



Meeting report



WHO-ITU consultation on the Making Listening Safe initiative

6-7 March 2017

WHO headquarters, Geneva, Switzerland

WHO Department for Management of NCDs, Disability, Violence and Injury Prevention

ITU Telecommunication Standardization Bureau

Executive summary

A WHO-ITU consultation on the Make Listening Safe initiative was held in Geneva, Switzerland on 6-7 March 2017 involving members of the expert groups and other stakeholders, with the objectives to: review progress made in the different areas of work as part of this initiative, determine appropriate exposure limits for safe listening and develop a health communication strategy and a research protocol.

Participants included experts in the field of audiology, otology, public health, epidemiology, acoustics, sound engineering, representatives of professional organizations, standardization organizations, manufacturers and users.

The meeting highlighted the need for a collaborative and consistent approach towards safe listening which takes into account the viewpoints of all stakeholders. Discussions focussed on determination of suitable exposure limits to be included in the standards for personal audio systems; evaluation of safe listening software application; health communication strategy for safe listening including messaging to be included in the standards and the app; outlining the research protocol and drafting of the global standards.

The key outcomes and next steps with respect to different areas are:

- Global standards for personal audio devices: drafting of the global standard ITU-T F.SLD initiated in October 2015 is progressing. This "integrative" standard will be aligned as far as possible to specifications from other standardization organizations and is expected to be finalized by mid-2018.
- Exposure limits for estimation of sound dose: a graded approach will be followed with three levels of exposure. Users should be provided information in order to make an informed choice on their risk level.
- Safe listening software application: would be reviewed as per inputs received and launched in a few months' time.
- Health communication: many channels and ways to disseminate information on safe listening were suggested. WHO will create a webpage on safe listening. All partner organizations were encouraged to explore ways and means to promote safe listening. Messages to be included in the safe listening app were discussed and will be finalized in next few weeks. A policy brief on integrating information on safe listening as part of the global standards for personal audio systems will be finalized by early 2018.
- Research protocol: key questions for developing a standardized research protocol were addressed. The first draft of the protocol will be developed and circulated to an expert group.

The meeting concluded with the agreement that another meeting would be organized in 2018 to move this initiative forward.

1. Introduction

WHO estimates that 1.1 billion young people worldwide could be at risk of hearing loss due to unsafe listening practices. The current trend of regularly listening to music at high volume and for long duration poses a serious threat to one's hearing. Hearing loss due to exposure to loud sounds can be prevented through certain simple practices, such as keeping the volume within safe listening levels and limiting the time spent engaged in noisy activities. While prevention of hearing loss through safe listening practices is the responsibility of the individual, the onus of raising awareness and creating an environment for safe listening lies with the community, manufacturers of devices, governments, and other stakeholders. Taking cognisance of these facts, WHO launched the Make Listening Safe initiative in 2015, with the overall vision to ensure that people of all ages can enjoy listening with full protection of their hearing.

WHO has adopted a consultative approach in the development of this initiative and has partnered with the International Telecommunications Union (ITU) in this effort. A stakeholder's consultation was held on 1 October 2015, followed by an expert group meeting on 2 October 2015. Since then, WHO has constituted working groups to look at each of the areas of work mentioned above. The groups provide technical inputs and guidance to the development of this initiative.

A strategic planning meeting was held on 6-7 March 2017 with the objectives to:

1. Review the progress made in the different areas of work.
2. Agree on the components of the health communication strategy.
3. Review the contents of the research protocol.
4. Discuss testing, finalization and dissemination of the safe listening app.
5. Determine next steps.

Participants at the meeting included:

- Experts in the field of audiology, otology, public health, epidemiology, acoustics, sound engineering, who are members of the Make listening Safe working groups
- Standardization organizations
- Professional organizations
- Manufacturers
- Users

2. Summary of proceedings

2.1 Opening session

The meeting was opened by **Dr Etienne Krug, Director of Department for Management of Noncommunicable Diseases, Disability, Violence and Injury Prevention, WHO**. Dr Krug introduced the Make Listening Safe initiative and highlighted the growing risk of hearing loss posed by an increase in use of technology. He highlighted the importance of the partnership with ITU and for it leading the cooperation with other standardization organizations and the private sector. He also thanked the attendees for their expertise and engagement in the development behind this initiative.

