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Outcomes of a Community of Practice on Quebec Speech Language Pathologists' Voice Assessment Practices and Professional Identity

Resultados de una comunidad de práctica sobre las prácticas de evaluación de la voz y la identidad profesional de los logopedas de Quebec

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Abstract

In a context where different protocols for recommended practices in clinical voice assessment exist, while there are gaps in the literature regarding the evidence base supporting assessment procedures and measures, clinicians from regions where a strong community holding expertise in clinical and scientific voice practices lack can struggle to confidently develop their voice assessment practices. In an effort to improve voice assessment practices and strengthen professional identity among speech-language pathologists in Quebec, Canada, a community of practice (CoP) was established, with the aim of promoting knowledge sharing, implementing change in clinical practice, and improving professional identity. Thirty-nine participants took part in the CoP activities conducted over a four-month period, including virtual meetings and in-person workshops. Participants had a high rate of attendance (> 74% participation rate in virtual meetings), and were highly satisfied with their participation and intended to remain involved after the project's end. Statistically significant changes in voice assessment practices were observed post-CoP, regarding probability of performing assessments ($p < .001$), and perceived importance of assessment for evaluative purposes ($p < .001$), as well as improvements in assessment specific confidence, specifically for procedure of auditory-perceptual assessment ($p < .001$) and purpose of aerodynamic assessment ($p = .05$). Moreover, there was an increase in professional identity post-CoP ($p < .001$) and participants felt they made significant learnings. The present study highlighted the need to involve SLPs in future research to identify assessments that are relevant to the specific evaluative objectives of SLPs working with voice, and suggests CoPs are an efficient tool for that purpose.

Keywords

Speech language pathology; voice assessment; professional identity; evidence-based practice; community of practice.

Data availability
All relevant data is in the article. For futher information, contact the corresponding author.

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Contribution of the authors
Ingrid Verduyckt: Conceptualization, data curation, formal analysis, funding acquisition, investigation, methodology, project administration, supervision, visualization, writing – original draft, writing – review & editing.
Lyne Defoy: Data curation, funding acquisition, investigation, project administration, writing – review & editing.
Imane Hocine: Data curation, investigation, methodology, project administration, writing – review & editing.
Vincent Martel-Sauvageau: Conceptualization, data curation, funding acquisition, investigation, methodology, project administration, visualization, writing – review & editing.

Resumen
En un contexto en el que existen diferentes protocolos para las prácticas recomendadas en la evaluación vocal clínica, y en el que se presentan vacíos en la literatura respecto a la base de evidencia que respalda los procedimientos y medidas de evaluación, los profesionales de regiones donde no hay una comunidad sólida con experiencia en prácticas vocales clínicas y científicas pueden enfrentar dificultades para desarrollar con confianza sus prácticas de evaluación vocal. Con el propósito de mejorar las prácticas de evaluación vocal y fortalecer la identidad profesional entre los logopedas de Quebec, Canadá, se estableció una comunidad de práctica (CdP). Esta tenía como objetivo fomentar el intercambio de conocimientos, implementar cambios en la práctica clínica y mejorar la identidad profesional. Un total de treinta y nueve participantes se involucraron en las actividades de la CdP, llevadas a cabo durante un período de cuatro meses, que incluyeron reuniones virtuales y talleres presenciales. Los participantes tuvieron una alta tasa de asistencia (> 74% de participación en las reuniones virtuales) y expresaron un alto grado de satisfacción con su participación, manifestando su intención de continuar involucrados después de la finalización del proyecto. Se observaron cambios estadísticamente significativos en las prácticas de evaluación vocal posterior a la CdP, en lo que respecta a la probabilidad de llevar a cabo evaluaciones ($p < .001$) y la percepción de la importancia de la evaluación con fines evaluativos ($p < .001$), así como mejoras en la confianza específica en la evaluación, particularmente en el procedimiento de evaluación auditivo-perceptual ($p < .001$) y el propósito de la evaluación aerodinámica ($p = .05$). Además, se registró un aumento en la identidad profesional posterior a la CdP ($p < .001$) y los participantes sintieron que obtuvieron aprendizajes significativos. El presente estudio destacó la necesidad de involucrar a los logopedas en investigaciones futuras, para identificar evaluaciones pertinentes a los objetivos evaluativos específicos de los logopedas que trabajan con la voz, y sugiere que las CdP son una herramienta eficiente con ese propósito.

Palabras clave
Patología del habla y del lenguaje; evaluación vocal; identidad profesional; práctica basada en evidencia; comunidad de práctica.

Introduction
Clinical voice assessment of a person seeking care for voice problems typically involves both an otolaryngologist and a speech language pathologist (SLP). The otolaryngologist's assessment focuses on identifying underlying pathologies and determining best management strategies [1], while, although sometimes the SLP assessment has the role of supporting the otolaryngologist [2], SLPs have assessment objectives specific to their discipline. These include describing the vocal quality and understanding the physiological processes underlying this quality, as well as appreciating the functional impacts that the voice problem may generate in an individual's everyday life, thereby establishing general and specific therapeutic objectives [1,3]. For both professionals, the initial voice assessment also constitutes a baseline measure that will allow to quantify and qualify the outcomes of the chosen intervention [1,3-5], making voice assessment an essential part of clinical management.

Several standardized voice assessment protocols have been suggested throughout the years to support clinicians in their assessment practices [2,4,5]. The European laryngological society (ELS) suggested a basic protocol for the assessment of voice pathology in 2001 [2], with the specific aim to produce comparable data regarding the results of voice treatment, specifically phonosurgical interventions, and in that way facilitate meta-analyses of the literature. This protocol is presented in forms of guidelines elaborated on the principle that voice is multidimensional and that a basic set of measures, including auditory-perceptual measures, videostroboscopy, acoustic and aerodynamic measures, and patient reported measures, applicable to all common dysphonias, is required to allow for comparison and meta-analyses. In a systematic review in 2013, Roy et al. [1] acknowledged the lack of a standardized voice-protocol in the United States (US), and, while acknowledging the ELS guidelines and a paper documenting frequently used practices among SLPs in the US [3], concluded that there was a lack of a strong evidence base to support measures included in recommended or de facto voice assessment practices.

In agreement with Dejonckere et al. [2], Roy et al., [6] also argue that this situation prevents comparison of data in the literature, but also "restricts comparisons among different facilities, patients, and even repeated assessments of the same patient" [6 p. 213]. Disappointingly, only 17 articles met sufficient scientific quality to be included in the review and, although evidence was provided for some measures' capacity to accurately diagnose presence, and in some cases nature, of a voice disorder, most of the reported measures (acoustic, visual analysis or aero-dynamic) were either not readily available or not ready for routine clinical use. In 2018, Patel et al. [4] provided a consensus paper outlining recommended protocols specifically for the instrumental assessments of voice, such as laryngeal endoscopic imaging and acoustic and aerodynamic assessments. The aim of this consensus paper was, much like that of the ELS, to facilitate valid comparisons and to improve evidence of voice assessment measures which, by extension, could facilitate evaluation of treatment efficacy. That same year, Mattei et al. [5] also published a consensus paper, suggesting a simplified protocol for the assessment of unilateral vocal fold paralysis specifically. Their protocol was prompted by the realization that a large percentage of published papers in clinical voice research fails to include the ELS recommended assessment practices, leading the authors to conclude that prior attempts to reach consensus on assessment practices of voice disorders had failed and that the concerns about generalizability of results expressed in 2001 remained. Unlike the 2018 consensus paper by Patel et al. [4], which provides extensive details on the technical specificities and procedures to perform the tasks underlying the elicitation of the signal (from the patient) used to perform instrumental measurements, Mattei et al. [5] do not elaborate much on the details surrounding the procedures of the recommended assessments. They [5] also suggest leaving out acoustic assessments, as they consider these measures lack evidence base supporting their clinical usefulness. This claim, unsupported with literature in the consensus paper, seems to echo the conclusion of systematic review by Roy et al. [6], but based on the globality of their results, it seems the same claim would hold true for all assessments.

