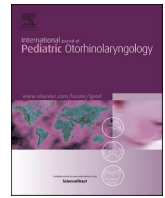


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Ankyloglossia in Australia: Practices of health professionals

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ABSTRACT

Objectives: To investigate the opinions and practices of health professionals involved in ankyloglossia diagnosis and management in Australia.

Method: Two hundred and thirty-seven health professionals across Australia responded to an online survey including their diagnostic and management practice of ankyloglossia. Descriptive statistics, content analysis and thematic analysis were used to analyse quantitative data and open-ended responses, respectively.

Results: Most (91.6%) respondents reported they are responsible for the assessment and diagnosis of ankyloglossia in their clinical practice. A majority (56.7%) reported using more than one assessment tool in clinical practice. Less than half (46.4%) reported providing treatment to manage ankyloglossia. Surgical management was used by 44.5%, and 56.4% used non-surgical management as their primary treatment of ankyloglossia. Of the total sample, 26.6% had completed no further training or professional development in the field. 46% of respondents stated they always educate parents about ankyloglossia diagnoses, whereas 29.5% reported they always educate parents about management of ankyloglossia. Of respondents, a high level of confidence was reported by 62.6% of health professionals in the assessment of infants with ankyloglossia. Of those who perform surgical management, 53.7% reported feeling extremely confident in their skills. Fifty-two percent of respondents reported they were dissatisfied with the current service delivery for infants with ankyloglossia.

Conclusions: The diagnosis, management and education practices varied greatly amongst health professionals in Australia. Clinical guidelines for all relevant health professionals are needed to ensure standardised diagnosis and management processes. In future, this will help guide evidence-based diagnosis and intervention for infants with ankyloglossia.

1. Introduction

Ankyloglossia refers to the limited movement of the tongue causing functional limitations, as well as a visually restricted lingual frenulum [1]. The anatomy of the lingual frenulum has recently been described as a structure formed by the dynamic elevation of a midline fold in the floor of mouth fascia; not a band or cord, as it has previously been described [2]. Whilst these definitions are used most frequently, there are no established universal criteria [3]. Internationally and within Australia, a broad range of health professionals are involved in the diagnosis and management of ankyloglossia [1]. With a lack of clinical guidelines, the diagnostic criteria, diagnostic tools and management pathways for ankyloglossia likely vary greatly amongst these health professionals [3, 4].

Tools that have been developed to classify ankyloglossia diagnoses

include the Coryllos criteria, which classifies ankyloglossia into two types – anterior (types I and II), and posterior (types III and IV) [5]. Classification systems to describe the severity of ankyloglossia based on the length of the lingual frenulum have also been developed [6]. The tools were designed to describe the lingual frenula but do not address the functionality of the tongue, and should be used with caution. Several tools have been developed to examine the impact of ankyloglossia on function. The Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF) was developed to determine the severity and functional impact of ankyloglossia [7]. The Lingual Frenulum Protocol for Infants [8] was established to assess and diagnose anatomical differences of the lingual frenulum, and identify the possible impacts of these on breast-feeding. The Bristol Tongue Assessment Tool (BTAT) was developed using principles from the HATLFF to rate severity of ankyloglossia by measuring the tongue tip appearance, attachment of the frenulum to the

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lower gum ridge, lift of tongue with mouth wide and protrusion of tongue [9]. An adjunct to the BTAT is The Tongue-tie and Breastfed Babies (TABBY) assessment, which was developed to provide a pictorial representation of the BTAT [10]. Despite a variety of tools to classify and assess the impact of ankyloglossia, these tools lack reliability and standardisation, and consensus regarding a preferred ankyloglossia grading system has not been established [3]. The tools are often used in conjunction with informal functional assessments which are likely to be variable amongst health professionals [1].

Non-surgical management of ankyloglossia can include strategies such as positional changes, the alteration of feeding frequency, providing support to mothers to maintain a milk supply, latch optimisation and the use of external tools such as nipple shields or supplementary nursing systems [1,11]. These strategies are recommended to be implemented by relevant, trained health professionals such as International Board Certified Lactation Consultants (IBCLCs), midwives, child health nurses and/or speech-language pathologists [1]. Currently, frenotomy is the primary surgical intervention used to manage ankyloglossia. This surgical intervention involves cutting the frenulum found between the inferior surface of the tongue and the floor of the mouth [12]. Although frenotomy is generally considered a safe procedure, complications may include bleeding, airway obstruction, damage to salivary structures, scarring and oral aversion [3]. Increases in the rate of frenotomy in Australia have been reported as high as 420% [13], and reiterated internationally [14]. Other less common surgical procedures to manage ankyloglossia include frenuloplasty - releasing and suturing the lingual frenulum, Z-plasty - releasing the frenulum and creating flaps and suturing these, and laser interventions - used by dentists to remove and separate the frenulum tissue [15,16]. These surgical procedures have been recommended to be performed by suitably trained health professionals, and to be considered only following unsuccessful non-surgical management [1].

