



# Acoustic Shocks Research Project

Final Report

# Abstract

This report is the result of a study undertaken by AIIC, the International Association of Conference Interpreters, in collaboration with Dr Philippe Fournier, a Canadian audiologist and acoustic shocks specialist at the University of Aix/Marseille (France), between September 2019 and June 2020. The aim of this first-of-its-kind study was to assess and define the prevalence of acoustic shocks among AIIC members, and to identify the symptomatology of interpreters who have been exposed to acoustic incidents. The analysis of the data used in this two-phase survey, collected from more than a thousand members (n=1035), revealed a high prevalence of acoustic incidents and acoustic shocks in the sample (between 47% and 67% of the respondents), with associated symptoms severity ranging from mild and temporary to severe and permanent. In their conclusion, the authors invite the interpreter community to consider the hearing health of conference interpreters as a priority. The list of ten recommendations targeted at interpreters, conference participants, sound technicians, employers of interpreters, or health agencies, underlines the need for training, prevention, medical monitoring, and encourages further research on specific findings.

Le présent rapport est le fruit d'une étude conduite par l'AIIC, l'Association internationale des interprètes de conférence, en collaboration avec Philippe Fournier, audiologiste canadien spécialiste des chocs acoustiques à l'université Aix-Marseille, de septembre 2019 à juin 2020. Cette étude, la première jamais effectuée sur le sujet, visait à évaluer et à définir la prévalence des chocs acoustiques chez les membres de l'AIIC, et à identifier la symptomatologie des interprètes ayant été exposés à des incidents acoustiques. L'analyse des données recueillies durant les deux phases, auprès de plus de mille membres (n=1035), révèle une forte prévalence d'incidents et de chocs acoustiques parmi les participants (entre 47 % et 67 %), ainsi qu'une gravité des symptômes associés allant de modérée et temporaire à grave et permanente. Les auteurs du rapport invitent la communauté des interprètes à juger prioritaire la question de la santé auditive des interprètes de conférence. La liste de dix recommandations destinées aux interprètes, aux conférenciers, aux techniciens du son, aux employeurs et aux agences de santé, souligne le besoin de formation, de prévention, de suivi médical, ainsi que de travaux de recherche sur plusieurs conclusions spécifiques de l'étude.

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## Background

During its 2019 meeting in Geneva, and subsequent to the issue of acoustic shocks (AS) reported earlier by staff and freelance interpreters working at the Translation Bureau of Canada, the Advisory Board and the Executive Committee of AIIIC tasked the Research Committee, the Technical and Health Committee and the Canada Region to collaborate with Dr Philippe Fournier from the Aix-Marseille University to investigate acoustic shocks among AIIIC members. The objective of the Acoustic Shocks Project is to provide the association with scientific data with a view to drafting a set of guidelines and recommendations for conference interpreters and equipment providers.

## Project team

**Linda Ballantyne:** AIIIC Advisory Board Member, Canada Region

**Philippe Fournier:** Canadian audiologist and researcher at the *Laboratoire de Neurosciences Sensorielles et Cognitives*, Aix-Marseille University, specialist in acoustic shocks.

**Marc Orlando (project leader):** Coordinator of AIIIC Research Committee

**Gabriella Verdi:** Member of AIIIC Technical and Health Committee

**Klaus Ziegler:** Coordinator of AIIIC Technical and Health Committee

## Method

The project was carried out in two phases, using questionnaires and surveys:

- Phase 1 aimed at defining the prevalence of acoustic shocks among AIIIC members.
- Phase 2 was an in-depth analysis of the symptomatology of members who had been exposed to acoustic shocks.

# Introduction

In simultaneous interpretation, the auditory message received by the interpreter is of crucial importance as every feature of the source message may influence the rendition. While interpreting, conference interpreters have to engage their attention fully towards the continuous flow of sounds that form the source speech, and most of the time for hours. During that time, many unwanted acoustic incidents might occur: a feedback loop, the drop of a microphone, someone unexpectedly tapping on or yelling in the microphone, etc. These acoustic incidents transmitted via the headsets are usually unexpected, brief and perceived as quite loud by the interpreters, and may trigger some symptoms such as tinnitus, ear fullness or pain in the ear, to name a few. The combination of acoustic incidents (loud, brief and unexpected sounds) with the appearance of one or multiple symptoms have been called 'acoustic shocks' (Westcott, 2006).

There have been many attempts to define acoustic shocks but there is still no scientific consensus on the definition (McFerran & Baguley, 2007; Parker et al., 2014). Acoustic shocks have been first described in workers of call centres reporting symptoms after acoustic incidents transmitted through their headset (McFerran & Baguley, 2007; Parker et al., 2014). In 2019, issues of acoustic shocks experienced by interpreters at the Canadian Parliament have made the headlines. In a recent article entitled "Federal interpreters suffer 'acoustic shock,' other concussion-like symptoms" (CBC News, 2019), the journalist reports that, according to the Translation Bureau of Canada, 17 of the Bureau's 72 permanent interpreters have filed a total of 28 complaints of acoustic shocks over the last three years. The most severe cases were displaying concussion-like symptoms including nausea, vomiting, postural instability, balance problems, fainting, disorientation, and hearing loss.

Concerned with the health of conference interpreters, the Advisory Board and the Executive Committee of AIIIC tasked the Research Committee, the Technical and Health Committee and the Canada Region to collaborate with Dr Fournier (a Canadian audiologist, researcher, and acoustic shock specialist, at the *Laboratoire de Neurosciences Sensorielles et Cognitives* in Dr Arnaud Norena's team, Aix-Marseille University) and to carry out a study on acoustic shocks. The research project was conducted in two distinct phases.

## Phase I

The first phase of the project aimed at defining the prevalence of acoustic shocks amongst AIIC members. An online survey was designed with specific questions on acoustic shocks (AS). The questions covered the prevalence of AS, the number of AS experienced, the official reports of such incidents and the use of headsets during the AS. Acoustic shocks were defined as any acoustic incidents (brief, loud and unexpected sounds) that triggered one or more symptoms. The nature of the symptoms (one or many, transient or permanent, light or severe) was not defined and thus, any acoustic incident producing symptoms was considered an acoustic shock. In addition, several demographic questions regarding the age, the gender, the country of residence and the years of experience were added. Finally, a question about all the symptoms experienced since the beginning of the interpreter's career was also added.

## Results

### *Who were the respondents?*

A total of 1035 interpreters responded to the Phase I online survey (77% were women, 22.3% were men, 0.7% did not specify). Out of this total of respondents, 985 completed the questionnaire entirely and 50 partially (a completion rate of 95.2%), which represents a response rate of approx. 35% of all AIIC membership.

The sample was made of interpreters from 81 different countries and representing five different continents. The continent with the most respondents was Europe (71.8%, n=709), followed by the Americas (19.3%, n=191), Asia (4.4%, n=43), Africa (3.6, n=36) and Oceania (0.6%, n=6). Table I below shows the ranking of the 20 countries with the most respondents. The first five countries with the most respondents were France, Germany, Belgium, Italy and Switzerland.

Ranking	Country	Number of respondent	Percentage of respondent	Number of respondent			% of respondent		
				With AS	Without AS	Don't know	With AS	Without AS	Don't know
1	France	128	13	61	39	28	47.7	30.5	21.9
2	Germany	120	12.1	38	49	33	31.7	40.8	27.5
3	Belgium	101	10.2	35	47	19	34.7	46.5	18.8
4	Italy	77	7.8	33	26	18	42.9	33.8	23.4
5	Switzerland	68	6.9	40	14	14	58.8	20.6	20.6
6	Canada	68	6.9	31	28	9	45.6	41.2	13.2
7	UK	46	4.7	18	16	12	39.1	34.8	26.1
8	USA	45	4.6	27	14	4	60	31.1	8.9
9	Spain	31	3.1	11	7	13	35.5	22.6	41.9
10	Brazil	25	2.5	18	1	6	72	4	24
11	Austria	20	2	7	11	2	35	55	10
12	Greece	19	1.9	9	5	5	47.4	26.3	26.3
13	Netherlands	19	1.9	9	8	2	47.4	42.1	10.5
14	Argentina	15	1.5	10	3	2	66.7	20	13.3
15	Mexico	13	1.3	8	1	4	61.5	7.7	30.8
16	Portugal	13	1.3	6	7	0	46.2	53.8	0
17	Sweden	9	0.9	6	3	0	66.7	33.3	0
18	China	8	0.8	5	3	0	62.5	37.5	0
19	Turkey	8	0.8	4	2	2	50	25	25
20	Luxembourg	8	0.8	2	5	1	25	62.5	12.5

Table I: The top 20 ranking of countries with the most respondents. [The table shows the raw number of respondents and the overall percentage of respondents, as well as the number and the percentage of respondents with AS, without AS and who "don't know" for each country].

