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Reflections, Impact and Future Recommendations Following 'Prime Time of Life' – an Online 12-week Multimodal Physical Activity and Health Education Programme for Middle Aged and Older Adults in Laois

RESEARCH

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ABSTRACT

Introduction: Multimodal training (MMT) is important for healthy ageing. However, few middle-aged (MAA) and older adults (OA) engage in MMT. This study aimed to (1) explore MAA and OA reflections, impact and future recommendations following 'Prime Time of Life' (PTOL) – a 12-week online multimodal physical activity and health education programme; and (2) examine if participants implemented and sustained lifestyle changes during and after the programme.

Methods: A qualitative study was conducted with purposeful sampling to explore the experiences of MAA and OA who completed PTOL. Six semi-structured focus groups and five interviews were conducted using online communication technology, audio-recorded, and transcribed verbatim. Transcripts were analysed using thematic analysis.

Results: Twenty-one male (n = 7,65.9 ± 6.6 years) and female (n = 14,65 ± 7.6 years) participants completed the study. Accessibility, health benefits, suitability, social influence, and accountability were identified as key facilitators. Poor awareness, social influence, accessibility, and poor self-efficacy were perceived as potential barriers. Participants primarily (90.5%, n = 19) made lifestyle changes during the PTOL programme, and 61.9% (n = 13) maintained at least one lifestyle change seven months after completing the programme.

Discussion: Although lack of social interaction between participants was identified as a barrier, PTOL was a well-accepted method to promote healthy ageing for MAA and OA. Given there was a poor awareness of other MMT programmes and health benefits prior to PTOL there is a need for increased awareness. It is important to MAA and OA that they have convenient access to MMT programmes that are suitable for all fitness and functional abilities and provide technical support.

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INTRODUCTION

Ageing is associated with numerous negative physiological adaptations including decreases in aerobic fitness (Stratton *et al*. 1994), muscle size, strength and function (Volpi *et al*. 2004), balance (Osoba *et al*. 2019), flexibility (Nonaka *et al*. 2002), and cardiovascular and metabolic health (Harber *et al*. 2017). These adaptations can increase the risk of frailty, sarcopenia, and the development of cardiometabolic, inflammatory and bone diseases such as type 2 diabetes, hypertension, arthritis, and osteoporosis (Chodzko-Zajko *et al*. 2009). This in turn leads to poor physical and mental health, loss of independence, poor quality of life, morbidity, and early mortality (Larsson *et al*. 2018). The risk of developing these conditions is heightened when ageing is combined with physical inactivity (Strasser and Burtscher 2018).

However, there is a substantial body of evidence to show that physical activity can ameliorate this physiological decline and is fundamental to functional healthy ageing (Chodzko-Zajko *et al*. 2009). The positive functional and health enhancing physiological adaptations that occur in response to training are specific to the mode of training undertaken (Chodzko-Zajko *et al*. 2009). For this reason, it is important that middle aged adults (MAA) and older adults (OA) undertake sufficient amounts of multimodal training (MMT) incorporating aerobic, resistance, balance and flexibility exercises to obtain all of the adaptations that promote healthy ageing (Chodzko-Zajko *et al*. 2009).

Aerobic training improves the health and functionality of the cardiovascular system, body composition, blood glucose and lipid concentrations, and insulin sensitivity (Chodzko-Zajko *et al*. 2009). Aerobic training also improves aerobic fitness which is a strong and independent predictor of health (Strasser and Burtscher 2018). These beneficial adaptations mean that aerobic training plays an important role in the prevention, treatment and management of metabolic and cardiovascular clinical conditions that are prevalent in MAA and OA (Strasser and Burtscher 2018). To obtain these benefits it is recommended that adults engage in moderate intensity aerobic exercise for ≥30 minutes per day on ≥5 days per week for a total of ≥150 minutes per week, or vigorous intensity aerobic exercise ≥20 minutes per day on ≥3 days per week (≥75 minutes per week), or a combination of moderate and vigorous intensity exercise to achieve a total energy expenditure of >500–1000 metabolic equivalent minutes (MET minutes) per week (Chodzko-Zajko *et al*. 2009).