There are only a few reports documenting the practices of health professionals in the diagnosis and management of ankyloglossia internationally [4,17], with no literature investigating practices in Australia. There is also a complete lack of studies investigating the identification and management practices of health professionals in the field of ankyloglossia in remote settings, both in Australia and internationally. Reports of a lack of professional education in the field of ankyloglossia, and a lack of consensus amongst health professionals on assessment and diagnostic tools has led to inconsistencies in clinical practice amongst clinicians [17]. These inconsistencies, as well as the increase in frenotomy rates has led to greater interest in the clinical practices and thoughts of health professionals managing ankyloglossia. It has become increasingly important to address the issue of overdiagnosis and over-treatment of ankyloglossia in this context.

The lack of standardised guidelines and varying interpretations of ankyloglossia have contributed to the potential for overdiagnosis of the condition. In some cases, infants may undergo frenotomy without a genuine clinical need, leading to unnecessary interventions [18]. This overdiagnosis can result from the subjective judgements made by health professionals in the absence of clear diagnostic and management criteria. Awareness of the clinical practices in ankyloglossia diagnosis and management across all health care settings in Australia will allow for clinical guidelines that are sensitive to the resources available in all areas of Australia.

This study, therefore, aimed to examine the opinions and practices of Australian health professionals in the assessment and management of ankyloglossia. It was hypothesised that (i) opinions about ankyloglossia will vary between professions, (ii) the diversity of professions involved in the diagnosis and management of infants with ankyloglossia will be numerous, (iii) the majority of clinicians do not use established tools to guide management of babies with suspected ankyloglossia and (iv) clinicians would have low confidence in their skills due to a lack of standardised diagnostic and management guidelines. Reporting on the current ankyloglossia diagnostic, management, and educational

practices of health professionals in Australia will inform the future development of policies to standardise processes nationally.

2. Method

Ethical approval for this cross-sectional questionnaire study was granted by the Central Australian Human Research Ethics Committee (CA20-3629).

2.1. Survey design

A survey was developed using Qualtrics software to evaluate the opinions and practices of Australian health professionals working with ankyloglossia. All questions in the survey were categorised into four blocks that included multiple choice and open response question formats. The four blocks explored health professionals' background and clinical experience, assessment practices, management practices and the provision of education. Open response questions were included.

The first block surveyed health professionals on their qualifications, geographical location based on Modified Monash Model classifications [19], clinical setting and years of experience. Participants were asked whether they have completed any professional development in the area of ankyloglossia or frenotomy and were provided with an open response text box to describe the training. The assessment practices section contained questions about factors leading to assessment of infants for ankyloglossia, the assessment/screening tools used, and revisions made to these assessment tools. A 5-point Likert scale ranging from 1 - 'Not confident' to 5 - 'Extremely confident' was used to identify the health professionals' self-reported confidence level in assessing ankyloglossia. Fixed anchor points were used as they have been recommended as more reliable when making quantitative comparison [20]. The management of ankyloglossia was explored using multiple choice questions for the type of treatment provided, number of treatments provided per month, timeframes for intervention and improvements in management. Likert scales were used to ascertain the self-reported confidence levels in the surgical management of ankyloglossia and non-surgical management of ankyloglossia, and satisfaction levels with the current service delivery for infants with ankyloglossia. The frequency of education provided about ankyloglossia and frenotomy was explored through two 5-point Likert scales.

2.2. Data collection

Data was collected from a survey developed and published using Qualtrics software (www.qualtrics.com). Australian health professionals who practiced in the area of ankyloglossia were invited to complete an online survey through the Qualtrics web link. Health professionals were recruited via email, professional body newsletters, interest groups and through social media groups for paediatric feeding, ankyloglossia, and related topics, as well as via managers of speech pathology, midwifery and nursing departments throughout a number of hospitals and community health centres across Australia. The survey was disseminated through a link generated by the online survey tool. This link was not personalised to any one participant and an email outlining the study and survey was sent to moderators of the interest groups and managers of health services asking them to disseminate to staff and/or colleagues, as well as posted on relevant social media pages and professional body websites. Eligible participants for this study included English speaking health professionals with clinical experience in the diagnosis and/or management of ankyloglossia in Australia.