### *Prevalence of acoustic shocks amongst interpreters and geographical differences*

To the question, "Have you ever experienced an acoustic shock during your work as an interpreter?", 488 interpreters responded "yes", 335 responded "no" and 212 responded "I don't know", representing respectively 47.1%, 32.4% and 20.5% of the total sample.

Among the interpreters who answered "I don't know", some mentioned that they had experienced acoustic incidents but without the occurrence of any symptoms, while others were either not linking the appearance of the symptoms with the incident or considered that the symptoms were too temporary or mild to be considered a true acoustic shock (see quotations in Table II below). Overall, these comments suggest that the interpreters who responded "I don't know" may have experienced acoustic incidents but with no or mild/temporary symptoms.

"I have experienced loud, unexpected and very annoying sounds at work but I don't know if they would fall under the scientific category of an acoustic shock."
"Never really experienced acoustic shock as such, but some Larsen and Doppler effects or others, but was quick enough to rip earphones off."
"I do remember many episodes of unpleasantness when a sudden strong sound enters my headphones, such as somebody blowing into the mike to see whether it works, something falling down in front of the mike, or especially acoustic phase interference, but without any of the mentioned symptoms afterwards."
"I'm still unclear as to what qualifies as acoustic shock. I've certainly experienced loud noises/feedback that have caused temporary but not lasting pain..."
"Hard to say whether I have been subject to acoustic shock according to the strict definition, but many times I have experienced sudden increases in volume in the booth which have been painful: people hitting the microphone, very loud music suddenly coming on, audio feedback, etc."

Table II: Quotations from interpreters in the *Don't know* group.

In addition, the survey looked at identifying the top 20 ranking of the countries with the highest number of reported acoustic shock incidents. As shown in Table III, the country with the highest prevalence is Brazil with 72% of the respondents reporting experience of acoustic shocks; and the lowest is Luxembourg, with a 25% prevalence. These results have to be carefully interpreted, as the number of respondents by country varies greatly.



Ranking	Country	Number of respondent	Percentage of respondent	Number of respondent			% of respondent		
				With AS	Without AS	Don't know	With AS	Without AS	Don't know
1	Brazil	25	2.5	18	1	6	<b>72</b>	4	24
2	Argentina	15	1.5	10	3	2	<b>66.7</b>	20	13.3
3	Sweden	9	0.9	6	3	0	<b>66.7</b>	33.3	0
4	China	8	0.8	5	3	0	<b>62.5</b>	37.5	0
5	Mexico	13	1.3	8	1	4	<b>61.5</b>	7.7	30.8
6	USA	45	4.6	27	14	4	<b>60</b>	31.1	8.9
7	Switzerland	68	6.9	40	14	14	<b>58.8</b>	20.6	20.6
8	Turkey	8	0.8	4	2	2	<b>50</b>	25	25
9	France	128	13	61	39	28	<b>47.7</b>	30.5	21.9
10	Greece	19	1.9	9	5	5	<b>47.4</b>	26.3	26.3
11	Netherlands	19	1.9	9	8	2	<b>47.4</b>	42.1	10.5
12	Portugal	13	1.3	6	7	0	<b>46.2</b>	53.8	0
13	Canada	68	6.9	31	28	9	<b>45.6</b>	41.2	13.2
14	Italy	77	7.8	33	26	18	<b>42.9</b>	33.8	23.4
15	UK	46	4.7	18	16	12	<b>39.1</b>	34.8	26.1
16	Spain	31	3.1	11	7	13	<b>35.5</b>	22.6	41.9
17	Austria	20	2	7	11	2	<b>35</b>	55	10
18	Belgium	101	10.2	35	47	19	<b>34.7</b>	46.5	18.8
19	Germany	120	12.1	38	49	33	<b>31.7</b>	40.8	27.5
20	Luxembourg	8	0.8	2	5	1	<b>25</b>	62.5	12.5

Table III: The top 20 ranking of the countries with the highest prevalence of AS.

### *Number of acoustic shocks*

The number of acoustic shocks was assessed only for respondents who had previously answered that they had experienced acoustic shocks (n=488). To the question, "How many acoustic shocks have you experienced during work?", most interpreters reported having experienced more than one AS (85%) with 25% of them reporting having experienced more than ten AS. Figure 1 shows the distribution of the number of AS across the total sample of respondents from the *With AS* group.

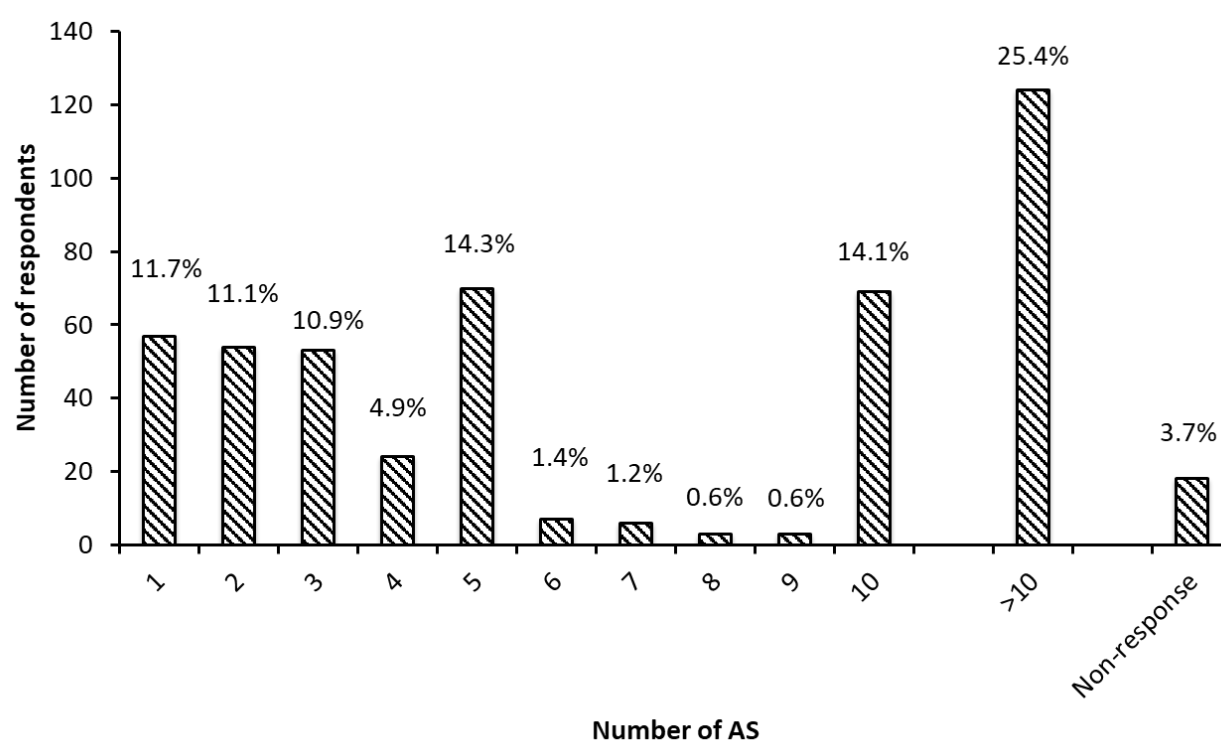


Figure 1. Distribution of the number of acoustic shocks amongst the interpreters who have experienced acoustic shocks (n=488).

### *Headsets as the AS transmitter*

The question about headsets was assessed only for respondents who had previously answered that they had experienced acoustic shocks (n=488). To the question, "When the acoustic shock occurred were you wearing a headset or headsets?" 95.3% of the respondents answered "yes" (n=465), 1.6% answered "no" (n=8), 0.4% answered "I don't know" (n=2) and 2.7% answered "other" (n=13). Most respondents who answered "other" stated that they were wearing headsets when AS occurred but that sometimes, they also experienced AS without the headsets on.

### *Officially reporting the acoustic shock(s)*

As for the two previous questions, the question about the reporting of AS was assessed only for respondents who had previously answered that they had experienced acoustic shocks (n=488). To the question, "Did you officially report the acoustic shock(s) incident(s)?", a majority of interpreters (n=374) responded "no" which corresponds to 76.6% of the total number of respondents who have experienced acoustic shocks. In addition, 90 interpreters (18.4%) responded "yes", 24 (4.9%) responded "I don't know". For the follow-up question, "Please describe the reasons for not officially reporting the incident", many reasons were put forward. One of the most reported reasons was the lack of official procedure to report the incident. The other reasons are shown in Table IV below with examples of interpreters' quotations.