Resistance training increases muscle mass, strength, power, and function (Hughes *et al*. 2018) and reduces the risk of sarcopenia and frailty (Larsson *et al*. 2018). Resistance training also increases bone density (Layne and Nelson 1999), balance (Orr *et al*. 2006), and the ability to perform activities of daily living independently (Muehlbauer *et al*. 2012). Muscle strength and power are established as independent predictors of health and are among the strongest predictors of independence, morbidity and mortality in OA (Metter *et al*. 2004). Declines of 20–30% of total muscle mass have been reported from young adult to 80 years of age (Carmeli *et al*. 2002). Declines are magnified in older untrained individuals concomitant with sarcopenia and frailty (Larsson *et al*. 2018). There is a substantial reduction in the size and amount of the powerful type II muscle fibers with ageing (Larsson 1983) and this greatly limits the ability to execute powerful movements such as postural corrections when balance is challenged (Henwood and Taaffe 2005). In order to avoid sarcopenia and associated complications and achieve the beneficial adaptations to resistance training it is recommended that adults perform 2–3 sets of 8–10 repetitions of resistance exercises for all major muscle groups in the body on 2–3 days per week (Chodzko-Zajko *et al*. 2009).

Balance, particularly one-legged balance is a crucial component of walking, getting dressed and other activities of daily living (L. Sturnieks *et al*. 2008). Balance declines with age and is associated with poor gait, poor walking speed, frailty and falls, fractures, hospitalisation and premature mortality in older adults (L. Sturnieks *et al*. 2008). Due to the devastating consequences of poor balance in older adults, balance training is commonly recommended for adults aged 65 and older (Tiedemann *et al*. 2011). However, from a falls prevention perspective, balance training is also recommended for MAA. Balance training significantly improves balance and reduces the risk of falls and the consequences associated with same (Tiedemann *et al*. 2011). To achieve these benefits it is recommended that adults perform specific balance exercises at least two days per week, but a greater frequency of training is required for individuals who are at medium and high risk of falls (4–7 days per week) (Chodzko-Zajko *et al*. 2009). Leg strength and total

body strength impact balance ability, so it is particularly important for individuals with poor balance to also focus on developing strength (Chodzko-Zajko *et al*. 2009).

Independent living is detrimentally impacted by the reductions in flexibility, mobility and range of motion that are associated with ageing (Singh 2004). Flexibility training is very important in maintaining and improving mobility, range of motion and the performance of activities of daily living (Singh 2004). Importantly, flexibility training has been shown to reduce pain and stiffness (Singh 2004), which is commonly cited as a barrier to physical activity participation in OA (Spiteri *et al*. 2019). The literature shows that these benefits can be obtained by adults engaging in joint range of motion and flexibility exercises for all major muscle tendon groups on ≥2 days per week (Chodzko-Zajko *et al*. 2009).

The benefits of multimodal training for MAA and OA are well established. However, globally one in four adults are currently not meeting the minimum weekly physical activity recommendations (WHO, 2018) which poses a challenge for healthy ageing (Cooper *et al*. 2020). Online health programmes for healthy ageing are increasing due to the increased acceptability of information and communication technologies among OA (Ienca *et al*. 2021). Online MMT programmes can significantly improve aerobic fitness, strength, balance, and flexibility among MAA and OA (Cooper *et al*. 2021) and can overcome common barriers to exercise including weather, time constraints and lack of facilities (Spiteri *et al*. 2019). No studies have qualitatively examined the facilitators and barriers to online MMT and health education programmes for MAA and OA in Ireland. The primary aim of this study is to reflect on and identify future recommendations following an online 12-week 'Prime Time of Life' (PTOL) multimodal physical activity and health education programme for MAA and OA in Laois by identifying the facilitators and barriers for online programmes. The secondary aim of this study is to examine if participants implemented and sustained lifestyle changes during and after the PTOL programme.