Dr Shelly Chadha, Technical Officer, Prevention of Deafness and Hearing Loss, WHO, presented WHO's vision toward hearing loss prevention. She spoke of the challenges and barriers that WHO faces in addressing hearing loss as a public health issue and elaborated on the advocacy and technical support approach that WHO provides to Member States. Dr Chadha introduced the Make Listening Safe initiative and its three areas of focus: technology; research and risk assessment; and health communication. Further, she gave insight into the collaborative approach that is being taken involving ITU, standardization organisations, stakeholders, experts and users. Dr Chadha thanked the attendees of the consultation for their partnership.

Dr Alarcos Cieza, Coordinator of the Prevention of Blindness and Deafness, Disability and Rehabilitation Unit presented on the objectives and expected outcomes of the WHO-ITU consultation on Make Listening Safe. Dr Cieza discussed the working groups that were established in 2016 to explore the various aspects of the Make Listening Safe initiative including: standards for safe listening devices, safe listening app, determination of exposure limits/risk criteria, health communication and research protocol. She detailed the outcomes that were to be reached from this 2017 meeting as follows:

1. Standards for safe listening understood and way forward agreed.
2. Exposure limits for the standards agreed.
3. Safe listening app reviewed and messages proposed.
4. Communication strategy defined.
5. Key aspects of research protocol decided.

Following this, Dr Cieza outlined the structure of the consultation, breaking the two days down into categories of presentations and working groups.

2.2 Presentations – 6 March 2017

2.2.1 CDC study on non-occupational noise induced hearing loss: Vital signs

Mr John Decker, Associate Director for Science, National Center for Environmental Health/Agency for Toxic Substances and Disease Registry, USA, presented a study held in the United States of America in 2011-2012 which concluded the incidence of noise induced hearing loss is significant and largely preventable. Education, testing and protective strategies were suggested as methods to prevent harmful noise exposure and associated hearing loss. Mr Decker presented key statistics throughout his presentation surrounding the relationship between hearing loss and age, gender and occupational noise such as job exposure. A detailed report can be accessed at:

https://www.cdc.gov/mmwr/volumes/66/wr/mm6605e3.htm?s_cid=mm6605e3_w.

2.2.2 Standards for personal audio devices

Situational analysis of standards for personal audio systems

Mr Simão Campos, Counsellor, ITU-T Study Group 16 "Multimedia", began his presentation by introducing ITU as the specialized agency of the UN for telecommunications and information and communication technology (ICTs). Mr Campos detailed the three Sectors of ITU: Radiocommunication, Telecom Standardization, and Telecom Development. He spoke of ITU's global presence and informed of the membership it has with 193 Member States, 115 universities and research organizations, and over 670 companies. He used evidence to discuss the impact and contribution of global standards to consumers and companies. Mr Campos then presented the benefit of developing of a technical standard for safe listening systems through the timeline of collaborative meetings held since October 2015 between WHO and ITU. Furthermore, Mr Campos highlighted suggested actions identified in a gap analysis that had been requested at a previous meeting of this group and identifies aspects concerning existing standards and personal music players and how messaging to end users is so far performed. Finally, in closing, Mr Campos highlighted the essentiality of dosimetry in safe listening, of global standards in this area, and of the free availability of the related publications and of a reference implementation.

Key considerations for standards - standards for personal audio systems

Dr Brian Fligor, Adjunct Professor, Northeastern University, USA, introduced the purpose of developing standards for personal audio systems (PAS) is to provide guidance to manufacturers, public health professionals and end users on the provision of safer use of PAS while still allowing end users to benefit from use of the devices. Dr Fligor discussed the risk for non-occupational noise induced hearing loss (NIHL) associated with the use of PAS and how these risks must be considered when developing standards. Referencing the literature, he stressed there is benefit to using PAS and highlighted the dose-effect

relationship between level and benefit. He referenced evidence regarding the influence of ambient noise in the listening environment on the end user's chosen/preferred listening level. Dr Fligor introduced some baseline guidance on the dose-effect relationship in occupational NIHL, as suggested by seminal studies in this area. This guidance proposes the following aspects be considered: there are limitations of generalizing occupational noise exposure to non-occupational noise exposure: specifically, exposure duration (i.e. 40 year working lifetime vs. lifespan) a threshold for "acceptable" risk, and the fact there is no established dose-effect relationship for risk for noise-induced tinnitus. Dr Fligor suggested a framework of solutions which included dosimetry as the appropriate metric for hearing loss risk monitoring, the provision of dosimetry through current PAS technology, and drawing from best practices in current health communication to provide information to users (i.e. product packaging, instructions for use, user interface, parental controls). Finally, Dr Fligor proposed the next steps in developing the standards for PAS are to agree upon a framework, while allowing manufacturers to innovate and risk tolerance to be determined at the local/regional level, and update the standards as a living document as new knowledge is obtained.

