**Supplementary table 6** Coding tree

| Theme | Subtheme | Code | Code descriptor |
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| **Theme 1: Engagement** | Enhancing emotional wellbeing and resilience | Emotional well-being | The music-supported exercise programme should be challenging, motivate pwMS to stay physically active and promote emotional well-being. |
| | | Mindfulness | Engaging in physical exercise while listening to music can act as a distraction from stressful thoughts or situations, helping pwMS focus on the present moment and the enjoyment of the activity. |
| | | Mind-body connection | The combination of movement and music can strengthen the mind-body connection, promoting mindfulness and bodily awareness. |
| | | Stress relief | Exercise, when accompanied by music, can reduce muscle tension, and improve overall physical health, all of which contribute to stress reduction. |
| | | Gamification aspects* | The implementation of these playful elements may increase the attractiveness of the training activities and can also contribute to long-term commitment and adherence to the prescribed exercise routines. |
| | | Sense of achievement | The satisfaction with one's physical performance is linked to a sense of accomplishment in pwMS. |
| | | Regaining joy in movement | Music can create a more engaging and pleasant exercise environment, making the activity more enjoyable and less daunting despite sensorimotor impairment. |
| | | Finding motivation despite MS progression | PwMS aim to continue exercising despite increasing physical limitations and changing symptoms, emphasising the importance of finding personal and meaningful reasons to stay active. |
| | Desired exercise types | Strength and endurance exercises* | The exercise programme should incorporate strength and endurance training for the arms, legs, and trunk, with a preference for body weight exercises. |

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| | | Walking and running training* | The programme should include walking and running training as possible, utilising assistive devices as necessary, to improve gait, cardiovascular health, and mobility. |
| | | Coordination and balance training | The exercise programme should incorporate coordination and balance training to enhance movement synchronisation, physical stability and control, and reduce the risk of falls. |
| | | Upper limb and fine motor skills training | Exercises specifically targeting the upper extremities , integrating sensory and fine motor skill activities, are desired to enhance dexterity and hand function in pwMS. |
| | | Dance exercises | The programme should include dance-based exercises for different levels of mobility, some of which are designed to be accessible for wheelchair users. |
| | | Stretching, relaxation, and breathing exercises | Stretching, relaxation, and breathing exercises should be included as they appear to support pwMS enhancing flexibility, mental well-being, and overall relaxation. |
| | | Building muscle mass | For some pwMS, the exercise programme should specifically target the goal of increasing muscle mass. |
| | | Real-life scenarios | Exercises should be relevant to the everyday lives of pwMS by incorporating exercises that mimic real-life activities and situations, integrating practical movements into the exercise programme. For example, movements related to cooking or vacuum cleaning, or getting up from the floor or setting up speed training by repeatedly covering a fixed distance (e.g., 5 metres) during a song to assess and improve rapid movement capabilities for real-life situations, like crossing a street at a traffic light. |
| | | Group exercising | PwMS are positive about group-based exercise training, highlighting benefits like enjoyment, shared learning, and valuable social interaction. It is essential to provide tailored training accommodating various physical abilities. |

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| | Preferred exercise programme design | Communication strategies | Clear, effective instructions, communication and guidance are preferred by pwMS to enhance engagement and motivation. |
| | | Challenge | Exercises designed specifically for pwMS with different physical performance levels are considered acceptable if they have a certain level of difficulty. |
| | | Individual adaptability to MS progression. | PwMS emphasise the importance of flexible, adaptable exercise programmes that adjust to changing physical capabilities and symptoms over time, and express a preference for programmes tailored to their individual physical and cognitive needs, abilities, and goals. |
| | | Progressive difficulty in exercise programmes | Including various levels of difficulty can encourage engagement with the programme and support training progression. PwMS prefer exercise programmes that offer adjustable intensity to accommodate both improvement and potential decline in physical capability. Enhancing motivation through routines that systematically progress from basic to advanced movements promotes adaptability while reducing the risk of fatigue, discomfort, and injury. |
| | | Simple structure | PwMS express a desire for a simple exercise structure allowing for easy implementation into daily routines. |
| | | Brief explanations | PwMS show a preference for brief and straightforward explanations, aiming for a quick transition into action. |
| | | Lucidity | Exercises that are clear and easy to understand can promote adherence and engagement. |
| | | Exercise quality | Ensuring proper execution of exercises, including attention to details like leg positioning, body posture, and consistent breathing. |
| | | Preventive guidance | PwMS emphasise the need for proactive measures, such as oral and written instructions, to ensure optimal execution of exercises and prevent errors that could potentially lead to harm when utilising the exercise videos. |