METHODS

INTERVENTION AND PARTICIPANTS

Sixty-one MAA and OA who completed a 12-week PTOL home-based online MMT and health education programme in December 2020 (Cooper *et al*. 2021) were contacted six months following the completion of the programme via email to invite them to participate in this study. The programme involved two weekly 60-minute MMT sessions and one weekly 15-minute health education session. A purposive sample of twenty-one male (n = 7, 65.9 ± 6.6 years of age) and female (n = 14, 65 ± 7.6 years of age) participants were recruited with a follow-up response rate of 34.4%. Participant characteristics are outlined in Table 1.

Gender	Male (n = 7)
	Female (n = 14)
Age (years) (mean ± SD)	65.3 ± 7.1
Age group (years)	50–59 (n = 4)
	60–69 (n = 12)
	70–79 (n = 5)
Height (m) (mean ± SD)	1.7 ± 0.1 (n = 21)
Living arrangements	Alone (n = 3)
	With spouse (n = 11)
	With family (n = 7)

Table 1 Participant characteristics. m; metres.

PROCEDURE

This study was approved by the Research Ethics Committee at Dublin City University. Informed written consent was obtained prior to data collection. Qualitative data was collected in July 2021 through semi-structured online focus groups (n = 6) which ranged in size from two to four participants and interviews (n = 5) to facilitate participants who could not attend focus groups on the scheduled dates. Interviews and focus groups were audio and video recorded using Zoom (Zoom Video Communications, California, USA) due to COVID-19 social-distancing requirements. The interviews and focus groups lasted between 17 ± 4.5 (12–22) minutes and 37.10 ± 1.7 (22–53) minutes respectively and were moderated by one principal investigator (RK). A moderator guide containing open-ended questions was used (Supplementary File 1).

Participants were asked to state their age, gender, living arrangements and to discuss their thoughts on the health needs of MAA and OA, access to health information and community-based interventions, the content of the 12-week intervention, lifestyle changes implemented during the intervention, opinions of online interventions and how to engage MAA and OA to take part in future online MMT.

DATA ANALYSIS

The audio recordings from the interviews and focus groups were transcribed verbatim using Microsoft Word (Microsoft Corporation, Washington, USA). The video recordings were used to identify participants' name and gender. Participants were allocated identification numbers during transcription to protect confidentiality and maintain anonymity. All transcripts were coded using Microsoft Excel (Microsoft Corporation, Washington, USA). Braun and Clarke's framework was used for thematic analysis (Braun and Clarke 2006). RK transcribed the data, actively read, and noted initial trends within the data. Transcripts were read by a second author (DC) who was blinded to the participants. RK and DC independently coded the transcripts manually before they discussed the codes to confirm their application to the data. The codebook was reviewed and agreed by all authors. Common themes and sub-themes were identified, reviewed, and approved by all authors. Quotations were extracted to illustrate common views from diverse participants and are reported in the results. Data saturation was achieved when the ability to obtain additional new information had been attained and when additional coding was no longer feasible (Guest *et al.* 2006, O'Reilly and Parker 2012). The Standards for Reporting Qualitative Research were adhered to (O'Brien *et al.* 2014) and can be viewed in Supplementary File 2.

RESULTS

Table 2 outlines the facilitators and barriers identified following participation in the PTOL programme. There were five themes for facilitators: accessibility, accountability, health benefits, social influence, and suitability. There were four themes for barriers: poor awareness,

FACILITATORS / POTENTIAL BARRIERS	THEMES AND SUB-THEMES
Facilitators	**Accessibility**
	• Convenient access (n = 21)
	• Funding (n = 15)
	• Access to on demand relevant health resources (n = 14)
	• Flexible class timetable (n = 4)
	Health Benefits
	• Physical and mental health benefits (n = 15)
	Suitability
	• Exercise classes suitable for all fitness and functional abilities (n = 11)
	• Programme workshop content specific to middle-aged and older adults (n = 4)
	• Time of year (n = 4)
	Social influence
	• Support from others (n = 6)
	• Ageing (n = 2)
	Accountability
	• Pre and post test results (n = 3)
Barriers	**Poor awareness**
	• Unaware of available MMT programmes / services (n = 17)
	• Poor awareness of MMT health benefits (n = 16)
	Social influence
	• Lack of social interaction with online programmes (n = 11)
	• Inactive ageing culture (n = 7)
	Accessibility
	• Perceived technical concern (n = 10)
	• Cost (n = 4)
	Poor self-efficacy
	• Poor self-belief about capabilities (n = 9)

Table 2 Facilitators and potential barriers following the 'Prime Time of Life' programme.