Despite the efforts made in recent years to establish standard protocols for voice assessment, SLPs are left with a wide choice of assessment tasks but little guidelines to robustly justify which one to prioritize, as data on assessments' reliability, validity, or prognostic power are lacking and different protocols and rationales are suggested [1,2,4,5,7]. Recently, a clinical focus article [7] on US clinicians' experiences in implementing acoustic and aerodynamic assessments as per the Patel et al. [4] consensus paper revealed that, although feeling supported

by the guidelines provided in the paper, they experience several obstacles in implementing the recommendations, leading to substantial variations in their individual clinical practices. Regulatory bodies place demands on SLPs to develop evidence-based practices [8-10], but current standards and the evidence underpinning the recommended practices for voice assessment are designed with the main purpose to generate comparable data to advance scientific evidence of voice treatment outcome, with a focus on phonosurgical interventions [2,4,5] and the limited evidence base for assessment procedures mainly address their diagnostic power [6]. However, generating comparable data for research purposes and diagnosing presence or nature of a voice disorder are rarely clinical SLPs' main professional mandate. In Behrman, 2005, SLPs' reported using voice assessment measures and tools for the definition of overall and specific therapy goals, patient education, patient support to achieve a target production, patient reinforcement, and measuring treatment outcome [3].

The lack of clear guidelines specific to the professional context of SLPs can affect their professional confidence, manifested in their assurance regarding their clinical skills and aptitudes, which, in turn, can affect their inclination and capability to provide services for voice patients [11]. The difficulty to find one's way around contradictory information, and a body of literature presenting with knowledge gaps, is possibly exacerbated for SLPs practicing in countries with a shorter clinical and research tradition in voice treatment, where a strong clinical community capable of offering individuals mentorship and training opportunities to translate global standards into local practices is lacking. Global standards necessarily need adaptations to local contexts depending on accessible resources, cultural values and beliefs [12] and best practices outlined foremost with scientific purposes in mind will most probably require adjustments to effectively meet practitioners needs and capacities [13]. The need for reconciliation between evidence stemming from scientific studies, global standards, and experiential knowledge stemming from local field practice, is in fact acknowledged by recommendations for evidence-based practice (EBP) [8-10]. Indeed, EBP is not limited to the best available evidence in the form of explicit knowledge, that is, data from the scientific literature [8,14,15], but involves the integration of tacit, or experiential knowledge, corresponding to knowledge, skills, and judgments acquired through clinical experience and practice [8,14]. However, tacit knowledge is difficult to share and specific spaces for meaningful interaction with those who hold it are necessary in order to make it accessible [16,17].

In Quebec, prior to this study, there were no specific grouping of SLPs with an expertise or specific interest in voice, such as ASHA's special interest groups [18]. There was thus a need to create a structured space for reflective exchanges where both tacit and explicit knowledge regarding voice practices among SLPs could be shared. A way to create such a space is by actively establishing a community of practice (CoP) [19]. CoPs refer to groups of people who share a common issue or topic of interest and who deepen their expertise and knowledge through regular interaction. They are promoted as a means to harmonize clinical practices [14] and are generally characterized by three key elements: 1) a common domain, described as a field of knowledge or strategic activities, that unites the participants and motivates action; 2) shared practices or knowledge, including scientific knowledge, existing tools and resources, as well as new knowledge gained from common problem solving and developing common skills; 3) a community, defined as the emerging social structure of community activities, resulting from interactions among members and eventually leading to the formation of a group identity [14,17,19]. Research indicates that CoPs enable members to develop their own knowledge while participating in building new knowledge through the interactions with other members [20,21]. By

promoting professional socialization, CoPs can also contribute to the development of the professional identity of the individuals who participate [14,21]. Moreover, members of CoPs also report benefits such as increased confidence in their own expertise [14], which is linked to the concept of "self-efficacy", that is, what an individual feels they are capable of doing based on their knowledge and skills [22]. Specifically, it is "an individual's confidence in their ability to complete a given task" [23,24] and it is considered a good predictor of performance [22,23]. In a disciplinary context, where there is a certain ambivalence about the best practices of clinical voice assessment by SLPs, and more particularly in a regional context, where the clinical field of voice does not benefit from a strong clinical or scientific community, the CoP format presents as an interesting way to horizontally engage professionals with a wide range of knowledge and expertise likely to contribute to the development of a local consensus on the recommended voice assessment practices rooted, on the one hand, in global standards and, on the other, in experiential knowledge about local needs, capacities, and challenges.

The main objectives of this research project were to establish a CoP specifically aimed at voice assessment practices in Quebec SLPs and to evaluate its outcomes.

Our specific objectives were 1) to evaluate the feasibility of establishing the CoP, and to evaluate its short-term outcomes on 2) voice assessment practices, 3) professional identity of its members, and 4) general learnings and implementation of, or intention to implement, change. The hypotheses were that 1) it would be feasible to establish a CoP of n>10 SLPs, and that their participation in the CoP would 2) bring about changes in their voice assessment practices or intention to implement changes, as well as 3) improve their levels of professional identity (sense of belonging and confidence) regarding voice assessment practices, and 4) generate learnings. A secondary objective was to explore associations between variables to understand relationships between participant satisfaction, changes in practice and professional identity, and learnings.

Method

Ethical approval

Ethical approval was granted by the ethics board of the Centre de Recherche Interdisciplinaire en Réadaptation du Montréal métropolitain, # CRIR 1363-0818 on January 8, 2019.

Participants

SLPs and students in speech-language pathology (Master and doctoral level) were recruited through advertisement of the project in their employer's or universities' newsletters. Some SLPs were directly invited to participate to the project by mail after having previously participated in a continuous training regarding voice assessment practices. The project was also advertised in the newsletter of the professional association of SLPs and Audiologists in Quebec. The project was advertised as a research project that would allow participants to meet other professionals in their (future) field of practice, and with whom they could engage in a mutual exchange of knowledge sharing surrounding voice practices, in general, and voice assessment practices, specifically.

In order to ensure a consistent minimum level of participation throughout the research project, the aim was to recruit 10 participants as "core members" of the CoP. The core member participants had to commit to participating in all the projected meetings as well as engaging in reflexive work in between those. These participants received a monetary compensation for their participation. Other participants were invited to participate as "regular members". They could engage in all activities, but did not have to commit to participating, and they did not receive a monetary compensation for their participation. There was no minimum or maximum target

established for the number of regular member participants. Inclusion criteria for all participants was to be a French speaking speech language pathologist —defined as member of the Ordre des orthophonistes et des audiologistes du Québec (OOAQ), the regulatory organ of the profession in Quebec—, or a student (Master or PhD), enrolled in one of Quebec's university program for SLP. The research team was composed of one SLP (LD) with a >30-year expertise in voice, of two researchers specializing in voice (IV and VM-S), whereof IV also has a 12-year clinical expertise as a voice SLP, and one Master student in SLP (IH). The research team was involved in the CoP, with LD acting as facilitator, and LD, IV, VM-S, and IH participating in the preparation of the meetings and the reflexive activities suggested in between, as well as by contributing with short formal presentations and their expertise and reflections to the discussions.

