

# Protective measures against COVID-19: communicative, social and emotional impacts on hearing aids users

## Medidas de proteção contra a COVID-19: impactos comunicativos, sociais e emocionais em usuários de aparelhos de amplificação sonora individual

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### ABSTRACT

**Purpose:** to investigate the communicative, social, and emotional impacts generated by adopting protective measures against COVID-19 and associate them with the degree of hearing loss and the time of use of hearing aids. **Methods:** cross-sectional quantitative study, with 72 individuals, divided into adults and older adults, with bilateral hearing loss up to moderately severe degree, users of hearing aids fitted before the pandemic in a public hearing health program who had maintained effective use of the devices. The participants were invited to participate in the study while waiting for an appointment and signed the consent form. After that, medical records were accessed to collect information about audiological profiles and the fitting/use of hearing aids. Afterward, a protocol with objective questions was orally applied in a silent room. Data were tabulated and subjected to Equality of Two Proportions and Chi-Square statistical tests. **Results:** in both groups, a significant number of users had communication impacted by the use of masks and by social distancing, with difficulty with digital technologies (cell phones/computers) predominating among adults, while older adults more commonly experienced communicative impairments during video calls. The communicative impediment existed regardless of the audiological profile and device use time. When asked if they stopped communicating and if the measures affected their social life, the sample was divided between “yes/sometimes” and “no”. As for the emotional impact of protective measures, there was a greater impact among adults. **Conclusion:** protective measures affected the communication of hearing aids users but did not discourage communicative exchanges and social interactions for approximately half of the sample, with the emotional impact being more evident in adults. Such difficulties were not related to the audiological profile and daily use of the devices.

**Keywords:** Hearing loss; Hearing aids; Communication barriers; COVID-19; Personal protective equipment; Physical distancing; Digital technology

### RESUMO

**Objetivo:** investigar os impactos comunicativos, sociais e emocionais gerados pela adoção de medidas protetivas contra a COVID-19 e associá-los ao grau da perda auditiva e ao tempo de uso dos aparelhos de amplificação sonora individual. **Métodos:** estudo transversal e quantitativo, com 72 indivíduos, divididos em adultos e idosos, com perda auditiva bilateral, de grau até moderadamente severo, protetizados antes da pandemia em um programa público de saúde auditiva e que mantiveram uso efetivo dos dispositivos. Os sujeitos foram convidados a participar do estudo enquanto aguardavam consulta. Os prontuários foram acessados, a fim de coletar informações sobre o perfil audiológico e adaptação/uso dos aparelhos de amplificação sonora individual. Em sala silenciosa, foi aplicado, oralmente, protocolo contendo questões objetivas e os dados foram tabulados e submetidos aos testes estatísticos Igualdade de Duas Proporções e Qui-Quadrado. **Resultados:** nos dois grupos, um número significativo de usuários teve a comunicação impactada pelo uso de máscaras e pelo distanciamento físico, predominando, entre os adultos, a dificuldade com as tecnologias digitais (celulares/computadores), enquanto nas videochamadas, os prejuízos comunicativos foram mais experienciados pelos idosos. Os empecilhos comunicativos e sociais existiram, independentemente do perfil audiológico e do tempo de uso dos dispositivos. Quando questionados se deixaram de se comunicar e se as medidas afetaram a sua vida social, as respostas ficaram divididas entre “sim/às vezes” e “não”. Quanto ao impacto emocional das medidas protetivas, constatou-se maior repercussão entre os adultos. **Conclusão:** As medidas protetivas afetaram a comunicação dos usuários de aparelhos de amplificação sonora individual, porém, não desencorajaram as trocas comunicativas e as interações sociais de, aproximadamente, metade da amostra, sendo o impacto emocional mais evidente nos adultos. Tais dificuldades não estiveram relacionadas ao perfil audiológico e uso diário dos dispositivos.

**Palavras-chave:** Perda auditiva; Auxiliares de audição; Barreiras de comunicação; COVID-19; Equipamento de proteção individual; Distanciamento físico; Tecnologia digital

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**Conflict of interests:** No.

**Authors' contributions:** BLF participated in the conception of the study, carried out data collection, analysis and interpretation of results and writing of the manuscript; FSAP participated, as a supervisor, in the conception of the study, analysis and interpretation of the results and review of the article.

**Funding:** None.

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**Received:** September 07, 2022; **Accepted:** October 30, 2023

## INTRODUCTION

The World Health Organization (WHO) estimates that, globally, more than 430 million people have hearing loss<sup>(1)</sup>, which results in several communicative difficulties in their daily lives, making interventions necessary, such as the use of individual sound amplification devices (hearing aids), combined with communicative strategies, among which, the most commonly used, such as approaching the sound source, paying attention to facial expressions, and performing orofacial reading<sup>(2,3)</sup>.

