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To cite this article: Katy Pedlow, Natalie Duff, Suzanne McDonough, Karen McConnell, Claire McFeeters, Angela Carlin, Noelene Hughes, Zoe Campbell, Andrew Bell, Aoife Stephenson, Gary Adamson, Jemma Hawkins, Charlene Edwards & Sarah Howes (31 Aug 2026): Co-design of a physical activity maintenance intervention for adults with stroke, Disability and Rehabilitation, DOI: [10.1080/09638288.2026.2723372](https://doi.org/10.1080/09638288.2026.2723372)

To link to this article: <https://doi.org/10.1080/09638288.2026.2723372>



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RESEARCH ARTICLE



Co-design of a physical activity maintenance intervention for adults with stroke

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ABSTRACT

Purpose: To co-design a physical activity (PA) maintenance programme for stroke survivors who have completed a community-based rehabilitation programme.

Materials and methods: A mixed methods approach, following the DECIPHER framework, incorporated stakeholder consultation (five focus groups) and intervention co-production (three workshops) involving stroke survivors, carers, physiotherapists, and exercise professionals. The final phase, intervention prototyping, remains ongoing and will be reported separately.

Results: Thirty-eight participants participated in the stakeholder consultation, with 11 participants participating in the co-production workshops. Focus groups results through inductive thematic analysis identified two themes: shifting realities of PA post stroke and motivation through community. Subthemes included barriers to PA, building confidence through PA, peer support and structuring a supportive post stroke PA pathway. Co-production workshops focused on identifying key characteristics of the intervention resulting in the development of a group-based exercise programme in a gym setting, led by exercise professionals and supported by a physiotherapist.

Conclusions: Co-design with key stakeholders informed the development of a prototype PA maintenance programme that reflects the priorities of those who will use and deliver it. Social connection and appropriate stroke-specific training for providers may improve long-term engagement in PA and inform future implementation and evaluation.

ARTICLE HISTORY

Received 5 March 2026
Revised 17 August 2026
Accepted 19 August 2026

KEYWORDS

Physical activity
maintenance; stroke;
post-rehabilitation; adults;
fitness professionals;
co-design

► IMPLICATIONS FOR REHABILITATION

- Physical activity participation commonly declines after stroke and following completion of structured rehabilitation programmes.
- Co-design involving stroke survivors, caregivers, and rehabilitation professionals can identify priorities and support needs for ongoing physical activity participation.
- Stakeholder involvement in intervention development may help ensure that strategies to support long-term physical activity are relevant to real-world rehabilitation contexts.

Introduction

Stroke is the third leading cause of death and disability combined globally [1]. Several comorbidities, including hypertension, atrial fibrillation, and metabolic disorders, have been shown to significantly increase the risk of stroke [2,3]. Adopting a healthy lifestyle, particularly one that includes regular physical activity (PA), can play a key role in reducing stroke risk [4–8]. Furthermore, engaging in PA following a stroke has been associated with a reduced risk of stroke recurrence [6,9]. However, for many people after a stroke this can be challenging. Individuals may experience reduced capacity due to impairments such as muscle weakness and post-stroke fatigue, while functional limitations may restrict the types of

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 Supplemental data for this article can be accessed online at <https://doi.org/10.1080/09638288.2026.2723372>.

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suitable physical activities. Alongside this, personal factors such as anxiety and amotivation may further decrease willingness to participate in PA [10,11]. Environmental barriers such as lack of transport and of accessible facilities and equipment also restrict opportunities for PA [12–14]. This is compounded by inadequate support from family, carers and health professionals which has been identified as crucial for long-term engagement in PA among stroke survivors [15,16].