<b>Reasons not to report AS</b>	<b>Interpreters' quotations</b>
<b>No procedure, no official way to report</b>	<p>"There was no system or method for reporting."</p> <p>"I don't know to whom I can report this, particularly as a freelancer. Also, I'm unconvinced that it would have any effect."</p> <p>"I did not know I could. To whom should I report it?"</p>
<b>Nature of symptoms: temporary, not severe, no long term impact...</b>	<p>"As the symptoms improved during the day and disappeared later on, I didn't consider it necessary to take the matter any further"</p> <p>"Symptoms disappear and they are not debilitating"</p> <p>"Not a big shock, I took off the headset immediately every time. No perceptible consequences on my health"</p>
<b>Told someone unofficial: technician, organizer, colleague...</b>	<p>"I reported them to the organizer and they promised not to hire this tech company again."</p> <p>"Plus, many years ago I had no one to complain to except for the technician, who obviously was aware of it."</p> <p>"I was not aware there was anything we could do about it except tell colleagues."</p>
<b>Feeling that the complaint won't be taken seriously and/or will have any effects</b>	<p>"My employers or clients would not take it seriously"</p> <p>"Not conscious of the importance of reporting - nobody would care"</p>

Reasons not to report AS	Interpreters' quotations
	<p>"I don't think it would have made any difference. Furthermore, I did not want to upset the client."</p>
<p><b>Acoustic shock(s) is (are) part of the natural events when you work as an interpreter</b></p>	<p>"It's part of our job"</p> <p>"Nobody was 'appointed' to deal with this kind of incidents, they were treated like part of the job. If the incident occurred during a speech, "the show must go on"..."</p> <p>"I thought it is a normal thing in our profession to suffer these kind of incidents"</p>
<p><b>The incident that led to AS was accidentally/ unintentionally triggered by someone, or by the interpreter</b></p>	<p>"Feeling that these incidents are always unintended, the result of inappropriate handling of the equipment, or often the result of inexperienced speakers who drops or tap on the microphone"</p> <p>"I was put on an assignment where there was no sound engineer. The equipment was very obviously inadequate. I should not have put the headset on in the first place, so felt partly responsible myself. Also, I was still inexperienced at the time."</p> <p>"As far as I remember, the only instances of AS were when a participant accidentally hit the microphone. No point reporting that, as they clearly did it by mistake."</p>
<p><b>Afraid of losing job and/or future clients/contracts</b></p>	<p>"Fear of not being hired again"</p> <p>"I was worried it would negatively affect my prospects with the client in question."</p>
<p><b>Unaware of the potential consequences of AS in the long term</b></p>	<p>"I didn't report the incident because I didn't know it could cause such serious and long-term effects."</p> <p>"I never knew it was reportable or that I was expected to report. I never had symptoms other than the acuteness of the sound in my ears. I did not know that it had more serious consequences."</p>

Table IV: Reasons mentioned by interpreters for not officially reporting acoustic shocks. The table also includes some interpreters' quotations for each reason.

### *Symptoms experienced since the beginning of the interpreter's career*

All respondents, regardless of their experience of AS, responded to the question, "From the list of symptoms below, check all the symptoms (one or more) that you have experienced since you started working as an interpreter". Figure 2 below shows the distribution of respondents for each of the symptoms for respondents with previous experience of acoustic shocks (*With AS*), respondents who did not experience AS (*Without AS*) and those who "don't know" if they have experienced AS (*Don't know*).

Interestingly, for some symptoms, the prevalence is higher in the *With AS* group than in the *Without AS* group. For example, the prevalence of experiencing "tinnitus" is of 54% for the *With AS* group and of 20% for the *Without AS* group, a 34% difference. This means that, in the *With AS* group, more than 1 out of 2 interpreters have experienced tinnitus since the beginning of their career. The prevalence of "feeling of clogged ear" symptoms is 20% higher for the *With AS* group. The same observations can be made for "hypersensitivity to sound", "stabbing type pain in the ear", "sensation of floating eardrum" and "hearing impairment" symptoms, with a prevalence difference of 16%, 15%, 12% and 12%, respectively. Moreover, the prevalence of interpreters reporting that they have "never experienced any of the symptoms" is of 24% in the *Without AS* group and only 8% in the *With AS* group.

As for the interpreters from the *Don't know* group, it is important to note that their responses about their experienced symptomatology are somewhat similar to the responses from the *with AS* group, which would suggest that those interpreters who weren't sure if they experienced AS most probably did.

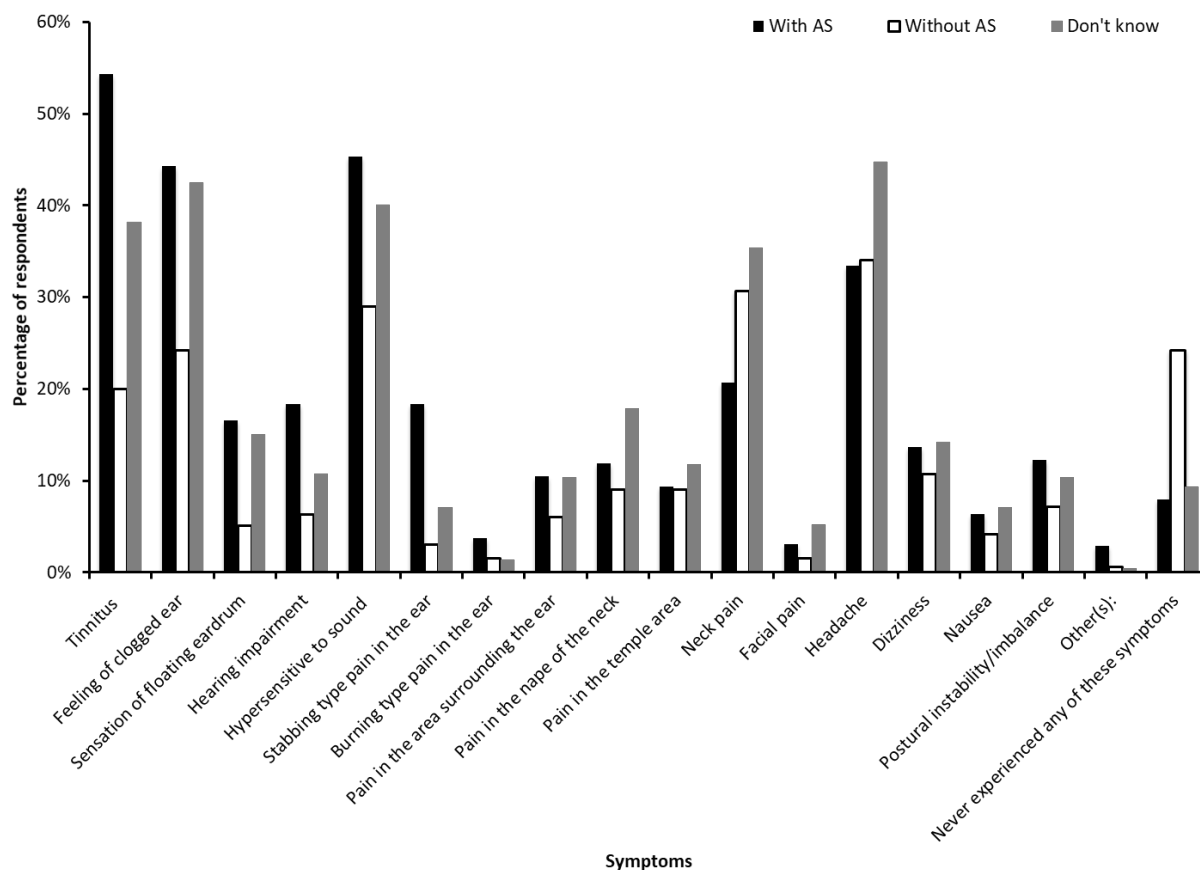


Figure 2: Distribution of the different symptoms experienced since the start of their interpreting career, for interpreters who have experienced acoustic shocks (With AS), interpreters who have not (Without AS), and interpreters who are not sure if they have (Don't know).

Further analysis revealed that interpreters from the *With AS* group and the *Don't know* group have also experienced more symptoms (3.2 symptoms in mean) than the *Without AS* group (2.3 symptoms in mean). Figure 3 shows the distribution of the number of symptoms experienced per individual for the three different groups. For the *Without AS* group, 68.1% of the respondents reported having experienced 2 or less of the symptoms since the beginning of their career. 50.8% of respondents from the *With AS* group have experienced 3 or more symptoms since the beginning of their career. The data for the *Don't know* group is pretty similar, with 51.9% of respondents having experienced 3 or more symptoms since the beginning of their career. This similarity could suggest that interpreters from this group have actually experienced AS.

