





Flávia Pereira da Costa<sup>1</sup>   
Daniella Priscila de Lima<sup>2</sup>   
Karoline Mendonça<sup>3</sup>   
Lúcia Figueiredo Mourão<sup>1,2,3</sup> 

### Keywords

Deglutition Disorders  
Speech, Language and Hearing  
Sciences  
Tracheostomy  
Continuing Education  
Specialization

### Descritores

Transtornos da Deglutição  
Fonoaudiologia  
Traqueostomia  
Educação Continuada  
Especialização

### Correspondence address:

Flávia Pereira da Costa  
Programa de Pós-graduação em  
Gerontologia, Universidade Estadual  
de Campinas – UNICAMP  
Rua Tessália Vieira de Camargo,  
126, Cidade Universitária Zeferino  
Vaz, Campinas (SP), Brasil,  
CEP: 13083-887.  
E-mail: flaviapdacosta@yahoo.com.br

Received: April 22, 2020

Accepted: September 16, 2020

# Professional qualification of Brazilian Speech-Language Pathologists and its impacts on the Blue Dye Test (BDT)

## *Formação profissional do fonoaudiólogo brasileiro e seu impacto na aplicação do Blue Dye Test (BDT)*

### ABSTRACT

**Purpose:** To characterize the professional profile of Speech Pathologists working in health services in Brazil and to verify if the time length of professional practice, specialized formation and experience in dysphagia contribute to the more adequate interpretation and application of the Blue Dye Test (BDT). **Methods:** Through social medias and class entities, speech pathologists from all over Brazil were contacted by e-mail, that provided them a link from which they could access the online quiz, containing questions about the professional profile and the application of the BDT. The responses were categorized dichotomously according to the most robust scientific researches on the BDT and were compared statistically according to time length of professional practice, specialized formation and experience in dysphagia. **Results:** 145 speech pathologists participated, 91.7% of them females. Most work in hospitals, have 11 to 15 years of profession (27.6%), and working from 1 to 5 years in the area of dysphagia (32.4%). Professionals with lato sensu training (54.3%) and with more than a decade of profession (58.1%) showed greater adequacy in interpreting the positive result of BDT. **Conclusion:** The present study reinforces the important role of specialized training in dysphagia in addition to continuing health educational practices in determining the excellence of clinical speech therapy, especially with tracheostomized patients after intubation and at risk of bronchoaspiration.

### RESUMO

**Objetivo:** Caracterizar o perfil dos profissionais de Fonoaudiologia atuantes nos serviços de saúde do território brasileiro e verificar se o tempo de profissão, formação especializada e o tempo de experiência em disfagia contribuem para a interpretação e aplicação mais adequada do Blue Dye Test (BDT). **Método:** Por meio de mídias sociais e órgãos de classe, profissionais fonoaudiólogos de todo território nacional foram contactados por e-mail, com envio de um link para acessar um questionário online, contendo perguntas sobre o perfil profissional e a aplicação do BDT. As respostas foram categorizadas de forma dicotômica de acordo com as referências científicas mais robustas do BDT e foram comparadas estatisticamente de acordo com o tempo de profissão, formação especializada e o tempo de experiência. **Resultados:** Participaram 145 fonoaudiólogos, com predomínio do sexo feminino (91,7%). A maioria atuante em hospitais, com 11 a 15 anos de profissão (27,6%) e de 1 a 5 anos na área de disfagia (32,4%). Profissionais com formação lato sensu (54,3%) e com mais de uma década de profissão (58,1%) apresentaram maior adequação na interpretação do resultado positivo do BDT. **Conclusão:** O presente estudo reforça o importante papel da formação especializada em disfagia e das práticas de educação continuada em saúde, na determinação da atuação fonoaudiológica clínica de excelência, principalmente com pacientes traqueostomizados pós intubação e com risco de broncoaspiração.

Study conducted at Universidade Estadual de Campinas – UNICAMP - Campinas (SP), Brasil.

<sup>1</sup> Programa de Pós-graduação em Gerontologia, Universidade Estadual de Campinas – UNICAMP - Campinas (SP), Brasil.

<sup>2</sup> Programa de Saúde, Interdisciplinaridade e Reabilitação, Universidade Estadual de Campinas – UNICAMP - Campinas (SP), Brasil.

<sup>3</sup> Centro de Estudos e Pesquisa em Reabilitação – CEPRE, Universidade Estadual de Campinas – UNICAMP - Campinas (SP), Brasil.

**Financial support:** Programa de Iniciação Científica e Tecnológica da UNICAMP (PIBIC) (Ago/2018 – Jan/2019).

**Conflict of interests:** nothing to declare.



This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

## INTRODUCTION

Healthcare education refers to learning activities promoting sequential and cumulative acquisition of technical and scientific information by therapists, both by formal practices (continued education) and by problematizing experiences in the field (permanent education)<sup>(1)</sup>. Considering the goal of improving professional practices for greater safety and productivity, attention is brought to the importance of discussing healthcare education aiming to promote acquisition of ever-changing knowledge<sup>(2)</sup>.