Thus, globally, individuals who have experienced a stroke face ongoing challenges in maintaining long-term participation in PA [4,10,17]. One mechanism to support PA is the implementation of community-based programmes that incorporate behaviour change strategies. In Northern Ireland, the post-stroke rehabilitation programme (PREP), addresses this issue by providing a structured six-week intervention delivered by a regional community and voluntary organisation (Northern Ireland Chest Heart and Stroke; NICHHS). Each week consists of one hour of group exercise led by a physiotherapist and one hour of education delivered by a coordinator, who is a support worker or exercise professional trained to deliver PREP, from the organisation [18,19].

Whilst PREP has successfully supported stroke survivors to complete rehabilitation-based exercise [19,20], there remains a significant gap in interventions designed to support the transition from structured exercise to sustained long-term PA, leaving many stroke survivors without the skills and support needed to remain active over time. Previous research shows that PA levels decrease after individuals complete their structured programme [21–24]. Although, current Physical Activity Referral Schemes (PARS) exist to support people living with chronic health conditions, stroke survivors are not eligible for referral based solely on their stroke diagnosis [25] in NI and across many parts of the UK. This exclusion highlights a critical deficiency in long-term support for PA maintenance for this population. To address this gap, the present study (called PREP Maintain) employed a co-design and prototyping framework [26] to guide the design of an acceptable and sustainable PA maintenance intervention for stroke survivors in Northern Ireland. The aim of the co-design process was to develop a complementary intervention intended to follow completion of PREP and support the maintenance of PA behaviours beyond the structured rehabilitation-based exercise programme. The co-design framework outlines a three-stage process for developing complex public health interventions in collaboration with key stakeholders. This includes stakeholder consultation (stage 1), co-design (stage 2), ultimately leading to prototype development (stage 3) of the PA maintenance intervention. This paper reports on stages 1 and 2; therefore, the objectives were:

1. To understand the perspectives of key stakeholders regarding their needs, experiences and preferences in relation to a PA maintenance programme [stage 1- stakeholder consultation].
2. To co-design and refine the components, structure, and content of a PA maintenance programme in collaboration with stakeholders to help with development and customisation of the intervention [stage 2- co-design].

Methods

Study design

A detailed description of the overall study design and intervention development procedures is available in the published protocol paper [27]. Stage 1 of PREP Maintain, as per the first stage of the co-design framework [26], involved synthesis of existing literature and consultation *via* focus groups with key stakeholders to understand their experiences of participating in or delivering PA interventions for people who have experienced a stroke and their perceptions of the requirements of a PA maintenance programme. Stage 2 involved co-design workshops informed by the focus group findings and conducted with a sub-group of the stakeholders with the aim of developing and refining the PA maintenance intervention (intended to follow completion of PREP and support the maintenance of PA behaviours beyond the structured rehabilitation-based exercise programme). The co-designed intervention and its piloting (stage 3), which is ongoing, will be reported elsewhere.

The study was approved by Ulster University Research Ethics Committee (REC/24/0044). The protocol was registered on OSF (Open Science Framework, <https://osf.io/5sc2r>) and has been submitted for publication.

The patient and public involvement (PPI) group consisted of two staff members from NICHHS, and one stroke survivor. The NICHHS representatives included the Head of Stroke Services and a Senior Care Services Co-ordinator. Their involvement was particularly relevant given their roles within the charity supporting people living with stroke and their experience in delivering the existing PREP programme, providing valuable insights into service user needs and programme implementation. This group was involved at all stages of the study including reviewing of the focus group questions, reviewing the analysis of the focus groups and creation of topics for the co-design workshops.

Stage 1: stakeholder consultation via focus groups

Participants and recruitment

Separate focus groups were organised for each of the three stakeholder groups: stroke survivors currently completing PREP (including their caregivers), PREP staff (physiotherapists and PREP coordinators), and those involved in delivering community exercise to stroke survivors outside of PREP. Eligible participants included adults aged 18 and over who were willing and able to communicate in a group setting. PREP participants were required to be currently completing or have previously completed PREP. The caregivers were eligible if they were supporting/had supported a stroke survivor to complete PREP. PREP staff were eligible if they were currently a care coordinator or physiotherapist and had a minimum of 12 weeks' involvement with PREP. Health and exercise professionals, such as physiotherapists and gym instructors with training and/or experience working with neurological conditions, who had experience supporting survivors of stroke in community-based PA. For online focus groups, participants needed access to a digital device with internet and a microphone; in-person focus groups were offered as an option to PREP participants, but this was not possible for the other groups due to geographical spread.