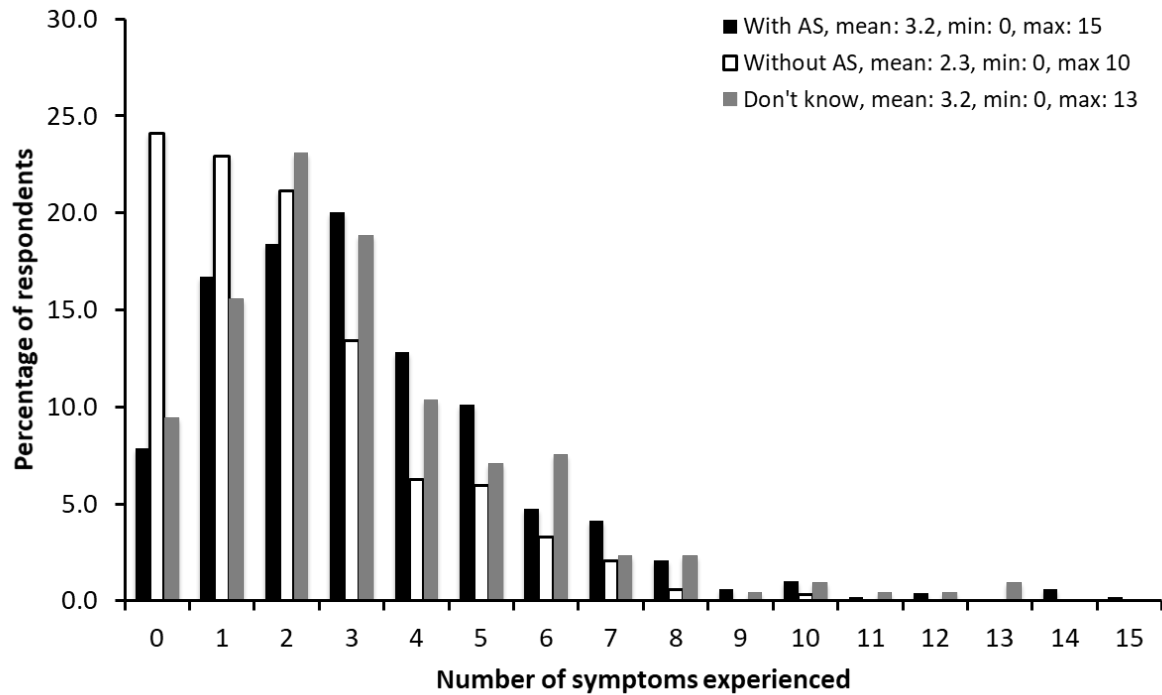


Figure 3: Distribution of the number of symptoms experienced per individual for the three different groups.

#### *Demographics of the three groups*

All the participants were asked about the number of years of experience as an interpreter, their age, and their gender. The responses are shown in Figure 4, 5 and 6. The data for the three groups is very similar in terms of years of experience, age and gender. These demographic characteristics are thus very unlikely to explain the risk of experiencing AS and the difference seen in the prevalence of symptoms between groups of interpreters.

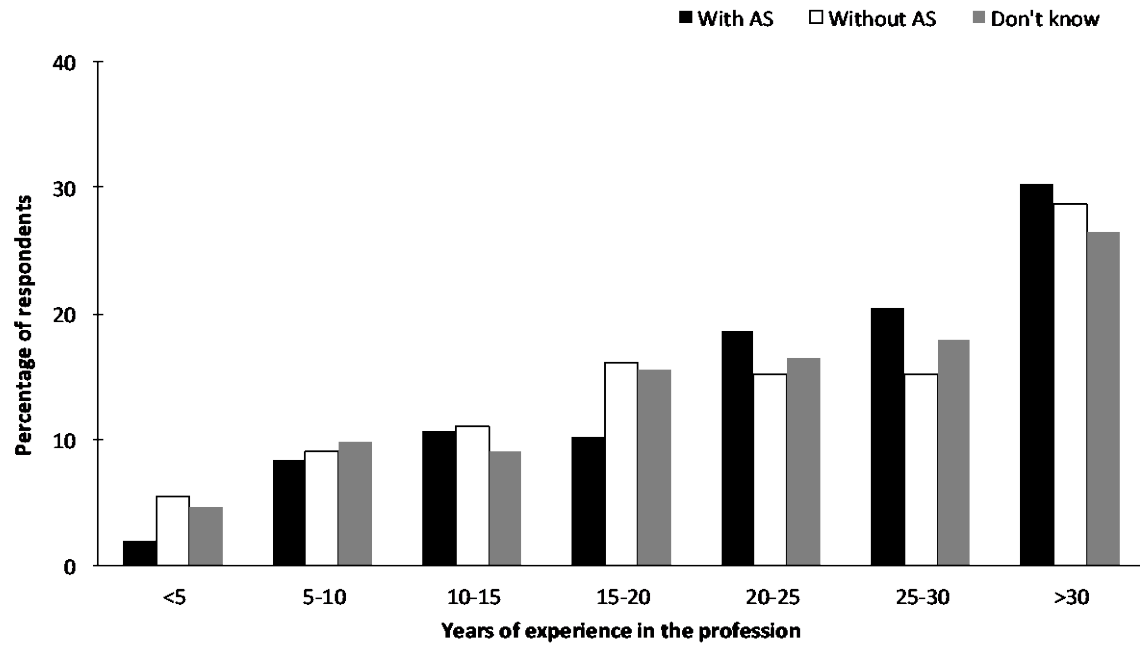


Figure 4: Distribution of the years of experience as an interpreter for the three different groups.

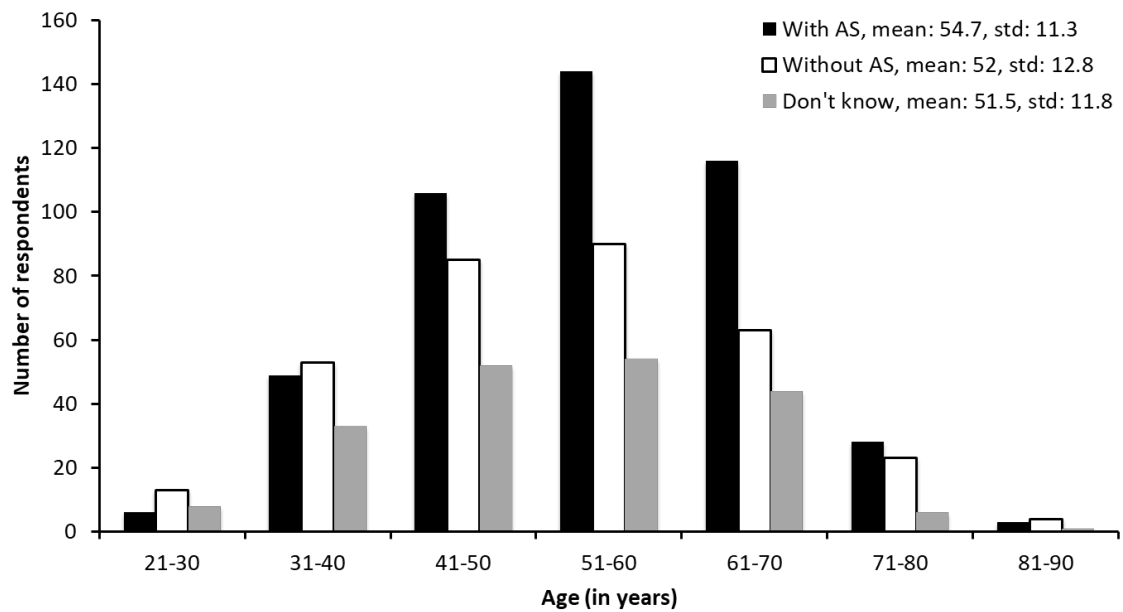


Figure 5: Distribution of age for the three different groups.



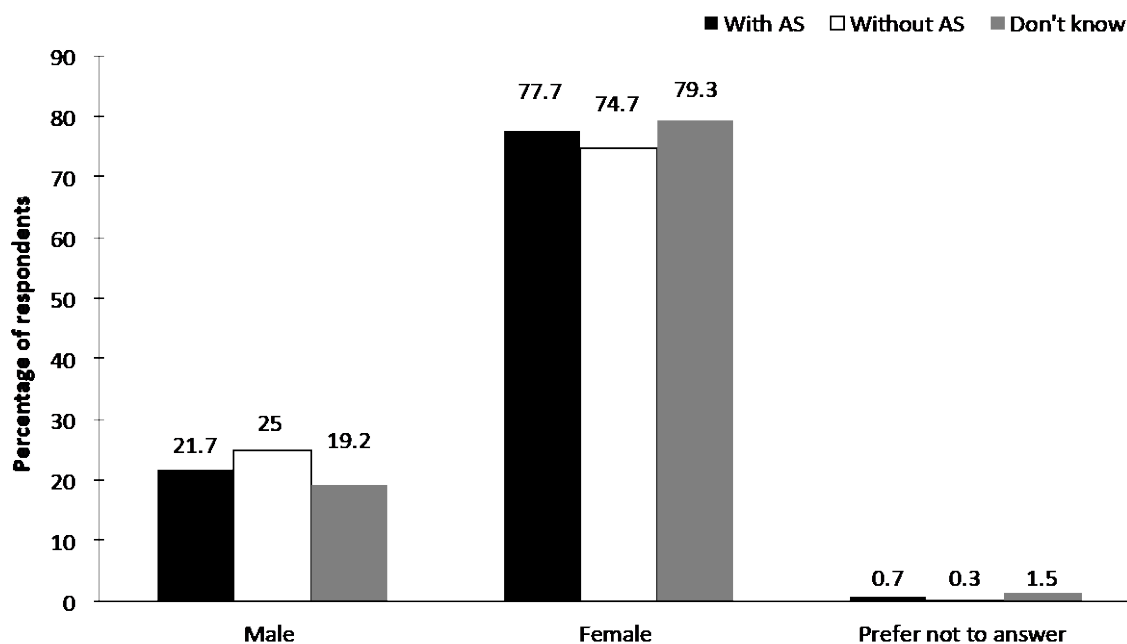


Figure 6: Distribution of gender for the three different groups.