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accessibility, poor self-efficacy, and social influence. The themes and supporting quotes are presented below. Additional supporting quotes are presented as Supplementary File 3.

FACILITATORS

Accessibility

Convenient access was the main facilitator following the PTOL programme as it was home-based and delivered online during the Winter lockdown period in Ireland. Weather was not a barrier and participants described how time efficient it was to exercise online as there was no commuting to and from classes:

> "If it's a wet evening you might not go out walking whereas this was on zoom, so it's indoors and you would do the class" (PT8, Male aged 68).

Most MAA and OA in this study would prefer MMT and health education programmes to be delivered online (n = 9). Six participants would prefer a mixed mode approach and three participants would prefer programmes to be delivered solely offline.

Funding was mentioned as a facilitator especially "for people who haven't done these things before" (PT15, Female aged 65). The funding promoted equality as "it just made everyone equal" (PT10, Female aged 66). Participants liked that they had access to on-demand health resources including health education notes, exercise circuits and videos to facilitate learning:

> "I loved having the material printed off I love the access to that afterwards" (PT14, Female aged 66).

The flexibility associated with the class timetable suited participants as they were required to attend any two classes that suited them during the week:

> "The fact that you could, if Wednesday at two o'clock didn't suit you, you could do 7:00 o'clock" (PT2, Male aged 69).

Health benefits

Physical health benefits were reported from participants with and without clinical conditions. One participant who has a diagnosed heart condition reported that "this programme gave me back a lot of confidence to do things…I know I'm not going to collapse halfway because I've been educated as to what I can do because I have done it under supervision and the confidence that comes from that is invaluable" (PT19, Male aged 70). Older participants mentioned how improvements in balance and flexibility positively contributed towards completing activities of daily living:

> "I have this problem Dystonia, which affected my balance…I would start to wobble about and by the time I was finished with the exercises…my balance had improved greatly" (PT13, Male aged 75).

Similarly, mental health benefits were also reported by participants. One male mentioned how "the benefits of the flexibility and the strength and conditioning as to how it affects me in my daily life, and my mentality" (PT5, Male aged 57). By participating in regular online sessions, the participants felt that they were socially connected. The programme provided structure during the Winter lockdown period and a sense of belonging to people who were isolated and lived alone:

> "While we were all going through this whole lockdown period, we all actually felt so alone, and this kept us going. It helped us in more ways than one. Not just physically but emotionally and mentally as well…You just knew you weren't on your own, even though I was one of the people on my own in the house" (PT11, Female aged 65).

Suitability

Participants liked how the PTOL programme was suitable and designed specifically for MAA and OA "I liked that it was specifically for the older age group because it was very focused on all the issues that happened to people as they age" (PT15, Female aged 65) and adaptations

and progressions were available for all exercises to suit all fitness and functional abilities. One participant described the sense of achievement she felt as she progressed throughout the levels, "I loved the choice within the structure. You know, the different levels and that you could actually feel yourself improving…you can self-evaluate which I found really good, and that was a great incentive" (PT14, Female aged 66).

Time of year was considered an important element of the programme, which was during the Autumn and Winter months. One participant mentioned how it would be difficult for him to engage with online programmes during the summer months, "It depends on the time of the year…the summertime sometimes it is difficult when the evenings get brighter to force yourself to come in… I wouldn't mind in the fall of the year again" (PT7, Male aged 58).

Social influence

Support from family motivated some participants to engage with the programme, "our daughter saw it online and she prompted us in the beginning" (PT12, Female aged 75). Additionally, the PTOL team created a supportive environment to motivate participants:

> "…so professional and you motivate people, and you encourage, and you never judge" (PT15, Female aged 65).