2.3. Data analysis

Responses were downloaded into IBM SPSS Statistics For Windows (version 26) [21] for further analysis. Descriptive statistics were used to describe general trends. Additionally, chi-squared and Mann-Whitney U

tests were used to explore differences between groups of respondents. All p-values were calculated with a two-sided significance level of 0.05 and power was set at 0.80.

Responses to open-ended questions were transferred to Microsoft Excel for content analysis. Content analysis was completed to determine practices of health professionals in the areas of assessment and management of ankyloglossia. A thematic analysis was used to identify key themes.

3. Results

3.1. Study sample

A total of 357 responses were collated, of which 120 responses were removed due to incomplete survey data or lack of consent to participate in the study. Responses received from 237 health professionals are reported.

Demographic information about the respondents is represented in Table 1. Speech pathologists were the largest participant group (40.1%), followed by lactation consultants (20.7%) and paediatricians (7.6%). Several health professionals, including midwives, dentists, nurses, chiropractors, general practitioners, osteopaths and other professionals, responded to the questionnaire in fewer numbers.

Participants responded from all eight Australian states and territories, with most health professionals practicing in New South Wales (31.6%) and Queensland (29.1%). Based on workplace location, 177

Table 1
Demographic information of participants.

	N	%
Profession		
Speech Pathologist	95	40.1
Lactation Consultant	49	20.7
Midwife	14	5.9
Nurse (RN)	12	5.1
Paediatrician	18	7.6
Chiropractor	11	4.6
Osteopath	6	2.5
Dentist	13	5.5
GP	11	4.6
Other	8	3.4
Work setting		
Hospital	98	41.4
Community-based government health	44	18.6
Private practice	87	36.7
Non-profit organisation	3	1.3
Other	5	2.1
State or Territory		
ACT	6	2.5
NSW	75	31.6
NT	19	8.0
QLD	52	21.9
SA	11	4.6
TAS	2	.8
VIC	46	19.4
WA	26	11.0
Workplace location		
Major city	136	57.4
Inner regional	41	17.3
Outer regional	35	14.8
Remote	22	9.3
Very remote	3	1.3
Years of clinical experience		
0	1	0.4
1–2	21	8.9
3–4	40	16.9
5–6	42	17.7
7–8	28	11.8
9–10	23	9.7
10+	82	34.6

respondents (74.7%) worked in metropolitan or regional cities, whereas 60 respondents (25.3%) worked in rural and remote areas. The highest proportion of health professionals working in rural and remote areas was in Northern Territory.

Majority of participants worked in a hospital setting (41.4%), followed by private practices (36.7%). Participants also worked in settings including community-based government health services, other settings and non-profit organisations. Most health professionals reported working in the field of ankyloglossia for over 10 years (34.6%), with over 90% of the respondents working in the field for longer than two years.

3.2. Ankyloglossia diagnosis

Of the health professionals who responded to the survey, 217 (91.6%) respondents reported that they assess and diagnose ankyloglossia in their clinical practice.

3.2.1. Factors that led to assessment

When health professionals were asked what led them to assess for ankyloglossia in infants, it was revealed that the factors preceding ankyloglossia assessment were often multifactorial. Over half of the respondents reported that they assess all infants (56.7%). Health professionals also reported that they assessed for ankyloglossia due to the infant demonstrating a poor latch (56.2%), the appearance of the tongue (55.3%), poor sucking (52.1%), and due to maternal nipple pain (4.5%).

3.2.2. Assessment tools

Most health professionals reported using more than one assessment tool in their clinical practice. The most frequently used tools were observation (72.2%), an informal screening tool (44.3%) and the HATLFF (41.4%).

The responses of health professionals to the question of why this was their assessment tool of choice were analysed through both content and thematic analysis and overall themes of a preference for a functional assessment, and limitations in training, availability of tools and time emerged. These themes and subthemes are depicted in Table 2.

Thirty-three participants reported that they had a “no formal training” in the tools they were using (P39; P92) and that they “haven’t heard of the others” (P91). As a result, their clinical practice was impacted by their level of expertise.

“I do not have confidence I have the skills or tools to complete a formal Ax [assessment], nor feel it is within my scope of practice.” (P81)

Conversely, health professionals that were more familiar with diagnostic tools believed using “a combination of assessment/screening tools” (P77) achieves “a thorough assessment of the mobility and function of the tongue” (P187).

Health professionals were asked why they use the assessment tools they use in their clinical setting (Q3.3). A variety of limitations were reported by 57 health professionals to be a contributing factor as to why they used the assessment tools selected. For example, limitations in time were reported by 5 health professionals, who commented that they had “no time to complete formalised assessment tools” (P15), highlighting the fast-paced nature of many health care settings.

