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>> SIMÃO CAMPOS: Good afternoon, ladies and gentlemen. I'd like to welcome you to WSIS 2018 Forum session where we focus on a very interesting and important topic to raise awareness, that is the safe listening initiative that start with WHO and with which ITU is part for its promotion so we're going to hear a little bit about the important topics in this area.

Highlighting that one of the people that -- groups of people that we are most excited about the young listeners that are being exposed to sound and at high levels at a very early age so we're looking at possibly in a few years to start seeing people with hearing loss that is coming prematurely in their lives.

So we have here in the panel two presenters. We have -- actually Shelly from -- Shelly Chadha from WHO, who is here for two speakers, because Elena Altieri importantly could not be here today. So going to have an introduction of the topic on the general initiative, and then Shelly's going also to talk about other aspects of communications that Elena is focusing on.

After that we have the Rapporteur for the Question 26, Study Group 16, with developing a standard together with WHO for

personal audio systems. So Shelly, please go ahead.

>> SHELLY CHADHA: Thank you, Simão. So since we talk a lot about ICTs and hearing loss, I thought let me first give you a little experience of what hearing loss means, what it is like to have hearing loss.

[Hearing loss simulator playing]

So this is just to give you an idea of what it sounds like to have hearing loss, which is not just to have complete loss of hearing, but actually one can this mild loss, moderate loss, or severe, and of course, in certain cases, profound loss.

What is really a concern for us is the fact that the moderate and greater degrees of hearing loss which we label as hearing loss is on the right. It has been rising for the past decade at least that we estimated, and we project that unless action is taken, this is going to increase considerably in the coming years, and by 2050, we can expect to have nearly one out of every 10 persons would be having disabling hearing loss. So those are certain factors which is why we want to pay so much attention to it.

What's important is also to realize that there are many factors across the course of one's life which affect our hearing and lead to hearing loss, so as a child it could be certain infections. Infections even before a child is born, maternal infections or childhood infections. It could be otitis media, ear infections. It could be due to certain genetic predispositions and very importantly, it could be due to exposure to noise across the course of one's life. It could be due to certain medicines which are taken for various illnesses.

It could also be as one grows older diseases such as diabetes, hypertension, smoking, other chronic illnesses contribute to hearing loss. Many of these causes are preventable. So just sharing briefly what are those factors which are preventable such as ear infections. Infections which affect nearly 330 million people globally and these infections which can be treated.

There is the hearing loss which is caused by the use of certain medicines, medicines which are commonly prescribed for infections, for tuberculosis, for malaria and treatments for cancer. These are powerful tools of medical care, we don't deny that. It must be used wisely so the impact on hearing loss can be minimized, and then the concern which we're highlighting today is about noise induced hearing loss, and hearing loss due to exposure to noise occurs both in occupational settings as well as in recreational settings. In occupation settings it is well established that this is the second most common risk factor encountered in the workplace. In many countries there are huge amounts paid out by employers as compensation, and many

countries, developed countries, have implemented measures to control to prevent occupation noise induced hearing loss which has led to reduction in hearing loss in the workers which shows to us also that reducing noise exposure is an important preventive strategy to hearing loss.

In the recreation setting what we find is over a billion young people are at risk of hearing loss just because of the way they're listening to music. Listening to music over their personal music player, at various recreational venues such as when going to concerts or discos, and sporting events, even bars and restaurants. So over a billion young people are at risk of hearing loss just because of the way they're experiencing music.

And what is important is also to raise awareness and put in place certain legislation, certain regulations, in order to minimize this.

Before I talk about the details of what WHO is doing, I wanted to just share also how noise impacts hearing, and how it leads to hearing loss. So this is a very simple animation to show how hearing works. These are the sound waves, which come inside the eardrum. This is the tiny very thin membrane which separates the outer ear from the middle ear, and as the sound waves hit it, this is set into motion, which also sets into motion these little bones behind the eardrum, which causes further movement of fluid, which is -- which lies in this shell-shaped structure, which is known as the cochlea.

Once there is movement inside, vibrations are transmitted inside the cochlea, it causes a movement of hair cells, tiny little hair cells -- you can see this diagram here. These are tiny little hair cells -- which move, and every time a hair cell moves, it leads to generation of an impulse in this nerve, this blue-colored nerve that you see here, which is carried to the brain through the brain stem to the brain and it is analyzed by the brain and perceives sounds and of course the brain then further familiarizes it, contextualizes it and we can understand sound, so this is just basically how we hear sound.

