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Research Article

COVID-19 Pandemic: Innovative Digital Tool Using Progressive Muscle Relaxation to Promote Mental Health Among Frontline Healthcare Workers

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Abstract: The COVID-19 pandemic has caused adverse social, economic, physical and psychological repercussions to mankind. Global healthcare systems are pushed to breaking points. Lockdowns and movement control orders imposed by the Malaysian government and many other nations on its citizens have necessitated home-based solutions to manage rising stress and anxiety due to personal, professional, financial and work-related uncertainties. Frontline healthcare workers bear the brunt of the crisis. This study responds to mental issues caused by the virulent pandemic and recognizes the increasing need for psychosocial rehabilitation among healthcare workers. It aims to create an effective, on-demand, mobile and pleasurable tool based on original music and progressive relaxation techniques that empower users to foster mental health and wellness. A combination of practice-based and user-centred design methodologies was adopted in this interdisciplinary study. Spectral analysis using Raven-Pro sound analysis offers insights into the sonic content of the tool. The result of the study is a prototype model of an innovative digital tool crafted and narrated in the English Language and Malay Language using Bespoke Music and Narration to promote mental health among COVID-19 frontline healthcare workers.

Keywords: ***Bespoke Music and Narration; COVID-19 pandemic; mental health; progressive muscle relaxation***

1. Introduction

On 11 March 2020, the World Health Organisation (WHO) declared the coronavirus disease of 2019 or COVID-19 as a pandemic. By 18 October 2020, the COVID-19 Weekly Epidemiological Update by WHO stated that over 40 million cases and 1.1. million deaths have been reported globally with over 2.4 million new cases and 36000 new deaths reported over the previous week [1]. Such is the ferocity of the SARS-CoV-2 novel coronavirus, infecting the common man on the street to the Prime Minister of the United Kingdom, Boris Johnson and the President of the United States of America, Donald Trump. Global infections continue to escalate as large proportions of the public remain susceptible. As societies grapple with job losses, health concerns, political uncertainties, impending elections, street demonstrations, propagation of herd immunity, news of frustrated communities holding COVID-19 parties and infections raging exponentially with little end in sight, it is unsurprising that mental health is in danger of reaching crisis levels. The pandemic has inflicted dire economic, social, physical and psychological repercussions to humankind. Frontline healthcare workers bear the brunt of the onslaught. Physicians, nurses, technicians, ambulance drivers, hospital administrators and intensive care unit staff suffer exhaustion, stress and anxiety. Large numbers of

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healthcare workers have contracted COVID-19 and passed away in their line of duty [2]. Health and mental related issues caused by the virulent pandemic necessitate new ways to develop coping skills, support recovery, foster social reintegration and enable psychosocial rehabilitation among healthcare workers affected by the COVID-19 experience.

COVID-19 is caused by the severe acute respiratory syndrome coronavirus 2 (SARS-C0V-2) virus. The virus is highly virulent and it has been found to spread easily between individuals even during the asymptomatic phase. National healthcare systems and medical staffing in many countries have reached crisis levels due to the phenomenal outbreak. While there has been much deserved encouragement and appreciation of frontline healthcare workers, ranging from global ovations of medical staff and communities making personal protective equipment for frontline healthcare workers, there lurks a silent virus of mental illness germinating among these dedicated professionals. Inadequate personal protective equipment, fear of exposure to the virus, concerns about infecting their loved ones and longer working hours aggravate depression, frustration and anger. Frontline healthcare workers also risk developing post-traumatic stress disorder, a silent killer brought about by tremendous stress and anxiety experienced both during and after the COVID-19 mayhem [3]. Reports from Wuhan, China, where the pandemic began, found that frontline health workers experienced continued stress, anxiety and fatigue due to sleep deprivation, calling for greater social support to address such detrimental health manifestations. As of 24 October 2020, Malaysia has entered its third wave of infections with 25,742 coronavirus cases and 221 deaths reported [4]. So dynamic is the situation that at the time of writing this article, Malaysia has extended its Recovery Movement Control Order (RMCO) from 1 September 2020 to 31 December 2020, imposing hefty fines and even imprisonment for non-compliance amid political uncertainties of an impending election during a pandemic, thereby fueling nervous apprehension and anxiety among its citizens and healthcare workers who fear worsening conditions. Against this dire scenario, aside from medication, there is an urgent need to develop the armamentarium of non-pharmacological and technology-enabled research-based tools that support vulnerable communities in their fight against mental deterioration.