“I run a drop-in for breastfeeding mothers so I haven’t got time to do a lengthy assessment.” (P175)

The availability of tools was a limitation for 19 health professionals, who reported that they use their current tool as it “is what the health service uses” (P78). A health professional in a regional setting had additional availability constraints due to the logistics of their health service.

Table 2
Assessment practice of health professionals.

Assessment tool	N	%
Observation	171	72.2
Informal screening/tool	105	44.3
Hazelbaker Assessment Tool for Lingual Frenulum Function (HATLFF)	98	41.4
Bristol Tongue-Tie Assessment Tool	31	13.1
Unspecified	20	8.4
Lingual Frenulum Protocol (Martinelli)	18	7.6
Frenotomy Decision Tool for Breastfeeding Dyads (Dobrich)	9	3.8
Functional assessment	9	3.8
Neurological exam	4	1.7
Kotlow classification protocol	2	0.8
Referral	2	0.8
Coryllos classification system	1	0.4
Factors that led to assessment	N	%
All infants are assessed	123	56.7
Poor latch	122	56.2
Poor suck	113	52.1
Maternal nipple pain	118	54.4
Poor weight gain	98	45.2
Appearance of tongue	120	55.3
Other	43	19.8
Other factors that led to assessment	N	%
General feeding difficulties	13	30.2
Routine screening	9	20.9
Request for an assessment	5	11.6
Reasons for assessment tool selection	N	%
Preference for a combination of assessments	26	12
Dissatisfaction with other tools	14	6.4
Preference for a tool that is easy to use	37	17
Evidence base behind the tool	10	4.6
Preference for a functional assessment	53	24.4
Limitation of time	5	2.3
Limitation in tool availability	19	8.8
Limitation in training	33	15.2
Referral to other services for assessment	20	9.2

“I work in remote [supplied] region and am unable to bring all of my assessments with me due to weight limits on planes and large case-loads.” (P237)

Functional assessments were a priority when selecting assessment tools for 53 health professionals, who reported that they “take a very function-based approach to the assessment” (HP90).

“Not aware of any screening tool with strong evidence to support its use over functional assessment and clinical observation of feeding” (P140)

3.2.3. Revision of assessment tools

A total of 37 health professionals (15.6%) reported that they have made revisions to existing ankyloglossia assessment tools. Revisions were made to the HATLFF by 19 health professionals, the BTAT by 5 health professionals, and 13 respondents indicated that they had revised another existing informal screening tool. Further, 10 health professionals reported combining tools and adding test items, as well as revising tools which were not listed, including informal assessment tools developed specifically for their organisation. Some health professionals (40.5%) reported that they had made more than one type of revision to the above tools. The types of revisions made to these assessments are depicted in Fig. 1.

3.3. Ankyloglossia management

Of the health professionals who responded to the survey, 110 (46.4%) respondents reported that they provide treatment for and

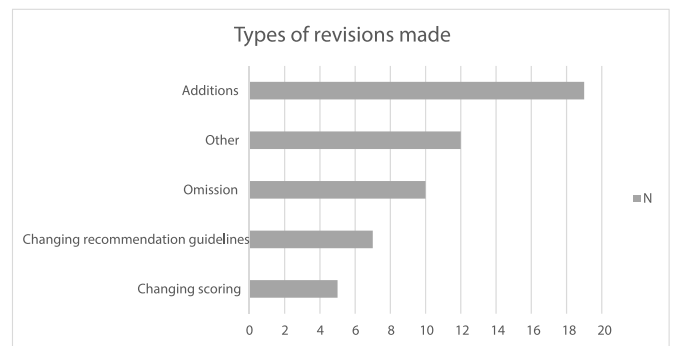


Fig. 1. Revisions made to assessment tools.

manage ankyloglossia. Of these, surgical procedures were performed by 49 health professionals (44.5%) as primary treatment for ankyloglossia. These procedures included frenotomy (29%), frenuloplasty/z-plasty (5.5%) and laser surgery (10%). Non-surgical management was provided by 62 health professionals who treat or manage ankyloglossia (56.4%). Health professionals were asked to specify the non-surgical treatments that they provide, which can be seen in Table 3.

Other treatments were reported by 60 health professionals (54.5%). Content analysis of these treatments found common themes, included using a multidisciplinary approach to treatment (8.5%), non-invasive treatments such as feeding therapy, oral therapies and compensatory feeding treatments such as positioning changes (64.8%), and referring to

Table 3
Management practices of health professionals.