Procedure

The CoP activities took place over a period of approximately four months and were organized into six one-hour virtual meetings that were held through the AdobeConnect web platform and one in-person meeting, consisting of two two-hour workshops that were held at a facility at IV's research centre. The approach to the structure of the CoP was a mix between a top-down and a bottom-up approach. Indeed, the main topic addressed by the CoP was predefined by the research team and announced during the recruitment process to potential participants (top-down approach), while specific topics discussed during the different meetings, as well as the content of the workshops, were defined according to the interests and concerns of the CoP members (bottom-up approach). In order to identify the CoPs priorities, members were invited to vote on three themes, each containing two categories at the first virtual meeting: 1) Administration, 32% (tasks 23% and instructions 11%); 2) Data gathering, 25% (environment 14% and material 11%); and 3) Data analysis, 43% (interpretation 23% and software 20%). According to the votes, the research team oriented the content of the CoP towards the analysis of data, with a focus on interpretation, and the administration of assessment procedures, with a focus on tasks.

Each virtual meeting began with a brief (+/- 15 min) scientific presentation related to the chosen topic up for discussion, given by the researchers involved in the project (IV and VM-S). The presentations were followed by a discussion period in which members were invited to react to the presentation, share their professional experiences, and raise important issues to discuss. During the in-person meeting, the workshops offered an invitation to CoP members to practice some of the assessment approaches discussed during the prior meetings (acoustic and auditory-perceptual evaluation of voice quality) and to share on the topic afterwards. Between meetings, the Adobe Connect platform remained available as a forum where members could exchange messages and access material. Members were also encouraged to engage in reflective practice exercises between meetings to fuel the discussions.

Data collection

Participants were invited to answer an online survey pre-CoP and post-CoP (within two weeks after the last meeting). The survey was developed for this particular study by the research team as no existing questionnaire specific to the research aims of this study was identified in the literature. The survey questions related to clinical practice of voice SLPs were adapted from Behrman [3], who studied voice assessment practices in SLPs, and questions relative to professional identity, learnings, and implementation of changes were based on suggestions of outcome domains expected from CoPs [25]. The survey also included items related to socio-demographic variables.

Items related to objective 1 (feasibility) were answered post-CoP and included one statement pertaining to members' satisfaction with the CoP (I am satisfied being part of the CoP); and their willingness to continue being part of the CoP (I intend on remaining involved in the CoP) answered on a 10-point Likert scale with end anchors of 1 equaling "not true at all" and 10 equaling "entirely true". Participants could motivate each chosen score with a free text answer. Finally, participants were asked to indicate how many meetings they attended.

Items related to objective 2 (outcomes on assessment practices) were grouped in three general categories. The first category pertained to the probability of participants performing a certain type of assessment (acoustic, aerodynamic, electro-glottographic, patient-reported outcomes, auditory-perceptual, visual observation of posture and movement, and patient's vocal plasticity) or, in the case of video-stroboscopy[1], the probability of them having access to exam results. Answers for each type of assessment were given on a 4-point Likert scale where 1 = not probable, 2 = somewhat probable, 3 = probable, and 4 = very probable. Based on these answers, 8 distinct Probability of doing the Assessment scores were computed.

The second category pertained to the importance participants attach to each type of assessment in achieving the following clinical purposes: 1) defining the overall therapy goal, 2) defining specific therapy session goals, 3) educating the patient about voice production, 4) helping the patient achieve a target production, 5) providing reinforcement to the patient, and 6) measuring treatment outcomes, by means of a 4-point Likert scale where 1 = not important, 2 = somewhat important, 3 = important, and 4 = very important. Based on these answers, 8 distinct Mean Importance of Assessment scores were computed. Both categories were answered pre- and post-CoP, and, when answering these items, participants were instructed to have in mind the case of a patient referred for voice therapy for muscle tension dysphonia (MTD), in accordance with Behrman [3].

The third category contained 2 statements evaluated post-CoP and pertaining to changes brought about by the CoP (Because I participated in the CoP, I made changes in my clinical practice; Because I participated in the CoP, I want to make changes in my clinical practice). These items were answered on a 10-point Likert scale with end anchors of 1 equaling "not true at all" and 10 equaling "entirely true" and could be motivated with a free text answer.

Items related to objective 3 (outcomes on professional identity) were grouped in four categories that were evaluated both pre- and post-CoP. The first three categories pertained to participants' degree of confidence regarding 1) how to perform each type of assessment (assessment procedure), 2) the reason why the assessment is performed (assessment purpose), and 3) the assessment's validity (assessment validity). For each type of confidence, participants indicated their level of confidence for specific types of tools or measures related to a type of assessment (see Table 1) on a 4-point Likert scale where 1 = not confident, 2 = somewhat confident, 3 = confident, and 4 = very confident. The option "does not apply" was also available. Four mean assessment scores for each confidence category were computed based on these answers: Acoustic Measures Mean, Aerodynamic Measures Mean, Patient Reported Measures Mean, and Auditory-perceptual Measures Mean.

[1] SLPs in Quebec are not allowed to perform endolaryngeal exams; it is considered a medical act legally reserved for physicians.

Table 1. List of measures evaluated for each of the assessment types and composing the mean assessment scores.

Acoustic measures	**Aerodynamic measures**
Mean f0 speaking voice	Mean airflow rate
f0 range speaking voice	Estimated subglottic pressure
Physiological f0 range	Aerodynamic efficiency
Jitter	Maximum phonation time
Shimmer	Vital capacity
Mean intensity speaking voice	Phonatory quotient
Intensity range speaking voice	S:Z ratio
Physiological intensity range	
Patient reported measures	**Auditory-perceptual measures**
Voice Handicap Index	CAPE-V
Voice Related Quality of Life	GRBAS

The fourth category pertained to members' professional identity as SLPs working with voice and contained 11 statements answered on a 5-point Likert scale with end anchors of 1 equaling "not true at all" and 5 equaling "entirely true". These eleven questions were grouped in two subscales (professional belonging, n = 5; professional competence, n = 6) and two scores were created: The Professional Belonging score (created by getting the mean score of the five statements on the sense of belonging) and The Professional Confidence score (created by getting the mean score of the six statements on confidence and competence) (see Table 2 for a list of the statements).

Items related to objective 4 (learnings) were evaluated post-CoP by three statements pertaining to learning outcomes of the CoP (I gained important new knowledge on a personal level through the CoP; I gained important new knowledge on a professional level through the CoP; I learned a lot from the CoP).

Analyses

Quantitative data

Quantitative data were subjected to descriptive statistics. Due to small sample size and non-normality of distribution, the non-parametric Wilcoxon Signed Rank Test for paired samples was used to evaluate pre-post differences in participants' voice assessment practices, perceived importance of the evaluation, confidence in assessment and professional identity [26]. Significance level was set at p = .05. Effect-size was calculated by dividing the z-value by the square root of N (the number of observations over the two time points) and Cohen criteria of 0,1 = small effect, 0,3 = medium effect, and 0.5 = large effect was applied [27]. Since the option "does not apply" was available for some items of the survey, some participants had missing scores either pre-CoP, post-CoP, or both. Since Wilcoxon Signed Rank test can only be run on paired samples, the sample size varies for the different scores. Pearson correlations

Table 2. List of statements composing the Professional Belonging score (PBS) and Professional Confidence score (PCS).

Items (n = 5) composing the PBS	Items (n = 6) composing the PCS
I'm satisfied with the resources and tools available to help me when working with patients with voice disorders.	I feel confident when working in therapy with patients with voice disorders.
I feel that I have a common language with speech-language pathologists in Quebec for exchanging information on my activities in the field of voice disorders.	I feel competent when providing therapy to patients with voice disorders.
I feel a sense of belonging to the group of speech-language pathologists practicing in the field of voice disorders in Quebec.	I feel competent when assessing patients with voice disorders.
I have access to a forum to broaden my skills and expertise in the voice field.	I feel credible as a speech-language pathologist when working with patients with voice disorders.
I feel part of a network that helps me keep up to date in the field of voice disorders	I feel confident when assessing patients with voice disorders.
	I feel that I have expertise in the field of voice disorders

were used to explore the relationship between linear variables. Qualitative data, in the form of free text answers to five statements in section 4 of the questionnaire was too scarce to perform a meaningful content-analysis (21 free text answers all in all) and are simply summarized in the results sections. Overall, four categories of variables were analysed:

1. The feasibility of establishing a CoP was measured by number of participants, number of attended meetings per participant, and by participants' scores on the two statements regarding 1) satisfaction with the CoP and 2) willingness to continue engaging in the CoP after the research project's ending.