Speech-Language Pathology, as well as other fields, has been through significant shifts facing current society's demands<sup>(3)</sup>. An example is extension of its scope to include more practice areas such as dysphagia, which was recently admitted as a clinical specialty in 2010 by the Conselho Federal de Fonoaudiologia (CFFa) Board<sup>(4)</sup>. In 2016 this board, which oversees speech-language pathologists working with dysphagia, broadened its recommendations to include "[...] supplementary training in professional residence, specialized development and attendance in continued education activities<sup>(5)</sup>.

Although professional instruction is essential in every area of Speech-Language Pathology, there are specific issues in dysphagia practice regarding critical patient care. As stated in previous studies, treatment offered to patients with dysphagia requires more consistent conducts from care providers so they can improve their assistance standards<sup>(6)</sup>.

In dysphagia practice, tracheostomy is often recommended to patients experiencing low levels of consciousness, prolonged intubation or failure in airway protection. These patients are considered at high risk for pulmonary aspiration, leading to a delay in returning to oral feeding<sup>(7)</sup>.

Early diagnosis of dysphagia by therapists facilitates immediate care and precise intervention<sup>(8)</sup>. In the list of technical procedures available to speech-language pathologists to assist in bronchoaspiration risk determination, there are clinical speech therapy evaluations and instrumental evaluations (videofluoroscopy and videoendoscopy of swallowing). Particularly for tracheostomized patients, clinical assessments often make use of the Blue Dye Test (BDT), with and without food<sup>(9)</sup>.

BDT is a frequently employed procedure in speech therapy practice, either in hospital or home care settings<sup>(10)</sup>, but its variable sensitivity and specificity gives rise to conflicting interpretation of its results and, consequently, differing courses of action for tracheostomized dysphagia patients<sup>(8)</sup>. Furthermore, usage of the test varies greatly in clinical settings. It has been reported that standardization of procedures might contribute for patient safety, streamlining conducts and reducing the risk of iatrogenic events.

Healthcare professionals are regarded as qualified to expertly manage their own learning process, grounding their decisions on their personal assessments<sup>(11)</sup> and allowing them to be positively influenced by practice backgrounds. Therefore, this study focuses on [1] establishing the professional profile of speech-language pathologists using BDT and [2] determine if practice time, specialized training and experience in dysphagia promote better BDT usage and interpretation by Brazilian healthcare providers.

## METHODS

This is a quantitative descriptive cross-sectional study, submitted and approved by the Research Ethics Committee from the Faculdade de Ciências Médicas da Universidade Estadual de Campinas (FCM/UNICAMP, CAAE 952264.18.0.0000.5404). All patients signed a free and clarified consent term.

Research data were collected by an online survey with 25 open and closed questions about professional qualification and BDT usage from speech-language pathologists.

The survey was developed on the free "Google Forms" platform. Initially, a pilot survey was answered by five graduate students from several programs in speech-language pathology, all of whom had specialized training and a practice background in dysphagia. The pilot survey intended to ascertain the students' understanding of the survey process, the performance of the online platform and the time needed for filling out the form, as well as assess the relevance and topics of the questions.

Afterwards, a focus group was organized with the authors of this study and two therapists who took part in the pilot survey. At this time, survey topics were reviewed (item inclusions, alterations or exclusions), developing the final version which was validated by members of the group<sup>(12)</sup>. This version consisted of open and closed questions (multiple choice, some allowing more than one answer) to establish a profile of speech-language pathologists, as well as how they use, interpret, base and determine their decisions concerning BDT.

The second step consisted in advertising the study in social media to enroll participants, as well as contacting public or private healthcare providers with dysphagia patients and professional bodies across the country. Only Brazilian speech-language pathologists currently working with dysphagia patients and using BDT as a swallowing evaluation instrument, as determined by the first question, were enrolled in the study. Other professional categories, speech-language pathologists who did not work with dysphagia and non-Brazilians were excluded from the results. All participants were contacted by e-mail with a link to the survey.

Data were collected from October to December 2018. They were then converted into a sheet (Microsoft Excel) and answers related to BDT were divided into correct/adequate or incorrect/inadequate, according to usage recommendations by Cameron et al.<sup>(13)</sup>, which requires to apply, every four hours, four drops of Evans blue dye (methylene blue solution, 1%) on the dorsal surface of the patient's tongue, with tracheal aspirations every four hours for 48 hours. For issues unaddressed by Cameron et al.<sup>(13)</sup>, current scientific publications were used as reference. Results were, thus, dichotomously analyzed on the following points: objective of BDT utilization, indications of use, dye amount, dye placement, cuff conditions, cannula occlusion conditions and interpretation of positive test results.

In order to determine if there was an association between these variables and practice time, professional qualification, workplace settings, dysphagia experience and BDT familiarity, a chi-squared test was performed with the software Statistical Package for the Social Sciences 22 (IBM).