With the emergence of COVID-19 and its high transmissibility, it became necessary to implement collective and individual preventive measures to reduce exposure to the virus and its spread, such as the use of face masks and physical distancing from the speaker<sup>(4,5)</sup>. In the case of individuals with hearing impairment, these measures bring additional barriers to conversation, as they hinder and/or prevent them from using the usual communicative strategies<sup>(6-10)</sup> – essential elements for the hearing-impaired subject to understand the message more easily and integrate better into the conversation and, therefore, into society<sup>(11)</sup>.

Face masks, because they cover the face, do not allow the use of the communicator's visual cues, making speech a murmur difficult to understand and inefficient communication<sup>(10-12)</sup>. Besides these barriers, protective masks and/or shields, depending on the manufacturing material and the model, act as an acoustic filter and attenuate speech sounds between the frequencies of 2000 Hz and 16000 Hz, with this attenuation being greater at high frequencies (above 4000 Hz), which also impairs dialogue<sup>(13)</sup>. Also, the need for constant distancing between a speaker and their interlocutor further impairs the oral message since the greater the distance between the speaking subjects, the greater the dissipation and the lower the transmission of sound energy<sup>(6)</sup>.

Furthermore, most people and organizations adopted virtual means of communication to maintain contact with family and friends and conduct their study and work activities at a time when social distancing was essential<sup>(14)</sup>. However, this form of communication, especially video calls, can become another obstacle to the insertion of the hearing-impaired person in their social environment since the specificities of these virtual environments, such as delays in relation to the image and audio, the possibility of keeping the camera off and/or the poor quality and proportion of the image hinder their communication<sup>(6,11)</sup>.

Therefore, given the need for the continuous practice of protective measures against COVID-19 in many places and the potential emergence of new respiratory viruses that may require the mandatory reintroduction of these measures, the objectives of this study were to investigate the perception of adults and older users of hearing aids regarding the communicative, social, and emotional impacts resulting from the adaptations imposed by the pandemic and to verify the existence of an association between communicative and social difficulties and the variables degree of hearing loss and the mean time of daily use of the devices, to avoid the exclusion of these people from social life.

## METHODS

This is a quantitative study with a cross-sectional design, conducted in a public health service in southern Brazil and approved by the Human Research Ethics Committee of Universidade Federal de Santa Maria - UFSM, under opinion No. 4.844.159 (CAAE 48652721.0.0000.5346).

This study included subjects of both genders, aged 18 years or older, treated at the hearing aid outpatient clinic of a public hearing health service, and with bilateral hearing loss of up to moderately severe degree. The most recent WHO classification was used to categorize the degree of hearing loss, which considers the mean air thresholds of the frequencies of 500 Hz, 1000 Hz, 2000 Hz, and 4000 Hz<sup>(15)</sup>. Also, to compose the sample, all individuals should have been adapted to hearing aids for at least one year before the beginning of the pandemic and, according to self-report, have maintained the continuous use of the devices in the pandemic period, in addition to consenting to participate in the research voluntarily, signing the Free and Informed Consent Form (FICF).

Users with neurological and/or psychiatric impairments that could affect the understanding of the questions were excluded, as well as individuals who, at the time of data collection, were unable to answer the interview due to communication difficulties resulting from the use of masks by the interviewer(s) or physical distancing since the low intelligibility of speech resulted in damage to the quality of the data collected.

From the aforementioned eligibility criteria, 88 subjects would be part of the sample; eleven individuals, however, were excluded due to the speech intelligibility factor, and five due to neurological and/or psychiatric impairments, resulting in a final sample of 72 subjects, divided into two groups: adults ( $n = 23$ ) and older adults ( $n = 49$ ).

Among adults, 15 were female (65.2%), and eight were male (34.8%), aged between 18 and 59 years, with a mean of 38.2 years. The prosthetization time of adult users ranged from three to 14 years, with a mean time of use of the devices of 7.5 years. The older people group consisted of 32 male subjects (65.3%) and 17 female subjects (34.7%), aged between 60 and 89 years, with a mean of 72.6 years. The prosthetization time in this group ranged from two to 15 years, with a mean time of use of amplification devices of 6.6 years. The mean prosthetization time did not differ between groups ( $p=0.331$ ).

Data collection was conducted between September and December 2021. The subjects were approached at the reception of the service while waiting for assistance at the hearing aid outpatient clinic and invited to participate in the present study after receiving clarifications about the objectives and procedures that would be performed. Upon acceptance and signature of the FICF, the participants' medical records were accessed to verify information related to their hearing aspects, such as type and degree of hearing loss and date of diagnosis.

Subsequently, 42 questions were applied using a data collection form (Appendix 1) prepared by the responsible researchers through oral presentation in individual interviews conducted in a large, silent room. During the collection, the necessary precautions were taken to prevent COVID-19 in force in that period.