## Preliminary Conclusions & Limitations – Phase I

The findings of Phase I suggest that acoustic shocks are prevalent amongst AIIIC members. Indeed, almost 1 out of 2 interpreters (47%) in the sample (n=1035) reported having previously experienced acoustic shocks during their career. Even if we speculated that the AIIIC members who did not respond to the survey had never experienced an acoustic shock, the prevalence among members would still be high, around 16% (488/3063). Unfortunately, there is no official data available on the prevalence of AS in the interpreting profession. Only CBC news (2019) reported that 17 out of 72 permanent interpreters of the Ottawa's Translation Bureau have suffered from AS, representing a prevalence close to 24%. One can conclude from the above that the prevalence of AS amongst interpreters is similar to the one reported for telephone operators in call centres, estimated between 13% and 46 % (El-Bestar et al., 2010; Loyal Poonamjeet, 2015; Subbarayalu, 2013).

If we considered the respondents who were unsure of previous experience of AS (those who responded "I don't know"), and added them to those who definitely experienced AS, the prevalence of AS in our sample of interpreters would be close to 67%, so more than 2 out of 3 interpreters. Taking into account the comments of some of the individuals from the *Don't know* group, who mentioned their experience of acoustic incidents and acoustic shocks but with no or mild/temporary symptoms, it would appear fair to consider them as part of the overall prevalence of acoustic shocks. In addition, the

experienced symptomatology of this *Don't know* group was more similar to the *With AS* group than to the *Without AS* group, supporting the idea that they are more similar to the *With AS* group and should be included in the overall prevalence of AS. More so, this specific group highlights the need for more awareness and education around acoustic shocks within the community of conference interpreters.

Some of the findings suggest that AS are not rare events for conference interpreters. Most respondents (85%) with previous AS experience reported having experienced more than one acoustic shock, and 25% of them reported having experienced more than ten AS. The interpreters who reported AS are also more inclined to experience ear related symptoms compared to interpreters who never experienced AS with the most important ones being: 1) Tinnitus, 2) Clogged ear, 3) Hypersensitivity to sound, 4) Stabbing pain in the ear, 5) Hearing impairment & Sensation of floating/vibrating eardrum. Finally, the number of symptoms experienced per individual is also higher for interpreters who experienced AS compared to interpreters who did not experience AS, with a mean 3.2 symptoms per individual for the former, and 2.3 symptoms per individual for the latter.

Despite the many acoustic shocks suffered by interpreters and the high prevalence of AS, only a minority of interpreters officially report these incidents. Many reasons were put forward to justify this choice. The most cited one was the lack of official procedure to report such events. It is obvious that employers, agencies for health and safety or professional associations should create such official procedures. This would ultimately lead to a better recognition of AS issues by the conference interpreter community, a better understanding of the issue and, ultimately to solutions including technical innovations and prevention.

These findings need to be interpreted with some caution as they have notable limitations. First, the definition of AS used in Phase I is very broad and includes acoustic incidents that led to any symptoms regardless of the duration, the intensity and the severity of the symptoms. Considering that there is no consensus on the definition of acoustic shocks, this choice was deliberately made to include, as much as possible, any acoustic event that led to one or many symptoms. In addition, the question related to the symptoms only indicates if interpreters have experienced symptoms and which symptoms they have experienced. It does not provide any additional information or characteristics of those symptoms such as their frequency of occurrence or their severity. It is also worth mentioning that the current findings only show an association between AS and the experience of symptoms and not a causal relationship.

## Phase II

The second phase of the project aimed at exploring further the symptomatology of the AllC members who had experienced AS, and in particular the frequency of occurrence, the intensity and the modulators of the symptoms. It was carried out through an online questionnaire that was sent to the 310 interpreters (out of 488) who expressed their interest in participating in Phase II. 160 interpreters started the questionnaire (= a 52% response rate), 104 completed it and 56 filled it in only partially (= a 65% completion rate). The following analysis considered only the fully completed questionnaires. This sample of 104 respondents represents 21.3% of the *With AS* group from Phase I.

## Results

*Who were the respondents and what symptoms do they currently have?*

Table V below shows that like the respondents of phase I, most respondents of phase II were women (84%) and the mean age of the sample was 55 years old. Many respondents reported currently experiencing tinnitus (42.3%) and sound hypersensitivity (42.3%). Tinnitus was defined as a constant buzzing, ringing or hissing in the ears or head, and hypersensitivity to sound as perceiving low or medium intensity sounds as loud or very loud. Thirty-eight respondents (36.5%) reported currently experiencing pain in any location of the head, neck, or face with almost half of them experiencing pain in and/or around the ears. In addition, 50 respondents (48.1%) reported having previously felt pain following an acoustic incident at work. Surprisingly, only about a third of all the respondents consulted a health professional for symptoms that occurred after AS. These results suggest that the symptoms are either temporary or mild and do not affect the interpreters enough for them to seek medical and professional help. A total of 74 respondents reported that some specific sounds annoy/irritate them or put them in a state of distress (71.2%). A minority of 5 respondents reported that all sounds put them in a state of distress (4.8%). Jaw muscle tension and bruxism were the most reported conditions in the questions related to medical history.

*Frequency of occurrence of the current symptoms*

Figure 7 below shows the distribution of the frequency of occurrence for different head, neck and ear symptoms. Some symptoms are more experienced in general than others: only 17.3% of the respondents reported never experiencing headaches compared to 90.4% of the responses for facial pain. 17.3% of the respondents reported experiencing tinnitus "always" (i.e. constantly), 10.6% "almost always" (a few times a day) and 7.7% "often" (a few

times a week). Tinnitus is thus one of the most recurrent and permanent symptoms experienced by interpreters who previously experienced AS. Interpreters who previously experienced AS also experience a variety of head and neck symptoms such as jaw and neck tension, clogged ear and tension pressure in the ear. Some of these symptoms may be interconnected and have similar pathophysiological mechanisms (Noreña et al., 2018).

<b>Demographic characteristics</b>			
	Average	Minimum	Maximum
Age in years (SD)	55.3 (10.9)	29	80
	Men	Women	Prefer not to answer
Gender (M/F)	16	87	1
	Yes	No	I don't know
<b>Current symptoms</b>			
Sound hypersensitivity	42.3%	50.0%	7.7%
Tinnitus	42.3%	54.8%	2.9%
- if yes, (n=44)			
- it is stable, never varies	38.6%	61.4%	0.0%
- it increase/decrease with contraction of neck muscles	11.4%	88.6%	0.0%
- it increase/decrease with movement of the jaw	18.2%	81.8%	0.0%
- it increase/decrease with sound exposure	22.7%	77.3%	0.0%
Pain in any location of the head, neck or face	36.5%	59.6%	3.8%
- if yes, (n=38)			
- pain in and/or around ears?	47.4%	44.7%	7.9%
- pain triggered and/or worsen by sound?	28.9%	52.6%	18.4%
<b>Medical history</b>			
Repeated ear infections as a child	13.5%	80.8%	5.8%
Significant dental problems	14.4%	85.6%	0.0%
Temporomandibular joint disorder	15.4%	80.8%	3.8%
Muscle tension in the jaw	39.4%	54.8%	5.8%
Bruxism (snapping/grinding of the jaw during sleep)	46.2%	44.2%	9.6%

**Noise exposure at work**

Required to wear hearing protections	26.5%	70.4%	3.1%
Exposed to uncomfortable noise for prolonged periods	50.0%	45.9%	4.1%
Have you ever felt pain following an acoustic incident at work	48.1%	42.3%	9.6%

**Health professional consultation**

For symptoms that occurred after an acoustic shock (n=104)	33.6%	66.3%	--
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**Intolerance to particular sounds**

Particular sound annoyance, irritation, distress	71.2%	24.0%	4.8%
Annoyance and irritation to all sounds	4.8%	90.4%	4.8%

Table V: Characteristics of phase II respondents.