## RESULTS

The survey was answered by 145 Brazilian speech-language pathologists, 133 (91.7%) of whom were female and 12 (8.3%) were male. Brazil's southeastern region contributed the higher number of participants (46.9%), followed by South (17.95%), Northeast (15.9%), Middle-West (11%) and North (6.9%). A descriptive analysis to categorize therapists working with dysphagia is presented in Table 1.

Table 2 displays associations between professional qualification (undergraduate degree and *lato sensu/stricto sensu* graduate degree), workplace (clinic, home care or hospital settings) and familiarity with BDT (less than 1 year, 1-5 years, 6-10 years,

11-15 years and more than 16 years) with answers relative to BDT execution and interpretation procedures (use of a protocol or other references, objectives, indications of use, dye amount and placement, cuff conditions, tracheostomy cannula conditions and interpretation of positive test results). Professional qualification when interpreting a positive result (presence of dye in the cannula) was significant ( $p = 0.042$ ), since *lato sensu* graduates tended to correctly interpret this result. Besides, there was also a correlation between *lato sensu* degrees and the use of scientific references to employ BDT ( $p = 0.009$ ).

Table 3 shows associations between all studied variables and experience in dysphagia and practice time (both categorized into: less than 1 year, 1-5 years, 6-10 years, 11-15 years and

**Table 1.** General categorization of enrolled speech-language pathologists

	Variables	N (%)
<b>Practice time</b>	Less than 1 year	6 (4.1)
	1-5 years	37 (25.5)
	6-10 years	28 (19.3)
	11-15 years	40 (27.6)
	Over 16 years	34 (23.4)
	Total	145 (100)
<b>Dysphagia experience</b>	Less than 1 year	13 (9)
	1-5 years	47 (32.4)
	6-10 years	40 (27.6)
	11-15 years	28 (19.3)
	More than 16 years	17 (11.7)
	Total	145 (100)
<b>BDT familiarity</b>	Less than 1 year	22 (15.2)
	1-5 years	49 (33.8)
	6-10 years	45 (31)
	11-15 years	22 (15.2)
	Less than 16 years	7 (4.8)
	Total	145 (100)
<b>Workplace settings</b>	Private clinic	35 (8.8)
	Home care	87 (21.8)
	Hospital – ICU	99 (24.8)
	Hospital – Infirmarium	102 (25.6)
	Hospital – Clinic	55 (13.8)
	Healthcare center	12 (3)
	Every location above	2 (0.5)
	Others	7 (1.8)
	Total	399 (100)

**Caption:** BDT = Blue Dye Test

**Table 2.** Association between workplace settings, professional training and familiarity of speech-language pathologists with procedures and interpretation of positive BDT results

N/%	Workplace settings			Professional training			BDT familiarity					
	Clin	HC	Hosp	UD	LS	SS	Le1	1-5	6-10	11-15	Mo16	
Protocol or scientific reference												
Standard	26/17.93	1/3.8	8/30.8	17/65.4	4/15.4	11/42.3	11/42.3	4/15.4	7/26.9	9/34.9	4/15.4	2/7.7

Chi-squared test. Significance\* =  $p$  value < 0.05

**Caption:** Clin = Clinic; HC = Home Care; Hosp = Hospital; UD = Undergraduate Degree; LS = *Lato Sensu*; SS = *Stricto Sensu*; Le1 = Less than 1 year; 1-5 = 1 to 5 years; 6-10 = 6 to 10 years; 11-15 = 11 to 15 years; Mo16 = More than 16 years; BDTM = Modified Blue Dye Test