Some participants noticed deterioration of their own physical condition, while others were aware of a decline in the functional capacity of their acquaintances, leading to increased dependency on others to perform tasks which acted as a catalyst to engage in the PTOL programme.

> "I was getting my son to lift and move stuff and I eventually said I should be able to do that" (PT2, Male aged 69).
> "What frightens me about lots of my acquaintances is their total immobility. I have friends now in nursing homes. It frightens the life out of me. They're not able to get out of bed" (PT18, Female aged 77).

Accountability

Some participants were motivated to improve their multimodal fitness as they were aware of assessments pre and post the 12-week programme:

> "I think the pre- and post-tests are very motivational…the pre is an eye opener" (PT4, Female aged 61).

BARRIERS

Poor awareness

Most participants stated that they were unaware of available MMT and/or services prior to engaging in the PTOL programme. Two participants identified the gym as a potential service outlet but one of these participants stated that they would not attend a gym because "it isn't something that would suit me" (PT2, Male aged 69). In addition, the health benefits associated with MMT prior to joining the PTOL programme, particularly regarding balance, flexibility, and strength training, were not well-known:

> "I knew nothing about the balance or anything. It was all aerobic really" (PT19, Male aged 70).

It was also mentioned that some people may not identify "that they need exercise" (PT8, Male aged 68) or the need to engage in MMT as they perceive aerobic training to be sufficient for health:

> "I suppose the perception that I run 6 kilometres every day, so I know what I'm doing and I don't need to participate" (PT16, aged 51).

Social influence

The lack of social interaction with others is a barrier associated with online programmes. Some participants recommended that future programmes should incorporate a peer support group to enable social connection:

> "There's no social aspect to it and comradeship is a great thing to motivate you... even if it was left online, I think it would be great to meet up even once a month or something like that" (PT12, Female aged 75).

Some participants believe that there is an inactive ageing culture in society which leads them to believe that they are "too old for this" and should "sit down and watch television or... go out and potter around the garden or something" (PT2, Male aged 69).

> "It kind of can be intimidating for people of that age group middle age because they always think oh that's for the young ones or whatever" (PT11, Female aged 65).

Accessibility

Participants mentioned that technology could be a barrier to accessing online programmes for people who are not confident using technology as "zoom and using the laptop stuff can be quite daunting" (PT14, Female aged 66). Cost was also identified as a potential barrier to joining online programmes as one participant said, "it probably would have deterred me from taking that first leap" (PT5, Male aged 57).

Poor self-efficacy

Judgement from others for being overweight and/or unfit were identified as barriers for some participants. An inability to perform exercises correctly was also mentioned as a potential barrier:

> "People are afraid to be seen in a group, you know if they're a little bit overweight and very unfit...I think possibly that's another advantage of online is that the comparison of the individuals within the group isn't so obvious" (PT1, Female aged 69).
> "There's a slight fear joining a class that everybody else knows about it and you don't know about it" (PT5, Male aged 57).

LIFESTYLE CHANGES DURING AND AFTER THE PTOL PROGRAMME

Nineteen participants (90.5%) mentioned that they made lifestyle changes during the PTOL programme, and thirteen participants (61.9%) stated that they maintained at least one lifestyle change seven months after completing the programme. The main lifestyle change reported was increased participation in exercise, more specifically aerobic (n = 9), balance (n = 5), flexibility (n = 4) and resistance exercise (n = 3).

> "Because I've seen the benefits of the flexibility and the strength and conditioning as to how it affects me in my daily life, and my mentality that is something I certainly won't let lapse again" (PT5, Male aged 57).

The health education workshops were pivotal in increasing awareness and knowledge of the health benefits of MMT, and one participant mentioned that she now prioritises her exercise "as opposed to fitting it in at the last minute" (PT17, Female aged 61). The health knowledge obtained was a motivator to engage in exercise "I had gained weight prior to all of this and there were times I was self-conscious of doing stuff from going out...it got me outside thankfully, I walked more I started to feel more comfortable knowing how it was all helping me" (PT11, Female aged 65). Seven participants want additional support to maintain lifestyle behaviours. One participant mentioned how she became more relaxed during the summer months but believes that "it's very important that I get back into it again" (PT21, Female aged 72). Many of the participants want "the discipline of the classes" as it "was hugely important", particularly for flexibility exercises as "it is something that we don't do enough" (PT17, Female aged 61).