	N	%
Treatment	110	46.4
Non-surgical	62	56.4
Frenotomy	32	29.1
Laser surgery	11	10
Frenuloplasty/Z-plasty	6	5.5
Other treatment	60	54.5
Number of surgical treatments provided (per month)		
0–5	23	46.9
5–10	1	2.0
10–20	4	8.2
20–30	14	28.6
30+	7	14.3
Non-surgical treatments provided		
Positioning changes	25	24
External tools e.g. nipple shield, dummy	11	10.6
Oral exercises	11	10.6
Latch optimisation	9	8.7
Osteopathic treatment	9	8.7
Myofunctional therapy	8	7.7
Chiropractic treatment	7	6.7
Referral to other providers	7	6.7
Feeding therapy e.g. sucking therapy	6	5.8
Education	5	4.8
Other	3	2.9
Speech therapy	2	1.9
Sensorimotor exercises	1	1
Preferred time frame for intervention		
Immediately	24	10.4
1–3 days	32	13.9
3–7 days	30	13
7+ days	38	16.5
Other	107	46.3
Preferred time frame for intervention (other)		
Individualised	44	62.9
Age-dependent	9	12.9
As soon as possible	7	10
Following assessment and non-surgical	6	8.6
Management at the discretion of the health professional	4	5.7

other providers for management (27.8%).

The frequency of surgical procedures for the management of ankyloglossia was examined. Over half of the health professionals performed less than five surgical treatments per month, with five health professionals (11.6%) working in private practice settings providing over 30 surgical procedures per month (See Fig. 2). These health professionals encompassed three dentists, one lactation consultant and one ‘other’ health professional. Of the 15 health professionals performing more than ten procedures per month, 11 were dentists, 1 was a surgeon, 1 was a general practitioner, and 2 were midwives. Ten of these health professionals used lasers as their surgical tool.

A Mann-Whitney *U* test revealed that there was no significant difference in the number of procedures performed by health professionals when comparing metropolitan/regional locations and rural/remote locations ($p = 0.220$).

The Australian health professionals who responded to this survey were asked about their preferred timeframe from diagnosis to intervention in Q4.7. Responses varied among the health professionals, with 24 (10.4%) reporting intervention should occur immediately, 32 (13.9%) preferred 1–3 day time frame, 30 (13%) preferred 3–7 days, 38 (16.5%) preferred over 7 days, and 107 (46.3%) reported that they would prefer a different time frame. The responses of health professionals were analysed through content and thematic analysis. The themes and subthemes are depicted in Table 3.

In Q4.7.5, health professionals were asked to give details about their preferred timeframe from diagnosis to intervention, as they had selected ‘other’ in Q4.7. Various timeframes and ideas were reported by health professionals.

Individualised timeframes were preferred by 44 health professionals, who reported that the management timeframe “Depends on the presenting patient in every case” (P207).

“Optimal timing of release is imperative for good outcomes. There is no one size fits all approach as each infant is different in relation to function. Each dyad is treated individually. I feel release of restricted oral tissue is vital for all dyads but the timing is also very important for good outcomes.” (P48)

Intervention for ankyloglossia as soon as possible was a priority for seven health professionals, who reported that a procedure should occur “As soon as diagnosis is made” (P153).

“Ideally if impacting feeding they would be seen and given intervention ASAP.” (P158)

When asked what should be improved in the field of ankyloglossia management, multiple areas for improvement were identified by health professionals. Improved education for staff and clinicians was an area identified by 88.2% of health professionals. Improved education for parents was highlighted by 74.3%, regular training by 55.7% and different screening tools by 26.2%. Other areas of improvement were

identified by 24.9% of health professionals, and included themes such as the creation of clinical guidelines, equitable access to ankyloglossia services, and further research.

3.4. Education to parents

When surveyed, less than half (46%) of health professionals reported that they always educate parents about ankyloglossia, and 72% of health professionals provided education to parents about ankyloglossia in over half of their clinical interactions. A smaller proportion (27.5%) of health professionals provide education to parents on ankyloglossia half of the time or less.

Education to parents on frenotomy procedures was completed in all clinical interactions for 29.5% of health professionals. Over half of health professionals (57%) practicing frenotomy procedures reported that they educate parents on frenotomy in more than half of their clinical interactions. Frenotomy education was provided to parents half of the time or less by 36.2% of health professionals. One participant stated that they never provide education on ankyloglossia, and 15 (6.3%) participants stated they never provide education on frenotomy.