**Table 2.** Continued...

	N/%	Workplace settings			Professional training			BDT familiarity				
		Clin	HC	Hosp	UD	LS	SS	Le1	1-5	6-10	11-15	Mo16
Scientific reference	119/ 82.0	4/3.4	15/12.6	100/84	3/2.5	76/63.9	40/33.6	18/15.1	42/35.3	36/30.3	18/15.1	5/4.2
p value			0.068			0.009*			0.892			
Test objectives												
Incorrect	30/20.7	0/0.0	5/16.7	25/83.3	2/6.7	18/60.0	10/33.3	5/16.7	6/20.0	12/40.0	5/16.7	2/6.7
Correct	115/79.3	5/4.3	18/15.7	92/80.0	5/4.3	69/60.0	41/35.7	17/14.8	43/37.4	33/28.7	17/14.8	5/4.3
p value			0.509			0.86			0.48			
Indications for the use of BDT												
Incorrect	33/22.8	1/3.0	6/18.2	26/78.8	1/3.0	24/72.7	8/24.2	4/12.1	14/42.4	7/21.7	6/18.2	2/6.1
Correct	112/77.2	4/3.6	17/15.2	91/81.3	6/5.4	63/56.3	43/38.4	18/16.1	35/31.3	38/33.9	16/14.3	5/4.5
p value			0.911			0.236			0.571			
Dye amount												
Incorrect	120/82.8	4/3.3	18/15.0	98/81.7	5/4.2	73/60.8	42/35.0	20/16.7	42/35.0	36/30.0	18/15.0	4/3.3
Correct	25/17.2	1/4.0	5/20.0	19/76.0	2/8.0	14/56.0	9/36.0	2/8.0	7/28.0	9/36.0	4/16.0	3/12
p value			0.804			0.699			0.309			
Dye placement												
Incorrect	10/6.9	1/10	1/10.0	8/80.0	0/0.0	3/30.0	7/70.0	1/10.0	1/10.0	4/40.0	3/30.0	1/10
Correct	134/92.4	4/3.0	22/16.4	108/80	7/5.2	83/61.9	44/32.8	21/15.7	47/35.1	41/30.6	19/14.2	6/4.5
p value			0.459			0.021*			0.364			
Cuff conditions												
Incorrect	45/31.0	2/4.4	7/15.6	36/80.0	2/4.4	29/64.4	14/31.1	8/17.8	16/35.6	11/24.4	6/13.3	4/8.9
Correct	100/69.0	3/3.0	16/16.0	81/81.0	5/5.0	58/58.0	37/37.0	14/14.0	33/33.0	34/34.0	16/16.0	3/3.0
p value			0.907			0.763			0.457			
Interpretation of positive results												
Incorrect	40/27.6	3/7.5	3/4.5	34/85.0	0/0.0	30/75.0	10/25.0	7/17.5	15/37.5	13/32.5	4/10.0	1/2.5
Correct	105/72.4	2/1.9	20/19.0	83/79.0	7/6.7	57/54.3	41/39.0	15/14.3	34/32.4	32/30.5	18/17.1	6/5.7
p value		0.075				0.012*			0.726			
Cannula occlusion (BDTM)												
Incorrect	92/63.4	2/2.2	14/15.2	76/82.6	3/3.3	59/64.1	30/32.6	15/16.3	28/30.4	32/34.8	13/14.1	4/4.3
Correct	53/36.6	3/5.7	9/17.0	41/77.4	4/7.5	28/52.8	21/39.6	7/13.2	21/39.6	13/24.5	9/17.0	3/5.7
p value		0.505			0.291			0.646				

Chi-squared test. Significance\* = p value < 0.05

**Caption:** Clin = Clinic; HC = Home Care; Hosp = Hospital; UD = Undergraduate Degree; LS = *Lato Sensu*; SS = *Strictu Sensu*; Le1 = Less than 1 year; 1-5 = 1 to 5 years; 6-10 = 6 to 10 years; 11-15 = 11 to 15 years; Mo16 = More than 16 years; BDTM = Modified Blue Dye Test

**Table 3.** Association between dysphagia experience and familiarity with procedures and interpretation of positive BDT results

	N(%)	Dysphagia experience					BDT familiarity				
		Le1	1-5	06-10	11-15	Mo16	Le1	1-5	06-10	11-15	Mo16
Standard protocol or scientific reference											
Standard protocol	26/17.9	3/11.5	6/23.1	6/23.1	8/30.8	3/11.5	1/3.8	3/11.5	5/19.2	9/34.6	8/30.8
Scientific reference	119/82.1	10/8.4	41/34.5	34/28.6	22/18.5	14/11.8	54.2	34/28.6	23/19.3	31/26.1	26/21.8
p value			0.482						0.445		
Test objectives											
Incorrect	30/20.7	2/6.7	5/16.7	12/40.0	5/16.7	6/20.0	2/6.7	3/10.0	8/26.7	8/26.7	9/30.0
Correct	115/79.3	11/9.6	42/36.5	28/24.3	23/20.0	11/9.6	4/3.5	34/29.6	20/17.4	32/27.8	25/21.7
p value			0.108						0.205		
Indications for the use of BDT											
Incorrect	33/22.8	1/3.0	15/45.5	6/18.2	4/12.1	7/21.2	1/3.0	8/24.2	6/18.2	8/24.2	10/30.0
Correct	112/77.2	12/10.7	32/28.6	34/30.4	24/21.4	10/8.9	5/4.5	29/25.9	22/19.6	32/28.6	24/21.4
p value			0.046*						0.876		

Chi-squared test. Significance\* = p value < 0.05

**Caption:** Le1 = Less than 1 year; 1-5 = 1 to 5 years; 6-10 = 6 to 10 years; 11-15 = 11 to 15 years; Mo16 = More than 16 years; BDT = Blue Dye Test; BDTM = Modified Blue Dye Test