PREP participants and their caregivers were recruited from three sites. Sites were PREP groups identified by the regional care coordinator of the community and voluntary organisation, to include one rural and two urban sites (from two different geographical locations in Northern Ireland). Written study information was provided to potential participants by the PREP coordinators during week 4 of the PREP programme. Interested individuals consented to share their contact details with the research team, then the research associate followed up *via* telephone and answered any questions regarding participation. If interested, an online consent form was emailed to the potential participant along with information relating to the time and location of the focus group. A demographic questionnaire was also sent to capture key information such as age, time post stroke, mobility levels, and self-report of weekly pre- and post-stroke PA levels.

PREP staff were recruited regionally across all PREP sites *via* an email disseminated from the regional care coordinator to invite them to participate in an online focus group. Local health and exercise professionals were recruited *via* social media and emails sent to previous research participants that had expressed an interest in future involvement. Those who responded expressing interest were subsequently contacted by a member of the research team to complete an online consent form before providing demographic information to support study analysis.

Procedure

Separate focus groups were conducted for each stakeholder group to promote open discussion, minimise potential power imbalances and allow exploration of the unique perspectives of each group. To maximise accessibility and participant comfort, focus groups were conducted either in person or online according to participant preference, and participants could attend with a family member or carer, who was permitted to contribute to the discussion if appropriate. Five focus groups were conducted: three in-person (stroke survivors and their caregivers; this was their preferred format) and two online (one for PREP staff and one for other health and exercise professionals).

The literature synthesis completed as part of Stage 1 involved a scoping review of six studies [28–33]. This scoping review identified commonly used intervention components (e.g. group exercise programmes, home exercise programmes), including behaviour change strategies (e.g. goal setting,

self-monitoring), and outcome measures (subjective or objective PA level) used in previous interventional studies investigating PA maintenance post-stroke. These findings were used to inform the focus group topic guides ([Supplementary 1](#)). Questions focused on participants' perspectives on attitudes, barriers and facilitators to PA for people living with stroke, experiences of participating in or delivering PA for this population and perceived requirements for a PA maintenance programme. Focus groups lasted between 60 and 90 min and were facilitated by KP or SH, both researchers with experience in qualitative methods and focus group facilitation. ND attended each session as an observer to take field notes. The research team comprised academics with backgrounds in physiotherapy and sport, and experience in qualitative health research. All online focus groups were video- and audio-recorded, which were both recorded as standard by the videoconferencing software, while in-person focus groups were audio-recorded only.

Analysis

The focus groups were transcribed verbatim by a member of the research team before undergoing Reflexive Thematic Analysis [34]. Two members of the research team (ND and SH) independently listened to the focus groups alongside the written transcriptions to allow in-depth familiarisation with the data. The data were inductively coded independently by two researchers to understand participants' experience in relation to PA maintenance. Codes were reviewed to identify repeated or connected ideas, and codes related to each other were grouped to identify subthemes. These subthemes were then discussed with the wider research team to reach consensus on the final themes. Data related to the requirements of a future intervention were coded deductively, according to components, content and structure. These themes were summarised in lay terms with the support of the patient and public involvement (PPI) representative (CE) on the research team. This summary was then used in the co-design workshop phase to present the data to the workshop participants.

Stage 2: co-design workshops

Participants and recruitment

Workshops included the same stakeholder groups included in stage 1. The aim was to recruit 12 participants, with representation from all stakeholder groups within each workshop. Focus group participants from stage 1 were invited to participate in the workshops. An email containing workshop information was sent to all participants. If interested, they completed and returned an online consent form and were sent the details for joining the first workshop.