Health professionals in Australia used a variety of tools, and often used more than one modality to educate parents and caregivers on ankyloglossia and frenotomy procedures. Health professionals primarily used verbal explanations when providing education to parents and caregivers (94.5%). Written education was provided by 44.7% of health professionals, as well as the use of web-based education materials (31.6%) and video resources (12.2%). Australian health professionals also reported providing education to parents and caregivers through other methods.

3.5. Professional development

Professional development was completed by 174 (73.4%) of health professionals, with 26.6% of respondents having completed no further training in the field. There was no significant difference in the rates of professional development among health professionals working in metropolitan and rural/remote regions (Chi-square; $p = 0.171$).

The types of professional development completed by Australian health professionals were group following content analysis and fell into three categories. These included formal training (e.g., specialist training in paediatric dentistry) completed by 36 (20.8%) of respondents, informal training (e.g., attendance at conferences and workshops) completed by 122 (70.5%) of respondents, and self-directed professional development (e.g., reading of published literature) completed by 15 (8.7%) of health professionals.

3.6. Confidence and satisfaction of health professionals

Health professionals were asked to rate their confidence on a Likert scale from 0 to 5 in the areas of assessment, non-surgical management, and surgical management of ankyloglossia. On this scale 0 indicated ‘no confidence’ and a 5 indicated ‘extremely confident’. The responses of

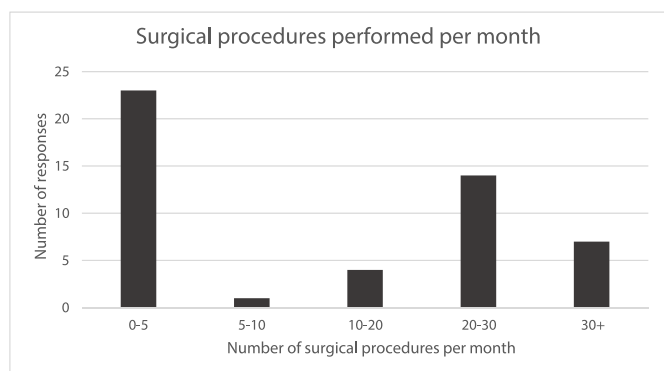


Fig. 2. Average number of surgical procedures performed per month.

Table 4
Confidence of health professionals.

	Assessment		Non-surgical management		Surgical management	
	N	%	N	%	N	%
0 (no confidence)	0	0.0	1	1.3	4	9.8
1	4	2.0	1	1.3	0	0.0
2	17	8.4	3	3.9	0	0.0
3	55	27.1	15	19.5	5	12.2
4	81	39.9	35	45.5	10	24.4
5 (extremely confident)	46	22.7	22	28.6	22	53.7
	203		77		41	

health professionals are outlined below and in Table 4.

Of the 203 health professionals who conducted assessment of ankyloglossia, 62.6% reported a high level of confidence about their assessment skills, rating themselves as confident or extremely confident. More than one-third (37.5%) of health professionals rated their confidence as moderately confident or less. No health professionals rated themselves as having no confidence in the assessment of ankyloglossia.

A majority (74.1%) of health professionals performing non-surgical management reported they are moderately to extremely confident in their skills. Average to minimal confidence in their non-surgical management skills was reported by 24.7% of health professionals. One health professional reported no confidence in their non-surgical management skills.

Over half of respondents (53.7%) who perform surgical management of ankyloglossia reported that they feel extremely confident in their skills. Most participants (90.3%) rated moderate to extreme confidence in their surgical management of ankyloglossia. Four health professionals (9.8%) who perform surgical management reported no confidence in their skills. Of the 15 health professionals providing more than 10 surgical procedures per month, 14 reported they were 5/5 confident in their surgical skills.

Further analysis using a Mann-Whitney *U* test revealed that there was a significant difference found in the confidence of health professionals when asked about their assessment skills. The confidence of health professionals practicing in metropolitan areas was rated higher than in rural areas (mean 3.9; SD = 0.83 vs mean 3.3; SD = 1.18; *p* = 0.001). There was no significant difference in the confidence of health professionals practicing in metropolitan and rural areas when it came to non-surgical or surgical management of ankyloglossia (*p* = 0.973 and *p* = -0.628 respectively). This can be seen in Table 5.

Over half (52%) of the health professionals involved in this study reported that they were dissatisfied with the current service delivery for infants with ankyloglossia, compared to 29.9% who reported that they were satisfied with the current service delivery.