DISCUSSION

This study provided a qualitative investigation into the reflections, impact and future recommendations following PTOL – a 12-week home-based online MMT and health education programme for MAA and OA. The main findings of this study were that accessibility was the main facilitator, while poor awareness of available MMT programmes/services was the main

barrier identified following the programme. These findings indicate that home-based online programmes are accepted among this population and can promote the adoption of healthy lifestyle behaviours. However, there is a need for an increased availability and promotion of funded MMT programmes and services that are specifically designed and targeted for MAA and OA to promote healthy ageing.

ACCESSIBILITY

Accessibility was the main facilitator following the PTOL programme. Many older people, including participants in our study, prefer to exercise in their own homes with some professional guidance (Yardley *et al*. 2006, Beauchamp *et al*. 2007, Hillsdon *et al*. 1995) as it is convenient, time efficient and can overcome common perceived barriers to exercise such as cost, unfavourable weather conditions and feelings of judgement and intimidation in group exercise environments, especially for new adopters to exercise who may be more prone to improper technique, fear of contracting COVID-19 and those living with overweight and obesity (Costello *et al*. 2011, Goethals *et al*. 2020). There is a growing emphasis on home-based physical activity interventions as they can be less costly than gym-based interventions (Jansons *et al*. 2018). Financial costs and affordability are well established barriers to physical activity for MAA and OA (Buman *et al*. 2010, Spiteri *et al*. 2019). This free PTOL programme incentivised participation in the programme and promoted equality. The use of financial incentives may assist with the initiation of physical activity. Physical activity is a habitual behaviour and financial incentives may not necessarily result in long term behaviour change (Strohacker *et al*. 2014). However, 61.9% of participants in this study reported that they maintained at least one lifestyle change seven months after completing the programme. Longer term effectiveness should be explored in future research. Although technical concern was identified as a barrier for MAA and OA to engage with online MMT programmes in our study and others (O'Connell *et al*. 2021), this was not a barrier for PTOL participants as they received step-by-step written and video instructions and additional technical support. This is an important element to incorporate into future MMT programmes to improve accessibility by overcoming technology barriers. Participants in our study appreciated the adaptations and progressions that were available for all exercises to suit varying fitness and functional abilities as it enabled them to work to their own ability and monitor progress throughout the programme. Similar to findings reported by Bethancourt et al (2014), motivating factors for programme utilisation included having instructors who were motivating and equipped with the knowledge to work with older populations with clinical conditions, having the ability to attend preferred exercise class times and having access to free classes. It has been previously noted that staff who deliver exercise programmes can lack the skills required to deal with specific medical conditions (Garner-Purkis *et al*. 2020). In our study, participants received exercise education from a clinical exercise physiologist and had access to on-demand health resources including health education notes, exercise circuits and videos to facilitate learning for participants living with and without clinical conditions.

POOR AWARENESS

Although the physical and mental health benefits associated with regular MMT are well-established (Chodzko-Zajko *et al*. 2009), findings from the current study indicate that many MAA and OA had a poor awareness of the health benefits associated with MMT prior to joining the PTOL programme, particularly in relation to balance, flexibility, and resistance training. Walking is often the most popular form of physical activity for adults worldwide (Wennman and Borodulin 2021, Dai *et al*. 2015) and although there was a greater awareness about aerobic exercise in our study, it was acknowledged that some participants may not identify the need to engage in MMT as they perceive themselves to be aerobically active and believe it is sufficient to obtain health benefits. Although different modes of exercise may benefit different health-related factors, the combination of all modes (aerobic, resistance, balance, and flexibility) is essential for positive healthy ageing effects (Chodzko-Zajko *et al*. 2009). Our results indicate that there is an evident need to increase awareness about the health benefits associated with MMT among MAA and OA and to increase the provision of MMT and health education programmes that are specific to this cohort as there was a poor awareness of other available MMT programmes and services which has been previously identified in this cohort (Bethancourt *et al*. 2014).

