapy.

Methods: We analyzed both the national data from The Collaboration Center of Health Information Application, and medical insurance data of a medical center in Taipei. We also administered a questionnaire survey to 80 medical personnel before and after an education program was given for patients and medical personnel.

Results: Treatment referral rates of inpatients with tracheostomy for speech therapy were found to be at 4.87% and 10%, from national and medical center data, respectively, and only a few patients received both communication and swallowing training. Over 50% of the medical personnel never referred any tracheostomized inpatients for speech therapy. The rate of referral was not significantly affected by experience and knowledge of medical personnel of tracheostomy.

Conclusion: Fundamental education about the availability of speech therapy and speech-language therapists for medical personnel would be the best way to help tracheostomized patients obtain entitled proper speech therapy in Taiwan.

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1. Introduction

Tracheostomy is a way for cleansing the secretions in the airways, or for improving their respiratory function. However, tracheostomy causes physical pain, limits effective communication and swallowing ability, makes the patients barely enjoy food or conversation, and affects quality of life.^{1–4} Tracheostomy adversely affects adult quality of life, and seriously affects the development of language and expression in growing children. It also influences patients' voice quality and makes intelligibility poorer in noisy environments.^{5,6} Tracheostomized patients suffer from communication or swallowing difficulties that affect their daily life. Those swallowing and communication difficulties can be improved

through treatment by speech-language therapists. Positive rehabilitation and better quality of life for tracheostomized patients can be obtained through speech therapy.

Over the past decade, many papers have described the importance of multidisciplinary professional teams for management of tracheostomized patients. Researchers suggest that early involvement of speech-language therapists is important for communication and swallowing management of tracheostomized patients.^{7–9} If patients have compliance with medical management to enhance the treatment effect, they are more satisfied with their life because of regaining communication and swallowing ability.¹⁰

Speech-language therapists provide advice for the decannulation decision. They also assess patients' respiratory protection, vocal ability, use of speaking valve or augmentative and alternative communication, and training ability to express and eat. Treated tracheostomized patients can improve their ability to smell and swallow, decrease the number of suctionings, reduce the number of tracheostomy intubation days and infection rate, as well as improve quality of life.^{7,11} These are all included in the job descriptions of speech-language therapists in some Western countries.⁸ In other words, through professional advice,

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tracheostomized patients regain their communication and swallowing ability, and improved quality of life.^{2–4,12,13} Tracheostomized patients with swallowing difficulty should be evaluated and treated by speech-language therapists.¹⁰ All adult and child tracheostomized patients or any person with communication or swallowing difficulties, should be referred to speech-language therapists once their medical and pulmonary status becomes stable.^{8,14} Moreover, communication and swallowing which are both important for tracheostomized patients, should be assessed and treated.¹⁵ However, not all tracheostomized patients have been referred for evaluation or training by speech-language therapists. Low speech therapy rates have been noted in previous studies.^{8,16,17}

Some studies have reported that tracheostomized patients have been referred to speech-language therapists for assessment and treatment such as cuff deflation on average 14 days after tracheostomy intubation. Over 70% of tracheostomized patient have directly been evaluated and treated by a speech-language therapist.^{8,18}

To understand the referral status of speech therapy in tracheostomized patients in Taiwan, we intended (1) to explore the answers to questionnaires and the level of speech therapy for patients with tracheostomy, and (2) to establish the relationship between rates of referred tracheostomized patients for speech therapy and knowledge and behavior of medical personnel.

2. Methods

2.1. Data collection

We extracted the national data retrospectively from The Collaboration Center of Health Information Application (CCHIA), which is a health insurance system covering 99.5% of the population in Taiwan. We analyzed service claim data of tracheostomized inpatients that had been submitted to obtain reimbursement from the National Health Insurance in Taiwan from January 1, 2010 to December 31, 2010. We also collected and compared medical insurance data of inpatients with tracheostomy from a medical center in Taipei from 2009 to 2013 and compared the data from September to January of the following years in each year of those five years. Data for speech therapy had two different service types: evaluation and training. Each type was separated into both communication and swallowing items. Thus, we analyzed five categories: communication evaluation, swallow evaluation, communication training only, swallowing training only, as well as both communication and swallow training. This study was focused on studying the training types of those tracheostomized patients who received speech therapy.