[Comité Européen de Normalisation Electrotechnique \(CENELEC\): update on dosimetry](#)

Dr Thomas Lund, Convenor TC108X/WG3, Senior Technologist, Genelec OY, Finland initiated his presentation by discussing a timeline of European standards (EN) and International Electrotechnical Commission (IEC) standards on safety requirements of audio/video technology and measurement methodology of sound pressure level (SPL) and exposure. He highlighted the aim for the European Standard EN 62368-1 for exposure-based requirements that has been approved in 2017. Dr Lund informed that, following research published by the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in 2008 that detailed the potential risk of noise exposure from personal music players (PMP¹), the European Commission released a mandate in 2009 limiting exposure to sound levels as follows:

- At 80 dB(A) exposure time limited to 40 hours/week
- At 89 dB (A) exposure time limited to 5 hours/week

For other exposure levels, a linear interpolation is applied. It was also determined that PMP's shall provide warnings on the risks involved in their use and ways of avoiding these. Dr Lund provided comparison of a variety of sound exposure durations and dB(A) SPL, with emphasis on PASs. Dr Lund highlighted a statement from music professional Bob Ludwig who acknowledges the art of music and commends the new ITU/EBU standards for respecting the 'life-giving qualities' of music and stressed that the prevention of hearing loss should not jeopardize music's heritage. Dr Lund stated that threatening noise levels may

¹ Referred to as PAS in this report.

gradually degrade auditory nerve fibres and that compressed music could in the long term harm the auditory system. He defined the terms "sound exposure" and "sound exposure level" and discussed draft requirements for the sound dose and short-term exposure level of PMP's going forward. To conclude, Dr Lund noted that the EU's mandatory requirements are in accordance with medical research and that the IEC 62368-1, clause 10.6 adequately addresses sound exposure in PASs.

Current status of WHO-ITU standards and next steps

Prof. Masahito Kawamori, Rapporteur, ITU-T T SG16 Question 28/16 (e-health), Keio University, gave an overview of the aims of ITU-T Q28/16. He discussed the previous WHO-ITU Joint Stakeholders Consultation on Safe Listening Devices held in 2015 and presented a new draft recommendation "Guidelines for safe listening devices/systems" (F.SLD). Prof. Kawamori stated that the standards are still in their early stages and welcomed comments. Following this, he presented the situational analysis relating to the standards for safe listening which provides overview of current practices amongst standardization bodies and manufacturers. This highlights that there is a lack of standards for PAS aside from CENELEC and IEC and the lack of uniformity of safe listening standards across the world. Prof. Kawamori reflected on the ITU Safe Listening workshop held in 2016, informing that all comments have been included in F.SLD as notes however further text is needed. Prof. Kawamori introduced the term 'dose' as the sound pressure level multiplied by the duration of the exposure, though he stated an official definition is needed. He informed that this formula is used to measure occupational noise exposure, however a different measurement may be needed for PAS. Some requirements on dosage for PAS that he presented included: consideration of recovery phase, desired sound (music) vs undesired sound (noise), measurement of sound in the ear, rather than the surrounding, acceptable level of risk and consideration of age. Prof. Kawamori prompted the consideration of health communication aspects of safe listening i.e. messaging. He explained the next steps for WHO-ITU are to include the text and results of discussion from this consultation meeting, provide edited version at Q28/16 meeting in Geneva, 8-12 May 2017 and should it be finalised, propose for consent at ITU-T SG16 meeting in October 2017.

2.2.3 Exposure limits

Determination of risk of noise-induced hearing loss due to recreational sound: review

Dr Richard Neitzel, Associate Professor, University of Michigan, USA, addressed the question "are existing exposure limits for occupational noise exposure suitable for determination of risk due to recreational sound?" Dr Neitzel identified most occupational limits as being 85 dBA $L_{ex,8h}$ and most environmental limits as 70 dBA $L_{eq(24)}$. He summarized studies comparing temporary threshold shift (TTS) from music and noise exposures with equal or similar energy, several of which suggest that music may produce less TTS than