Procedure

Three 90-min co-design workshops were conducted online over the course of five weeks. The aim of the workshops was to iteratively co-design the PA maintenance intervention. The workshops were facilitated by a member of the research team (KP), with a second member of the research team (ND) present to take field notes. All workshops were video- and audio-recorded to support analysis. The discussions were structured using the Implementation Framework for Intervention Development [35], which provided a practical guide for exploring contextual factors influencing feasibility, acceptability, and delivery. Each workshop began with an overview of the objectives of the project, a summary of the preceding findings and how they informed workshop content, and an outline of the workshop structure. The facilitator then prompted discussion by asking an initial question which was then discussed to gain the perspectives of the group. The facilitator ensured consensus was reached for decisions on intervention design. The first workshop utilised breakout rooms to allow for small-group discussion of each intervention component, with feedback to the wider group to gain consensus. Breakout rooms were discontinued in workshops 2 and 3, as it was felt that the co-design process benefitted from whole-group discussions that allowed participants to build on each other's perspectives and ideas.

The workshops in stage 2 were built off the findings from stage 1 focus groups and key literature identified in the scoping review [28–33]. Topics of workshops two and three were also informed by the preceding workshops. Workshop one focused on the type of exercise, the setting, and those who should

be involved; i.e., PREP staff and volunteers. Workshop two focused on the intervention length, instructors, and to outcome measurement. The purpose of the third and final workshop was to finalise the intervention materials.

Analysis

Field notes from each workshop were crosschecked with the audio-recordings (ND). These were analysed iteratively between each workshop and key content, such as decisions on intervention design and feedback from participants, was identified. This was summarised and presented at the beginning of the subsequent workshop to confirm participant consensus and obtain further feedback to inform intervention development.

Following the workshops, workshop data were coded using the themes identified during focus group analysis. Emergent findings from both the focus groups and workshops were reviewed by the research team to develop a PA maintenance intervention prototype. This was discussed with staff members from the voluntary organisation supporting delivery of the planned intervention to finalise refinement of the prototype intervention based on the findings of the co-design process and the feasibility and practicalities of delivery.

Key components of the proposed prototype intervention are reported below. Full details of intervention design and its evaluation through a three-wave process to allow for iterative refinement of the intervention are ongoing and will be reported elsewhere.

Results

Stage 1: stakeholder consultation via focus groups

Participants

Participant recruitment occurred between September 2024 and November 2024. Participant flow is summarised in Figure 1. Of 116 people contacted about the study, 46 individuals consented, but due to scheduling issues 38 participants took part in the focus groups. Focus group participants included stroke survivors ($n=18$) and their carers ($n=3$), PREP staff ($n=10$), and exercise professionals ($n=7$).

Characteristics of participants living with stroke

Table 1 provides the demographics of the PREP participants. Participants ($n=18$), of which 55% ($n=10$) were male, ranged in age from 47 to 87 years (mean $\pm$ SD age: 66.61 ± 12.58 years). Participants were on