**Table 3.** Continued...

	N(%)	Dysphagia experience					BDT familiarity				
		Le1	1-5	06-10	11-15	Mo16	Le1	1-5	06-10	11-15	Mo16
<b>Dye amount</b>											
Incorrect	120/82.8	12/10.0	41/34.2	33/27.5	24/20.0	10/8.3	6/5.0	33/27.5	25/20.8	33/27.5	23/19.2
Correct	25/17.2	1/4.0	6/24.0	7/28.0	4/16.0	7/28.0	0/0.0	4/16.0	3/12.0	7/28.0	11/44.0
p value				0.075					0.072		
<b>Dye placement</b>											
Incorrect	10/6.9	0/0.0	1/10.0	2/20.0	3/30.0	4/40.0	0/0.0	1/10.0	1/10.0	3/30.0	5/50.0
Correct	134/92.4	13/9.7	45/33.6	38/28.4	25/18.7	13/9.7	6/4.5	36/26.9	27/20.1	36/26.9	29/21.6
p value				0.030*					0.27		
<b>Cuff conditions</b>											
Incorrect	45/31.0	4/8.9	17/37.8	11/24.4	7/15.6	6/13.3	3/6.7	12/26.7	6/13.3	14/31.1	10/22.2
Correct	100/69.0	9/9.0	30/30.0	29/29.0	21/21.0	11/11.0	3/3.0	25/25.0	22/22.0	26/26.0	24/24.0
p value				0.838					0.629		
<b>Interpretation of positive results</b>											
Incorrect	40/27.6	5/12.5	15/37.5	11/27.5	8/20.0	1/2.5	04/out	14/35.0	9/22.5	10/25.0	3/7.5
Correct	105/72.4	16/15.2	20/19.0	29/27.6	20/19.0	16/11.5	2/1.9	23/21.9	19/18.1	30/28.6	31/29.5
p value				0.264					0.012*		
<b>Cannula occlusion (BDTM)</b>											
Incorrect	92/63.4	8/8.7	25/27.2	31/33.7	20/21.7	8/8.7	3/3.3	19/20.7	19/20.7	33/35.9	18/19.6
Correct	53/36.6	5/9.4	22/41.5	9/17.0	8/15.1	9/17.0	3/5.7	18/33.9	9/17.0	7/13.2	16/30.2
p value		0.081					0.028*				

Chi-squared test. Significance\* = p value < 0.05

**Caption:** Le1 = Less than 1 year; 1-5 = 1 to 5 years; 6-10 = 6 to 10 years; 11-15 = 11 to 15 years; Mo16 = More than 16 years; BDT = Blue Dye Test; BDTM = Modified Blue Dye Test

more than 16 years). There was a significant association between dysphagia experience and indications for the use of BDT ( $p = 0.046$ ) and dye placement ( $p = 0.030$ ). Therapists with 1-5 and 6-10 years of dysphagia experience provided a higher number of correct/adequate answers regarding these two variables.

Practice time was correlated with interpretation of a positive test result ( $p = 0.012$ ) and cannula occlusion conditions ( $p = 0.028$ ). Participants with 11-15 years and more than 16 years of practice time were able to interpret positive BDT results more accurately.

There was no statistically significant association between familiarity with BDT and hospital experience with better test execution parameters.

## DISCUSSION

The smaller proportion of therapists who work with dysphagia for more than a decade (31%) can be attributed to the recent formal establishment of the field<sup>(5)</sup>. According to CFFa<sup>(14)</sup>, in December 2019 the number of speech-language pathologists with a valid registration in Brazil amounted to 45.123, distributed in all five regions. However, 354 of them (less than 1%) have the title of specialist in dysphagia awarded by the CFFa board<sup>(15)</sup>.

This study verified that specialized qualification correlates with the use of scientific references and a more adequate interpretation of BDT results. Most survey participants who use references (63.9%) and correctly interpreted positive test results (54.3%) according to the publication considered by this study<sup>(13)</sup> (presence of dye in the tracheostomy cannula) are

*lato sensu* graduates, underlining the importance of the CFFa recommendation on the need for professional formation and specialized dysphagia training<sup>(5)</sup>.

Current literature exhibits great disparity in methods of employing BDT and interpreting its results, with different execution parameters (dye amount, how it's offered and execution time), besides the fact that there is no standard protocol for this test<sup>(8,16-18)</sup>. Furthermore, sensitivity estimates for BDT vary greatly in different studies, with reports ranging from 38% to 95%, which requires caution in its interpretation. Consequently, it is extremely important that speech-language pathologists be familiar with literature discrepancies and look for scientific references to provide safer and clinically relevant care.

119 of 145 participants (82%) declared they base BDT execution on scientific references, while 26 (18%) stated they use a protocol for this purpose, suggesting therapists seek scientific guidelines for applying the test. *Lato sensu* graduates form the majority of this group.

The last years saw a rise in the number of tracheostomies<sup>(19)</sup>. Accordingly, distinct swallowing complications have been reported<sup>(20,21)</sup>, demanding specific swallowing assessments focused on this population. Suitable indications of patient conditions for BDT application have been noted among participants with less than a decade of dysphagia experience (1-5 years: 28.6%; 6-10 years: 30.4%). These therapists were also more accurate regarding dye placement (dorsal surface of the tongue). Such results may be related to formal continued education in academic institutions, both in undergraduate and graduate levels.