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| | | Labelling | Indicating the level of difficulty and duration of exercise videos in advance can help pwMS select suitable exercises that match their motor skills while allowing them to effectively manage their time and energy expenditure. |
| | | Short instructional videos | The exercise programme should comprise short, concise explanatory videos that give a comprehensive overview of the exercise programme and thus facilitate users' understanding |
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| | Expert-led and personalised evaluation and exercises | Cardiovascular exam and questionnaire* | Conducting autonomous cardiovascular checks, possibly with a brief questionnaire before starting the exercises. |
| | | Friendly video presenters | A welcoming and positive demeanour in exercise video presenters is desired, contributing to a supportive and motivating environment. |
| | | Expert guidance | PwMS seek theoretical insights and precise recommendations from specialists. This encompasses expert advice on exercise videos delivered by neurologists, physiotherapists, and sports therapists. |
| | | Personalised supervision through physiotherapists | There is a desire for real-time interaction and personalised feedback during training sessions, which is suggested for increasing engagement and safety. |
| | | Physiotherapy post-relapse* | The importance of seeing a physiotherapist after a relapse is emphasised to receive individualised, specific rehabilitation. |
| | | PwMS presenting exercises | Some pwMS suggest that exercise presenters with MS can provide relatable guidance and inspiration, fostering a sense of community and understanding. |
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| **Theme 2: Ease** | Exercise environment and regimen parameters | Exercise location | Choosing an exercise space that is easily accessible, especially if mobility is limited. When exercising at home, participants emphasised the importance of ensuring both adequate lighting in the exercise area to enhance visibility and the absence of obstacles or barriers that could hinder movement. Furthermore, they |

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| | | | referred to the importance of having furnishings and materials, e.g. for holding on to during balance exercises. Having any necessary exercise equipment or assistive devices readily available in the exercise space. |
| | | Video setting | PwMS like to exercise in a comfortable, predominantly home environment, with both vivid and specific backgrounds and a balance between neutral and visually engaging elements. |
| | | Everyday objects | PwMS prefer using everyday materials like water bottles instead of dumbbells, for exercises avoiding the need to acquire specialised training equipment. |
| | | Countdown | Displaying the seconds could enhance the training experience and help pwMS to effectively manage their time and create a clear structure during training sessions. |
| | | Exercise dosage* | Neurologists and therapists recommend adhering to WHO recommendations of 150 minutes of moderate aerobic activity per week, tailored to enhance both effectiveness and adherence. |
| | | | Minimum of 30 minutes per training session recommended by therapists, with flexibility in duration and the possibility of multiple short intervals. |
| | | | Ensuring that the exercise intensity is appropriately matched to the individual's performance and activity level, thereby minimising the risk of injury and ensuring effective training. |
| | | | PwMS indicate an exercise duration ranging from 10 to 60 minutes, highlighting the importance of flexibility, cautioning against excessive duration, and encouraging consistent, time-efficient sessions. |
| | | | Varied frequency depending on disease activity and individual capabilities, ranging from 2-3 times per week in disease active or rapidly progressing conditions to 3-7 times per week for home exercises. |
| | | | Balancing the intensity of training with the essential recovery time to optimise the outcomes of the exercise programme. |

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| | Adressing diverse symptoms and needs in pwMS | Specific information for wheelchair users | Specific instructions, demonstrations and exercises tailored for wheelchair users should be integrated in exercise videos to enhance usability. |
| | | Need for support | It is important for pwMS to convey information about the need for support, particularly for those severely affected. This involves assistance in assuming starting positions, reaching objects, and potentially starting the exercise videos. |
| | | Monitoring and feedback | Involving both external and self-monitoring, setting focus areas in sessions, days, or weeks, and adjusting routines based on symptom changes or training plateaus. |
| | | Using scales and scores* | Utilising scales, scores, patient-reported measures (PROMs) and patient reported experience measures (PREMs) to visualise progress and enhance patient-centred care. |
| | | Collaboration between physicians and healthcare professionals*. | Ensuring the safe use of the programme through consultation between the treating physicians and physiotherapists regarding patient symptoms and their treatment e.g., by providing an overview of the exercises performed by the patients. |
| | | Exercising after MS relapse | Following a relapse, pwMS seek specialised exercises aimed at restoring lost capabilities and enhancing balance, among other goals. They value close collaboration with healthcare professionals, including neurologists and physiotherapists, to create a personalised recovery plan tailored to the specific symptoms experienced during the relapse. |
| | | Sensory perception training | PwMS benefit from tailored exercise programmes that address specific MS-related needs, such as sensory perception training. |
| | | Pelvic floor training | For concerns like pelvic floor dysfunction, it is advisable for pwMS to consult medical experts, particularly specialised physiotherapists, to ensure the selection of appropriate and effective exercises.. |