2.2. Questionnaire survey

A questionnaire survey was administered to 80 employees of the above medical center from January 1, 2014 to March 31, 2014. Excluded in this study were all interns, clerks, and student nurses. Study participants who gave informed consent and completed the questionnaire received a gift valued at NT\$100 (about US\$3.50).

The whole study protocol (both data analysis and questionnaire) was approved by the Joint Institutionalized Review Board of Taipei Medical University, Taipei, Taiwan. Those medical center employees who completed the questionnaire survey signed the informed consent before participating in the survey.

2.3. Education program

Based on the need to educate medical personnel who are unfamiliar with the process and the method about referring inpatients

with tracheostomy for speech therapy¹⁹ and speech language therapists' responsibility to educate patients, caregivers, and medical personnel,¹⁴ we conducted an education program to stress the need and importance of speech therapy at the medical center.

2.4. Statistical analysis

We presented the data with descriptive statistics. The differences between groups were tested using Student *t* test, χ^2 test, and Mann–Whitney *U* test for continuous and categorical variables. We used Statistical Analytic System (SAS) for Windows version 9.3 (SAS Institute Inc., Cary, NC, USA) and SPSS for Windows version 15.0 (SPSS Inc., Chicago, Illinois, USA) to calculate all study data. The differences between the groups were considered significant if *p*-values were smaller than 0.05.

3. Results

Table 1 lists the distribution of inpatients with tracheostomy and the speech therapy they had in Taiwan in 2010. **Table 2** shows the distribution of inpatients with tracheostomy by region and hospital level in Taiwan in 2010. **Table 3** presents speech therapy status of tracheostomized inpatients by the top 10 medical divisions in Taiwan and at a medical center. **Table 4** describes the status of speech therapy in tracheostomized inpatients at a medical center in Taipei from 2009 to 2013. **Table 4** shows the status of speech therapy in tracheostomized inpatients at a medical center in Taipei from 2009 to 2013. **Table 5** indicates the status of speech therapy in tracheostomized inpatients at a medical center in Taipei from 2009 to 2013. **Table 6** reveals changes in medical personnel by groups prior to and after the education program at a medical center in Taipei.

4. Discussion

Table 4 shows that the number of tracheostomized inpatients who received speech therapy (from 25 to 12) and referral rate (from 8.4 to 5.7) were decreased, and that numbers of tracheostomized inpatients (from 298 to 209) and training frequency had a declining trend from 2009 to 2013 at the medical center. The reason for the overall reduced number of tracheostomized inpatients who received speech therapy was possibly the decreased number of inpatients. Increases in other types of rehabilitation patients (e.g., head and neck cancer, voice disorder, or dementia) when speech-language therapist manpower was kept at the same level may also have led to decreased frequencies in training, as reflected in the service claims.

Our findings showed that the main training that tracheostomized inpatients received was communication training only (52.4%, 657/1253) in Taiwan (**Table 1**), swallowing training only (63.6%, 82/29) in the medical center (**Table 4**), and that 25%–33.3% of tracheostomized inpatients who received speech therapy received both communication and swallow training (**Tables 1 and 4**). However, speech-language therapists should manage both communication and swallowing problems in tracheostomized patients.⁸ The differences are possibly caused by fewer speech-language therapists in Taiwan compared with Western countries, low monetary values in insurance reimbursements, or poor patient conditions in Taiwan. To clarify these unanswered questions, we suggest that future studies are needed.

Another findings from the study indicated that both referral rates of the medical center and the whole island were 10% (**Table 4**) and 4.87% (**Table 1**), respectively. The percentage of tracheostomized inpatients who received therapy and average training number were decreased as the age of the population increased, from the national data. Our findings showed that the referral rate was below

Table 1 Distribution of inpatients with tracheostomy and speech therapy in Taiwan in 2010