2. Short term outcomes on voice assessment practices was measured by the changes between participants' eight Mean Probability of doing the Assessment scores and eight Mean Importance of the Assessment scores pre- and post-CoP, as well as by their scores on the two statements pertaining to implementation and intention to implement change and their free text comments pertaining to these statements.

3. Short term outcomes on professional identity was measured by the changes between participants' scores pre- and post-CoP, regarding 1) their degree of confidence for four different assessments, 2) their sense of professional belonging, and 3) their professional confidence.

4. Short term outcomes regarding learnings and implementation of, or intention to implement, change was measured by participants' scores on the three statements pertaining to learnings, as well as their free text comments pertaining to these statements.

Associations between participant satisfaction, changes in practice and professional identity, and learnings were explored by correlations between these variables.

A summary of the variables used for each objective is provided in Table 3.

Table 3. Summary of the variables used in the study, per objective.

Objective	General variable			Dimension	Range of score (per dimension)
1) Feasibility	Number of participants per meeting			N/A	N/A
	Number of meetings attended				1-7
	Intention to remain involved				1-10
	Overall satisfaction				
2) Assessment practices	Probability of performing or having access to assessment	Importance of assessment in achieving clinical goals		Acoustic	1-4
				Aerodynamic	
				Electro-glottographic	
				Patient-reported outcomes	
				Auditory-perceptual	
				Visual observation	
				Vocal plasticity	
				Video-stroboscopy	
	Professional changes			Implementation of change	1-10
				Intention to implement change	
3) Professional identity (confidence and belonging)	Confidence in assessment procedure	Confidence in assessment purpose	Confidence in assessment validity	Acoustic measures	1-4
				Aerodynamic measures	
				Patient-reported measures	
				Auditory perceptual measures	
	Professional identity			Professional belonging	1-5
				Professional confidence	
4) General learning	Learning outcomes			Personal knowledge	1-10
				Professional knowledge	
				Knowledge in general	

Results

Feasibility of establishing a CoP

Participants

Thirty-nine participants engaged in the CoP and answered the initial questionnaire. Thirty-five were clinicians and four were students. Ten clinicians engaged in the research project as core members of the CoP. Fifty-four percent (n = 21) worked in a public practice, 13% (n = 5) in a private practice, 31% (n = 12) both in a public and a private practice, and 3% (n = 1) did not answer. There was a large spread in years of professional experience with a mean of 10,37 years (SD = 10.33, Min = .1 year, Max = 40 years), and of professional experience specific to voice with a mean of 7.33 years (SD = 9.60, Min = .1, Max = 40 years). The participants reported having a mean of 4.53 voice evaluations per year (SD = 9.03, Median = 1.5, Min = 0; Max = 52). It is notable that all but 1 of the participants reported 12 or less evaluations per year, and 1 participant reported 52 per year (1/week).

Participant engagement, satisfaction, and commitment to future engagement

Out of the 39 participants initially engaging in the CoP, 23 also answered the post-CoP questionnaire and could be considered for calculating engagement in the different sessions. All 23 participants attended at least four meetings of the CoP, with 15% (n = 4) attending all seven meetings, 19% (n = 5) attending six meetings, 33% (n = 9) attending five meetings and 19% (n = 5) attending four meetings. 48% (n = 11) participated at the in-person workshop session. The n and percentage of participants at each meeting is detailed in Table 4.

Table 4. Number of participants partaking in the meetings*.

Meeting	Type	Date	Duration	n participant (%)
1	Virtual	March 1st	1h	18 (78%)
2	Virtual	March 22nd	1h	20 (87%)
3	Virtual	April 12th	1h	21 (91%)
4	Virtual	April 26th	1h	17 (74%)
5	Virtual	May 10th	1h	17 (74%)
6	In-person	May 31st	2h+2h	11 (48%)
7	Virtual	June 28th	1h	19 (83%)

Note. *results are based on the answers of the 23 participants who completed the post-CoP questionnaire.

Participants' satisfaction levels with the CoP were high with a mean score of 9.26 (SD = 1.3, Median = 10, Min = 5, Max = 10). Their intention to remain engaged in the CoP was also important with a mean score of 8.17 (SD = 2, Median = 9, Min = 3, Max = 10).

Short-term outcomes of participating in the CoP

The results pertaining to the outcomes of the CoP are based on the replies of the participants who answered both the pre- and post-CoP questionnaire (n=23). Due to missing data on some questions, the total n for each analysis varies between n = 15-23. The sample-size underlying each analysis is specified in the corresponding tables.

Outcomes of the CoP on voice evaluation practices

Probability of performing assessment

The assessments participants report most probability of performing for a patient diagnosed with MTD undergoing a voice evaluation were auditory-perceptual evaluation, evaluation of posture, acoustic assessment, patient reported measures, and vocal plasticity (therapeutic testing), all with a mean of over 3.55 both pre- and post-CoP (see Table 5 for details). Electro-glottography and video-stroboscopy were the assessments they reported least probability of performing or having access to, with a mean of less than 1.91 both pre- and post-CoP. The aerodynamic assessment was in the intermediate range with a mean around 2.9 pre- and post-CoP. All scores increased post CoP except for acoustic and aerodynamic assessment. The Wilcoxon signed rank test was statistically significant (p = .025) with a medium size-effect (r = .34) for the difference observed for EGG.

Table 5. Participants results on the Mean Probablility of doing the Assessment scores.

Assessment	n	Pre			Post			Z-score	r
		M	Median	SD	M	Median	SD		
Video-Stroboscopy	21	1.57	1	0.18	1.91	2	0.19	1.508	0.23
Acoustic	22	3.68	4	0.15	3.64	4	0.14	0.432	0.07
Aerodynamic	21	2.9	4	0.32	2.86	3	0.24	0.530	0.08
Electro-glottography	22	1.09	1	0.06	1.32	1	0.1	2.236*	0.34
Patient reported	22	3.64	4	0.15	3.91	4	0.06	1.890	0.28
Auditory-perceptual	22	3.82	4	0.14	4	4	0	1.342	0.20
Posture	22	3.68	4	0.15	3.82	4	0.08	0.707	0.11
Plasticity	22	3.55	4	0.19	3.68	4	0.1	0.647	0.10

Note. *p = .025

Importance of assessment

Participants judged the Auditory-perceptual assessment to be the most important, with mean scores over 3.56 both pre- and post-CoP (see Table 6 for details). Posture, vocal plasticity, and patient reported measures also were evaluated as important with means over 3 both pre- and post-CoP. EGG was judged as least important of all assessments with a mean score of 2.45 pre- and 1.62 post-CoP. Acoustic and aerodynamic assessments as well as video-stroboscopy were judged of intermediate importance with mean scores between 2.17 and 2.98 pre- and post-CoP. Participants evaluation of the importance of the different assessments decreased post-CoP for the acoustic assessment, the aerodynamic assessment, patient reported measures, auditory perceptual-evaluation, evaluation of posture and plasticity, while it

Table 6. Participants' results on the Mean Importance of Assessement scores.