Considering procedures for BDT execution, one of the crucial aspects is to check cuff conditions. The evaluation must be performed with a deflated cuff<sup>(22,23)</sup>, since it influences mechanisms of airway safety (altering movements of laryngeal elevation and anteriorization), negatively affects the esophageal phase, destabilizes the laryngopharynx and stimulates creation of granulation tissue and secretion build-up<sup>(22)</sup>. Most participants (69%) reported the cuff should be deflated during the test, but there was no significant association with other variables.

During BDT application, therapists can opt to occlude the tracheostomy cannula, a point that raises different opinions in the literature, since original authors are not clear about it<sup>(24)</sup>. According to Logemann et al.<sup>(25)</sup>, a slight digital occlusion of the tracheostomy tube might positively affect swallowing biomechanics due to increased tracheal resistance. However, each patient must be independently assessed to determine if there are any benefits from the procedure<sup>(25)</sup>. Nevertheless, a recent study reports that cannula occlusion allowed voluntary clearing of laryngeal residue, decreasing the number of penetration and aspiration events<sup>(23)</sup>.

This study, based on current literature recommendations, considered occlusion of the tracheostomy cannula during swallowing<sup>(23)</sup> as the correct procedure. Thus, participants with 1-5 years (33.9%) and more than 16 years (30.2%) of practice time were able to provide more correct answers than other groups, allowing the inference that, more than formal continued education, experience is also a relevant element in determining a proper conduct for BDT application. Such experience could be traced to permanent education practices, a politico-pedagogical strategy which, based on workplace challenges, introduces process updates to yield positive results<sup>(26)</sup>. In spite of this possibility, the survey used in this study did not specifically list permanent education in the workplace as an answer, allowing further research in this matter.

Investigation of interpretations following a positive result when dye flows through the cannula during endotracheal aspiration<sup>(8,27)</sup> demonstrated that *lato sensu* graduates (54.3%) and professionals with practice time of 11-15 years (28.6%) and over 16 years (29.5%) provided more correct answers on the matter. These findings support previous results regarding specialized training and practical experience when executing the procedure, since they promote more accurate clinical inferences. This upholds reports from other authors who point out that, beyond normalized instructions, it is essential to take into account the experience and personal knowledge each therapist brings to his/her workplace<sup>(1)</sup>.

Regarding work locations, there were no significant differences on BDT application. It was noted, however, that hospital settings (infirmery, ICU or clinic) was more often mentioned by participants (256 mentions)<sup>1</sup>. Home care was the second most cited setting. Current literature reveals growing speech-language pathology services in hospital settings due to increased diagnoses of swallowing impairments arising from noncommunicable chronic diseases, such as cancer, respiratory diseases, diabetes and circulatory system diseases<sup>(28)</sup>. Alongside

that, the offer of home care services by multidisciplinary teams has also increased, a current trend of speech-language pathology<sup>(29)</sup> in dysphagia, highlighting the importance of specialized training for BDT application in every work setting.

Another interesting aspect of the survey was the aggregation of information beyond American Speech-Language-Hearing Association<sup>(30)</sup> considerations regarding possible conducts after BDT application, proposing retesting, additional evaluations (including clinical and/or instrumental assessments to determine if and in what degree swallowing physiology might be impaired) and/or referral to other services. These results suggest Brazilian speech-language pathologists understand test limitations, basing their conducts on additional strategies.

## CONCLUSION

Therapists using BDT are, for the most part, working in hospital settings and have 11 to 15 years of practice time, with experience of 1 to 5 years with dysphagia. Professionals with specialized training in dysphagia are the ones who mostly base BDT use in scientific references, in addition to interpreting the presence of dye in the cannula more accurately.

Recently graduated speech-language pathologists and those with over a decade of experience provided more correct answers for specific parts of the survey, such as indications of use for BDT and dye placement (up to 10 years of practice time) and interpretation of positive results (more than 11 years of practice time).

Consequently, this study emphasizes the important role of specialized training in dysphagia and continued education efforts in healthcare to provide first-rate clinical speech-language pathology treatment, especially in severe cases, such as patients who were tracheostomized after intubation and are at risk of bronchoaspiration.

## ACKNOWLEDGEMENTS

UNICAMP Scientific and Technological Initiation Program - PIBIC for the financial support of the research.