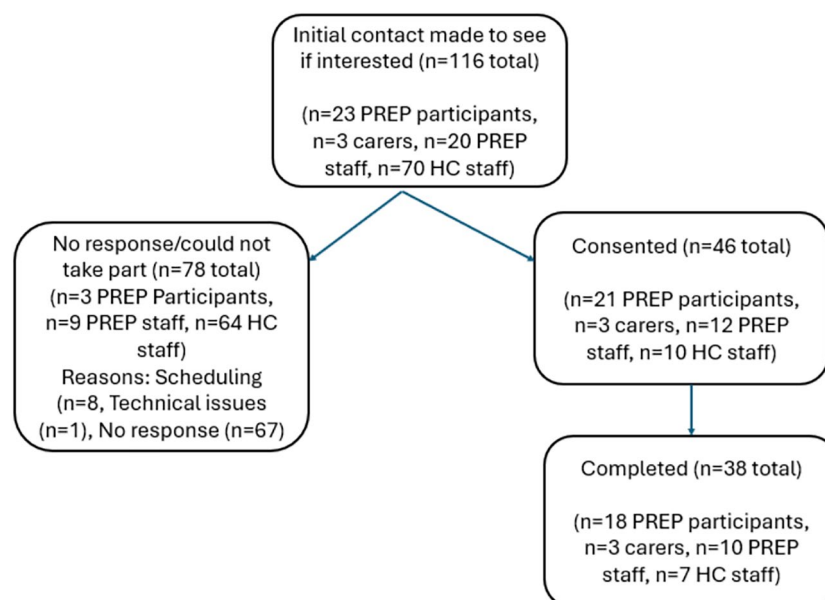


Figure 1. Participant flow diagram.

Table 1. Demographics of PREP participants.

PREP participants (n = 18)		
Age: years average $\pm$ SD (range)		66.61 $\pm$ 12.58 (47–87)
Gender (M:F)		10:8
Time post stroke: weeks average (range)		63 $\pm$ 68.77 (12–254)
Mobility	Walk independently (w/o aid)	11
	Walk independently (w/aid)	6
	Walk w/ supervision	1
Pre-stroke PA level	Sedentary / minimal PA	2
	Moderate PA	11
	Vigorous PA	5
Current PA level	Sedentary/ minimal PA	11
	Moderate PA	6
	Vigorous PA	1

average 63 weeks (range 12–254 weeks) post-stroke at the time of consent and most were independently mobile (61%, $n=11$) post stroke. They self-reported a moderate level of PA prior to having their stroke (61%, $n=11$). Only 55% ($n=10$) stated they engaged in some form of PA, whereas 39% ($n=7$) engaged in a moderate level or vigorous level of PA after having their stroke. In total, 66% ($n=12$) showed a decrease in their PA level since having a stroke, whereas 6% ($n=1$) displayed an increase, and 28% ($n=5$) maintained their PA level post stroke.

PREP staff and other health and exercise professionals

Characteristics of the PREP staff and other exercise professionals are provided in [Supplementary 2](#). Nine professionals (53%) had between 1 and 5 years of experience supporting individuals with stroke, while the remaining ($n=8$) had six or more years' experience. Ten professionals were involved directly in the delivery of the PREP programme as a care co-ordinator ($n=5$) or a physiotherapist ($n=4$), while seven professionals had experience of delivering PA to people who had experienced a stroke within a health care trust or a private physiotherapy role ($n=5$) or as an exercise professional ($n=2$).

Key findings from the focus groups

Two themes and four sub-themes were identified from the focus group data, alongside collation of feedback on the requirements of a PA maintenance programme from the perspectives of the key stakeholder groups.

Theme 1: From Participation to Preservation: Shifting Realities of PA Post-Stroke.

This first overarching theme represented how participants reflected on the change they experienced in their volume and type of physical activities after having a stroke. Pre-stroke activities spanned leisure, occupational, domestic and transportational domains, with participants feeling they were unable to participate to the same extent with their previous activities.

Sub-theme 1.1: a shift in movement; barriers to PA

Reflecting on the types of physical activities they engaged in and enjoyed prior to their stroke, PREP participants described a wide range of pursuits, including exercise classes, cycling, physical jobs and involvement with community events. However, following their stroke, participants reported engaging in different activities. These activities were often more functional in nature, focusing primarily on daily tasks such as doing laundry, preparing meals, or walking the dog.

"I was at Pilates, and I was at yoga. I was at everything [...] I wouldn't be doing any of that now " (PREP Participant 7)

"I walk my dog, I'm trying to build it up again. It's just going to take time" (PREP Participant 3)

PREP participants identified numerous barriers that limited their ability to resume or enjoy similar forms of PA post stroke such as physical limitations, reduced confidence and a lack of appropriate support.