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| | | Eye movement disorders | Addressing issues such as eye movement disorders through specific care and training has been suggested by pwMS. |
| | | Fatigue management* | PwMS emphasised the need for clear education on the difference between fatigue and normal tiredness, addressing misconceptions about exercise-related fatigue. They highlighted the importance of using fatigue diaries and carefully planning activities and breaks to manage energy. To improve exercise tolerance, they recommended integrating rest periods, pacing strategies, and energy-saving techniques into the programme. |
| | | Heat* | PwMS point out that heat sensitivity, common in MS, can affect the feasibility and well-being of physical activities. |
| | | Regular physical activity* | PwMS and caregivers state that regular exercise regularly can alleviate some symptoms of MS. |
| | | Body awareness | Increased body awareness is an important motivator for pwMS to take part in sport and strengthens their commitment to physical activity. |
| | | Pain reduction | For pwMS, consistent physical activity can be an effective way of coping with and reducing pain. |
| | | Individual response to exercise | Attention should be paid with respect to how the body responds to exercise. If individuals experience heightened fatigue, weakness, dizziness, pain, or other symptoms, they should cease exercising and take a rest. It is vital to strike the right balance between pushing oneself and avoiding overexertion. |
| | | Adjusting starting positions | It is suggested to adjust the starting position to align with the difficulty level of the exercise and the functional level and needs of the exercising pwMS, ranging from independent walkers to wheelchair users. |
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| **Theme 3: Autonomy** | Utilisation and accessibility of technology and digital resources for exercise | Lacking experience in using exercise videos | Some pwMS are relatively unfamiliar with exercise videos encounter challenges such as difficulty in navigating content or integrating these videos into their exercise routine. |
| | | Technologies | PwMS emphasise the need for technological flexibility, requesting that exercise videos be accessible on a range of devices (TV, laptop, tablet, or phone) to facilitate seamless integration into their daily routines. |
| | | Exercise programmes on TV are perceived as motivating. | PwMS find televised exercise programmes to be motivating. Aspects contributing to this motivation include the presence of a charismatic trainer, the programme's structure, and the convenience of participating at home. |
| | | Integrating exercise apps for physiotherapy | Some pwMS have prior experience with physical training apps, and integrating these tools into physiotherapy allows for the development of highly personalised exercise programmes. These programmes can be tailored and adapted to an individual's current health status, physical abilities, and progress, enhancing the effectiveness of their rehabilitation. |
| | | Apps facilitate location-independent and self-contained use | PwMS consider mobile applications suitable for regular use, as they allow exercises to be performed anywhere. They prefer a dedicated app as a practical, customisable solution for participating in the programme. |
| | | Apps as a source of ideas for exercises | To find ideas for new exercises, pwMS use existing apps as a source of ideas and adapt the exercises to their individual needs. |
| | | YouTube facilitates exercise practice | The widespread availability and simple search function on YouTube is used by some pwMS to find suitable exercises. |

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| | | YouTube videos are rather difficult to use | The content is primarily designed for highly active individuals in sports, which means the exercises are not tailored to meet the needs of pwMS. As a result, the existing videos may not be suitable for this audience |
| | | Instruction videos on YouTube are helpful | PwMS rate some instruction videos on YouTube as helpful, they praise the clear structure and prefer short and to the point instructions. |
| | | Accessibility | The programme design should incorporate technical solutions to enhance visual accessibility, employ effective visual design strategies, include subtitles, and adopt clear communication practices to all improve overall accessibility for participants with diverse needs. |
| | Ensuring safety in exercise | Safety* | It is important to pwMS that clear instructions are included in videos to ensure safe movement practice. |
| | | Information on potential risk | PwMS sought information about potential risks associated with practicing music-supported exercises at home. These risks include falls or injuries due to balance issues or an unsafe environment, overexertion that could lead to fatigue or worsen MS symptoms, and strain from performing exercises that are too intense or fast-paced. They also expressed concerns about the possibility of musculoskeletal injuries resulting from improper technique or lack of supervision. |
| | | Assistive devices | PwMS emphasise the use of assistive devices, such as wheelchairs, in the programme to demonstrate specific exercises, e.g. highlighting the importance of secure braking during training. |
| | | Furniture for safety | PwMS emphasise the need for including practical safety tips in videos to prevent falls during exercises, suggesting demonstrators advise trainees to hold onto stable furniture if there is a risk of falling. |
| | | Safe exercise spaces | Establishing secure training areas with secure holding options to minimise the risk of falls and injuries. This includes creating spaces free from obstacles and |