	Tra	Tra-SpT	Training	SwT	ComT	BoT	SwE	ComE
Patient sex								
Overall	27,546 (100)	1,342 (100)	1,253 (100)	261 (100)	657 (100)	335 (100)	531 (100)	689 (100)
Male	18,387 (66.8)	956 (71.2)	896 (71.5)	208 (79.7)	463 (70.5)	225 (67.2)	380 (71.6)	479 (69.5)
Female	9,095 (33.0)	382 (28.5)	357 (28.5)	53 (20.3)	194 (29.5)	110 (32.8)	151 (28.4)	210 (30.5)
Unknown	64 (0.2)	4 (0.3)						
<i>p</i>			< 0.001	< 0.0001	< 0.05	N.S.	< 0.05	N.S.
Patient age								
< 40 y	2,012 (7.3)	211 (15.7)	193 (15.4)	26 (10)	113 (17.2)	54 (16.1)	70 (13.2)	126 (18.2)
> 40 y	25,534 (92.7)	1,131 (84.3)	1,060 (84.6)	235 (90)	543 (82.8)	282 (83.9)	462 (86.8)	565 (81.8)
<i>p</i>			< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Times								
Overall			25,254 (100)	1,510 (100)	13,051 (100)	10,693 (100)	731 (100)	1,250 (100)
Male			17,031 (67.4)	1,140 (75.5)	8,901 (68.2)	6,990 (65.4)	513 (70.2)	861 (68.9)
Female			8,223 (32.6)	370 (24.5)	4,150 (31.8)	3,703 (34.6)	218 (29.8)	389 (31.1)
Times/patient								
Overall			20.15	5.79	19.86	31.92	1.38	1.81
Male			19.01	5.48	19.22	31.07	1.35	1.80
Female			23.03	6.98	21.39	33.66	1.44	1.85

Data are presented as *n* (%).

BoT = both communication and swallow training; ComE = communication evaluation; ComT = communication training only; SwE = swallow evaluation; SwT = swallowing training only; Tra = tracheostomized inpatient; Tra-SpT = tracheostomized inpatient who received speech therapy.

that in other countries, where the rate is 48.1%–78%.^{8,15–17} We suggest that the differences are caused by the unfamiliar referral process and the role of speech-language therapists, as well as lack of a professional team for patients with tracheostomy in Taiwan.

In our study, we found that the number of tracheostomized inpatients and experience of medical personnel in any subspecialties did not affect referral rates for speech therapy among tracheostomized patients (data not shown). Although not being listed in the top 10 medical divisions to have tracheostomized inpatients, rehabilitation medicine referred more patients for speech therapy. The medical personnel in the neurosurgery/neurology division had more opportunity to contact speech-language therapists and understood the job content of speech-language therapists. We contend that the rate of referral might be influenced by understanding the role of speech-language therapists and their contact intensity. This may be due to the fact that stroke patients who need physical/occupational therapy have more chance to make contact with speech-language therapists.

We also found that medical personnel and different types of wards had different levels of understanding of the role of speech-language therapists in handling tracheostomized patients. Most

medical personnel are still not aware that the tracheostomized patients may be helped by speech-language therapists for swallowing and communication problems.^{18,20,21}

Readers are cautioned not to over-interpret the study findings because this study had two major limitations. First, the questionnaire survey was conducted at a medical center in Taipei where it serves a diverse population of tracheostomized patients, but this center cannot represent patients throughout Taiwan. During this study, the most recent data of the CCHIA were from 2010. This situation makes it difficult to compare those 5 years data from the medical center with those from the whole of Taiwan. Second, this study did not collect a pediatric sample. There were no pediatric tracheostomized inpatients at the medical center during the study period. Tracheostomy affects adult quality of life, and affects the development of growing children, especially those who are aged < 1 year. Most tracheostomized children are < 1 year and have severe diseases. Caregivers are more concerned about the child's physical development and often ignore communication development, resulting in a delay in seeking help. Thus, it is important to collect data for children with tracheostomy. In addition, according to the regulation of CCHIA, data with < 2 units cannot be used for analysis.

Table 2 Distribution of inpatients with tracheostomy by region and hospital level in Taiwan in 2010