## REFERENCES

1. Macêdo NB, Albuquerque PC, Medeiros KR. O desafio da implementação da educação permanente na gestão da educação na saúde. *Trab Educ Saúde*. 2014;12(2):379-401. <http://dx.doi.org/10.1590/S1981-77462014000200010>.
2. Coswosk EDRC, Caldeira AB, Silva NCR, Rocha JM. Educação continuada para o profissional de saúde no gerenciamento de resíduos de saúde. *Rev Bras Anal Clín*. 2018;3. <http://dx.doi.org/10.21877/2448-3877.201800645>.
3. Silva DGM, Sampaio TMM, Bianchini EMG. Percepções do fonoaudiólogo recém-formado quanto a sua formação, intenção profissional e atualização de conhecimentos. *Rev Soc Bras Fonoaudiol*. 2010;15(1):47-53. <http://dx.doi.org/10.1590/S1516-80342010000100010>.
4. CCFa: Conselho Federal de Fonoaudiologia. Resolução CFFa nº 383, de 20 de março de 2010 [Internet]. *Diário Oficial da União*; Brasília; 22 abr. 2010 [citado em 2019 Dez 17]. Disponível em: [https://www.fonoaudiologia.org.br/resolucoes/resolucoes\\_html/CFFa\\_N\\_383\\_10.htm](https://www.fonoaudiologia.org.br/resolucoes/resolucoes_html/CFFa_N_383_10.htm)
5. CCFa: Conselho Federal de Fonoaudiologia. Resolução CFFa nº 492, de 7 de abril de 2016 [Internet]. *Diário Oficial da União*; Brasília; 18 abr. 2016. Disponível em: <https://www.fonoaudiologia.org.br/cffa/wp-content/uploads/2013/07/res-492-2016.pdf>

<sup>1</sup> This question allowed more than one possibility of answer.