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| | | | ensuring stable flooring, such as training mats or firm carpets. In addition, using assistive devices should be considered. |
| | | Footwear | The importance of wearing appropriate footwear, whether solid shoes or barefoot, during exercising is highlighted. |
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| | Empowering personal choice and self-directed participation in exercise | Empowering workability | Maintaining or regaining workability is a relevant goal for pwMS enhancing their engagement in music-supported exercising. |
| | | Personal accountability | In addition to the general usage instructions, a reference to personal responsibility for using the videos in the form of introductory videos should be included. |
| | | Preservation of autonomy* | PwMS note that exercise allows them to maintain independence, control over their health, daily activities, and increases their sense of self-efficacy and autonomy. |
| | | Fostering self-determination | Allowing pwMS to select music that resonates with them empowers them to make choices, promoting autonomy in their exercise experience. |
| | | Individual pace | PwMS prefer self-paced, individual training, highlighting the importance of autonomy and the need for exercises tailored to their varying physical abilities. for safety and health. |
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| **Theme 4: Musical meaning** | Integration of music in exercise | Exercising with music | Some PwMS already incorporate music into their exercise routines and are familiar with its use. They report varying levels of experience with music during exercise, which appears to influence their perception of the programme's auditory elements. |
| | | Balanced exercise instructions and music volume | Exercise instructions should be prominently audible, positioned in the foreground of the music, without excessively disrupting the overall musical experience. |

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| | | Aligning music with exercise goals | PwMS appreciate the combination of music with exercise, noting that the type of music should vary based on the activity. For strength training, powerful, energetic music is preferred to enhance motivation and focus, while for relaxation techniques, softer, calming music is more suitable to promote a sense of ease and recovery. |
| | | Background music | Particularly during relaxation and breathing exercises, the music can assume a background role with less emphasis on a distinct rhythm. |
| | Cultural and individual influences on exercise music | Music and cultural backgrounds | Consideration of cultural backgrounds in music selection is emphasised by pwMS, stressing the importance of choosing music that aligns with diverse preferences and rhythmic abilities. |
| | | Exercising without music | PwMS mention varying preferences, stating that depending on their daily condition, some may prefer exercising without music. |
| | | Impaired rhythm perception | Some pwMS report a lack of rhythm perception, indicating possible challenges or concerns related to synchronising movements with music. |
| | | Cognitive aspects | PwMS express a desire for physical movements to be linked with cognitive aspects of music including rhythm and lyrics. |
| | | Nature sounds | The use of nature sounds for exercises and relaxation techniques is mentioned, suggesting a broader spectrum of audio elements beyond traditional music in exercise programmes. |
| | | Music genres | PwMS suggest including various music genres in the exercise programme, recognising individual preferences. |
| | | Individual playlists | PwMS desire to use their own music libraries or playlists with the exercise programme, highlighting the importance of personalisation and familiarity. |
| | Musical elements in exercise | Music volume | PwMS describe that soft and loud music differently impact their bodily movement and emotions. |
| | | Rhythmic-auditory cues | Music beat provides a temporal structure i.e.,a rhythmic-auditory cue. |

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| | | Consistent rhythm | Most pwMS consider songs with a steady, constant rhythm easier to synchronise their physical movement with. |
| | | Instrumentation | Music and exercise movements should complement each other, with the right instruments creating various musical atmospheres. Music can enhance movements or be adapted to match them. |
| | | Music tempo | PwMS note that the tempo of the songs can influence the movement flow and synchronisation. |
| | | Music dynamics | The selection of rhythmic- dynamic music elements facilitates synchronisation of movement with the music beat. Music can either enhance the movements or be adapted to match them. |
| | The motivational impact of music on exercise | Music motivates to move | Music is acknowledged as a facilitator, making exercising easier and acting as a motivator for movement. |
| | | Joy | Use of enjoyable music as a motivator to increase adherence to therapeutic exercises. |
| | | Musical taste and mood | PwMS note that musical taste varies and is influenced by one's present mood, highlighting the subjective and dynamic nature of individual preferences. |
| | | Getting in sync | The tempo and rhythm of the music can influence the pace of exercises and help maintain a consistent rhythm, which can be particularly beneficial for coordination and balance. |
| | | Distraction from fatigue | Music can serve as a distraction from feelings of fatigue or discomfort, allowing pwMS to work out longer or with more intensity than they might without musical accompaniment. |
| | | Exercise-music synergy | The positive experience of combining exercises and music is highlighted. |

MS, multiple sclerosis; pwMS, people with multiple sclerosis.
*Covers perspectives from the analysis of interviews with healthcare professionals