The data obtained were tabulated in an Excel spreadsheet and then submitted to statistical tests with a significance level of 5% ( $p\text{-value}<0.05$ ).

The Equality of Two Proportions statistical test was used to describe the prevalence of the type and degree of hearing loss in the studied sample, according to each ear; to characterize the users regarding the mean time of daily use of the devices; to analyze the frequency and impact of the adoption of face protection masks; physical distancing from the sound source and use of digital technologies.

To compare the audiological profile, the time of daily use of hearing aids, and the communicative, social, and emotional impacts of protective measures between adults and older adults, the Chi-Square statistical test was used. The same test was used to show whether there was an association between communicative and social difficulties and the variables time of use of hearing aids and degree of hearing loss. It is worth noting that, when associating the degree of hearing loss and communicative and social difficulties, the degree of hearing loss of the best ear of each of the research participants was considered.

## RESULTS

The audiological profile did not differ statistically between the groups. The most prevalent type of hearing loss in both the adult and older adult groups was sensorineural. As for the degree of hearing loss, the prevalence among older adults and in the right ear of adults was moderately severe; in the left ear of adults, moderate predominated, followed by moderately severe, with no statistical difference between them (Table 1).

Regarding the time of daily use of hearing aids, a significant portion of the subjects in both groups reported using the devices for a period equal to or greater than 12 hours per day; the finding did not differ between the groups (Table 2).

With regard to protective measures against COVID-19, all participants in the sample experienced communication with people who wore face masks. In both groups, the significant majority reported having difficulty understanding what was said to them, which generated significant losses in interpersonal communication. Also, most subjects in both groups adopted physical distancing and faced problems of a similar proportion. However, approximately half of them reported not having experienced feelings of sadness and/or frustration resulting from this experience. At the same time, the other portion indicated feeling sad and/or frustrated at some point (Table 3).

As for digital technologies, most hearing aid users reported using these resources since before the pandemic, including participation in video calls. However, difficulties with cell phones and/or computers were reported more frequently among adults (yes and/or sometimes), while older adults mostly did not mention them. Regarding video calls in particular, it was found that the subjects of both groups mostly did not feel losses in communication due to pre-existing hearing difficulty. However, when comparing the groups, it was noted that older adults perceived the impact of hearing loss during video calls more (Table 3).

Also, in general, the adoption of face protection masks and physical distancing from the interlocutor, and the intensification of digital technologies for distance communication brought communicative difficulties to a significant part of both age groups. However, when asked if the protective measures represented obstacles to social life or if they resulted in the interruption of their interactions, both adults and older adults presented different opinions: approximately half of the sample of each group said “yes/sometimes”, and the other half answered “no”.

**Table 1.** Audiological profile of the sample subjects, according to the groups

Variables		Adults			Older people			p-value
		N	%	p-value	N	%	p-value	
Degree of hearing loss RE** (n=72)	Mild	0	0.0%	<0.001*	4	8.2%	<0.001*	0.369
	Moderate	7	30.4%	0.008*	14	28.6%	<0.001*	
	Mod. Severe	16	69.6%	Ref.	31	63.3%	Ref.	
Degree of hearing loss LE** (n=72)	Mild	0	0.0%	<0.001*	3	6.1%	<0.001*	0.046
	Moderate	12	52.2%	Ref.	12	24.5%	<0.001*	
	Mod. Severe	11	47.8%	0.768	34	69.4%	Ref.	
Type of hearing loss RE (n=72)	Sensorineural	18	78.3%	Ref.	44	89.8%	Ref.	0.419
	Mixed	4	17.4%	<0.001*	4	8.2%	<0.001*	
	Conductive	1	4.3%	<0.001*	1	2.0%	<0.001*	
Type of hearing loss LE (n=72)	Sensorineural	17	73.9%	Ref.	45	91.8%	Ref.	0.081
	Mixed	5	21.7%	<0.001*	4	8.2%	<0.001*	
	Conductive	1	4.3%	<0.001*	0	0.0%	<0.001*	

\*Statistically significant values ( $p \leq 0.05$ ) – Test of Equality of Two Proportions and Chi-Square; < less than; \*\*Classification of the degree of hearing loss according to WHO<sup>15</sup>

Subtitle: n = sample number; % = percentage; RE = right ear; LE = left ear; Ref. = reference value; Mod. = moderately

**Table 2.** Characterization and comparison of the sample of both groups regarding the variable time of use of the devices

Time of daily use	Adult			Older people			p-value
	n	%	p-value	n	%	p-value	
Up to 6 hours	0	0.0%	<0.001*	7	14.3%	<0.001*	0.116
From 6 to 12 hours	6	26.1%	0.001*	15	30.6%	0.014*	
12 hours or more	17	73.9%	Ref.	27	55.1%	Ref.	