SOCIAL INFLUENCE

Physical activity often serves as an important means of socialisation for MAA and OA and is positively associated with mental health-related quality of life (Devereux-Fitzgerald *et al*. 2016). Results from the Survey of Health, Ageing, and Retirement in Europe (SHARE) indicate that a poor sense of social support and increasing age were significant variables associated with physical inactivity (Gomes *et al*. 2017). Lack of social interaction between participants due to the online mode of delivery was identified as a barrier. However, some participants stated that the support they received from the online programme was a facilitator as it provided an opportunity for virtual connection and a sense of belonging to people who were isolated and lived alone during the Winter lockdown period in Ireland. Although there are disadvantages of online programmes, there are major advantages as they can overcome many external barriers to physical activity such as location and weather (Justine *et al*. 2013) provided that there are available and reliable internet services in rural and remote locations.

SELF-EFFICACY

Poor self-efficacy was identified as a potential barrier to engage with online MMT and health education programmes. OA tend to have lower self-efficacy for exercise as they believe that their physical ability has deteriorated with age and are at risk of injury (Conn *et al*. 2003). It is therefore important to advertise that programmes of this nature are designed by skilled professionals specifically for MAA and OA with varying fitness abilities and to incorporate strategies to improve self-efficacy as it is one of the strongest predictors of exercise adherence (Sherwood and Jeffery 2000). The PTOL programme incorporated weekly health education workshops to increase awareness about the importance of MMT for healthy ageing and the research team provided feedback on functional test results to participants upon completion of the programme to increase self-efficacy (Rajati *et al*. 2014). Most participants in our study made lifestyle changes during the PTOL programme and most continued to maintain at least one lifestyle change seven months after completing the programme. Increased participation in exercise was the most common lifestyle change reported by participants which indicates that self-efficacy increased.

Therefore, future healthy ageing programmes should incorporate health education, functional testing and provide feedback on test results. It is common for participation in exercise to steadily decline when not participating in structured exercise programmes. Cost, aversion to gyms, motivation and boredom were the main factors influencing exercise maintenance 12 months after the cessation of a supervised exercise intervention for OA (Timmons *et al*. 2020). Therefore, an increase of funded or low-cost, continuous, engaging and structured online multimodal physical activity programmes are warranted.

LIMITATIONS

Response bias may occur as participants had completed the 12-week PTOL programme. This poses a limitation on the generalisability of findings as they may have had a more positive opinion of the programme compared to those who did not complete the programme. It is also possible that participants provided socially desirable responses to questions. In qualitative research there are limitations associated with the potential role of the researcher in biasing research results (Robson 2002). However, this concern was addressed by using a semi-structured approach to the interviews and focus groups which enabled flexibility in the discourse. The effect of this was reduced as two researchers independently analysed the data.

CONCLUSION AND FUTURE RECOMMENDATIONS

This research has reflected on and identified future recommendations from participants who completed the PTOL programme by identifying the facilitators and barriers for online multimodal physical activity and health education programmes. There is an evident need to increase awareness about the health benefits associated with MMT, specifically resistance, balance, and flexibility exercise. MAA and OA want online multimodal physical activity and health education programmes to be funded, specifically designed for this cohort, suitable for all functional abilities and to provide technical and social support. Although many participants

implemented and sustained lifestyle changes since completing PTOL, there is demand for additional support to continue engaging in MMT to promote healthy ageing.

ADDITIONAL FILES

The additional files for this article can be found as follows:

- **Supplementary File 1.** Moderator guide. DOI: https://doi.org/10.5334/paah.181.s1
- **Supplementary File 2.** Standards for the Reporting Qualitative Research (SRQR) Checklist (O'Brien *et al*. 2014). DOI: https://doi.org/10.5334/paah.181.s2
- **Supplementary File 3.** Additional supporting quotes. DOI: https://doi.org/10.5334/paah.181.s3

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COMPETING INTERESTS

The authors have no competing interests to declare.

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