noise, and that music-induced TTS resolves faster. However, he noted that it is appropriate to assume that music is equally damaging to equivalent noise. Dr Neitzel discussed NIHL risk models from the International Standards Organization (ISO) and American National Standards Institute (ANSI) that are derived from occupational noise exposures. These models indicate that the greatest rate of NIHL occurs in the first 10 years of exposure, but are limited to a maximum duration of exposure of 40 years. He proposed that a 60-year duration (ages 10-70) is more realistic. Dr Neitzel highlighted that music exposure represented the greatest risk of any NIHL in a study of exposures to a variety of sound sources in New York City. He acknowledged that defining the maximum amount of NIHL acceptable is a political compromise, but that this needs to be a priority for WHO. Based on information from ISO, ANSI, and others, he suggested two options for exposure limits; 70dBA $L_{eq(24)}$, which represents a zero excess risk of NIHL over a 40-year duration, or 75dBA $L_{eq(24)}$, which represents a 1% excess risk of developing a material impairment after 40 years. Dr. Neitzel suggested that the 75 dBA $L_{eq(24)}$ – equivalent to an 80dBA $L_{ex,8h}$ – may represent the more socially feasible option. Finally, Dr Neitzel noted that exposure limits designed to prevent NIHL may not protect against other noise-related health impacts such as hypertension and heart attacks.

Prof. Jeremie Voix shared his recent work on revisiting recommended exposure limits for in-ear dosimetry. His findings showed that the change in ear sensitivity, from open to occluded condition, appears to be limited -for moderate sound pressure levels- to only a couple of decibels. Further research is being conducted to precisely assess if a correction of ear occlusion would be required to match existing exposure limits

Limits for recreational sound exposure: WHO Euro guidance

Prof. Mariola Śliwińska-Kowalska, Department of Audiology and Phoniatics, Nofer Institute of Occupational Medicine, Poland, summarised two European initiatives she has been lately involved and which were aimed at assessing the risk of permanent hearing loss and tinnitus as a result of listening to music through PAS. The first was a descriptive review of literature by SCENIHR in 2008. Prof. Śliwińska discussed the European standard EN 62368-1 that was developed by CENELEC and approved in 2010, outlining the average sound level limit of 85 dBA and a maximum average of 100 dBA in PASs. The second paper presented was a systematic review on the relationship between exposure to music listened to through PLDs and permanent hearing loss/tinnitus. The review was delivered by Śliwińska-Kowalska & Zaborowski as a part of the WHO Environmental Noise Guidelines for European Region in 2016 (paper under submission to the IJERPH). This study concluded that prolonged listening to loud music may increase the risk of hearing loss and result in worsening of the standard frequency audiometric thresholds; there is a lack of specific threshold analyses focused on stratifying risk of HL according to exposure to music and finally, that cohort studies to measure audiometric thresholds in teenagers along with monitoring music exposures with

personal dosimetry are very challenging due to the length of the exposure periods needed for development of loud music-related hearing loss.

2.2.4 Group work on exposure limits

The participants were split into four groups with the purpose of determining the most appropriate exposure limits to be followed for safe listening standards. They were presented with the following questions to answer.

1. Can the exposure limits recommended under occupational standards be applied to recreational setting?
2. What level of risk should be considered acceptable for safe listening?
3. Is it appropriate to propose a graded exposure limit?
 - a. If yes, what should those grades be?
 - b. What would be the most suitable terminology in this respect (e.g. safest; less safe or least risk; moderate risk...etc.)

Group work outcomes:

Each group presented the outcome of their deliberations and this was followed by an open discussion on exposure limits that should be recommended as part of the safe listening standards. The following outcomes were agreed:

- Risk estimates derived from occupational noise can be applied as exposure limits for non-occupational noise for adults, e.g. music.
- Risk estimates for infants and children are extrapolations and need further study to assess standards for these vulnerable populations.
- Based on the level of risk associated with listening to different sound levels, a graded-risk approach can be followed for safe listening standards. The proposed grades include:
 - The lowest, most protective exposure limit, should have no associated risk. This is 75 dBA $L_{ex,8h}$ (8-hour exposure) or 70 dBA $L_{eq(24)}$ (24-hour exposure), to be consistent with Environmental Protection Agency (EPA) and WHO community noise limits.
 - The middle exposure limit would be associated with minimal risk and higher permissible exposure levels. This is 80 dBA $L_{ex,8h}$ or 75 dBA $L_{eq(24)}$, – no reflect minimal risk and more permissible exposure, which has 1% risk of material impairment (>25 dBHL at 1, 2, 3, 4 kHz). This middle limit would be consistent with EU recommendations.
 - The highest exposure limit would have 8% risk of material impairment (>25 dBHL at 1, 2, 3, 4 kHz). This is 85 dBA $L_{ex,8h}$ or 80 dBA $L_{eq(24)}$ and is consistent with occupational limits outside of Europe.
- While referring to these grades in the standards, they can be categorized as least risk; slight risk and higher risk (rather than less "safe").