Very important in this entire process, of course, the whole chain is important, but these are the little cochlear hair cells which are very important. Now, these hair cells move every time there is a vibration, there is a sound. And as you can imagine, if you go to a party and you dance a bit, you come back a bit tired and then you rest and you're better. But if you go to a party and dance a lot, then you come back very much exhausted, and perhaps you're still tired, you just want to lie down on your couch and go to sleep.

And that's exactly what happens with these hair cells. When the hair cells move slowly, as in normal conversation or normal listening, well, they don't get tired. But when they go out and

party and listen to loud music, they have to work a lot, listen a lot and that's why they get tired. That's why if you've ever been to a very loud concert or loud disco, you come out and you feel your ears are a bit lost or you may feel that the hearing has reduced and that's because the hair cells are tired.

And then you can sit in a quieter environment, the hair cells recover, and your hearing comes back to normal. But what happens when these hair cells, this happens to them let's say every day, or many times a day, or many times a week, and then these hair cells finally are too exhausted, and they say we can't dance anymore, and they just die. And the moment that a single hair cell dies, in that moment, we lose our hearing just a little bit. There are millions, there are billions of hair cells in our ears but as of now, there is nothing known to humans that can regenerate a hair cell. So we're born with a certain amount, and it can only go down. We can never replenish that.

So it's important to list preserve these hair cells, because as they die out we start to have hearing loss, and this is what hair cells which have been affected by noise, this is a diagrammatic depiction of an actual microscopic picture of what damaged hair cells look like.

So it's important for us to understand that the hearing loss which occurs due to such damage, damage to these hair cells, is irreversible, because the hair cells cannot be regenerated. At the same time, it is completely preventable, preventable through safe listening practices.

And what then are these safe listening practices? What can prevent hearing loss? Well, it's simple practices. Reduce the volume. Keep the volume down. Limit the amount of time which is spent listening. And protect the ears from loud sounds.

It sounds very simple, but when you think about it, well, how much should I listen? And how long?

Typically in occupational settings you say that volumes of 85 decibels can be heard for an 8 hour period and beyond that, it becomes dangerous, and the chances of hearing loss increase.

In recreational settings we would suggest that volume be limited to 80 decibels for a recommended 8-hour duration. But the question here is: How does the listener, when you're listening on your device or going to a restaurant, how do you know that this is 80 decibels or 85 decibels?

Well, typically you don't, but you can follow certain rules, just general rules, which can help you to maintain the loudness levels below the recommended levels.

So on your personal audio device, if you make sure that you keep the volume to below 60%, chances are that you will not damage your hearing. Ultimately you can also determine what is

your comfortable listening level? So when you're sitting and listening to a device and a person sitting next to you should not be able to hear your music through your earphones.

If you're in let's say in a concert, if you can listen to the person who's speaking to you at an arm's length, chances are that the sound level is safe, but if you cannot, if you have to raise your voice to make yourself heard, or ask the person to raise their voice in order to hear them, then chances are that the sound level is too high.

You can also use apps to assess the sound levels, both on your device and in the environment. And you can use noise-chance link earphones, which reduce the need to raise the loudness.

Regarding how long, again because sound as Masahito will explain, that the amount of the volume, how much you can listen to and how long you can listen are interlinked and if you listen louder, you can only listen for a lesser amount of time, so again, this is something which will be explained by Masahito and how we're trying to address this through WHO and ITU, but generally if you maintain -- if you keep your listening period to between 60 to 90 minutes, chances are you will still be safe, probably.

In a noisy environment, it's important to limit the time and frequency, how often you go to a concert or a disco. Use ear plugs when possible. In a country sometimes ear plugs are provided free of cost. So use ear plugs. Give your ears a break in between and make sure that if you're in a concert don't stand next to the sound sources so these are certain principles which can help you limit your exposure to sound.

Well, in order to really make this very concrete for the users, for listeners, WHO in 2015 launched the Make Listening Safe initiative, and this initiative was launched mainly because we estimated that 50% of people who use personal audio systems, personal audio devices, like MP3 players, smartphones, et cetera, listen to their music too loud, so at least 50% of people who are using this are putting their hearing at risk.

At the same time, among those who frequent concerts and other entertainment venues. Around 40% are exposed to potentially damaging sounds at these places, including also sporting venues.

