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Functional impact of speech disorders in patients treated for oral or oropharyngeal cancer, assessed by perceptual and automatic measurements

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Rationale

Oral and oropharyngeal cancer affects anatomical regions involved in speech production.

Alterations of communicational functions lead to a **major impact on patients' quality of life** [1]:

- Little research on functional impact of speech disorders
- **Moderate correlations** between quality of life and speech disorder severity scores (assessed perceptually) [2]

But **standard perceptual assessment** shows several **limitations**, among which low intra- and inter-rater reliability.

The **development of tools for automatic speech signal assessment** can overcome these limitations [3].

Purpose

To analyze the **correlations** between **patients' quality of life** and the **speech disorder severity scores**, assessed **perceptually** and **automatically**.

Methods

Database: **C2SI project** [2]

87 patients treated for **oral (40%) or oropharyngeal (60%) cancer** (59% male, mean age = 65.8, SD = 9.6)

- Patients' speech recorded on different tasks, including sustained vowel "a", repetition of pseudo-words, text reading and picture description

Quality of life and speech-related impairment

- Overall quality of life questionnaire: **MOS SF-36** [4], including a "social role functioning" dimension ("SF36-SF")
- Two specific questionnaires related to speech:
 - Speech Handicap Index, **SHI** [5]
 - Phonation Handicap Index, **PHI** [6]

Spearman correlation

Perceptual assessment	Automatic assessment
Speech disorder severity score given by 6 experts	Severity score given by an automatic speech signal analysis: C2SI score
On: <ul style="list-style-type: none"> ▪ A semi-spontaneous task (picture description) 	On: <ul style="list-style-type: none"> ▪ Pseudoword repetition ▪ Text reading ▪ Sustained vowel "a"
Perceptual and C2SI scores ranging from 0 (no impairment) to 10 (maximum impairment)	

Results

Spearman correlation coefficients	Quality of life SF36-SF: "social role functioning"	Speech-related quality of life			
		Functional dimensions		Psychosocial dimension	
		PHI	SHI	PHI	SHI
Perceptual score	$r = .13$ <i>Negligible correlation</i>	$r = -.50$ <i>Moderate correlation</i>	$r = -.39$ <i>Low correlation</i>	$r = -.45$ <i>Low correlation</i>	$r = -.43$ <i>Low correlation</i>
Automatic C2SI score	$r = .31$ <i>Low correlation</i> (Figure 1)	$r = -.52$ <i>Moderate correlation</i>	$r = -.39$ <i>Low correlation</i>	$r = -.45$ <i>Low correlation</i>	$r = -.42$ <i>Low correlation</i>

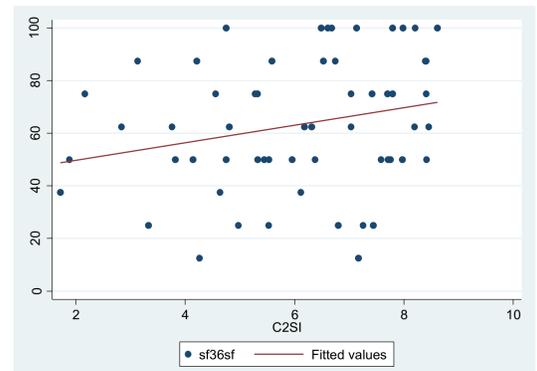


Figure 1: Scatter plot of automatic C2SI score and SF36-SF

Discussion

Only **low or moderate correlation** between quality of life and speech disorder severity scores:

- International Classification of Functioning: **Intermediate level** between deficits and quality of life is about **functional impact**
- In terms of speech disorders: Need to **consider the functional impact on communication** during everyday activities

Development of comprehensive models combining various acoustic measures:

- Analyses to be carried out to find out **which measures are relevant in conversational speech** (natural context of speech production)
- **Include functional impact measures in the models** to determine thresholds for speech disorder severity according to the functional impact on communicational acts
- Innovative objective tools including communicational impairment cues will **improve current clinical practice** by customizing patient care (adaptation to the patients' needs from the diagnosis)

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