- Users should be given information to make an educated choice on what risk level is acceptable to them.
- Information should explicitly state that for vulnerable groups (such as children) and those with exposure to noise at workplace or taking ototoxic medicines should opt for the safest limit to minimize their risk of NIHL.
- It was highlighted that headphones are often used by young children. Suitability of exposure limits recommended here should be studied for children and appropriate recommendations made in that regard.

2.2.5 Safe listening app

WHO's vision regarding the app

Dr Shelly Chadha, Technical Officer, Prevention of Deafness and Hearing Loss, WHO, explained that the concept behind the WHO safe listening app is to provide users with the information on how they are listening and encourage them to make safe choices regarding this habit. She further detailed that this requires accurate assessment of sound levels listened to through the device, assessment of listening time, calculation of dose received on the previous two parameters, warnings and safe listening messages through the app, and the availability of information on safe listening. Dr Chadha also outlined the limitations to this application, being that the music must be played through the media player integrated into the app, environmental noise is not taken into consideration and more features may be required to make it successful.

Dosimetry for safe listening

Mr Chucri (Chuck) A. Kardous, a senior research engineer with the National Institute for Occupational Safety and Health (NIOSH), USA, discussed the latest NIOSH research on smartphone and mobile applications (apps) and the recent NIOSH findings and publications on the accuracy and performance of smartphone sound measurement apps as well as the potential for using of smartphone and mobile devices to increase awareness about hearing health and hearing loss prevention. Mr Chucri discussed the collaboration with WHO and HörTech (the developer of the WHO safe listening app) to conduct an independent evaluation of the WHO safe listening (SL) app at the NIOSH Acoustics Laboratory. The SL app is a crucial component of the WHO's Safe Listening Initiative and ties all various recommendations into a practical and useful tool that could be available to the 2 billion or more owners of smartphone and mobile listening devices. The evaluation consisted of testing the SL app on several Android devices and several headphones/earphones using an acoustical test fixture. The app relies on equations and tables from the NIOSH Noise Exposure Criteria document to calculate an overall listening "dose" based on level and duration. The results of the NIOSH evaluation showed that the SL app's implementation and

overall dosimetry calculations are appropriate and provide a reasonable estimate of the overall noise dose from listening to music on mobile devices.

Safe listening app: review and features

Dr Michael Buschermöhle, HörTech gGmbH, Oldenburg, Germany, introduced HörTech as a not for profit company that aims to be an interface between science and industry, develop new methods and expertise and support science and research. Dr Buschermöhle detailed that the purpose of the Safe Listening app is to educate listeners on their recreational listening habits, give them a feeling for sound level and sound dose, and provide an estimate of the daily sound dose obtained through listening with the mobile device. He further explained some limitations of the app: it cannot measure dosage with absolute precision, it does not include sound sources other than the headphones, and it does not or measure sound exposure from other apps. He explained the app has been developed for both Android and iOS, has a typical music player functionality, displays daily sound dose based on NIOSH recommendations, provides notifications when the user has reached certain dosages, provides notification at start up, has a smart volume feature and informs the user with statistics of past and present daily dosage and average sound level. Dr Buschermöhle explained in detail the background of dose calculation and calibration involved in the app development.

2.2.6 International year of sound: 2019

Antonio Perez-Lopez, Treasurer of the International Commission for Acoustics (ICA) and President, Spanish Acoustical Society (SEA), explained that ICA is working towards the declaration of the year 2019, as the International Year of Sound (IYS 2019). The aim of the IYS is to highlight the importance of sound as part of our cultural, social and educational heritage as well as the need for quietness and peace in the lives for all in our society. Thus the IYS will coordinate a wide range of activities on regional, national and international levels to raise the awareness of the people on the sound and its use for the benefit of man and society, and to contribute to the general education on the need for controlling noise and protecting hearing. A committee has been formed to promote the idea among the scientific, educational, social and health committees throughout the world including WHO and it is in close contact with UNESCO who will be the organization to suggest this year to the United Nations. The committee has already received an enthusiastic support from several Institutions and countries and ICA hopes that eventually their effort will be successful. Finally, he has presented the report that Prof. Jean-Dominique Polack recently addressed to the Board of UNESCO with an overview of some of the current projects, steering committees and expected activities that hopefully will be integrated with the IYS2019, like the World Hearing Day, International Noise Awareness Day, La Semaine du Son, etc.