Total	Group											
	Overall	North	Northeast	Central	Southeast	South	East	Off-shore islands	Medical center	Regional hospital	District hospital	Other
Patients												
Population	23,162,123 (100)	6,900,273 (29.8)	3,491,387 (15.1)	4,482,196 (19.4)	3,407,085 (14.7)	3,646,992 (15.8)	1,029,964 (4.5)	204,226 (0.9)	—	—	—	—
Tracheostomy	27,546 (100)	8,706 (31.6)	2,964 (10.8)	5,353 (19.4)	4,479 (16.3)	4,589 (16.7)	1,382 (5)	73 (0.3)	10,428 (37.9)	8,726 (31.7)	8,385 (30.4)	7 (0)
Tra-SpT	1,342 (100)	536 (39.9)	105 (7.8)	343 (25.6)	190 (14.2)	126 (9.4)	42 (3.13)		843 (62.8)	422 (31.5)	77 (5.7)	—
Times												
SpT	27,320 (100)	10,251 (37.5)	2,522 (9.2)	11,914 (43.6)	1,295 (4.7)	652 (2.4)	686 (2.5)		8,586 (31.4)	10,872 (39.8)	7,862 (28.8)	—
Training**	25,325 (100)	9,437 (37.3)	2,120 (8.4)	11,475 (45.3)	1,108 (4.4)	556 (2.2)	629 (2.5)	—	7,725 (30.5)	10,246 (40.5)	7,354 (29)	—
SwT	14	—	—	—	—	—	—	—	—	—	—	—
ComT***	230.6	113.7	46.4	484.6	53.7	22.8	184.3	—	433.7	153.8	287.8	—
BoT	370.6	478.7	543.7	266.3	125	124.7	76	—	394.1	351.1	372	—

p* < 0.01; *p* < 0.001; Data are presented as *n* (%).

BoT = both communication training and swallow training; ComT = communication training only; SpT = speech therapy, included training and evaluation; SwT = swallowing training only; Tra-SpT = tracheostomized inpatient who received speech therapy.

Table 3 Speech therapy status of tracheostomized inpatients by top 10 divisions of medical and surgical subspecialties in Taiwan

Total	Taiwan										
	Overall	General chest	General medicine	Otolaryngology	Neurosurgery	Neurology	Surgery	Infectious diseases	Hematology & oncology	Cardiovascular	Nephrology
Tra [†]	27,546 (100)	10,467 (38)	4041 (14.7)	2534 (9.2)	1992 (7.2)	881 (3.2)	763 (2.8)	731 (2.7)	708 (2.6)	582 (2.1)	555 (2)
Tra-SpT [‡]	1342 (100)	149 (11.1)	42 (3.1)	181 (13.5)	339 (25.3)	146 (10.9)	41 (3.1)	7 (0.5)	37 (2.8)	18 (1.3)	7 (0.5)
Referral rate, %	4.9	1.4	1.0	7.1	17.0	16.6	5.4	1.0	5.2	3.1	1.3
Training [§]	22,418	2180	622	1072	3145	1052	473	112	531	194	137
Training frequencies	16.7	14.6	14.8	5.9	9.3	7.2	11.5	16.0	14.4	10.8	19.6

Total	Medical center				
	Overall	General chest	General medicine	Infectious diseases	Hematology & oncology
Tra [†]	1267 (100)	383*** (30.2)	311 (24.5)	79 (6.2)	61*** (4.8)
Tra-SpT [‡]	129 (100)	6 (4.7)	97 (75.2)	0 (0.0)	0 (0.0)
Referral rate, %	10.2	1.6	31.2	0.0	0.0
Training [§]	1573	84	1173	0	0
Training frequencies	12.2	14.0	12.1	-	-

*** $p < 0.001$
[†] Represented patient number
[‡] Represented times.
 Data are presented as n (%).
 Tra = tracheostomy inpatient; Tra-SpT = tracheostomized inpatient who received speech therapy.

Table 4 Status of speech therapy on tracheostomized inpatient at a medical center in Taipei from 2009 to 2013 and from September to January of the following year of those 5 years

	Overall	2009	2010	2011	2012	2013
Tra (patient)	1267	298	276	250	234	209
Referral rate, %	10.2	8.4	11.6	15.2	9.4	5.7
Patient number						
Tra-SpT (patient)	129 (100)	25 (100)	32 (100)	38 (100)	22 (100)	12 (100)
ComT	4 (3.1)	2 (8)	0 (0)	0 (0)	1 (4.5)	1 (8.3)
SwT	82*** (63.6)	0 (0)	15 (46.9)	37 (97.4)	20 (90.9)	10 (83.3)
BoT	43 (33.3)	23 (92)	17 (53.1)	1 (2.6)	1 (4.5)	1 (8.3)
Training times						
Tra-SpT	1573 (100)	491 (100)	339 (100)	407 (100)	239 (100)	97 (100)
ComT	49 (3.1)	5 (1)	0 (0)	0 (0)	6 (3)	38 (39)
SwT	729 (46.4)	0 (0)	99 (29)	394 (97)	189 (79)	47 (49)
BoT	795 (50.5)	486 (99)	240 (71)	13 (3)	44 (18)	12 (12)
Training frequencies						
Tra-SpT	12.1	20	11	11	11	8
ComT	12.3	3	0	0	6	38
SwT	8.9	0	7	11	9	5
BoT	18.5	21	14	13	44	12