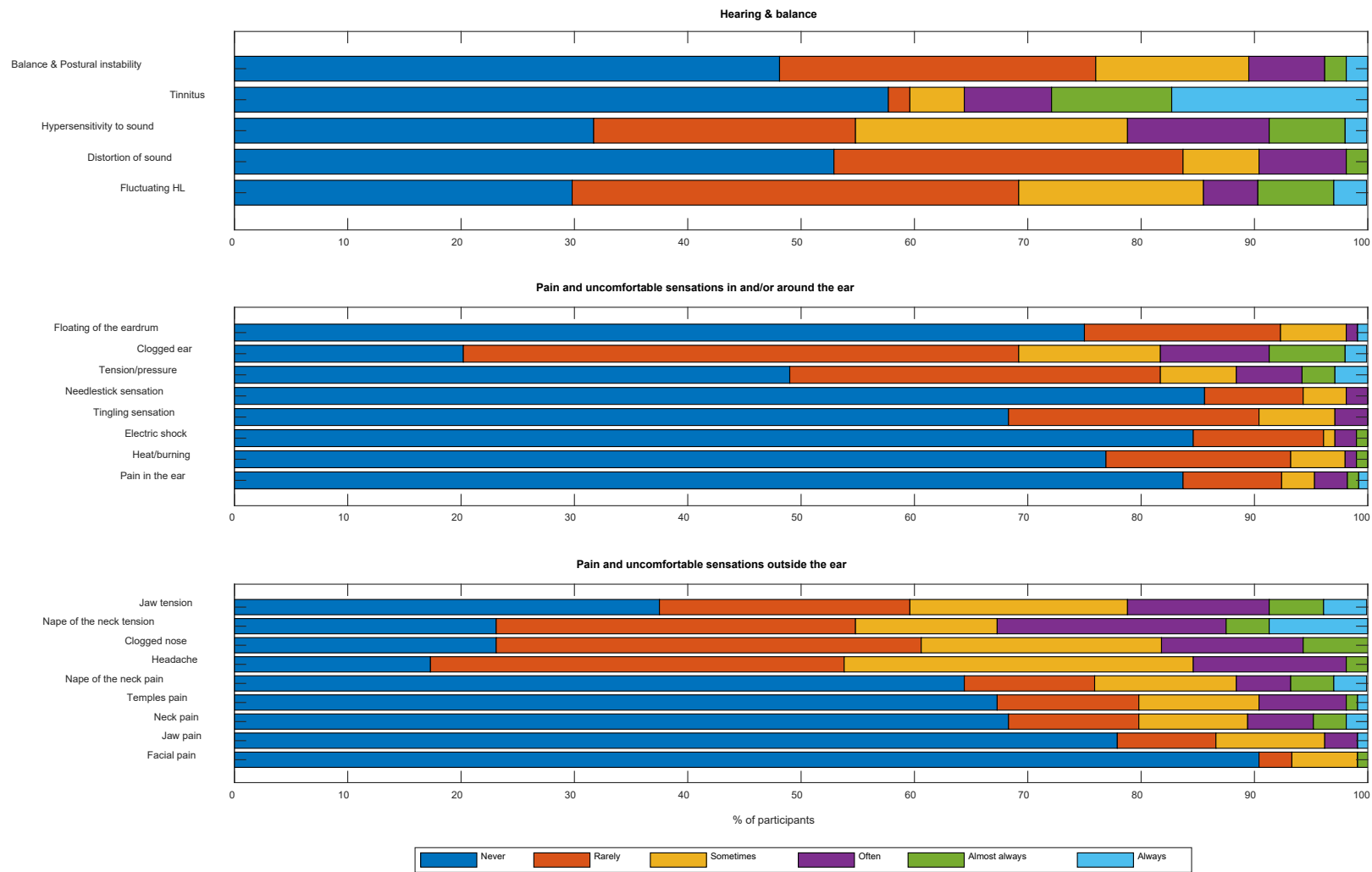


Figure 7: Distribution of the frequency of occurrence for different head, neck and ear symptoms.

### *Number of AS experienced and associated symptoms*

Almost half of the respondents (47%) reported having experienced between 1 and 5 AS during their work as an interpreter. Like for Phase I (25%), more than a quarter of respondents in Phase II (30%) reported having experienced more than 10 AS during their career (Figure 8, left panel). In addition, 58% of respondents (n=60) reported previous experience of tinnitus and clogged ear after acoustic incidents (brief loud noise) while working as an interpreter. These were the two most experienced symptoms followed by hearing hypersensitivity (47%), headache (42%), hearing impairment (30%) and stabbing type pain in the ear (29%) (Figure 8, right panel). These results corroborate the findings of Phase I suggesting that, AS are not isolated events in an interpreter's career. The results on the symptoms experienced after acoustic events extend the result obtain in Phase I, and they suggest that many of the symptoms experienced throughout the career of interpreters (Phase I) are similar to those experienced directly after acoustic incidents.

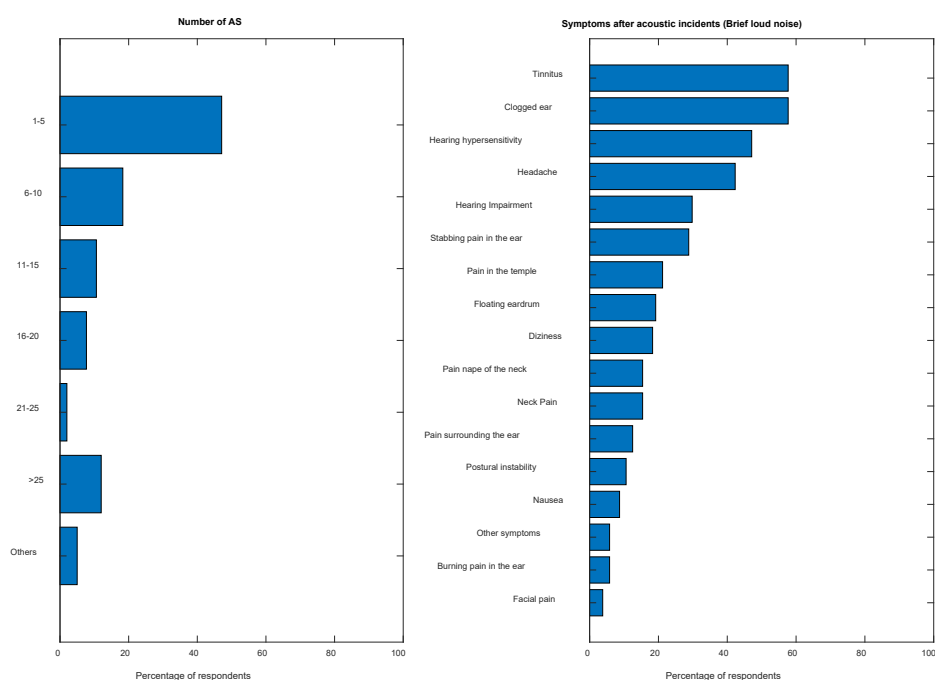


Figure 8. Left panel: Distribution of the number of acoustic shocks (AS), Right panel: Distribution of the different symptoms experienced after acoustic incidents (brief loud noise)



*How does the symptomatology of interpreters with AS compares with a large database of hyperacusis/tinnitus patients?*

To compare the symptomatology of the 'interpreters with AS' sample to a larger sample of hyperacusis-tinnitus patients, a principal component analysis (PCA) was run. This analysis included the answers provided on the frequency of occurrence for each symptom (the symptoms that are presented in figure 7) for all the respondents *with AS* (n=104) and all the patients with hyperacusis & tinnitus of the *Laboratoire de dynamique neurale et audition* at the Aix-Marseille University (n=722, unpublished data). The PCA analysis is used to assess association between variables. In this particular case, it one allows to see which of the symptoms are strongly associated and which are not.

Figure 9 shows the results of the PCA analysis for the variable: each arrow represents a symptom, and the closer the arrows are to each other, the more the symptoms are associated/correlated. For example, "fluctuating hearing loss (Fluctuation HL)" is well correlated with "tinnitus" and "neck pain" with "jaw pain". However, "tinnitus" and "jaw pain" are not well correlated. The x-axis of the PCA (Dim 1) is interpreted as the severity of the symptoms and the y-axis (Dim 2) as the location of the symptom (inner ear, middle ear, or head and neck). Using those same axes, we can look at the individual results that are presented in Figure 10. In this figure, every black dot represents an interpreter *with AS* and every red dot represents a hyperacusis/tinnitus patient. The individuals on the right side of the y-axis are considered to have more frequent pain symptoms than those on the left side who reported very low occurrence of pain symptoms or no occurrence at all. Based on this analysis, 14 out of the 104 interpreters with AS reported moderate to high occurrence of pain symptoms (13.5%) compared to 309 out of 722 (42.8%) for the symptomatic patients. These results suggest that moderate to high occurrence of pain symptoms in interpreters who have experienced AS is lower than in a population of hyperacusis/tinnitus patients' sample. The increased vulnerability to frequent pain symptoms of some interpreters who experienced AS should be investigated further.