2.2.7 Health communication

Role of health communication in Make Listening Safe

Dr Deanna Meinke, University of Northern Colorado, USA, introduced the role of health communication by explaining that current messaging on smartphones is often influenced by regulatory obligation or to avoid possible litigation, rather than reliance upon evidence-based health communication for promoting safe listening. Dr Meinke discussed the three theoretical bases of health communication (intrapersonal level theories, interpersonal level theories and community level theories) and their applicability to hearing health promotion. Further, Dr Meinke went into detail of the socio-ecological model adapted for hearing health promotion and its ability to predict how multiple levels of influence (individual, interpersonal, organizational, community and public policy) can affect health behaviour. Dr Meinke applied the socio-ecological model of hearing health promotion to the Make Listening Safe app. It was noted that there are other health communication theories that have not been evaluated in the context of listening behaviour with personal audio systems. Dr Meinke followed this by discussing examples of message-framing and noted that messaging requires careful consideration in order to avoid unintended consequences that may undermine the efforts. She noted that the use of technology in health promotion is an emerging field with applicability to the Make Listening Safe initiative. To conclude, Dr Meinke supported that there is a large body of evidence indicating that health messaging facilitates positive health behaviour changes, however more research needs to be undertaken before recommendations for regulatory standards related to messaging requirements in personal audio systems can be proposed.

Developing the health communication strategy: policy brief; messages; dissemination

Prof. Sara Rubinelli, Professor, University of Luzern, Switzerland, provided an update of her health communication working group. This working group consisted of a literature review of user groups and their risk awareness of NIHL, a survey to examine the user habits and their interest in the WHO safe listening messages, and a focus group to allow an in-depth insight into the persuasiveness of potential messaging. Prof. Rubinelli discussed message development and proposed numerous alternative message texts at various levels of dosage and decibels (dB). She defined the three age groups that contributed to the survey and detailed the outcomes of the eight blocks of data collection. Prof. Rubinelli then raised some key findings from the focus group, which included:

1. The majority of people are aware of the problem, but only a minority of people are thinking about or actually doing something about it.
2. There is evidence that people are discouraged from changing behaviour because they feel that the volume for safe listening can reduce their enjoyment of the music listening itself.

3. People would welcome an educational intervention from WHO, which would give clear directions regarding safe listening practices.
4. The majority of people liked the types of messages presented, and were in agreement regarding their use in an educational intervention.

With respect to the software application: privacy concerns should be addressed and interruption of professional activities (by an app) should be avoided. The use of images may be disturbing to users when consuming audio-visual content. Prof. Rubinelli stated that the Make Listening Safe app is a promising intervention and spoke highly of the value of endorsing the “brand” of WHO. She also stressed the importance of an additional awareness campaign about the risks of NIHL, and how to avoid this, in concrete terms. Finally, Prof. Rubinelli suggested a vision that the app should come pre-installed in mobile devices.

2.2.8 Group work on dissemination of information for safe listening

The objective of this working group was to determine methods for dissemination of Information and messages on safe listening. The following questions were posed:

1. What channels can be used for dissemination of information and messages for safe listening aimed at the target group (12-35 year-olds)?
2. What channels can be used for dissemination and popularization of the WHO safe listening app?
 - a. What role can industry play in this regard?
3. Is there a need to raise awareness on the proposed standards before they are finalized?
 - a. Once finalized, how can their adoption by governments and industry be promoted?

Group work outcomes:

Each group presented the outcome of their deliberations and this was followed by an open discussion, which is summarized as below:

- The following channels can be used for dissemination of information:
 - Social media including Facebook and Twitter
 - YouTube
 - Schools, including school curricula
 - radio
 - music teachers
 - train stations, buses, airports
 - healthcare centres
 - community events
 - workplace
 - music events e.g. concerts

- entertainment venues, sporting venues
- Industry partners can support by including information on safe listening on their websites and products including but not limited to the instruction manuals which accompany the personal audio systems.
- Efforts should be made to involve streaming services in the initiative, so that they can share information on safe listening with users.
- Engage with celebrities and famous bands to help raise awareness on safe listening.
- The need to involve user groups and associations was highlighted.
- Point of shadow-market was raised and the need to ensure that standards are implemented at all levels.