*** $p < 0.001$.
 Data are presented as n (%).
 BoT = both communication training and swallow training; ComT = communication training only; SpT = speech therapy, included training and evaluation; SwT = swallowing training only; Tra = tracheostomy inpatient; Tra-SpT = tracheostomized inpatient who received speech therapy.

Table 5 Status of speech therapy on tracheostomized inpatients at a medical center in Taipei from 2009 to 2013 and from September to January of the following year of those 5 years

	2009	2010	2011	2012	2013
Tra (patient)	165	165	129	129	111
Referral rate, %	7.3	11.5	9.3	9.3	5.4
Patient number					
Tra-SpT (patient)	12 (100)	19 (100)	12 (100)	12 (100)	6 (100)
ComT	0 (0)	0 (0)	0 (0)	2 (16.7)	1 (16.7)
SwT	0 (0)	17 (89.5)	12 (100)	10 (83.3)	4 (66.7)
BoT	12 (100)	2 (10.5)	0 (0)	0 (0)	1 (16.7)
Training times					
Tra-SpT	241 (100)	135 (100)	120 (100)	105 (100)	47 (100)
ComT	0 (0)	0 (0)	0 (0)	27 (26)	14 (30)
SwT	0 (0)	106 (79)	120 (100)	78 (74)	21 (45)
BoT	241 (100)	29 (21)	0 (0)	0 (0)	12 (25)
Training frequencies					
Tra-SpT	20	7.1	10	8.8	7.8
ComT	0	0	0	13.5	14
SwT	0	6.2	10	7.8	5.25
BoT	20	14.5	0	0	12

Data are presented as n (%).
 BoT = both communication training and swallow training; ComT = communication training only; SpT = speech therapy, included training and evaluation; SwT = swallowing training only; Tra = tracheostomy inpatient; Tra-SpT = tracheostomized inpatient who received speech therapy.

Table 6 Changes of medical personnel by group after education program at a medical center in Taipei

	Group A ^a	Group B ^a	Physicians ^b	Nurses ^b
Knowledge (score)				
Before	73	81	74	77
After	72	74	74	73
Referral rate, %				
Before	38	21	23	36
After	41	22	32	33

^a Not significantly different between Group A and Group B (by t test, $n = 145$)
^b Not significantly different between physicians and nurses (by t test, $n = 79$).

Personal data cannot be released to protect the confidentiality of the patients. According to this rule, we could not study the status of the tracheostomized inpatients aged < 3 years because the sample size for that age group is small. Most tracheostomized children are aged < 2 years and usually receive long-term tracheostomy in the 1st year.²² Other studies have indicated that ~50% of tracheostomized children are younger than 6 months, and half of the patients are referred to a speech-language therapist.^{15–17} Therefore, we cannot understand and compare the speech therapy status of tracheostomized children in Taiwan.

The present study shows a large gap between the expectation and supply of speech therapy and between Taiwan and other countries. Thus, the speech therapy service should be provided more aggressively. The findings in this study show that unfamiliarity with the referral process and the role of speech-language therapists by medical personnel lead to a low referral rate that does not meet the need of tracheostomized inpatients for speech therapy. The education program did not have an effect on referral rate. We believe that an insufficient period of education and short reaction time led to the result. Busy clinic work and job rotation of medical personnel are also important reasons. However, this study reflects the situation for tracheostomized inpatients and medical personnel. Therefore, fundamental education about speech therapy and speech-language therapists for medical students should be the best way to help all medical personnel to understand the role of speech-language therapists and the information related to rehabilitation of tracheostomized patients.