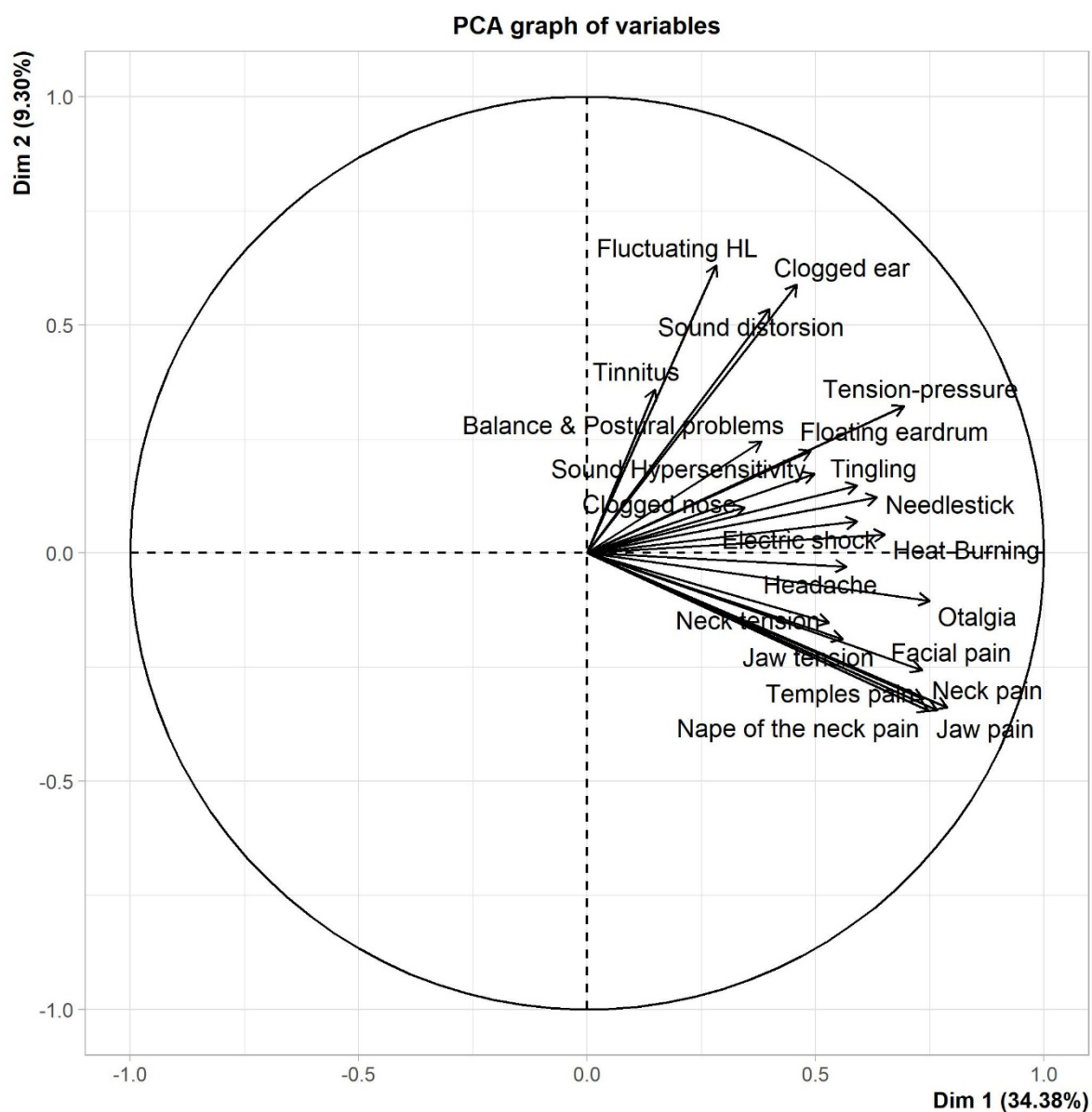


Figure g: Results obtained from the principal component analysis (PCA) on the frequency of occurrence of the symptoms. Each symptom is represented (arrow) as a function of the first two principal components derived from the PCA, that is, Dimension 1 and Dimension 2.

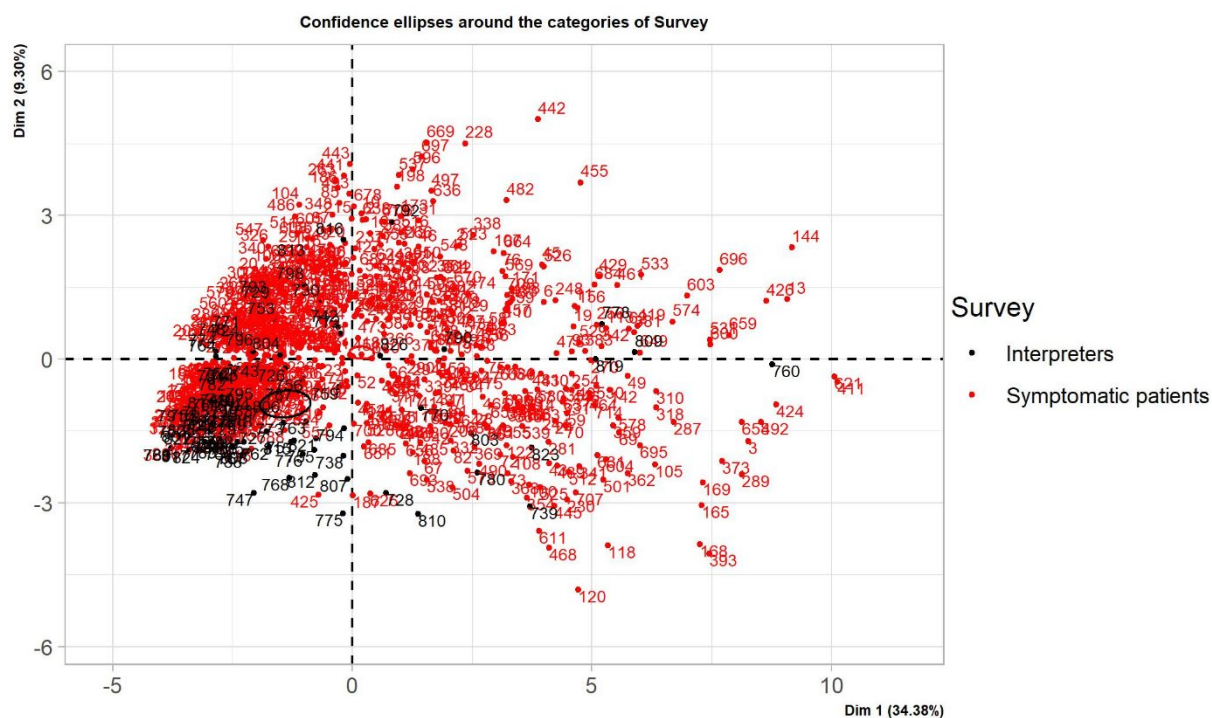


Figure 10: Results obtained from the principal component analysis (PCA). This figure represents the dispersion of all the individuals included in the analysis, that is, the interpreters (black) and the symptomatic patients (red).

## Conclusions, limitations & recommendations

The focus of the present research survey was to identify the prevalence of acoustic shocks amongst AIIIC conference interpreters to understand further the circumstances around these events and to explore the associated symptoms.

The analysis of the responses shows that a significant proportion of the interpreters surveyed (approx. 67%) have been exposed to acoustic incidents in the form of loud, unexpected, and brief sounds. Moreover, almost 1 out of 2 respondents (47%) reported previous experience of one or more symptoms following these acoustic incidents, with tinnitus being the most prevalent symptom, followed by hearing hypersensitivity, headaches, hearing impairment and stabbing type pain in the ear.

The prevalence of AS amongst interpreters is similar to the one reported for telephone operators in call centres, estimated between 13% and 46 % (El-Bestar et al., 2010; Loyal Poonamjeet, 2015; Subbarayalu, 2013). In addition, the symptoms reported by telephone operators following an experience of AS are similar to the ones reported by interpreters including, but not restricted to, pain, tinnitus, loss of balance and hypersensitivity to sound (Milhinch, 2002; Westcott, 2006).

The data collected in this study shows that the prevalence of the aforementioned symptoms was higher in the group of interpreters who experienced AS than in a similar group of interpreters (matched in age, gender and years of experience) who never experienced AS. This result suggests that AS and the symptoms experienced are linked. Moreover, interpreters who experienced fewer than 10 AS reported fewer symptoms than interpreters who experienced more than 10 AS, suggesting that the more AS interpreters experience, the more likely they are to experience symptoms. These results are in line with a previous study of telephone operators, which reported that those who had experienced more than one "shock" appeared to develop more severe symptoms (Hinke & Brask, 1999, Milhinch, 2002).