\*Statistically significant values ( $p \leq 0.05$ ) – Test of Equality of Two Proportions and Chi-Square; < less than

Subtitle: n = sample number; % = percentage; Ref. = reference value

There were also divergent perspectives between the groups regarding the feelings arising from the adoption of protective measures; the group of adults reported, for the most part, experiencing negative feelings resulting from the adoption of these measures, while the group of older people dealt better with the situation (Table 3).

Finally, no association was evident between the communicative and social difficulties listed in this study due to the COVID-19 pandemic and the factors of time of daily use of hearing aids and degree of hearing loss of the better ear, both in the adult and older adult groups (Tables 4 and 5).

**Table 3.** Distribution of users' responses to questions regarding protective measures and comparison between groups

Questions		Adults			Older people			p-value
		n	%	p-value	N	%	p-value	
Masks: Did you have difficulty understanding what people were saying to you while wearing masks?	No	2	8.7%	0.001*	9	18.4%	<0.001*	0.264
	Sometimes	9	39.1%	0.375	11	22.4%	<0.001*	
	Yes	12	52.2%	Ref.	29	59.2%	Ref.	
Masks: Do you believe that the fact that people wear masks when talking to you makes it difficult to communicate with them?	No	2	8.7%	<0.001*	7	14.3%	<0.001*	0.781
	Sometimes	5	21.7%	0.001*	9	18.4%	<0.001*	
	Yes	16	69.6%	Ref.	33	67.3%	Ref.	
Distancing: Did you have difficulty understanding what was said to you when distancing from the speaker?	No	3	14.3%	0.001*	12	26.1%	<0.001*	0.102
	Sometimes	5	23.8%	0.013*	3	6.5%	<0.001*	
	Yes	13	61.9%	Ref.	31	67.4%	Ref.	
Distancing: Did you feel frustrated/sad when you did not understand what they told you because they were keeping their distance?	No	11	52.4%	Ref.	22	47.8%	Ref.	0.160
	Sometimes	0	0.0%	<0.001*	7	15.2%	<0.001*	
	Yes	10	47.6%	0.758	17	37.0%	0.291	
Technologies: Before the pandemic, did you already use digital technologies to communicate with others or to work?	Yes	22	95.7%	Ref.	43	87.8%	Ref.	0.292
	No	1	4.3%	<0.001*	6	12.2%	<0.001*	
Technologies: Did you have difficulties communicating through digital technologies?	No	10	43.5%	Ref.	30	68.2%	Ref.	0.090
	Sometimes	7	30.4%	0.359	5	11.4%	<0.001*	
	Yes	6	26.1%	0.216	9	20.5%	<0.001*	
Technologies: Did you participate in video calls after the beginning of the pandemic?	Yes	15	65.2%	Ref.	26	53.1%	Ref.	0.331
	No	8	34.8%	0.039*	23	46.9%	0.544	
Technologies: If you participated in video calls, did you feel your communication was impaired due to hearing difficulties?	No	8	53.3%	Ref.	14	53.8%	Ref.	0.038*
	Sometimes	6	40.0%	0.464	3	11.5%	0.001*	
	Yes	1	6.7%	0.005*	9	34.6%	0.163	
Overall, did you feel that protective measures made it difficult for you to communicate with others?	No	7	30.4%	0.134	11	22.4%	0.031*	0.316
	Sometimes	4	17.4%	0.013*	17	34.7%	0.407	
	Yes	12	52.2%	Ref.	21	42.9%	Ref.	
Overall, did you feel frustrated/sad about not understanding what they wanted to tell you because of the protective measures?	No	6	26.1%	0.008*	30	61.2%	Ref.	0.020*
	Sometimes	2	8.7%	<0.001*	3	6.1%	<0.001*	
	Yes	15	65.2%	Ref.	16	32.7%	0.005*	
Overall, did you feel that protective measures made your social life difficult?	No	11	47.8%	Ref.	24	49.0%	Ref.	0.938
	Sometimes	3	13.0%	0.010*	5	10.2%	<0.001*	
	Yes	9	39.1%	0.552	20	40.8%	0.417	
Overall, did you stop communicating due to possible communication difficulties caused by the changes imposed by the pandemic?	No	11	47.8%	Ref.	25	51.0%	Ref.	0.847
	Sometimes	3	13.0%	0.010*	8	16.3%	<0.001*	
	Yes	9	39.1%	0.552	16	32.7%	0.065	

\*Statistically significant values ( $p \leq 0.05$ ) – Test of Equality of Two Proportions; < less than

Subtitle: n = sample number; % = percentage; Ref. = reference value

**Table 4.** Association between the communicative difficulties generated by the protective measures and the variables time of use of the devices and degree of hearing loss, in both groups