So in consideration of this and knowing that hearing loss which is caused by such noise exposure, such sound exposure, is irreversible, the thinking was that the ICTs and the technology which is causing the challenge, the technology such as the smartphone and such, which are part of the challenge, we see the ICTs, the mobile phones, smartphones, as a causative factor for this hearing loss, but can we not make it part of the solution by using them to reduce the risk of hearing loss, so by making

the devices compatible with actually risk reduction rather than risk augmentation, and use these devices as they have been used, and are being used in various other public health issues to raise awareness about hearing loss, and their role in safe listening.

So based on this, the approach which WHO has, on one side to raise awareness, raise awareness amongst the listeners, amongst policymakers, amongst Civil Society, about the need for safety and at the same time make sure that suitable products are available so that people can actually practice safe listening so we want to on one hand raise awareness, create a demand for safe listening. At the same time we want to make sure that the environment is right for users to actually practice safe listening, because there is in a way, yes, you can try to keep the volume below 60%, and maybe some people would do that for a week or two till they realize: I go on a train every day, and I can't listen to anything at 60% so this doesn't work for me.

But if we can get them a product which allows them to see how they're listening, how much sound they're being exposed to and are they putting their hearing at risk or not, then we're empowering them with that information, which they can use to make the right decision. Similarly, it's good to say that don't go to a disco too frequently but then you don't want to be an outcast and then you're in a disco or a concert, if the sound levels are too high, there is really nothing much that the listener can do, except, well, walk out of the place, which they don't want to do. You can't control the environment.

But if we can put in safe regulations so that every such venue, there is the need to provide information, there is need to provide ear plugs, et cetera, then the user who wants to listen safely can have that option to practice safe listening and save their hearing.

So with this approach, WHO identified three strategic targets for safe listening personal audio systems, safe listening behavior, and safe listening entertainment venues which are crucial to reduce hearing loss in the target group.

So for safe listening personal audio systems, we want to develop standards which pertain to audio systems such as smartphones, MP3 players, et cetera, and these are being developed in collaboration or rather are being led by ITU, but also with collaboration of all other stakeholders, academicians, industry partners, audiologists, and end users, as well.

So these are devices for -- these are standards for devices so that the devices, instead of being part of the problem, should also become part of the solution, and these focus on three things. The standards should allow the user to on one hand monitor how they're listening. They should be able to

inform the user how they're listening and what they can do to make their listening safe. And thirdly, provide concrete guidance as to, do this, or even have the option of the smart volume so that they can automatically reduce the volume when the user opts for that.

So the idea is to allow the user to monitor, and I will allow Masahito to kindly explain that further, but also to give certain warnings, allow the user to access information through the device and external link, as well as provide notifications, messages to the user, so that they can receive concrete recommendations that, you need to put your volume down below this level now that you have, you know, reached so much of a level.

So these are the standards. The second part of the strategy is to raise awareness in order to change listening behaviors in the at-risk population, and in order to do this, WHO is working on a campaign, a health communication campaign, in collaboration with various experts in this field, so just showing you here, these are some -- this doesn't here have an audio. We have a file with audio, as well. So these are for example certain social media GIFs that we developed in order to raise awareness through WHO's social media, et cetera.

We try to raise awareness using various messages targeting the general public, as well as targeting makers of the products, for different groups. These are some products which we put out through our social media about the -- explain the concept of daily sound allowance and how the sounds that our ears hear throughout the day, through the earphones, at the workplace, affect our sound allowance, and can affect our hearing using this egg image as our key vision.

So these are some -- we're also in the process of developing an educational app to promote safe listening practices, an app which can provide some information about what is meant by safe listening. It can have a media player whereby users can access some of their own music and determine what 80 decibels looks like on their own device, what 85 decibels look like, and how long can they listen at their threshold level before consuming their sound allowance, in order to give them certain notifications and daily messages, in order to reduce their risk of hearing.

The third part of our work pertains to developing a regulatory framework to control sound exposure in the broader recreation environment, so which is a fact -- which is an aspect we haven't yet started working on. We've only started right now thinking about how we would take this forward and what all it entails in terms of developing such a regulatory framework.

So we envision this going forward in the next 3 to 4 years.

WHO works in partnership, and our partnership with ITU is one example of such partnership, and we invite also other partners to join us in actually taking the messages of safe listening down to the community and also promoting the adoption of the standards which Masahito will talk about. So thank you very much, and just to say that we need to make more noise in order to reduce noise. Thank you, and I hand over to Simão.