Assessment	n	Pre			Post			Z-score	r
		M	Median	SD	M	Median	SD		
Video-Stroboscopy	22	2.55	2.67	0.17	2.28	2.17	0.18	1.311	0.20
Acoustic	22	2.98	3.00	0.15	2.66	2.75	0.15	2.444*	0.37
Aerodynamic	22	2.46	2.58	0.17	2.39	2.58	0.18	0.485	0.07
Electro-glottography	19	1.45	1.00	0.15	1.62	1.00	0.18	1.098	0.18
Patient reported	21	3.52	3.67	0.10	3.43	3.50	0.11	0.998	0.15
Auditory-perceptual	21	3.71	4.00	0.10	3.56	3.58	0.09	1.179	0.18
Posture	22	3.18	3.08	0.12	3.08	3.00	0.13	0.974	0.15
Plasticity	22	3.02	3.00	0.17	3.08	3.00	0.14	0.101	0.02

Note. *p = .015

increased slightly for video-stroboscopy and EGG. The Wilcoxon signed rank test was significant for the decrease in the perceived importance of the acoustic assessment with a medium effect size (p = .015, r = .37).

Implementation of changes and intention to implement changes

Participants' quantitative answers to the two questions regarding implementation of changes revealed they had not already implemented changes to their practice due to the CoP at a high degree, with a mean score of only 5.61 (SD = 3), but that they were adamant to make future modifications to their practice due to the CoP (M = 8, SD = 2.15). Nine participants left a free text comment on the first statement. Six of them explained they had not yet had the time to implement changes. Out of these, four explained this was because they had not yet had any new patients since the end of the CoP, while one explained she had not yet had the time to integrate all the information, and one did not explain further. Out of those six, three added they wanted to make changes with future voice patients. Two participants gave examples of specific changes they had already implemented. One mentioned having implemented the CAPE-V in her evaluations, and was more critical of her intensity measures. The other reported feeling more competent when explaining the reasons for the assessments and to collaborate with ENT specialists. She had got her team to question the different aspects of voice assessment and thinking of developing a system to improve their auditory-perceptual assessment. Two free text comments were given for the second statement. One participant reported she had not yet had new patients and did not quite know yet what changes exactly she wanted to make to her practice, although she knew she wanted to make some. The other participant reported she wanted to develop a practice that was more uniform to the other SLPs in the CoP.

Professional identity

Assessment Specific Confidence: Procedure

Participants' confidence in how the different assessment should be made was strongest for patient reported measures and lowest for auditory-perceptual assessment both pre- and post-CoP. The four scores improved post-CoP (Table 7), and the Wilcoxon Signed Rank Test showed a statistically significant difference for the Auditory-perceptual Measures Mean score ($p < .001$), with a large effect size ($r = .56$).

Table 7. Confidence in Procedure mean scores pre and post-CoP.

Measures	n	Pre			Post			Z-score	r
		M	Median	SD	M	Median	SD		
Acoustic	23	2.65	2.67	0.12	2.67	2.78	0.13	0.392	0.06
Aerodynamic	20	2.69	3	0.16	2.76	3	0.17	0.432	0.07
Patient reported	19	3.23	3	0.15	3.32	3.5	0.19	0.679	0.11
Auditory-perceptual	20	2.08	1.98	0.1	2.75	3	0.14	3.549*	0.56

Note. *p < .001

Assessment Specific Confidence: Purpose

Participants' confidence in why the different assessment should be made was strongest for patient reported measures and lowest for the aerodynamic assessment both pre- and post-CoP. The Acoustic Measures Mean, the Patient Reported Mean, and the Auditory-perceptual Measures Mean scores improved post-CoP with a medium effect size for the last one ($r = .33$), while the aerodynamic Mean score decreased (Table 8). The Wilcoxon Signed Rank Test failed to show statistically significant differences.

Table 8. Confidence in Purpose mean scores pre and post-CoP.

Measures	n	Pre			Post			Z-score	r
		M	Median	SD	M	Median	SD		
Acoustic	22	2.61	2.56	0.14	2.67	2.61	0.12	0.373	0.06
Aerodynamic	22	2.5	2.54	0.12	2.49	2.69	0.13	0.545	0.08
Patient reported	15	3.37	3	0.12	3.63	4	0.17	1.06	0.19
Auditory-perceptual	16	3.28	3	0.14	3.59	4	0.17	1.873	0.33

Assessment Specific Confidence: Validity

Participants' confidence in the different assessments' validity (do the assessment measure what it is intended to) was strongest for patient reported measures both pre- and post-CoP and lowest for the aerodynamic assessment pre-CoP and for the acoustic assessment post-CoP (see Table 9 for details). Regarding confidence in assessment validity, the Acoustic Measures Mean, the Aerodynamic Measures Mean, and the Patient reported Measures Mean scores improved post-CoP while the Auditory-perceptual Measures Mean score decreased. However, Wilcoxon Signed Rank Test shows that only the difference observed for the Aerodynamic Measures Mean score is statistically significant (p = .05) with a small effect size (r = .29).

Table 9. Confidence in Validity mean scores pre and post-CoP.

Measures	n	Pre			Post			Z-score	r
		M	Median	SE	M	Median	SE		
Acoustic	23	2.48	2.43	0.12	2.58	2.6	0.13	1.241	0.18
Aerodynamic	23	2.38	2.5	0.12	2.64	2.57	0.13	1.96*	0.29
Patient reported	17	3.03	3	0.09	3.21	3	0.14	1.318	0.23
Auditory-perceptual	18	2.78	3	0.1	2.67	2.75	0.14	0.933	0.16

Note. *p = .05

Professional belonging and confidence

Professional Belonging and Professional Confidence scores improved after participation in the CoP from M = 2.48 (SD = .16) to M = 3.68 (SD = .14) for belonging, and from M = 3.30 (SD = .20) to M = 3.72 (SD = .15) for confidence scores. The Wilcoxon Signed Rank Test shows that these improvements are statistically significant for both the Belonging score (Z = 4.065, p < .001), and the Confidence score (Z = 3.313, p< .001), with a large effect size for Belonging (r = .63), and a medium effect size for Confidence (r = .49).

Outcomes on learnings

Results for the three questions post-CoP pertaining to learnings showed that participants, overall, felt that they learned a lot from the CoP, with a mean score of 8,04 (SD = 1.43) for general learnings. They reported having made important professional and personal learnings, with a slightly higher mean score for the professional versus personal learnings (M = 7.83, SD = 1.34 versus M = 6.87, SD = 1.98). Two participants gave free text comments to the first statement and said that they appreciated having made connections with colleagues through the CoP; one mentioning that she realised not being alone with her questions. Five free text comments were given for the second statement. All reported having made professional learnings specific to the field of voice, either by learning about new tools, or gaining a better understanding of the gaps in the field and what type of research would be useful. One reported having made learnings on acoustic assessment, but did not yet know how to translate them to her practice. Five participants gave free text comments on the third statement. Two reported appreciating to push their knowledge further, or to refresh knowledge they already had. One

mentioned learning about knowledge gaps in the field and another that she had questions in common with other colleagues in the field. Another one still reported not having had enough time to digest all the learnings in order to put them into practice.

Associations between variables

Statistically significant and positive associations were found between satisfaction and intention to remain engaged ($p < .001$), as well as between those variables and several variables related to learnings, implementation of changes, and professional identity measured post-CoP (see Table 10 for details). Professional learnings were moderately correlated to satisfaction ($p = .042$) and strongly correlated to intention of remaining involved ($p = .006$), while general learnings were strongly correlated to both satisfaction and intention to remain engaged ($p = .005$ and $p = .007$). Personal learnings were moderately correlated only to intention of remaining engaged ($p = .041$). Sense of professional belonging, but not professional identity, correlated moderately with intention to remain engaged ($p = .47$). Type of learnings all correlated with one another with a stronger correlation for personal and professional learnings with general learnings than with one another.