Overall, did you feel that protective measures made it difficult for you to communicate with others?			No		Sometimes		Yes		Total		p-value
			n	%	n	%	n	%	n	%	
Adults	Time of daily use of hearing aids	6-12 hours	2	28.6%	2	50.0%	2	16.7%	6	26.1%	0.415
		12 hours or more	5	71.4%	2	50.0%	10	83.3%	17	73.9%	
	Degree of hearing loss BE*	Moderate	3	42.9%	2	50.0%	9	75.0%	14	60.9%	0.340
		Moderately Severe	4	57.1%	2	50.0%	3	25.0%	9	39.1%	
Older people	Time of daily use of hearing aids	Up to 6 hours	1	9.1%	2	11.8%	4	19.0%	7	14.3%	0.892
		6-12 hours	3	27.3%	5	29.4%	7	33.3%	15	30.6%	
		12 hours or more	7	63.6%	10	58.8%	10	47.6%	27	55.1%	
	Degree of hearing loss BE*	Mild	2	18.2%	3	17.6%	0	0.0%	5	10.2%	0.234
		Moderate	4	36.4%	5	29.4%	5	23.8%	14	28.6%	
		Moderately Severe	5	45.5%	9	52.9%	16	76.2%	30	61.2%	

Chi-square test \*Classification of the degree of hearing loss according to WHO<sup>(15)</sup>

Subtitle: n = sample number; % = percentage; HA = hearing aid; BE = both ears



**Table 5.** Association between difficulties in socialization generated by protective measures and the variables time of use of devices and degree of hearing loss, in both groups

Overall, did you feel that protective measures made your social life difficult?			No		Sometimes		Yes		Total		p-value
			N	%	N	%	N	%	N	%	
Adults	Time of daily use of hearing aids	From 6 to 12 hours	4	36.4%	0	0%	2	22.2%	6	26.1%	0.421
		More than 12 hours	7	63.6%	3	100%	7	77.8%	17	73.9%	
	Degree of hearing loss BE*	Moderate	5	45.5%	1	33.3%	8	88.9%	14	60.9%	0.081
		Mod. Severe	6	54.5%	2	66.7%	1	11.1%	9	39.1%	
Older people	Time of daily use of hearing aids	Up to 6 hours	3	12.5%	1	20.0%	3	15.0%	7	14.3%	0.591
		From 6 to 12 hours	5	20.8%	2	40.0%	8	40.0%	15	30.6%	
		More than 12 hours	16	66.7%	2	40.0%	9	45.0%	27	55.1%	
	Degree of hearing loss BE*	Mild	4	16.7%	0	0.0%	1	5.0%	5	10.2%	0.593
		Moderate	7	29.2%	2	40.0%	5	25.0%	14	28.6%	
		Mod. Severe	13	54.2%	3	60.0%	14	70.0%	30	61.2%	

Chi-square test \*Classification of the degree of hearing loss according to WHO<sup>(15)</sup>

Subtitle: n = sample number; % = percentage; HA = hearing aid; BE = both ears

## DISCUSSION

The data obtained from the interviews with 72 users of sound amplification devices allowed us to assess the communicative and social impacts generated by adopting protective measures against COVID-19 in two age groups: adults and older adults.

In both groups, sensorineural hearing loss predominated, similar to that found in other studies conducted in the same service<sup>(16)</sup> or others<sup>(2,17)</sup>. These results can be explained by the many pathologies that damage the sensory cells of the cochlea, such as metabolic diseases, prolonged noise exposure, and presbycusis – a condition that mainly affects older adults<sup>(18)</sup>.

The compiled literature identified the incident degree of hearing loss as moderate<sup>(2,16)</sup>. However, the present study found that the prevalent degree of hearing loss in the adult group was moderately severe in the right ear and moderate in the left ear, while in the older adult group, moderately severe in both ears. This result can be attributed to the use of different classifications. In this study, the most recent one, recommended by the WHO<sup>(15)</sup>, was used, denominating hearing loss as moderately severe, whose quadrilateral mean is equal to or greater than 50 dB and less than 65 dB.

Individuals with hearing loss, in addition to the need for auditory rehabilitation through the use of electronic hearing aids, among them hearing aids, lack communicative strategies that favor understanding the content of the message, such as, for example, observing facial expressions, performing orofacial reading, and approaching the sound source<sup>(2,3,19)</sup>.

With the advent of COVID-19, society had to reorganize itself to curb the curve of contagion by the virus and avoid overloading health systems. In this context, the use of face protection masks, physical distancing, and the use of digital technologies for distance communication became measures widely adopted by the population<sup>(4,5,8,20,21)</sup>, including the individuals who made up the sample of the present study. However, such measures compromise the usual communicative strategies and the integration of hearing aid users with society<sup>(8,10,11,21)</sup>.