>> SIMÃO CAMPOS: Thank you, Shelly.

[Applause]

I'd like to have some questions for Shelly at this point in time. Yes, Hiroshi?

>> Thank you, Simão. Thank you for this very interesting presentation. And my question is about noise level in a plane. Is that noise really dangerous or safe to be there for a long time? Does it depend on length? Does it make any difference between while we're awake or while we're asleep? Thank you.

>> SHELLY CHADHA: Thank you for that question. I'll answer the second one first: It doesn't make any difference that you're asleep or awake because our ears are always working and that's why we can hear the telephone ringing and it wakes us up in the morning.

Regarding the noise levels in the plane, it is usually not to the extent it can harm your hearing, but what can harm your hearing is when you turn up the volume. When you're listening to let's say or watching a programme on the -- during the flight, and because of the background sound, you need to turn up the volume of your headphones in order to listen properly.

And that can be harmful, so using noise cancellation earphones or headphones if those are available certainly makes a huge difference to the amount of volume you need in order to hear properly in these settings.

You can also monitor, if you wish. There are many apps available which can help you to monitor the background level of noise, so you can also monitor if at any point you want to make a complaint to an airline that it's very noisy. You can monitor also the background level in the airplane during your flight.

>> Thank you.

>> SIMÃO CAMPOS: Thank you Hiroshi. Are there any remote participants? Okay, very good. In that case I'd like to go on to the next presentation for Masahito. So just... Yes. Just tell me, and I'll move -- oh.

>> MASAHITO KAWAMORI: Thank you very much. Okay. I'd like to start the presentation about safe listening standards for personal audio systems. My name is Masahito Kawamori. I'm the Rapporteur of Question 26 of Study Group 16 of ITU-T. Next, please.

WHO as Shelly has explained WHO and ITU have started on this

work on safe listening, making listening safe initiative in 2015. That was when we had the first joint stakeholders consultation on safe listening devices, and based on the discussion, we agreed to create a new draft recommendation, F.SLD guidelines for safe listening devices/systems. And this is the scope of the -- this new recommendation, draft recommendation, guidelines for safe listening devices/systems.

The scope is for personal audio system, and the following devices are excluded from the scope: Communication devices such as walkie-talkie, rehabilitative and medical devices such as hearing aids, assistive listening devices, and also other cochlear implant systems, as well as personal sound amplification devices or products, PSAPs, and also professional audio equipment devices. These are excluded. So we're concentrating on personal audio systems.

Next please. And what is a personal audio system? This is one example of such a device. It typically consists of two parts. One is personal audio device, which plays back music, and sometimes it comes from the streaming from the Internet, for example, and typically has a listening device which is a headphone or earphone. Sometimes it's wirelessly connected through bluetooth.

So as a system, these two devices comprise a personal audio system, and this is our target scope of this draft recommendation.

Next please.

And we're primarily focusing on what we call dosimetry, which is measurement of what we call sound dose, how much pressure you receive, with an upper ceiling to protest against acoustic trauma which is varied pulsative sound that would destroy hearing, injure hearing. And also we have -- we have as a focus health care communication, which is an important aspect of this recommendation, which Shelly has just explained as raising awareness, and also to warn the user.

Next, please.

Before we go into the details of the standard itself, it would be good to have very brief introduction to what it means to have -- hearing, and Shelly has explained the mechanism of the ear itself, and this diagram shows the physical aspect of sound.

Sound is propagation of energy, or pressure, through a medium such as air, received by ear. And sound energy and pressure are usually associated with loudness. So when you hear loud sounds, that means you have lots of energy hitting your eardrum. And excessive energy or pressure, I.E. loud sound received by ear, can result in hearing damage. That was the explanation that Shelly made.

And air pressure is commonly expressed in Pascal. This is the unit that typically is used for sound pressure or air pressure. For example Hurricane Katrina in 2005 had 902 hectopascal, it's a hurricane in the United States or 90,200 Pascal, and 2600 Pascal is the pressure to make water boil at room temperature around 22 Centigrade degrees. So this is the unit that we use for air and pressure usually. But in conventional sound literature, literature, related to sound, sound energy is expressed in terms of decibels, and there are many definitions of decibel which makes things a bit confusing for the general public.