“Fatigue is the worst part.” (PREP Participant 7)

“Well, one of the biggest issues that I have now, you didn’t ever have before, was motivation. Everything takes an effort.” (PREP Participant 12)

These barriers to PA and its maintenance were mirrored in the discussions by the PREP staff and health professional participants. Barriers included stroke-related impairments as well as logistical and environmental challenges. Key obstacles included a lack of referral pathways, limited transportation options, and the inconvenient location of fitness facilities. A particular concern raised was the ineligibility of stroke survivors for referral to gyms through PARS and as a result, professionals reported seeking alternative avenues for referring individuals, although these efforts are often constrained by structural limitations. Additionally, the lack of adequately trained staff in fitness settings was frequently cited as a barrier. Professionals noted that even when stroke survivors are referred to community gyms, they may feel out of place due to a lack of confidence in staff members’ ability to tailor sessions appropriately.

“For some of my clients, the amount of effort they have to put in attending the class, the audio, the visual processing, listening to me doing the exercises, they’ll report that they’re basically wiped out for a couple of days afterwards.” (PREP Staff 22; Physio)

“There are difficulties there with accessibility and things that I think most people kind of can appreciate. So, we’re limited.” (Health professional 46; Community Physio)

Sub-theme 1.2: building confidence through supportive PA

Participants involved in the PREP programme as both participants and staff made a variety of positive comments that highlighted that they valued the experience of PREP in improving their knowledge of stroke and their confidence in completing PA. Furthermore, attending PREP with the support of staff and volunteers was identified as a positive support mechanism during the sessions. Carers identified their desire to support people living with stroke to be more physically active however they felt they didn’t have the expertise needed.

“It give, it helped my confidence up again. And, the fear of exercising and that. And I am waiting to get started on the gym again.” (PREP Participant 39)

The PREP staff described the ways they encouraged the participants to engage in PA at home during the week outside of the weekly PREP session.

“I would always check in with the group to see if they’re doing any other type of physical activity, be it just being out in the garden or just something other than exercise, just to see what they’re up to, and you find that for the most part most people do, because PREP, I find really encourages them to stay motivated.” (PREP Staff 20; Care Coordinator)

Theme 2: Motivation through community

The second theme referred to the participants reflecting on ways to ensure people living with stroke feel supported in a PA maintenance intervention. This included discussion of the aspects of the PREP programme that fostered support, as well as components of a future intervention that would support PA maintenance.

Sub-theme 2.1: moving together: peer support and structure in post stroke PA

Social connection was consistently highlighted as a major motivator, with a preference for group-based formats promoting peer support and shared experience viewed as essential for motivation and sustained participation. Participants agreed the programme should be limited to stroke survivors to ensure relevance and support.

“Yeah, PREP group is really good because everybody’s at different stages, and yet because we’ve all had a stroke, there are some people that are better than others and everybody can help each other.” (PREP Participant 19)

"So, I feel like grouping small groups in a community centre and mixing both age groups younger and older can help." (Health professional 31; Private Physio)

Sub-theme 2.2: Blending expertise with innovation

Structuring a supportive post stroke PA pathway Discussion around intervention delivery identified varied options for potential instructors or the future maintenance programme. Health and exercise professionals and the PREP staff tended to support delivery by an exercise professional, believing it would de-medicalise the programme and support sustainability of delivery. PREP participants/stroke survivors felt that some participants may require the support or oversight of a physiotherapist. All agreed that it would be beneficial to have a physiotherapist involved, with a suggestion of initial physiotherapy input transitioning to independent delivery by an exercise professional throughout the programme.