4. Discussion

This study aimed to explore the diversity and practices of health professionals working in the field of ankyloglossia assessment and management in Australia. The Australian health professionals working in the field of ankyloglossia were diverse regarding disciplines. The cohort included speech pathologists, lactation consultants, midwives, nurses, paediatricians, chiropractors, osteopaths, dentists, general practitioners and other health professionals such as craniosacral therapists, dietitians and oro-facial myologists. The type of health professionals who responded to our questionnaire were largely consistent with those listed as key relevant professionals in the field in Australia [1].

The spread of locations in which these health professionals practice reinforced that ankyloglossia assessment and management is occurring across all areas of Australia. In addition, the health professionals working in this field are incredibly varied in their training backgrounds. The variance in location and discipline highlights the importance of

health professionals involved in ankyloglossia assessment and management being unified in diagnostic and management pathways. The experience levels of the health professionals working with infants with ankyloglossia were high, with one third of professionals having worked with infants with ankyloglossia for over ten years.

Professional development that is relevant to the scope of practice of a health professional is vital in maintaining, improving and broadening knowledge, expertise and competency [22]. Continuing professional development is a legal requirement for health professionals in Australia since the establishment of the National Registration and Accreditation Scheme (National Scheme) in 2010. The National Scheme is enacted in each state and territory of Australia since 2009 and 2010 and is regulated by a corresponding National Board for each discipline of health professional. This ensures that Australian health professionals are competent in the areas that they provide care. The professional development rate of 73.4% in our study showcases that over one quarter of health professionals working in the field of ankyloglossia have not completed further training in this area of practice. There was no significant difference in the rates of professional development among health professionals working in metropolitan and rural/remote areas, highlighting that access to professional development did not appear to be the challenging factor. Of the health professionals who had completed professional development in the area of ankyloglossia, 79.2% reported that they had completed informal and self-directed professional development, including reading literature and attending workshops and conferences.

The AHPRA 2021/2022 annual report reported that following routine audits which encompass professional development and recency of practice, 0.23% of health professionals were non-compliant with the registration requirements of their profession [23]. This rate contrasts with the professional development rate of health professionals in our study. This may be due to the lack of training courses in Australia that allow health professionals to register as specialists or experts in the identification or treatment of ankyloglossia [1]. This is likely compounded by the diversity in health professionals involved in the assessment and management of ankyloglossia, with no clear guidelines on the requirements of health professionals working in this field.

In this current study, observations and informal screenings were the most common tools used by health professionals to identify ankyloglossia, with 72.2% and 44.3% using these methods respectively. This is reflected in the comments of health professionals in this study reporting a preference for tools that include functional assessment methods that are individualised to the infant breastfeeding dyad. The health professionals in our study also highlighted a lack of access and training in other ankyloglossia assessment tools. These findings are consistent internationally, with only 33% of Canadian health professionals reporting the use of a framework or policy such as the HATLFF or Frenotomy Decision Tool for Breastfeeding Dyads (FDTBD) to assess ankyloglossia in their clinical practice [24]. Additionally, over 50% of health professionals in this study reported that every infant is assessed for ankyloglossia. This is a higher proportion of respondents compared to available literature from Canada stating 11% of health professionals suggested that every infant regardless of their symptoms should be

Table 5
Confidence of health professionals in metro vs rural settings.

	Assessment			Non-surgical management			Surgical management		
	All	Metro	Rural	All	Metro	Rural	All	Metro	Rural
N	203	152	51	77	62	15	41	32	9
Mean	3.7	3.9 ^a	3.3 ^a	3.9	3.9	4.0	4.0	3.9	4.4
SD	0.97	0.83	1.18	0.98	1.02	0.85	1.51	1.65	0.73
Median	4.0	4.0	3.0	4.0	4	4	5	5	5
Variance	0.94	0.69	1.39	0.96	1.04	0.71	2.27	2.73	0.52
Min-Max	1-5	2-5	1-5	0-5	0-5	3-5	0-5	0-5	3-5

^a = Mann-Whitney *U* test; *p* = 0.001.

assessed for ankyloglossia [24]. The consensus statement released by the Australian Dental Association [1] outlines that the key pre-requisites for qualified health professionals making a suspected ankyloglossia diagnosis are a thorough case history, an objective functional assessment of tongue function using a diagnostic system and a complete assessment of functional issues impacted by the suspected ankyloglossia. This discrepancy between published literature and clinical practice may be contributing factors to the high rates of tongue-tie seen in Australia [13].

The Australian Dental Association's states "Surgical management should only be undertaken by appropriately trained health professionals" [1]. However, further detail outlining what is 'appropriately trained' is not provided, which may have contributed to the diversity of health professionals who performed surgical procedures to management ankyloglossia in this study. This lack of clarity around the necessary training required to perform frenotomy procedures may also be reflected in the low confidence self-ratings in some health professionals conducting these surgical procedures.