Decibel itself is a logarithmic value used to express the ratio of one value to another. So there are many, many different versions of decibel possible, and specifically for sound, the common decibel unit is called decibel at sound pressure level. This is the ratio of given sound pressure and a reference pressure, usually taken as 20 micro-Pascal. This is the minimal pressure that a human ear can detect at 1,000 hertz. And this is -- it's very important to note that decibel is not a simple absolute value, and simple addition is not possible.

Next slide, please.

And the relationship between decibels and pressure may be interesting, because it shows how human ear is sensitive, how extremely sensitive it is, and sound pressure expressed in Pascal makes it easier to appreciate this fact. Because as I said, 0 dB speak sound pressure level. This is the sound pressure level you can hear anything. This is the smallest sound you can hear, which is 0.0002 Pascal, or 20 times 10 to the minus 6th power Pascal. We don't know what it is. It's about 20 times one million Pascal and 20 dB SPL is 0.0002 Pascal, 60 dB is 0.02 Pascal. 60 dB is normal speech loudness, so usually this is the level that you use. 80 dB is 0.2 Pascal. This is the level that we hear for example in airplanes. And 94 dB Pascal is 1, dB SPL is approximately the same as 1 Pascal, so 94 dB is 1 Pascal and actually 1 Pascal is about the same as the pressure exerted by a U.S. dollar bill, one paper, resting flat on the surface of a table.

You can show it's very, very light and that's one Pascal. Then you get 100 dB, that's 1 Pascal, and 140 dB pressure level, sound pressure level, is 200 Pascal. And that's 10 to the 7th power. That's 10 million times the threshold of sound hearing so this is the threshold of hearing. After this, you lose hearing. So 140 dB is the utmost pressure that you can get. And this is 10,000 times more pressure than ordinary conversation, which is 60 dB.

This is the range that we can hear. But the problem with decibel unit is for example people will think that, oh, 80 dB

and 60 dB, there's only 20 dB difference but actually it's 10 times more, 80 dB is 10 times more and 100 dB, as I said, 94 dB and 100 dB, there's only 6 dB difference but actually 100 dB has twice the pressure level.

So it is okay to use decibels, but in terms of this monitoring, sometimes decibels give a false impression, so it will be better to use something more understanding. Next please.

And that's why we're trying to come up with a new unit in a sense. And there's a hey both sis called equal energy principle. This hypothesis says that the total effect of sound is proportional to the total amount of sound energy received by the ear, irrespective of the distribution of that energy in time.

In other words, equal amounts of sound energy will cause equal amounts of sound induced hearing loss regardless of the distribution of the energy across time, which means as the graph shows, the time variance of the sound level could be different, but they can average out in the same time frame, or -- next, please --

Or actual time varying sound with less energy for longer period of time can be the same as more energy for shorter period of time.

So if you listen louder music, then you can shorten the duration of the listening period, or if you're listening to softer music, then you can have longer allowance of duration.

Next, please.

And based on this equal energy principle in hearing impairment risk assessment, we are trying to standardize what we call dosimetry, and in a simple language a dose is the energy of sound pressure level integrated over the duration of the exposure of time, and the unit we use in this draft recommendation is Pascal-squared hour, which is a little different, but based on the Pascal that I just explained.

And this is comparable to L-EQ, which is used in occupational setting of noise induced hearing protection.

Next please.

And this is the definition of sound dose, definition. The first one is speech pressure level, and dose is defined as squared pressure taken from the time 1 to time T integrated. And it looks a little daunting, but it's not so difficult to calculate.

So for example, dose of listening to sound with 80 dB sound pressure level for 40 hours can be calculated in such a way that I just presented in this slide, and in the end, it comes down to 1.6 Pascal-squared hours. So this is 80 dB SPL for 40 hours.

Next please. And our previous studies show that acceptable

levels of risk which means that if you keep your sound pressure level or dosage to this level, then you won't get hearing impairment, which is 40 hours for 80 dB SPL in a week which is 1.6 Pascal-squared hours. But our team debated and we decided we needed a stricter requirement especially for young children as compared to adults and for that strict level of risk, we specified 40 hours for 75 dB SPL in a week which is 0.51 Pascal--squared hours.

Next please. So that was the definition of dose, and based on that dose, we've can create what we call dosimeter that will calculate how much dosage you have received with the sound. And that was what Shelly just explained.

[Captioner disconnected - 14:10 CET]

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