Table 10. Statistically significant correlations between variables measured post-CoP.

		1	2	3	4	5	6	7	8
1	Satisfaction								
2	Intention to remain engaged	.680**							
3	Personal learnings		.439*						
4	Professional learnings	.438*	.564*	.617**					
5	General learnings	.579**	.561*	.713**	.710**				
6	Implemented changes				.492*	.455*			
7	Intention to implement changes				.698**	.614**	.565**		
8	Professional belonging		.429*						

Note. ** p <.005; * p < .05

Discussion

Our study looked at the relevance of a CoP as a space for knowledge transfer in SLP to improve clinicians' practices and professional confidence in relation to voice assessment. The main objectives of this project were to evaluate the feasibility of establishing a CoP specific to voice SLPs and the outcomes of participating in terms of changes to their professional practices, professional confidence and identity, and learnings.

Feasibility of establishing a CoP

As no prior grouping of SLPs with a specific expertise or interest in voice disorders existed in Quebec prior to this study, the first challenge of the project was to actively create this type of grouping. The research team decided on the CoP modality as CoPs have been ascribed the potential to allow professionals to co-create and transfer knowledge in a way that facilitates actual changes in professional practices, while boosting professional confidence and

consolidating professional identity [14]. Establishing a CoP proved feasible, as 39 participants, mostly professionals but also a few future SLP (students), rapidly joined the project. From the 23 participants who completed both the pre- and post-CoP questionnaires, it was observed that participation in CoP activities was sustained, with a minimum participation rate of 74% in the virtual meetings. The in-person meeting, on the other hand, had a participation rate of only 48%, which could be explained by the fact that this meeting was held during working hours, unlike the virtual meetings (which were held during the lunch hour), and that the participants came from several regions at a distance of >1 hour from Montreal, making the in-person modality logistically more difficult. At the end of the research project, participants' satisfaction levels with the CoP were high, with a mean score of 9.26 on a scale where 10 was the highest degree of satisfaction. Participants' intention to remain engaged in the CoP was also high, with a mean score of 8.17 on a 10-point scale, pointing not only to the feasibility of establishing a CoP for voice SLPs in Quebec, but also for maintaining it in time. In fact, as of July 2023, the CoP is still active and counted 68 members.

Outcomes on voice assessment practices

One of the main objectives with this study was also to understand if participating in the CoP would improve clinician's professional practices. However, because of limitations in the available scientific evidence to support any of the assessments' relevance to SLP specific evaluative objective [1,5], it is difficult to judge the practices reported by the members pre- and post-CdP in terms of best practice. It is possible, nevertheless, to compare them with the practices described in the literature, bearing in mind that the usual practices of speech therapists do not necessarily mean that they are the best practices [3,28,29].

Implementation of evaluation procedures

With regard to the likelihood of carrying out the various evaluation procedures, the participants are above all inclined to carry out subjective assessments (either self-reported by the patient, or performed by visual or auditory observation by the SLP), and acoustic assessments. Aerodynamic assessments were reported to be less likely, and EGG and videostroboscopy were the least likely procedures participants would perform or have access to. These results are in part similar to those observed by Behrman [3], Kenny [30], and McAlister and Yanushevskaya [31], where subjective measures had a very high probability of being achieved, while aerodynamic and EGG measures had the lowest probability of being achieved. EEG, for example, was reported being used by only few speech therapists in Behrman [3], and by none of the participants in McAlister and Yanushevskaya [31].

On the other hand, in Behrman's study [3], video-stroboscopy, alongside acoustic assessment, also had a high probability of being performed. This difference with the present study is easily explained by the fact that few of the participants work directly with an ENT specialist and therefore do not have access to this type of examination that they are not allowed to do as SLPs. In fact, the majority of participants in the present study was not part of a multidisciplinary team systematically including stroboscopy, unlike for example the participants in Behrman's study [3], who could only participate if they attended at least one assessment including stroboscopy per week. The participants' reported practices after their participation in the CoP only showed a statistically significant increase and a medium effect size in the likelihood for performing EGG. This is surprising since this assessment was not part of the main topics discussed during the CoP (which were acoustic and audio-perceptual assessments). EGG is

used to characterize the glottic cycle much in the way of acoustic analyses, offering parameters related to irregularity and opening and closing phases of the vibratory cycle [32,33]. It is presented as a noninvasive tool, in contrast to endoscopic or electromyographic examinations, for documenting treatment-related changes in vocal [34], potentially serving as a proxy for laryngeal visualization. Ramig and Dromey [35], for instance, used EGG to explore whether increased vocal fold adduction could be an explanatory factor to observed gains in vocal intensity in patients with Parkinson's disease, which their study seemed to confirm. However, the reliability of EGG as a proxy for laryngeal visualisation can be questioned, as [36] it was found it to be a poor predictor of incomplete glottal closure in presbylarynges. Mayes et al. [37] looked into EGG's potential as a proxy for laryngeal electromyography (LEMG) and found that patients with a normal EGG were also likely to have a normal LEMG, but that not all patients with abnormal EGG had abnormal LEMG, limiting its use as a proxy for individual patients. Hosokawa et al, 2012, used EGG parameters as a sole measure to evaluate efficacy of treatment in a group of patients with MTD, finding significant differences in parameters related to regularity but not vocal fold contact after treatment. In another study, Ramírez et al. [38] found a significant but rather weak correlation ($r = 0.320$ and $r = 0.292$ respectively) between open quotient and irregularity, as measured by EGG and patient scores at the VHI in a study with patients having laryngopharyngeal reflux. Although several studies point to a clinical usefulness of EGG, this is one of the least reported tools used by voice SLPs [3,31]. Reasons for its under-use might be that it requires specific instrumentation not readily available to all SLPs, as well as substantial expertise to interpret the results [33]. Still, although the CoP topics did not revolve around EGG, because this measure was not well known to participants before the CoP, it is possible that the mere fact of having learned about it made them more inclined to implement it in their evaluation. Indeed, Albudoor and Peña [39] found that subjective norms, that is, word of mouth from individuals that are valued by the clinicians, accounts for a large proportion of SLPs intention to use a technology, and its perceived usefulness.

Contribution of evaluation procedures to clinical assessment purposes

The way participants felt the different evaluation procedures contribute to six different clinical assessment purposes was also evaluated. The subjective measures were judged as most important in contributing to the different clinical purposes of the evaluation with the auditory-perceptual assessment being judged as the most important, followed by evaluation of posture and patients' capacity to alter vocal quality, while EGG was judged as the least important. Acoustic, aerodynamic, and stroboscopic assessments were judged of intermediate importance. These results mimic in part those found by Behrman [3] and McAlister and Yanushevskaya [31]. As Behrman [3] looked at importance for each assessment type and each clinical purpose individually, she was able to see that her participants put high importance in acoustic and stroboscopic assessments for specific clinical purposes (such as defining overall therapy goals, educating patients, and measuring treatment outcomes for stroboscopy, and defining overall therapy goals and measuring treatment outcomes for acoustic measures). McAlister and Yanushevskaya [31] only looked at importance of measures in general, while in this study, a mean score based on the importance scores for the different specific clinical purposes was used. The use a mean score was decided upon after realizing that the participants did not discriminate between assessments' importance relative to different clinical goals, contrarily to what is observed in Behrman [3]. Perception of importance of evaluation procedures changed post-CoP for the acoustic evaluation only which decreased in perceived importance.

At the time for the CoP, the research team presented the results from the systematic review by Roy et al. [1], where it is concluded that although some acoustic measures have some evidence of detecting presence or severity of a voice disorder, these need further development to be usefully implemented in clinical practice. This information might have lowered clinicians' perception of their acoustic evaluation's importance. However, although limitations regarding the reliability and validity of auditory perceptual evaluation was also presented and discussed [40,41], no change regarding this evaluation was noted.