This study responds to a call for strategies to improve mental health, recognizing the needs of different cultural groups. Personal recovery, effective social integration and the ability to regain a satisfactory quality of life among affected communities are the goals of a successful intervention programme. The main objective of the study is to develop an innovative digital tool comprising original music and narration using progressive muscle relaxation to promote mental health and wellness. Progressive Muscle Relaxation (PMR) is an established non-pharmacological method of natural muscle relaxation introduced by American physician Dr Edmund Jacobson [5]. PMR techniques involve inducing tension followed by relaxation of targeted muscle-groups thereby relaxing the mind and body to create a feeling of well-being by lowering blood pressure, decreasing muscle tension and reducing anxiety particularly after a traumatic incident [6]. This approach recognizes the presence of muscular contraction and aims to consecutively relax principle muscle-groups of the body towards a state of repose.

Similarly, specially written music can foster a state of composure and tranquillity. Scientific studies have evidenced the power of music to reduce stress and anxiety with calls for greater details in the music used in music-medicine research [7,8]. Technology has transformed the way in which music is used in science. For example, scientists at the Massachusetts Institute of Technology have translated the amino acids of protein spikes (protein structures) of the coronavirus into music through a new technique called sonification where non-speech data is represented by the elements of musical sound to support COVID-19 research [9]. Rhythm is the soul of music. The human brain is hardwired to recognize and react to rhythmic stimuli. The rhythm of music evokes emotion. Pulse is the heartbeat of a rhythm. The neuroscience of rhythm examines parts of the human brain that are responsible for spontaneous movement [10]. Therefore, harnessing the inherent qualities of rhythmic pulse and speech in mobilizing movement and triggering emotion are central to the concept of using 'pulse-based' narration in this creation. This interdisciplinary study therefore combines knowledge from the arts and sciences in crafting an innovative digital tool to support the mental health and wellbeing of those who have put their lives at risk to save others during the COVID-19 pandemic.

2. Practice-Based and User-Centred Design Methodology

A combination of practice-based and user-centred design methodology was adopted in this study. Practice-based methodology is an established approach in the fields of interdisciplinary, translational and creative arts research whereby the results of the study are represented by the research-driven products or artefacts of the research [11,12]. Translational research is often interdisciplinary in nature and aims to speed up scientific discovery by developing new techniques and tools to benefit patients and the community at a practical level [13]. This methodological approach was deemed apt in view of the nature of the study. Three main practice-based processes were undertaken, namely (i) fieldwork, (ii) preparation of bespoke music and narration and (iii) tool content preparation.

Figure 1 illustrates the processes involved in creating Bespoke Music and Narration (BMN) using progressive muscle relaxation as content for the BMN Digital Tool.

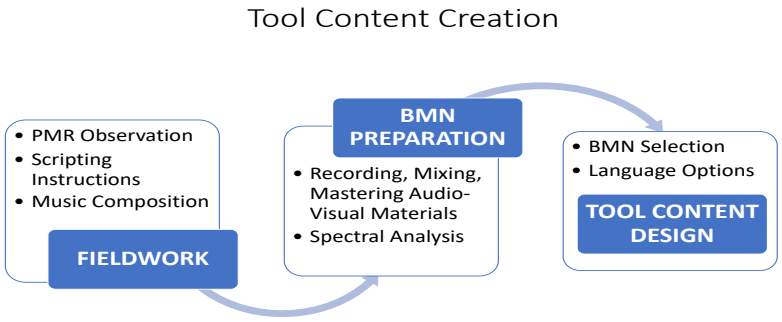

Figure 1. Practice-Based Processes for Tool Content Creation

The first stage comprised of (i) clinical observations of progressive muscle relaxation sessions instructed by occupational therapists at the UiTM Medical Specialist Centre, (ii) preparation of scripts for pulse-based narration premised on Edmund Jacobson's guidelines, in both English Language and Malay Language versions, (iii) composition of the original music using acoustic instruments and electronic soundscapes and (iv) selection of original nature-based photography taken from the Royal Belum Rainforest, Malaysia. The images serve to provide a pleasant and soothing visual background to the experience in the audio-visual versions of the tool. The second stage comprised the recording, mixing and mastering of the music and narration. This ensured good sound quality and clarity of instruction. The acoustical levels of the music and the instructions were carefully balanced so that users would be able to comfortably follow the pace of the progressive relaxation directions. A spectral analysis of the work was conducted to visualize the sound characteristics. Additionally, a session on progressive muscle relaxation conducted by a physiotherapist using a recording of the bespoke music and pulse-based narration was pre-tested by a group of twenty-nine healthcare workers at the UiTM Medical Specialist Centre. The final stage was an assembling of the tool content.

These processes worked in tandem with considerations of user-centred design strategies when crafting the digital tool. User-centred design or user-driven development positions the intended users at the centre of its project design and development [14]. This includes considerations of types of users, task expectations, accessibility, usability goals, functionality, user-environment and user-experience. Hence, in designing the digital tool, its usability and accessibility were grouped under four main facets, namely its (i) functionality, (ii) target users, (iii) person-centred features and (iv) choice of formats. Figure 2 illustrates the user-centred design approach in crafting the BMN Digital Tool.