According to the analyses conducted, the percentage of subjects who reported communicative difficulties resulting from the interaction with the use of masks was significant in both groups investigated. This finding confirms what the literature

had found: that masks become an obstacle to interpersonal communication due to a combination of different factors since, in addition to blocking orofacial reading and facial expressions during conversation, depending on the material of manufacture, they can attenuate the acoustic transmission of speech by up to 13.7 dB, making it more muffled and increasing the effort required to vocalize. This generates difficulties in maintaining adequate pneumo-phono-articulatory coordination and results in less intelligible speech<sup>(7,10,13,19,21-25)</sup>. Thus, the compiled literature may justify the reports of the adults and older adults participating in this study.

Also, the literature highlights that the use of transparent display masks and plastic *face shields*, despite allowing orofacial reading, has the worst acoustic speech attenuation indices (10.8 dB and 13.7 dB, respectively), while those made of other materials, such as propylene (3.6 dB) and KN95 (4 dB) have lower attenuation values<sup>(13)</sup>.

Regarding speech intelligibility with and without the use of masks, recent studies indicate that a transparent display significantly reduces speech understanding, compared to surgical and/or cloth masks, and worsens understanding when there is an increase in environmental noise<sup>(9,23,26)</sup>. Therefore, masks with transparent displays and face shields are not adequate resources for individuals with hearing loss, so it is important to adopt efficient strategies that help in the interpersonal communication of hearing aid users, such as speaking more slowly, with shorter utterances, and better articulation of sounds<sup>(9,23,26)</sup>.

The physical distancing between the listener and the speaker was pointed out as another impediment to interpersonal communication by the subjects of this research, which caused relevant communicative difficulties for both groups; this finding is also in line with that observed in other recently published studies<sup>(6,8-10)</sup>. The finding demonstrates that sound energy, at normal conversation distances of 0.5 to one meter, tends to dissipate by about 6 dB before reaching the listener; with increasing distance between people, this attenuation becomes even greater, creating communicative barriers for users<sup>(6,10)</sup>. Furthermore, it is possible to understand that distancing also disadvantages the perception of facial expressions and orofacial reading, in addition to making it difficult to capture sound through the microphone of the amplification devices since sound loses energy as a function of distance<sup>(6)</sup>.

Despite the above, only about half of the sample of each group reported experiencing negative feelings, such as sadness and/or frustration, resulting from the urgency of distancing. In contrast, the other participants did not experience these feelings. This contrast can be explained by the communicative needs of each subject since people with a greater demand for dialogue possibly felt the impact caused by the approach restrictions more considerably.

With COVID-19, digital technologies have become essential to keep in touch with loved ones during the social distancing period<sup>(14)</sup>. However, as previously explained and in the literature, these means of communication can present themselves as additional obstacles for people with hearing loss, especially in the quality and synchronization of audio and image, which often reproduce delays<sup>(6,11)</sup>.

Unlike, in a certain aspect, the compiled literature, no significant difficulties were evidenced in the use of digital technologies by older adults. In contrast, most adults alluded to them at some point. This can be attributed to the greater demand for adaptation (suffered by adults), which requires abrupt adaptation to new regimes, tools, and ways of working and may have contributed to the perceived difficulties related to technologies. On the other hand, the older research subjects who already had experience with some resources and were familiar with their use and handling did not have their routine so disturbed.

As for video calls, both adults and older adults, for the most part, did not feel the communicative losses resulting from the pre-existing hearing condition, differing from what is pointed out in the literature<sup>(6,11)</sup>, probably due to this resource favoring orofacial reading since, in these communicative situations, people are without masks covering the face. However, when comparing the groups, the already existing hearing loss had a greater consequence on video calls among older adults, which can be justified by the particularities of this instrument, such as the delays of the image relative to the audio or possible cuts in transmission<sup>(6,11)</sup>, impairing communication in this age group due to issues inherent to the aging process, such as the impairment of central auditory structures, important for the understanding and synthesis of speech.

Regarding the impact of the adoption of protective measures on social life, about which intra-group opinions were divided, the present study argues that the low perception of the negative effects of isolation in the pandemic in both groups is justified by the easy access to digital technologies that enabled maintaining social contact. This may have brought these individuals closer to friends and family members with whom they usually could not talk due to the distance and the hustle and bustle of daily life, thus enabling greater social interaction between these individuals<sup>(14)</sup>. Additionally, it is important to emphasize that adults and older adults generally have a more family-centered life, which means that their social circle tends to be more restricted. Therefore, it is possible that these age groups felt less impact in this area compared to adolescents and young adults, who used to have a more active social life<sup>(27)</sup>.