6. Lino MM, Calil AM. O ensino de cuidados críticos/intensivos na formação do enfermeiro: momento para reflexão. *Rev Esc Enferm USP*. 2008;42(4):777-83. <http://dx.doi.org/10.1590/S0080-62342008000400022>. PMID:19192914.
7. Schefold JC, Berger D, Zürcher P, Lensch M, Perren A, Jakob SM, et al. Dysphagia in Mechanically Ventilated ICU Patients (DYNAMICS): a prospective observational trial. *Crit Care Med*. 2017;45(12):2061-9. <http://dx.doi.org/10.1097/CCM.0000000000002765>. PMID:29023260.
8. Béchet S, Hill F, Gilheaney O, Walshe M. Diagnostic accuracy of the modified Evan's Blue Dye test in detecting aspiration in patients with tracheostomy: a systematic review of the evidence. *Dysphagia*. 2016;31(6):721-9. <http://dx.doi.org/10.1007/s00455-016-9737-3>. PMID:27530728492.
9. Medeiros GC, Sassi FC, Lirani-Silva C, Andrade CRF. Critérios para decanulação da traqueostomia: revisão de literatura. *CoDAS*. 2019;31(6):e20180228. <http://dx.doi.org/10.1590/2317-1782/20192018228>.
10. Santana L, Fernandes A, Brasileiro ÂG, Abreu AC. Critérios para avaliação clínica fonoaudiológica do paciente traqueostomizado no leito hospitalar e internamento domiciliar. *Rev CEFAC*. 2014;16(2):524-36. <http://dx.doi.org/10.1590/1982-021620144712>.
11. Carácio FCC, Conterno LO, Oliveira MA, Oliveira AC, Marin MJ, Braccioli LA. A experiência de uma instituição pública na formação do profissional de saúde para atuação em atenção primária. *Cien Saude Colet*. 2014;19(7):2133-42. <http://dx.doi.org/10.1590/1413-81232014197.08762013>. PMID:25014293.
12. Alexandre NMC, Coluci MZO. Validade de conteúdo nos processos de construção e adaptação de instrumentos de medidas. *Cien Saude Colet*. 2011;16(7):3061-8. <http://dx.doi.org/10.1590/S1413-81232011000800006>. PMID:21808894.
13. Cameron JL, Reynolds J, Zuidema GD. Aspiration in patients with tracheostomies. *Surg Gynecol Obstet*. 1973;136(1):68-70. PMID:4682266.
14. CCFa: Conselho Federal de Fonoaudiologia. Quantitativo de fonoaudiólogos no Brasil por Conselho Regional [Internet]. 2020 [citado em 2020 Jan 24]. Disponível em: <https://www.fonoaudiologia.org.br/cffa/index.php/numero-por-regiao/>
15. CCFa: Conselho Federal de Fonoaudiologia. Consulta por especialistas por especialidade/região [Internet]. 2020 [citado em 2020 Mar 23]. Disponível em: <https://www.fonoaudiologia.org.br/cffa/index.php/consulta-especialistas-por-especialidaderegiao/>
16. Brady SL, Hildner CD, Hutchins BF. Simultaneous videofluoroscopic swallow study and modified Evans blue dye procedure: an evaluation of blue dye visualization in cases of known aspiration. *Dysphagia*. 1999;14(3):146-9. <http://dx.doi.org/10.1007/PL00009596>. PMID:10341110.
17. Donzelli J, Brady S, Wesling M, Craney M. Simultaneous modified Evans blue dye procedure and video nasal endoscopic evaluation of the swallow. *Laryngoscope*. 2001;111(10):1746-50. <http://dx.doi.org/10.1097/00005537-200110000-00015>. PMID:11801938.
18. Fiorelli A, Ferraro F, Nagar F, Fusco P, Mazzone S, Costa G, et al. A new modified evans blue dye test as screening test for aspiration in tracheostomized patients. *J Cardiothorac Vasc Anesth*. 2017;31(2):441-5. <http://dx.doi.org/10.1053/j.jvca.2016.07.031>. PMID:27720495.
19. Young D, Harrison DA, Cuthbertson BH, Rowan K, TracMan Collaborators. Effect of early vs late tracheostomy placement on survival in patients receiving mechanical ventilation: the TracMan randomized trial. *JAMA*. 2013;309(20):2121-9. <http://dx.doi.org/10.1001/jama.2013.5154>.
20. Garuti G, Reverberi C, Briganti A, Massobrio M, Lombardi F, Lusuardi M. Swallowing disorders in tracheostomized patients: a multidisciplinary/multiprofessional approach in decannulation protocols. *Multidiscip Respir Med*. 2014;9(1):36. <http://dx.doi.org/10.1186/2049-6958-9-36>.
21. Jung SJ, Kim DY, Kim YW, Koh YW, Joo SY, Kim ES. Effect of decannulation on pharyngeal and laryngeal movement in post-stroke tracheostomized patients. *Ann Rehabil Med*. 2012;36(3):356-64. <http://dx.doi.org/10.5535/arm.2012.36.3.356>. PMID:22837971.
22. Furmann N, Costa FM. Critérios clínicos utilizados por profissionais para liberação de dieta via oral em pacientes adultos hospitalizados. *Rev CEFAC*. 2015;17(4):1278-87. <http://dx.doi.org/10.1590/1982-0216201517413614>.
23. Ledl C, Ullrich YY. Occlusion of tracheostomy tubes does not alter pharyngeal phase kinematics but reduces penetration by enhancing pharyngeal clearance: a prospective study in patients with neurogenic dysphagia. *Am J Phys Med Rehabil*. 2017;96(4):268-72. <http://dx.doi.org/10.1097/PHM.0000000000000602>. PMID:27552353.
24. Arakawa-Sugueno LPE. Uso do teste de corante azul na avaliação da deglutição. In: Furkim AM, Rodrigues KA, editores. *Disfagias nas Unidades de Terapia Intensiva*. São Paulo: Roca; 2014. p. 133-8.
25. Logemann JA, Pauloski BR, Colangelo L. Light digital occlusion of the tracheostomy tube: a pilot study of effects on aspiration and biomechanics of the swallow. *Head Neck*. 1998;20(1):52-7. [http://dx.doi.org/10.1002/\(SICI\)1097-0347\(199801\)20:1<52::AID-HED8>3.0.CO;2-2](http://dx.doi.org/10.1002/(SICI)1097-0347(199801)20:1<52::AID-HED8>3.0.CO;2-2). PMID:9464952.
26. Brasil. Ministério da Saúde. Política Nacional de Educação Permanente em Saúde: o que se tem produzido para o seu fortalecimento? [Internet]. Brasília; 2018 [citado em 2020 Jul 22]. Disponível em: <https://www.saude.gov.br/images/pdf/2018/dezembro/13/Politica-Nacional-de-Educao-Permanente-em-Saude.pdf>
27. Simão MA, Alacid CAN, Rodrigues KA, Albuquerque C, Furkim AM. Incidence of tracheal aspiration in tracheotomized patients in use of mechanical ventilation. *Arq Gastroenterol*. 2009;46(4):311-4. <http://dx.doi.org/10.1590/S0004-28032009000400012>. PMID:20232012.
28. Faria KCF, Pessoa ACN, Araújo LI, Paiva MLF. Perfil do paciente atendido pela fonoaudiologia na unidade de urgência e emergência de um hospital universitário. *Audiol Commun Res*. 2013;18(4):308-13. <http://dx.doi.org/10.1590/S2317-64312013000400012>.
29. Pereira KFPO, Pereira AS, Zeigelboim BS, Santos RS. Attention to oropharyngeal dysfunction in home care: speech therapy management. Appearance and content validation study of a guidance manual. *Rev CEFAC*. 2018;20(5):640-7. <http://dx.doi.org/10.1590/1982-021620182052918>.
30. ASHA: American Speech and Hearing Association. Preferred practice patterns for the profession of speech-language pathology [Internet]. Rockville: American Speech-Language-Hearing Association; 2004 [citado em 2019 Dez 19]. Disponível em: <https://www.asha.org/policy/pp2004-00191.htm>

## Author contributions

*FPC analyzed and interpreted data, reviewed existing literature on the subject and drafted the manuscript; DPL analyzed and interpreted data, reviewed existing literature on the subject and critically reviewed the manuscript; KM helped execute the study and collect data, while also reviewing existing literature; LFM, as the principal investigator, was responsible for designing methodology and supervising the project.*