Under functionality features, the tool is flexible, user-friendly, available on-demand anywhere and at any time. It also offers an option of more than one language. The targeted users are healthcare workers ranging from medical officers to rehabilitation support staff. The design embraces a person-centred approach in that the tool is open-access, mobile and space-effective. It empowers users as it is self-monitoring, non-invasive and easy to use. The tool will be accessible to registered users and it

is available in audio-visual file formats and web-based formats that may be accessed online or saved for later use [15].

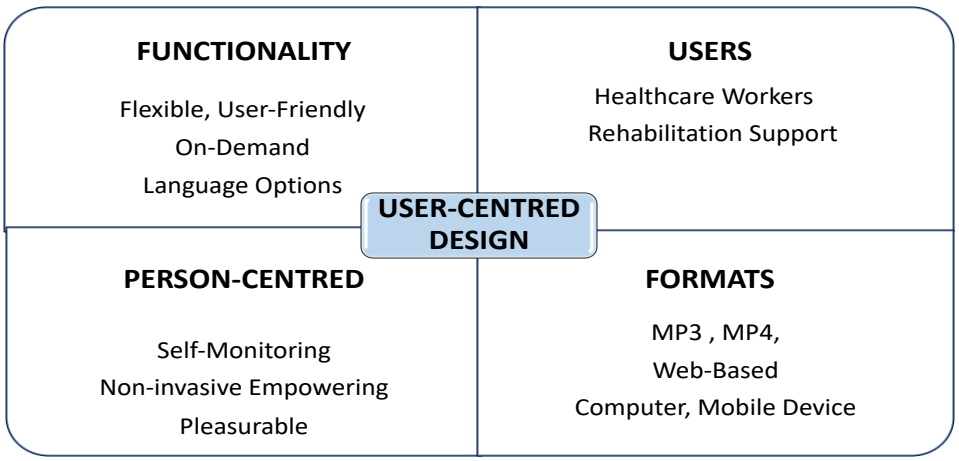

Figure 2. Usability and Accessibility of BMN Digital Tool

3. Results and Discussion: BMN Digital Tool

On applying the processes discussed, content for the digital tool was assembled and its sonic qualities were analysed using Raven Pro sound analysis software developed by the Cornell Lab for Ornithology, Cornell University. A visual representation of frequencies through time, spectrograms offer a detailed view of an audio recording and its unique characteristics. Each composition has its unique sound identity and spectrograms enable one to 'see' sound. This affords valuable insights into the sonic features of a composition, in this instance, depicting how music is used with narration to support physical movement and natural relaxation. Figure 3 is an example of a spectrogram or visual sound map of the first 60-seconds of the audio content of the BMN digital tool.

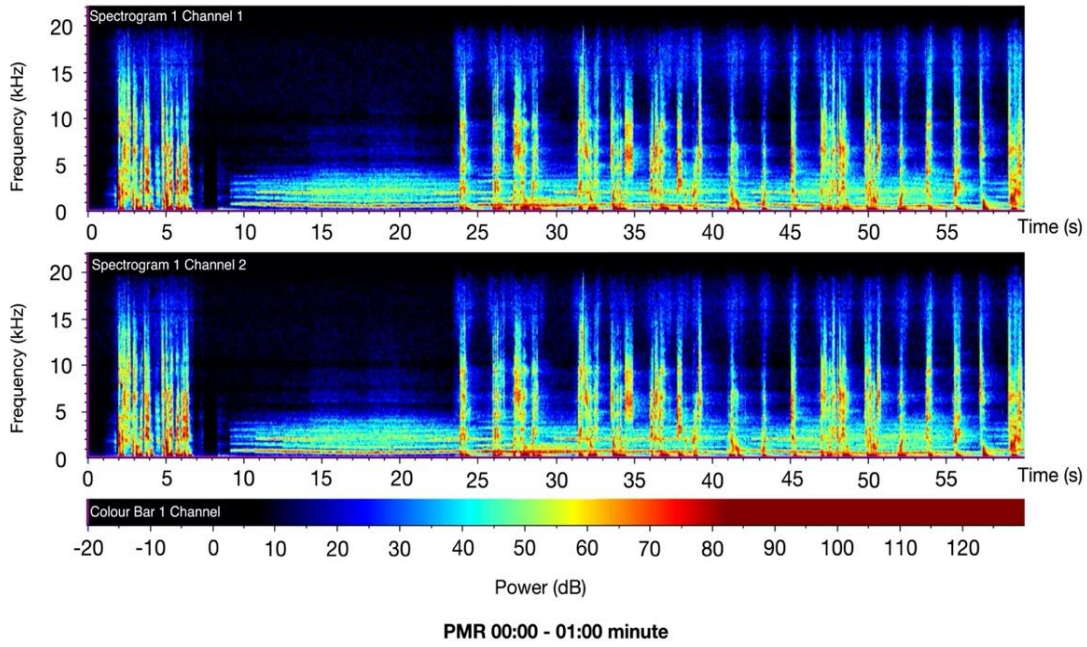

Figure 3. Spectrogram of Bespoke Music and Narration

The frequency is displayed at the vertical axis while the time is shown on the horizontal axis. The volume/power is represented by the colour gradient as illustrated at the bottom of the spectrogram in the form of a colour bar. A spectrum of cool to hot colours, ranging from blue to red, are used to illustrate the intensity of the sound in terms of volume. Overall, the