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References

1. Bjordal K, de Graeff A, Fayers PM, Hammerlid E, van Pottelsberghe C, Curran D, Ahlner-Elmqvist M, et al. A 12 country field study of the EORTC QLQ-C30 (version 3.0) and the head and neck cancer specific module (EORTC QLQ-H&N35) in head and neck patients. *Eur J Cancer* 2000;**36**:1796–807.
2. Donnelly F, Wiechula R. The lived experience of a tracheostomy tube change: a phenomenological study. *J Clin Nurs* 2006;**15**:1115–22.
3. Sherlock ZV, Wilson JA, Exley C. Tracheostomy in the acute setting: patient experience and information needs. *J Crit Care* 2009;**24**:501–7.
4. Foster A. More than nothing: the lived experience of tracheostomy while acutely ill. *Intensive Crit Care Nurs* 2010;**26**:33–43.
5. Jiang D, Morrison GAJ. The influence of long-term tracheostomy on speech and language development in children. *International Congress Series* 2003;**1254**:367–71.
6. Hopkins C, Whetstone S, Foster T, Blaney S, Morrison G. The impact of paediatric tracheostomy on both patient and parent. *Int J Ped Otorhinolaryngol* 2009;**73**:15–20.
7. Ward E, Jones C, Solley M, Cornwell P. Clinical consistency in tracheostomy management. *J Med Speech-Lang Pathol* 2007;**15**:1:7–26.
8. Freeman-Sanderson A, Togher L, Phipps P, Elkins M. A clinical audit of the management of patients with a tracheostomy in an Australian tertiary hospital intensive care unit: focus on speech–language pathology. *Int J Speech Lang Pathol* 2011;**13**:518–25.
9. Ward E, Morgan T, McGowan S, Spurgin AL, Solley M. Preparation, clinical support, and confidence of speech–language therapists managing clients with a tracheostomy in the UK. *Int J Lang Comm Disord* 2012;**47**:322–32.
10. Batty S. Communication, swallowing and feeding in the intensive care unit patient. *Nurs Crit Care* 2009;**14**:175–9.
11. Pandian V, Miller CR, Mirski MA, Schiavi AJ, Morad AH, Vaswani RS, Kalmar CL, et al. Multidisciplinary team approach in the management of tracheostomy patients. *Otolaryngol Head Neck Surg* 2012;**147**:684–91.
12. Hess DR. Facilitating speech in the patient with a tracheostomy. *Resp Care* 2005;**50**:519–25.
13. de Mestral C, Iqbal S, Fong N, LeBlanc J, Fata P, Razeq T, Khwaja K. Impact of a specialized multidisciplinary tracheostomy team on tracheostomy care in critically ill patients. *Can J Surg* 2011;**54**:167–72.
14. Eber E, Oberwaldner B. Tracheostomy care in the hospital. *Ped Resp Rev* 2006;**7**:175–84.
15. Ozmen Suay, Omer Afsin Ozmen, Omer Faruk Unal. Pediatric tracheotomies: a 37-year experience in 282 children. *Int J Pediatr Otorhinolaryngol* 2009;**73**:959–61.
16. Arvedson JC, Brodsky L. Pediatric tracheotomy referrals to speech–language pathology in a children's hospital. *Int J Pediatr Otorhinolaryngol* 1992;**23**:237–43.
17. Brendan AM, Sarah W. The UK National Tracheostomy Safety Project and the role of speech and language therapists. *Curr Opin Otolaryngol Head Neck Surg* 2014;**22**:181–7.
18. Ward E, Agius E, Solley M, Cornwell P, Jones C. Preparation, clinical support, and confidence of speech–language pathologists managing clients with a tracheostomy in Australia. *Am J Speech Lang Pathol* 2008;**17**:265–76.
19. Lu CJ, Wang YH. The status of tracheostomy patients receiving speech therapy: a pilot study (in Chinese). *Taiwan J Phys Med Rehabil (Taipei)* 2014;**42**:99–110.
20. Manley SB, Frank EM, Melvin CF. Preparation of speech–language pathologists to provide services to patients with a tracheostomy tube: a survey. *Am J Speech Lang Pathol* 1999;**8**:171–80.
21. Jung F, Bien MY, Yang SS. The Theorem and clinical application of speech device using in tracheostomy patients (in Chinese). *J Resp Ther (Taipei)* 2012;**11**:1–12.
22. Abraham SS. Babies with tracheotomies: the challenge of providing specialized clinical care. *ASHA Leader* 2003;**18**:4–5.