2.2.9 Research protocol for assessment of hearing loss due to recreational noise exposure:

Current practices: a review of literature

Dr Kamakshi Gopal, Professor of Audiology at the University of North Texas, Denton, USA, provided a critical review of current practices and outcomes from published literature in the area of recreational noise induced hearing loss (RNIHL) studies. Dr Gopal indicated that over 40 years of research has been done in this area with the intention of identifying and quantifying the effects of recreational sound on the auditory system. Dr Gopal provided results from a comprehensive literature review to highlight the inconsistencies and commonalities among the studies. She indicated that although most studies supported the risk posed by recreational sound on hearing, comparison of results was a challenge due to varied methods adopted by the studies. Dr Gopal recommended that future studies adopt a comparable protocol that is robust enough for comparison across studies. In conclusion, Dr Gopal endorsed the idea of creating a universal protocol for future studies in the area of RNHIL, and provided some key elements for inclusion in the protocol.

Developing a protocol: concept and approach

Dr Shelly Chadha presented the key questions behind developing a research protocol for the Make Listening Safe initiative. The research protocol for assessment of recreational noise induced hearing loss (RNIHL) is to be developed to facilitate the implementation of uniform procedures by researchers in order to enhance successful comparison of their results. It will provide a standardized methodology for assessment of hearing loss, assist data collection and facilitate comparison and compilation from different studies. Permanent hearing loss occurring as a result of exposure to loud sounds and tinnitus will be assessed across a variety of age groups. Dr Chadha questioned whether sampling methodology should be suggested and prompted participants to consider when, where, how and who to test. Furthermore, the aspects of ethical clearance, raising awareness on safe listening through the study and the research team and equipment required for testing were raised prior to Dr Chadha introducing the topics for group work.

2.3 Group discussions

2.3.1 Drafting group

The drafting group was led by **Prof Masahito Kawamori**, who is also the Rapporteur for the technical group in ITU on e-health standards (Question 28/16), which is developing draft new Recommendation ITU-T F.SLD. The discussion focussed on how to move forward the current draft of Recommendation [ITU-T F.SLD](#) (Guidelines for safe listening devices/systems). First, the group discussed definitions and abbreviations. It was discussed that as the term sound was not just referring to noise, but music as well, hence the group agreed that reference to sound induced hearing loss (SIHL) would be more appropriate than noise induced hearing loss (NIHL) for this draft new standard. Further, the group looked at some of the background references for existing standards such as CENELEC, IEC and ISO and considered the terminology adopted in these; reference and definitions identified in several well-known standards will be integrated into F.SLD. Some examples are sound exposure, dosage and equal energy exchange rate. It was also decided that they will utilize the standards and considerations in the WHO document on safe limits of sound exposure (authored by Richard Neitzel et al.) as it is comprehensive and there is no other text currently addressing this. There was in-depth discussion surrounding the definition of dosage and dosimetry. Some concerns were expressed with the idea to include the description of the WHO app into the standard itself, but it was agreed that the inclusion of a description on how dose measurement could be made was an excellent idea; Mr Peter Isberg has volunteered to draft text to be included in F.SLD. Other issues need to be further improved in the draft, and the present agreed to continue refinement of the draft via e-mail discussions. A target is to have an updated draft for the next face-to-face meeting of Question 28/16 during the week of 8-12 May 2017, at ITU HQs in Geneva.

2.3.2 Research protocol group

The group was led by **Dr Kamakshi Gopal**. A number of questions were posed to determine the purpose and method of research. The agreements reached are summarized below:

- What to test for: the protocol should assess both temporary threshold shifts (TTS), and permanent threshold shifts (PTS) along with tinnitus and hyperacusis.
- Whom to test: children and adults should be tested sub-grouped by age. The recommended age groups are: 6-11, 12-19, 20-29, 30-39, 40-49, 50-59, 60-69, 70-79.
- Criteria for defining the study group: comprehensive studies that evaluate most common types of recreational sound exposures such as PAS, clubs, concerts, and possibly fire arms. Exposure levels should be measured whenever possible. KEMAR²/real ear measures/dosimetry for PAS studies, dose measurements in club and concert venues.

² KEMAR refers to a head and torso simulator designed especially for acoustic research.

- Control group: a control group is required for longitudinal studies, and may be based on the questions to be asked as part of the research.
- Methodology: Targeted sampling is most likely the method adopted by researchers
- When to test: The panel recommended a minimum of 24 hours of rest, i.e., non-exposure to loud sounds, including music, prior to pre-exposure testing for TTS. Post-exposure testing must be conducted within a 30-minute window, but test as soon as possible after the exposure.
- Where to test: In an environment that allows obtaining reliable data. According to the permissible levels (ANSI/ISO standards), consider the type of transducers used.
- How to test: Air conduction pure tone audiometry - test at 1, 2, 3, 4, and 6 kHz is required. Testing at higher frequencies (including 8, 10, 12, 14, and 16 kHz) is optional. Use 2-dB threshold identification procedure. Whenever possible, distortion product otoacoustic emissions (DPOAEs) should be used in addition to audiometric measurements.
- Who will test: the testing must be performed by audiologists or trained staff under supervision of an audiologist.
- Other examinations: otoscopy and tympanometry are required prior to hearing testing.