The frequency of frenotomy procedures per month was not consistent with the rising rates of frenotomy reported as high as 400% in Canada, and 866% in the United States [25,26]. In our study, most providers of surgical procedures for the management of ankyloglossia performed less than five procedures per month.

The current study revealed that dentists performed the highest frequency of surgical procedures for ankyloglossia, using laser as their primary tool. This is consistent with reports of increased laser use in frenotomy procedures, with dentists performing 88% of frenotomies by laser [27–29]. A recent study has found that use of the lasers to perform frenotomy was significantly associated with oral aversion and feeding refusal as a complication, however, was associated with less reported bleeding than use of scissors/scalpel for frenotomy [28]. Further studies and protocols should be established to ensure the efficacy of these procedures in Australia, given the insufficient evidence to support laser as a superior technique for frenotomy [3].

Amongst the 237 health professionals who completed the survey and were involved in ankyloglossia assessment and management, satisfaction levels were reported as low regarding the current service delivery for infants with ankyloglossia. These health professionals reported that they are revising assessment and diagnostic tools, and using a combination of tools to assess infants, which highlights the likelihood that these health professionals are not satisfied with the tools currently available to them [17,28].

The confidence ratings among the workforce in remote areas was lower than that of the workforce in metropolitan areas. It is likely that the reason for this difference is multifactorial. Remote health services are often characterized by high staff turnover, limited numbers of specialist physicians and a reliance on more generalist health professionals [30,31]. Additionally, the current study highlighted that there was no significant difference in the rates of professional development amongst health professionals working in remote settings and metropolitan areas. These considerations may imply that the lower confidence ratings of health professionals in rural and remote areas is unlikely to be due to a lack of training, but perhaps the pressure of diagnosing and managing ankyloglossia without clear published diagnostic criteria, and without specialist physicians, in an isolated setting [17,32].

The rates of education provided to parents by health professionals on frenotomy and associated procedures were considered low. Whilst frenotomy is generally considered a low-risk procedure regardless of the instrument used to perform the division, risks such as bleeding, ulceration, oral aversion and swelling should be considered [1,3,33]. These risks should be discussed with parents prior to all frenotomy procedures, as part of the informed consent process [3]. Concerningly, the 15% of health professionals providing frenotomy procedures in this study reported that they only 'sometimes' educate parents on the procedure. Health professionals should ensure that they are adherent to the codes of conduct and ethical standards outlined by their professional governing bodies [34].

Potential sample bias was considered to be a limitation of the current study, in that Australian health professional survey participants were recruited based on their own perception of previous experience with infants with ankyloglossia. Additionally, a limitation of this study is the inconsistent and varied terminology used for ankyloglossia management. Terms such as frenotomy, laser surgery, and frenectomy are often used interchangeably and without necessary details of surgical practices. A lack of clarity regarding these procedure names may have impacted the responses of the health professionals responding to the survey. This discrepancy may result in challenges in applying research findings to clinical practice. A further limitation is the use of Likert scales, as may be considered a subjective method of evaluation. Evidence suggests that responses to a question on a Likert scale may vary across people from different cultures and countries [35]. This limitation was managed through the integration of open-ended questions, which offered participants the opportunity to provide detail about their current clinical practice.

Future directions in extending the current study may include examination of parental experiences with current diagnostic and management practices for ankyloglossia. This may lead to a clearer idea of the impact of clinical practice on parental experiences and informed consent. Future studies may explore the professional development opportunities for health professionals when expanding their scope of practice to ankyloglossia diagnosis and management.

5. Conclusion

This study was designed to explore the practices of Australian health professionals identifying and managing ankyloglossia in infants, and is the largest survey conducted to date regarding clinical practice in the field of ankyloglossia. At present, ankyloglossia diagnosis and management is occurring across Australia, by a broad range of health professionals including speech-language pathologists, lactation consultants, midwives, nurses, dentists, as well as medical professionals. The diagnosis, management and education practices varied greatly amongst health professionals in this study. Rates of professional development among health professionals were low. The health professionals performing over 30 frenotomy procedures per month reported high levels of confidence in their skills. Over half of the health professionals involved in this study were dissatisfied with the current service delivery for infants with ankyloglossia. Clinical guidelines for all relevant health professionals are needed to ensure standardised diagnosis and management processes, and to improve clinical confidence and satisfaction. Emphasis on a multidisciplinary approach is essential. These guidelines will help facilitate evidence-based diagnosis and intervention for infants with ankyloglossia.

Declaration of competing interest

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