Implemented changes and intention to implement change

Implementation of change and intention to implement change was also evaluated by participants' quantitative answers to two statements post-CoP. Participants' scores regarding implemented changes was quite low, which confirms the little observed differences in their evaluation practices pre- and post-CoP. However, their score regarding their intention to implement change was higher. The fact that participants completed the post-CoP questionnaire shortly after the end of the CoP could explain why they did not have time to implement these changes in their practice. Indeed, the qualitative comments revealed that most had not yet had new patients since the end of the CoP. One participant that commented having implemented changes described an actual change in practice (use of the CAPE-V that she had not used earlier), while other comments rather described changes in attitude such as feeling more confident, educating colleagues, and questioning their own practice. Some participants also mentioned lack of time as being a limitation to their capacity to implement change, and/or to participate meaningfully in the CoP, which seems to be a common barrier to health professionals' full and significant participations in CoPs [42,43]. It should also be kept in mind that the SLPs in this CoP reported an average of only 4.53 vocal assessments per year, which is rather small in comparison to an average of 4.9 assessments per week in the Behrman study [3]. It thus makes sense that most of the participants, within two weeks after the end of the CoP, would not have had the opportunity to perform a voice assessment where they could have implemented the desired changes. More generally, implementing change in healthcare is a slow and complex process. While individual clinicians may be motivated to instigate change, their capacity to do so is contingent upon various factors, including collaboration with other stakeholders in the clinical and social sphere, as well as considerations of economic and logistical influences that might impact their actual ability to enact and maintain desired changes [44].

Outcomes on professional identity

Assessment specific confidence

It was observed that participants' levels of assessment specific confidence regarding procedure, that is, how an assessment is made, were lowest for auditory-perceptual assessment pre-CoP, although this is one of the measures that participants find most important and are also most susceptible of using during an initial voice evaluation. This result sheds new light on the idea that usual practices are not necessarily best practices, since, in this case, one of the measures most used and judged as most important by SLPs is also one with which they feel least confident about the exact procedure to be followed in collecting it. Post-CoP, however, confidence scores had improved largely for this specific assessment procedure, which was one of the most discussed topics during the CoP, and also part of the in-person workshops.

Regarding confidence in assessment purposes, participants felt less confident in why acoustic and aerodynamic assessments should be made while they felt very confident in why patient-reported measures and auditory-perceptual assessments are performed. This is interesting because it shows that it is not just because SLPs feel confident into how to do an assessment (confidence in procedure), that they are sure about why they do the assessment. Although confidence in assessment purposes improved post-CoP, none did so significantly.

Regarding confidence in assessment validity, which was defined in this study as "does the assessment measure what it intends to", participants were most confident in patient reported measures. Overall, they were less confident in the different assessments' validity then they were of assessments' purposes or procedure. This is also interesting because it shows that SLPs do not feel assured that the assessment recommended as part of basic voice evaluation protocols really do measure what they claim to measure. In the face of limited evidence for specific measures' diagnostic values [1,5], it would seem they are right in being cautious. Post-CoP, participants' confidence in assessment purpose only showed significant improvement for aerodynamic measures. Although these measures were not centered in the CoP sessions, they were nonetheless touched upon, which might have yielded this difference post-CoP. The studies investigating SLPs voice assessment practices have found that aerodynamic measures are amongst the least used and judged little useful [3,30,31], as also in the present study. The evidence base is also limited for them [1], although some clinically informed researchers defend these measures' interest for SLP specific assessment purposes [45], and specific populations, such as singers [46].

Professional confidence and identity

Besides assessment specific confidence, participants' professional confidence and Professional identity was also measured, with five items relating to participants' sense of belonging to a community. There was a significant improvement in both scores post-CoP, showing, on the one hand, that being part of the CoP improved participants' sense of competence, expertise, credibility, and confidence in their professional role as voice SLPs, and, on the other hand, that the creation of the CoP enabled the participants to go beyond the simple gathering of professionals and to create a community with a collective identity, providing a network for support, skill building, and resources and tools, from which members derive a sense of belonging.

Outcomes on learnings

Outcomes in terms of learnings were specifically investigated by three questions post-CoP that all showed high mean scores, specifically general learnings and professional learnings. Because participant knowledge was not evaluated per se pre-CoP, it is not possible to confirm that participants did indeed learn or what they learned specifically. However, as CoPs are collaborative spaces where participants update their knowledge through discussions and sharing of experiences [47], it is not possible to define a priori what specific learnings will be made. It is important to keep in mind that although some might argue that learnings are the main individual outcomes for members of a CoP [48], they might not be the best outcome measure for the efficiency of a CoP aiming for change, as new knowledge does not automatically translate into changes in practice [49,50]. This was exemplified in the free text comments where one participant reported: "I've learned a few things about how to collect acoustic data, but I don't know to what extent I'll be able to apply these methods to my workplace". This revealed challenges for implementation of updated knowledge about practices in the workplace.

Relationships between participant satisfaction, changes in practice and professional identity, and learnings

As the participants were highly satisfied with their participation in the CoP, it appeared interesting to explore what this satisfaction rested on. Former studies have associated satisfaction to social and relational rewards drawn from sharing knowledge and engaging in collaborative work rather than monetary rewards [51,52]. Although the 10 core-members of the CoP were financially compensated for their participation in the CoP, the other participants were not, thus, satisfaction levels seem unlikely to be related to monetary rewards. Ikioda et al. [53], who studied satisfaction levels of health professional participating in a virtual CoP, identified a positive association between participants' levels of satisfaction with their perception of efficiency and effectiveness of collaboration with other members, as well as with their degree of participation (the more participants engaged, the more satisfied they were). In the present study, there was no relation between number of sessions participants attended and their level of satisfaction. Although perception of efficiency and effectiveness of collaboration were not evaluated per se, learning outcomes were evaluated, which might be considered as a proxy of collaboration efficiency and effectiveness, since CoPs knowledge sharing and production are based on participants' collaboration [54]. A positive and significant relation between participants' levels of learnings and their satisfaction with participating in the CoP, as well as with their intention of remaining engaged is observed, supporting the view that learning might be a primary individual outcome of CoPs [48].

Interestingly, participants' levels of general and professional learnings within the CoP were positively correlated both to their satisfaction levels and intention to remain involved, but their levels of personal learnings were only correlated to their intention to remain involved. The free text comments show that personal learnings were interpreted by some participants as professional belonging: "it is good to identify colleagues", and "I connected with other SLPs and realized I'm not alone in my questionings", and participants' levels of professional belonging post CoP were also positively and significantly associated to their intention to remaining involved but not to their satisfaction levels. These results point to the fact that members regarded the CoP as a professional learning space where professional learnings are important for satisfaction, but where the social benefits, such as a sense of belonging, are also important to maintain engagement. This finding further supports former claims that immediate individual outcomes of participating in a CoP pertain not simply to learnings, but to learnings that are made through the social practice of engaging in the community [19,48].

Moreover, both professional and general learnings were positively correlated to implemented changes and intention to implement changes, but correlated more strongly with intention to implement changes, indicating that changes were indeed supported by learnings within the CoP, but that more time was needed to implement these changes, which goes in line with the observation that a CoP can take several months to become effective [19] and that there are barriers to translating new knowledge into practice [44,49,50].