The preliminary analysis of Phase II revealed that 14 out of the 104 interpreters with AS reported moderate to high occurrence of pain symptoms (13.5%) compared to 309 out of 722 (42.8%) individuals of a symptomatic patient's database. These results suggest that moderate to high occurrence of pain symptoms in interpreters who have experienced AS is lower than in a population of hyperacusis/tinnitus patient's sample. This seems in accordance with anecdotal reports that pain symptoms are usually temporary, but this should definitely be studied more systematically. The increased vulnerability to frequent pain symptoms of some interpreters who experienced AS should be investigated further. However, the severe cases should be taken seriously, and more research should be

dedicated to understanding why some individuals are more prone to severe symptoms following the experience of AS. The susceptibility of some individuals to develop severe symptoms after traumatic sound exposure have been the focus of previous studies, mainly carried out by the army (Wilson, 1943). Future research should also focus on developing therapeutic avenues for those more severe cases.

From the many respondent comments, it is believed that a fair proportion of acoustic incidents are caused by mishandling of the audio equipment either by the client(s) (speaker, etc.), the technician(s) in charge of the audio mixing table, and even by the interpreter, and could therefore be avoided. These events include, for example, someone unexpectedly tapping on or yelling in the microphone, or mishandling cables of the audio mixing tables or of the interpreter's console. Therefore, a course of action towards reducing these detrimental events should focus on the training of clients, technicians, and interpreters in how to handle the equipment correctly to avoid such acoustic incidents. More information on how to use microphones safely should be given to all conference participants. As for telephone operators, "training should include proper fit, maintenance and use of headsets to reduce feedback, the need for keeping the volume levels of the headset amplifiers as low as possible" (Groothoff, 2005). Technology should be developed to avoid as much as possible these incidents from occurring, for example, a microphone that turns off automatically when dropped down could be a great asset to avoid acoustic incidents. In addition, headsets with sound limiters or add-in limiters are available on the market (Patel & Broughton, 2002). Although the review on the capability of such devices is beyond the scope of the present report, the benefits and limitations of this type of technology should definitely be thoroughly assessed. There is a definite need for new technology to prevent acoustic incidents and to block high-level sounds if the incident cannot be prevented.

Unfortunately, when they occur, acoustic shocks (acoustic incidents with symptoms) are not officially reported, as responses indicate: 77% of the interpreters who experienced AS did not officially report the incidents. Some respondents even considered these events as a normal part of their work; the potential incidents being "part of the job". This result has a major implication for the recognition of acoustic shocks as a true work-related accident by employers, work health and safety agencies and governments. As these events are not officially reported and collected, it is difficult to convince official agencies and employers that AS exist and that action should be taken in order to avoid them. However, one of the first reasons for not reporting those events was the lack of official reporting procedures. We hope that the current report will be used to convince employers and work health and safety agencies to develop official procedures to report

acoustic incidents and AS. In a similar fashion, the reports of work-related accidents leading to musculoskeletal problems have led to a better understanding the risk factors of musculoskeletal disorder, to epidemiologic surveillance of these accidents, to prevention plans and to better post-accident management of cases. On the one hand, it is difficult for employers to take prevention actions against acoustic shocks if they are not informed that these events are even occurring. On the other hand, being informed of what constitutes acoustic incidents and the symptoms of acoustic shocks, employers could recognize acoustic shocks and incidents, put in place prevention measures and create management systems including action plans following these incidents. As proposed for telephone operators in call centres, these actions could include "referral for audiological assessment, rest of the affected ear, temporary duties away from the headset and rehabilitation program" (Groothoff, 2005). However, as there is no current objective measure of the state of the ear (symptomatic or asymptomatic), we currently do not know how much rest is required for a total remission of the symptoms. As mentioned by Groothoff (2005), the action plan can "minimize the anxiety level and assist in a speedier return to work".

In 2012, the Australian Institute of Occupational Hygienists published a position paper on occupational noise and its potential for health issues that included a section on AS in call centres (Australian Institute of Occupational Hygienists, 2012). For a better management of AS, the authors recommended the development a reporting system for AS that should include "the time and date of the incident, a description of the noise including a way of indicating the loudness and other characteristics of the sound, the duration of the exposure, the activities carried out at the time, the symptoms experienced immediately after and later, follow-up e.g. referral to audiologist, details of headsets and equipment used and whether or not this equipment has been isolated" (Australian Institute of Occupational Hygienists, 2012). The code of practice of occupational safety and health in call centres approved in April 2005 by the Australian Minister for consumer and employment protection of Australia also states in their "Management of Acoustic Incidents" section that the employee should report the incidents and any symptoms to the supervisor/employer and that they should ensure that the event is recorded and logged (Commission for occupational safety and health, 2005, p. 30). In addition, the code mentions that the employee should be referred to a health specialist if the symptoms are severe or persistent, and that they should investigate the cause of the noise including a quality control of the headset. It is also recommended that special consideration should be given to employees who experienced AS, ensuring for example that they are not exposed unnecessarily to controllable noises, such as loud alarms during fire drills

(Commission for occupational safety and health, 2005). Such initiatives could be used as examples for professional associations and employers of conference interpreters to develop efficient procedures for the reporting and monitoring of acoustic incidents.

The current report highlights the urgent need for more research on conference interpreters' hearing health. To date, there is no available report, measurements or data that provide a good understanding of the levels of noise interpreters are exposed too; if they exceed noise regulations and put interpreters at risk of developing hearing loss and other auditory pathology. Such research was carried out for telephone operators (Patel & Broughton, 2002; Smagowska, 2010). Quantitative and qualitative data on 'listening effort' and the fatiguing effects of effortful listening (because of poor sound quality) for conference interpreters could also be studied to help preserving interpreters' hearing health. In addition, as part of ongoing medical monitoring, all interpreters should perform an annual audiological evaluation including a hearing test. It is difficult for any hearing healthcare professional to determine the impact of acoustic shock on the hearing health of an individual without proper baseline measurements. Conference interpreters who experience severe symptoms after an acoustic incident should rapidly consult a hearing healthcare professional. To better understand the complex pathophysiology of the symptoms, it would be interesting to recommend that, after an AS, patients assess the severity of each of their symptoms until the complete remission of the symptoms (Londero et al., 2017).

The recent rise of Remote Simultaneous Interpreting (RSI) due to the COVID-19 pandemic and its effects on interpreters' health will also have to be considered as it appears to have led to an increase in the reports of symptoms such as headaches, nausea, and tinnitus among interpreters (The Hill Times, 2020). According to the Hill Times, more than 50% of injuries reported by interpreters at the Bureau of Translation of Canada between the beginning of 2019 and May 1, 2020, have taken place in the last three weeks of April 2020, drawing attention to the possible effects of RSI on interpreters' health, and potentially leading to an increase in sick leaves with interpreters needing rest and healing. Data from the Translation Bureau shared with AIIIC Canada shows that, between March 16 and April 29, the number of 'reported hazardous occurrences' during tele- or videoconferences increased significantly but there were no reported 'minor or disabling injuries'. Interpreters attributed headaches, earaches, and fatigue to poor sound quality, corroborating many anecdotal reports stating that symptoms can appear following a remote simultaneous interpreting session during which no acoustic incidents occurred. This suggests that AS are not necessary to occur for an individual to experience symptoms. It is unclear though if the symptoms are related to the same pathophysiological

mechanisms as the severe ones reported by interpreters who experienced AS, or to different ones. As for many other elements discussed in this report, more research should be undertaken on the effects of poor sound quality and of listening effort for AIIC to better understand the various hearing issues conference interpreters are facing.

**Summary of recommendations:****Training, prevention, and medical monitoring**

1. A course of action towards reducing detrimental acoustic events should focus on the training of clients, technicians, and interpreters in how to handle audio equipment correctly during conferences to avoid acoustic incidents.
2. Information on how to use microphones and headsets safely should be given to all conference participants.
3. The benefits and limitations of technological devices such as headsets with sound limiters, add-in limiters or adapters, should be thoroughly assessed.
4. To raise awareness about acoustic incidents, professional associations and employers should provide interpreters with information about acoustic shocks and the associated risks and effects, as well as about noise regulations in their national jurisdiction.
5. Professional associations, employers, work health and safety agencies should be urged to develop official procedures to facilitate the reporting and monitoring of acoustic incidents occurring in the workplace.
6. As part of ongoing medical monitoring, interpreters should be encouraged to perform an annual audiological evaluation including a hearing test.



7. Conference interpreters who experience severe symptoms after an acoustic incident should rapidly consult a hearing healthcare professional (and assess the severity of each of their symptoms until their complete remission).

### **Research**

8. More research on conference interpreters' hearing health should be encouraged to obtain measurements and data that provide a better understanding of:
  - the levels of noise interpreters are exposed too and if they exceed noise regulation and put interpreters at risk of developing hearing loss and other auditory pathology
  - the fatiguing effects of effortful listening (because of poor sound quality).
9. The increased vulnerability to frequent pain symptoms of some interpreters who experienced AS should be investigated further.
10. More research should be dedicated on understanding why some individuals are more prone to severe symptoms following AS, and on developing therapeutic avenues for such severe cases.

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