spectrum indicates that more cool colours are captured, portraying the soothing and calming effect of the composition. The regular vertical sonic spikes captured in the image, reflect the rhythmic pulse-based qualities of the narration, therein supporting muscle contraction and relaxation. Spectrograms thus capture the science of sound, translating audio into visual representations of the compositional techniques engaged in creating content for the digital tool.

The BMN Digital Tool comprises a selection menu with several options comprising (i) an audio-visual overview of the tool (ii) bespoke music and pulse-based progressive muscle relaxation narrated in the English Language (iii) bespoke music and pulse-based progressive muscle relaxation narrated in the Malay Language. Figure 4 illustrates the interface of the BMN Digital Tool.

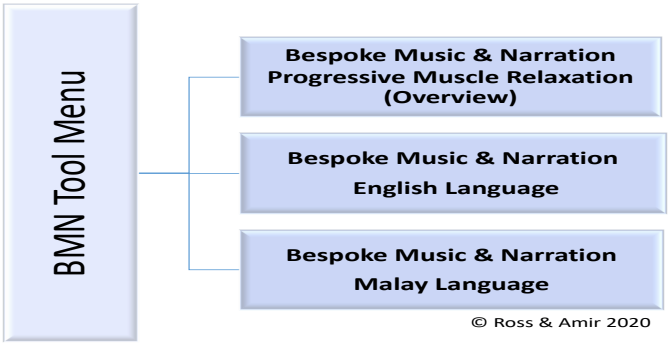

Figure 4. Bespoke Music and Narration Digital Tool Interface

The muscle relaxation session lasts a total of thirty-minutes comprising twenty-minutes of instructional narration accompanied by bespoke music and the last ten-minutes with the music alone, aimed at fostering rest and a state of repose. The instructional aim of the tool is to cultivate relaxation by systematically tensing and relaxing the specific muscles-groups of users. It commences with a guide to practising deep breathing exercises. This is followed by relaxing head and face muscles, neck and shoulder muscles, hand and arm muscles, upper and lower back muscles, and finishing with the relaxation of legs, calf, buttocks and stomach muscles. The instructions are poetically narrated in time with the natural pulse of the accompanying music and thus termed 'pulse-based narration' by the tool creators. Pulse-based narration helps users conduct the exercises methodologically, rhythmically and pleasurably. Another unique feature of the tool is its availability in the Malay Language (Bahasa Malaysia) thereby extending access to a wider cultural community and catering to the needs of users who may prefer instructions in their native language and for those who live in rural areas. The BMN Digital Tool is available in MP3 and MP4 formats. An overview of the tool may be previewed via a YouTube channel [16].

4. Conclusion

The world awaits with bated breath for a COVID-19 miracle vaccine. Meanwhile, global infections soar uncontrollably. Mental health and wellbeing are at risk. As societies grapple with financial, personal and professional uncertainties, the creation and accessibility of innovative devices to support mental health is timely. It is envisaged that this digital tool will assist and facilitate progressive relaxation at home, the workplace and at rehabilitation centres. The BMN Digital Tool is part of the Bespoke Music and Narration Soundbank Collection hosted at the Centre for Intercultural Musicology (CIMACC), University of Cambridge. To summarise, this study represents an innovative engagement of an established method of muscle relaxation premised on interdisciplinary practice-based and user-design methodologies. Original instructional scripts crafted in the English Language and Malay Language will reach a wider international audience and promote social and cultural inclusivity among disadvantaged communities affected by the pandemic. The attainment of deep relaxation and mental wellbeing represent the goals of the therapeutic sessions, empowering vulnerable communities such as frontline healthcare workers in need of readily

accessible, non-invasive, easy to use and enjoyable mental health support. The tool has potential for expansion into a mobile app incorporating more languages and music options supporting home-based therapeutics. Implications for future research include randomized clinical trials using novel therapeutic tools and further development of personalised rehabilitation support using a combination of composed music and complementary therapies to reach a growing population of users keen on finding research-driven materials to assist in coping with mental decline caused by stress and anxiety during the COVID-19 pandemic and the impending new normal that confronts global communities in the 21st century.

Acknowledgement

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