Finally, although sense of belonging post-CoP was indeed positively associated with intention to remain involved, it was not significantly correlated to any other variable, and neither was professional confidence. Both these variables did improve significantly post-CoP though. The mechanisms by which professional identity and confidence are built and how they relate to professional practices and learnings are complex. In a review by Fitzgerald, [11] knowledge alone is noted as insufficient to explain development of professional confidence, rather, some

studies point to professional confidence as the result of integrating personal and professional values and that professional identity is strongly related to an individual's social identity. It is possible that the opportunity to socialize with colleagues that share the same professional practice goals participated to increase the professional confidence of the participants. Also, the fact that the CoP for the first time created an identifiable grouping of voice SLPs in Quebec might have contributed to increased professional confidence, as participants now have a specific group they can identify with and create shared professional ideals and values [11]. Moreover, ambiguity in the professional role is known to decrease professional confidence. This can arise for example when there are disparities between the anticipated responsibilities of a professional role and the actual capacity of the practitioner to fulfill them, considering organizational demands and limitations [55]. SLPs have for example been reported to feel disempowered by not being able to meet EBP in aphasiology within the scope of their current services (Foster quoted in Jackson [55]). Participants in this CoP might have engaged in the project with a similar sense of disempowerment with regard to their limited capacities to meet voice assessment standards, but gained in confidence through realizing that they were not alone in that situation, and that they now were part of a community motivated to bring about positive changes.

Limitations and general considerations

The study presented here has several limitations, stemming, among other things, from a small participant sample, making it difficult to generalize results. Also, while inferential statistics were used to analyze pre- and post-participation differences within the participant group, it is crucial to scrutinize the implications of these results considering the study's nature. Beyond the small sample-size, it is important to keep in mind that the design that was employed only included one short term measure point post-CoP. A follow-up a year later could have gauged result stability. Moreover, the questionnaire, while inspired by prior research on voice assessment practices and professional identity, is not a validated tool. Consequently, there is a lack of comparative references from other studies to assess the significance of the findings. Nevertheless, the effect sizes indicated in the results section allow us to gain some understanding regarding the relative importance of the outcomes we measured, showing that participants primarily experienced a heightened sense of professional belonging and confidence rather than assessment specific confidence or modified practices. Qualitative data stemming from the participants would have provided additional information to nuance the quantitative results presented here, and better assess the importance and the nature of the outcomes of the CoP in participants' day-to-day practice. The authors have since performed semi-directed interviews with the ten core-members of the CoP that will be subjected to a qualitative content analysis in the light of the quantitative results presented in this study. Also, all data collected in this study is subjective in nature and thus subject to desirability bias [56]. The study's results could have been strengthened by inclusion of objective measures, such as evaluation of actual knowledge levels by clinicians, or documentation of their actual voice assessment practices by recordings of a voice assessment pre- and post-CoP. Still, the quantitative data presented here, although difficult to interpret as stand alone, might represent interesting benchmarks for future studies interested in quantifying the outcomes of similar initiatives and also serve to advocate for resources to support the continuation of the CoP, or to equip other teams wishing to carry out similar projects.

Nevertheless, this study is best seen as an instructive guide for professionals who wish to set up a process to transform their fields of practice by considering both experiential and scientific knowledge relevant to their disciplines and to quantify the outcomes of this process. Indeed, one of the main takeaways is that the CoP format enabled the swift and efficient engagement and organization of SLPs in a specialized subfield with relatively limited resources. The CoP allowed its members to actively contribute to the development of their field while also fostering an enhanced sense of professional belonging and confidence among its members. This is not insignificant, since professional confidence has shown benefits not only for the clinician, such as less stress, increased job satisfaction, and a better career, but also for the patient, who feels more secure and receives better services from professionals with a higher level of confidence at their practice [11]. Professional confidence can therefore be seen as a gateway to a virtuous spiral wherein elevated confidence levels pave the way for the improvement of day-to-day practices, allowing practitioners to thrive. Conversely, when a profession experiences low levels of professional confidence, there is a vulnerability to external definitions [11], which can lead to role ambiguity and feelings of disempowerment [55], initiating a negative spiral that impacts both the individuals and the profession as a whole.

Voice therapy, as a subfield of SLP, receives limited dedicated time in academic curricula, potentially falling short in providing SLPs with the required expertise to feel confident [57-59]. And even in the event of optimal training, the fact remains that the knowledge acquired during training quickly becomes obsolete and needs to be updated on a regular basis [44]. A CoP specifically dedicated to voice practices, including both younger and more experienced clinicians, as well as researchers active in the field, appears as an opportunity for continued training and for integration of new knowledge and its application to local contexts. Moreover, as expanded upon in the introduction, standardized protocols have been developed with the main aim to produce comparable data, foremost in the scientific literature [2,4,5], and research on assessment of voice function has mainly focussed on various measures' capacity to diagnose the presence or the nature of a vocal disorder [6]. While grounded in biomedical principles, voice therapy is encompassed within the wider field of SLP, and the role of SLP, as defined by the regulatory body in Quebec, extends to promoting the autonomy, well-being and integration of persons with communication difficulties within their living environment [60]. SLPs thus have different objectives when assessing a patient's voice, and face different challenges than scientists or otolaryngologists in their professional context. Having their practices informed by standards that have been developed with little consideration for the specificities of their profession can lead to a feeling of ambiguity and disempowerment [11], especially if they practice in a country or region where the profession's service model differs from the region where the standards were developed. A mixed CoP, such as the one initiated in this project, emerges not just as a platform for knowledge transfer to clinicians, but also as a space where clinicians are empowered to scrutinize recommended practices in light of their needs and challenges. It serves as a forum where they can voice their perspectives, suggesting research directions that would benefit them more directly.

For instance, the literature reminds us that most favored or frequently reported clinical practices should not be equated to best practice in a field [3,4]. This holds true even for this study, where results on participants' voice assessment practices should not be seen as data supporting or infirming the validity or importance of any tools or procedures. However, when this project started, it was with the idea to improve the practices of voice SLPs, under the assumption that best practices existed. As the project progressed, it became obvious that

"best practices" could not simply be prescribed without first questioning their relevance to clinical practice in the different professional contexts experienced by the participating clinicians. This project shed light on the need for research into how SLPs use and make sense of measures from different voice assessment tools and procedures to efficiently achieve their specific professional mandate. Such research could help defining the essential elements that a clinical SLP should include in a voice assessment, and address the need for specific assessment protocols that are thoughtfully adapted to various clinical realities [7], thereby enhancing their potential for implementation in everyday clinical practice. This type of research could pave the way for developing and evaluating novel assessment procedures with prognostic potential, currently lacking in standard assessment protocols.

Conclusion

In conclusion, this study examined and supported the relevance of a community of practice (CoP) as a platform for knowledge transfer in speech-language pathology (SLP) to improve clinicians' practices and professional confidence in voice assessment by facilitating information exchange and fostering strong connections between clinical and scientific experts in the field. A CoP specific to voice SLPs in Quebec was established and yielded a high level of participation and satisfaction among the members. While the short-term implementation of changes in assessment practices was limited, participants expressed a strong intention to implement changes and reported increased levels assessment specific confidence. The CoP fostered an increased sense of professional identity, belonging, and expertise among participants. The findings from this study suggest that CoPs can serve as valuable platforms for knowledge sharing, professional development, and fostering a sense of belonging among SLPs working in a subdiscipline such as voice disorders. The current study also highlighted the lack of available evidence in support for SLPs wanting to comply to EBP, shedding light on the need to foster research aiming to investigate and understand how SLPs use and make sense of measures obtained from voice assessment procedures to identify relevant and effective voices assessment protocols that align with the specific evaluative objectives of SLPs. This knowledge will not only enhance the quality of voice assessments but also provide clearer guidelines for SLPs in selecting appropriate assessment measures for their clients, improving the overall clinical management of voice disorders. This study suggests CoPs involving clinicians and researchers in a horizontal relationship present themselves as an interesting bidirectional tool for bridging the gap between clinical and scientific fields.

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