From another perspective, it is believed that the protective measures did not impact the social life of approximately half of the sample due to the change in the profile of the meetings, which started to happen with a small number of people, favoring social interactions in a domestic environment (a place where it is possible to control environmental noise, different from the

characteristic environments of bars and restaurants), allowing better understanding and participation of hearing aid users in conversations<sup>(6,28)</sup>.

There was a difference between the groups regarding the emotional aspect resulting from adopting these measures. While adults reported more negative emotional aspects, many older adults did not experience them. This finding may be because older adults were classified as a risk group and, thus, were the most protected individuals with the least social interactions; consequently, they had reduced opportunities to experience the emotional repercussions of the measures adopted in communication. On the other hand, adults adhered less to social distancing and, therefore, used protective masks more frequently, a finding also evidenced in the literature<sup>(29)</sup>.

COVID preventive measures, by preventing the processes commonly adopted by hearing aid users, brought communicative and social difficulties to both groups, regardless of the degree of hearing loss and the mean time of daily use of the devices, denoting that speech therapy guidance for all subjects who felt these impairments in communication is essential in order to minimize the impact<sup>(22)</sup>.

Counseling addresses different communication strategies to establish a clearer and more effective dialogue and minimize the consequences of hearing loss<sup>(3)</sup>. Some of the alternatives include reducing environmental noise; drawing the subject's attention; speaking slowly and using shorter utterances; articulating sounds more clearly; preferring to reformulate sentences instead of repeating the same words; using assistive technologies, when possible, and/or writing on paper or a cell phone, among other possibilities that do not cancel the recommended measures to reduce contamination by the virus<sup>(10,19,21)</sup>.

Finally, the present study had some limitations, with the lack of objective measures to assess the impact caused by the use of masks, digital technologies, and physical distancing being one of them. Another bias of this research was the discrepancy between the groups regarding the number and gender of participants, which may have predisposed some findings. Also, only individuals attended by the Unified Health System (SUS), with low income and education, and from the Southern Region of Brazil participated in the study<sup>(30)</sup>. It is suggested that future research be conducted in other regions of the country, with a more stratified sample, but homogeneous in number and gender. Also, it would be beneficial to have objective measures complementary to subjective ones, such as tests with words and/or sentences to be repeated and/or discriminated phonetically, to assist in measuring the communicative impairment caused by using different types of masks and physical distancing.

## CONCLUSION

The use of face masks and physical distancing from the interlocutor significantly impacted the interpersonal communication of hearing aid users in both groups, resulting in impairments in communicative interaction. The difficulty with using digital technologies, such as cell phones and computers, was predominant among adults due to pre-existing hearing loss. In contrast, older adults perceived the impact of hearing alteration on video calls more.

As for the negative repercussion of protective measures relative to social life, both for adults and older adults, opinions were divided between those who perceived it, at least at some point (“yes/sometimes”), and those who did not feel it. Regarding the emotional impact, adults experienced higher rates of negative feelings (sadness and/or frustration) than older adults.

Also, the communicative and social consequences of adopting protective measures against COVID-19 were independent of the degree of hearing loss and the time of daily use of individual sound amplification devices.

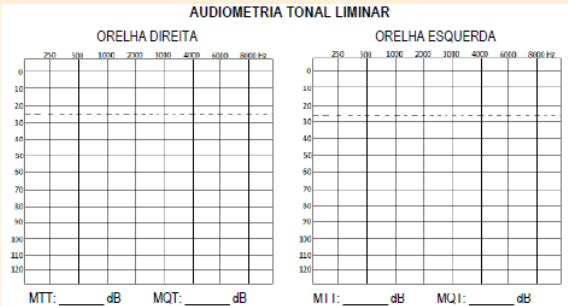
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**Appendix 1. Questions presented to users for data collection**

<b>DATA COLLECTION FORM (HEARING AID USER)</b>	
<b>COLLECTION IDENTIFICATION</b>	
No. _____ Collection date: ____/____/____ Location: _____	
<b>SUBJECT IDENTIFICATION</b>	
Name: _____ Gender: _____	
Age: _____ years Date of birth: ____/____/____ CPF: _____	
Arrived accompanied by: _____	
Phone: _____ and _____ Email: _____	
Marital status: _____ Resides with: _____	
1. Performs medical follow-up/with other health professionals: ( ) Yes ( ) No	
2. If yes, which: _____	
<b>AUDIOLOGICAL AND PROSTHETIZATION DATA</b>	
	