Next steps include:

1. Co-opting additional members for the research protocol group based on recommendations from the participating experts.
2. Circulating a summary of the research protocol group discussion and agreements for review and comments.
3. Preparing draft protocol and finalization through online consultations.

2.3.3 Safe listening messages group

The first aim of the group was to design the specific content that reflects the health messages WHO wants to communicate to users. Secondly, the group aimed to format the messages in light of clear target segmentation of the population. **Prof. Sara Rubinelli** was the lead and presenter for the discussion on safe listening messages. The proposals for specific educational content were discussed in the meeting at WHO. The discussants agreed on the fact that it was difficult to evaluate the message. The outcomes of the group discussion included:

- The dosimetry method/app and its messages have to be integrated in a higher and wider educational program.
- There must be first agreement on the algorithm that the app should implement and whether this is to be communicated as a "dose" (a word that resulted controversial among participants).

- WHO and other stakeholders should start communicating consistent information on safe listening to the world. Yet, there must be clarity on what educational messages should be delivered before having the algorithm fixed and decided.
- Once the algorithm is finalized, the educational messages have to be created. The content has to be tailored to different audiences. Thus, a market-segmentation is needed to identify main types/categories of users, as well as possible communication channels (e.g. parents and teachers for targeting children).
- The app has to be developed by considering the user experience. It should have personalization features and interactivity. Also, it is important to inform users of the time remaining until they have reached maximum daily dose.
- It was discussed that the messages must be tailored so that users still have a level of choice and responsibility.
- The idea that music can be of a low volume and still enjoyable needs to be promoted (although this is tough as indeed, people are used to high volume music).

The next steps identified are:

1. To decide what messages can be delivered within the overall education program before the algorithm of the app is finalized.
2. To plan the overall educational program, of which the app is only a part.
3. To reach agreement over the algorithm that the app should implement.
4. To identify the target (market-segmentation) and the related preferred communication channels.
5. Once the algorithm is settled, to develop messages for the different targets.
6. To design the app using participatory design (prospected users should be involved in the design in order to capture the user experience).
7. To pilot the app.
8. To implement overall educational strategy including the app.

3 Conclusion and next steps

It was agreed that safe listening recommendations should be based on a three-level graded approach to setting exposure limits for estimation of sound dose:

- 85 dBA for 8-hour/80 dBA for 24-hour exposure
 - 80 dBA for 8-hour/75 dBA for 24-hour exposure
 - 75 dBA for 8-hour/70 dBA for 24-hour exposure
- These should preferably be referred to as lowest risk; mild risk; and moderate risk.
 - Suitability of exposure limits for children needs to be explored.

- A drafting group worked to identify the key components of the standards and to start work on the draft standards development. The global standards for safe listening devices are expected to be finalized by mid-2018.
- Various aspects of the app were discussed. Based on the feedback received, the app will be reviewed with Hörtech. It will also be updated with the changes and messages which were agreed upon.
- Dissemination of information on safe listening was discussed. It is proposed that a dedicated webpage on Make Listening Safe be created in all UN languages on the WHO website. This webpage will provide readers with concrete information and facts on safe listening. Such a webpage or information should also be mirrored on the websites of all partner organizations.
- The key messages for safe listening were discussed and will be finalized following this meeting.
- Options and partners for dissemination of information must be explored by all participants and efforts made to provide consistent messages to all.
- The development of the research protocol was discussed and debated and some key questions answered in this regard. Other experts will be sought for the research protocol and suggested by the experts working on this.

Next steps:

- Meeting report to be prepared and circulated.
- Discussion will continue by e-mail with the experts that joined the drafting session for ITU-T F.SLD, aiming at having an updated draft for review at the May experts meeting of ITU-T SG16.
- The WHO safe listening app will be reviewed and prepared for release.
- Health communication strategy needs to be defined addressing different target groups.
- A policy draft will be worked on for health communications for promotion of safe listening practices.
- A multilingual webpage on safe listening to be set up by WHO.
- After induction of other experts suggested by the research protocol group, the first draft of research protocol will be written and shared with the participants.
- The background documents will be developed as monographs and uploaded on Make Listening Safe webpage.
- Suitability of recommended exposure limits for children will be reviewed.