Date of last audiometry: ____/____/____ Date of prosthetization: ____/____/____	
3. On average, how many hours per day did you use the hearing aids:	
( ) maximum 3 hours per day ( ) from 3 to 6 hours per day ( ) from 6 to 9 hours per day ( ) from 9 to 12 hours per day ( ) from 12 to 15 hours per day ( ) more than 15 hours per day	
4. Did not use the device in the last months: ( ) Yes ( ) No	
If yes: 5. When ____/____/____ 6. How long: _____	
<b>OCCUPATION</b>	
7. Do you work: ( ) Yes ( ) No 8. Where you work: _____	
9. Job function: _____	
10. If you work, did you remain in the same job after the beginning of the pandemic: ( ) No ( ) Yes	
11. How was your work routine after the beginning of the pandemic: _____	
<b>COVID-19 AND PROTECTIVE MEASURES</b>	
12. Did you adopt social isolation measures: ( ) No ( ) Yes	
13. Did you adopt protective measures ( ) No ( ) Yes	
14. Did you have a positive diagnosis for COVID-19: ( ) Yes ( ) No 15. When: ____/____/____	
16. Did you perceive changes in hearing after diagnosis: ( ) Yes ( ) No	
17. If so, what did you notice: ( ) Worsening in hearing – if you had it, on which side: ( ) right ( ) left ( ) both	
( ) Started to have tinnitus – If so, on which side: ( ) right ( ) left ( ) both	
( ) Worsening of tinnitus – if you had it, on which side: ( ) right ( ) left ( ) both	
( ) Otagia – if you had it, on which side: ( ) right ( ) left ( ) both	
( ) Otorrhea – if you had it, on which side: ( ) right ( ) left ( ) both	
( ) Auricular Fullness – if you had it, on which side: ( ) right ( ) left ( ) both	
18. Did you experience dizziness after diagnosis: ( ) Yes ( ) No	
19. If you had dizziness, this was of what type: ( ) Subjective vertigo ( ) Objective vertigo	
20. If so, how long did the dizziness last: ( ) Seconds ( ) Minutes ( ) Hours ( ) Days ( ) Months ( ) Years	
21. Did you present worsening of dizziness after diagnosis: ( ) Yes ( ) No	
22. If yes, before the dizziness was of what type: ( ) Subjective vertigo ( ) Objective vertigo	
23. If yes, what was the duration of dizziness before: ( ) Seconds ( ) Minutes ( ) Hours ( ) Days ( ) Months ( ) Years	
24. Did you use medications to treat the symptoms of COVID-19: ( ) Yes ( ) No	
25. If yes, which: ( ) Do not remember ( ) Chloroquine ( ) Hydroxychloroquine ( ) Azithromycin ( ) Remdesivir ( ) Favipiravir ( ) Lopinavir ( ) Other, which: _____	

## Appendix 1. Continued...

DATA COLLECTION FORM (HEARING AID USER)
<b>USE OF FACE PROTECTION MASKS</b>
26. Did you communicate with others while wearing masks? ( ) No ( ) Yes
27. Did you have difficulty understanding what people were saying to you while wearing masks? ( ) No ( ) Sometimes ( ) Yes
28. Do you believe that the fact that people wear masks when talking to you makes it difficult to communicate with them? ( ) No ( ) Sometimes ( ) Yes
<b>PHYSICAL DISTANCING</b>
29. Have you communicated with anyone while distancing from them? ( ) Yes ( ) No
30. Did you have difficulty understanding what was said to you when distancing from the speaker? ( ) No ( ) Sometimes ( ) Yes
31. Did you feel frustrated/sad when you did not understand what they told you because they kept their distance? ( ) No ( ) Sometimes ( ) Yes
<b>USE OF DIGITAL TECHNOLOGIES</b>
32. Did you use digital technologies to communicate with others at a distance? ( ) No ( ) Yes
33. Before the pandemic, did you already use digital technologies to communicate with others or to work? ( ) No ( ) Yes
34. Did you have difficulties communicating through digital technologies? ( ) No ( ) Sometimes ( ) Yes
35. Did you participate in video calls after the beginning of the pandemic? ( ) No ( ) Yes
36. If you participated in video calls, did you feel your communication was impaired due to hearing difficulties? ( ) No ( ) Sometimes ( ) Yes
<b>PROTECTION MEASURES AND COMMUNICATION DIFFICULTIES</b>
37. Overall, do you feel that protective measures made it difficult for you to communicate with others? ( ) No ( ) Sometimes ( ) Yes
38. Overall, did you feel frustrated/sad about not understanding what they wanted to tell you because of the protective measures? ( ) No ( ) Sometimes ( ) Yes
39. Overall, do you feel protective measures made your social life difficult? ( ) No ( ) Sometimes ( ) Yes
40. Overall, if you work, do you feel the protective measures have made your professional life difficult? ( ) No ( ) Sometimes ( ) Yes
41. Overall, do the difficulties of understanding arising from protective measures cause you to interact less with other people? ( ) No ( ) Sometimes ( ) Yes
42. Did you stop communicating with people at times due to possible communication difficulties caused by the changes imposed by the pandemic? ( ) No ( ) Sometimes ( ) Yes