"Physio, definitely, with a physio to oversee and then an exercise trainer experienced off at a certain level of qualification is a must." (PREP Participant 27)

"I think it's like a triangle where the base will be the provider, whether it can be a physiotherapist or personal trainer, but then the other two are - one is a patient, another one is family." (Health professional 31; Private Physio)

This subtheme also included other intervention components to support behaviour change and continuation of PA. PREP staff and exercise professionals suggested additional components to the programme such as activity diaries, goal setting, and education. It was stated that these components are difficult to fit into the current PREP but could possibly be adapted to the future programme. Additionally, the potential use of technology to support online delivery of a programme was suggested.

"I think the big and small goals is really important.... I think having those goals is really what drive people to change." (Health professional 43; Private Physio)

"You know, using things like that to try and get people to maybe do the exercises a wee bit at home in between classes and then try and direct them even to some online things you know, like there's that get up and go online." (PREP Staff 25; Physio)

Key learning from focus groups on intervention development to inform co-design workshops

The focus groups highlighted impact of stroke on individuals' participation as well identifying where current provisions fall short in terms of supporting them to maintain PA. Feedback on the barriers, needs and preferences was included in the workshops to ensure shared understanding to support consideration of accessibility, feasibility and acceptability of a future PA maintenance intervention. A strong theme centred on the importance of social engagement and support from peers, family, physiotherapists, and other professionals. The workshops included a dedicated session to determine roles within the intervention. This also accounted for who the intervention would be designed for and training requirements for those involved in delivering it. Focus groups identified clear preferences, for example group-based exercise was preferred over individual exercise. Additionally, participants shared what had worked well in their experience, for example classes with an exercise and educational component. This was summarised in workshops encouraging participants to expand on and identify intervention components to support PA and its maintenance, particularly strategies to progress towards becoming more active in daily life outside structured classes.

Stage 2: co-design workshops

Participants

Eighteen participants consented to take part in the co-design phase, of which eleven participated in at least one of the three workshops (stroke survivors; $n=3$ and caregiver; $n=1$, PREP physiotherapist; $n=1$, PREP coordinators; $n=1$, and other health and exercise professionals; $n=5$. [Figure 2](#) shows the participant flow for the workshops. Workshops 1 and 3 had eight participants and workshop 2 had six participants; all workshops had representation from all stakeholder groups. Three participants attended all three workshops, five participants attended two workshops and three participants attended only one workshop.

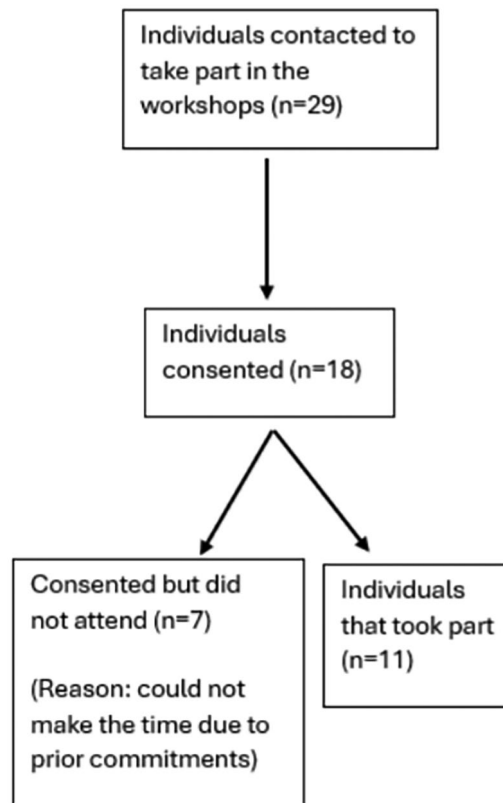


Figure 2. Participant flow diagram for workshops.

Table 2. Summary of workshop topics and results.

Workshop	Purpose	Overview	Results
1	Co-design intervention components and content	Presentation - Overview of data from stage 1 Group discussion- ranking of priorities linked to preferred activities, setting, and staff involvement	Activities prioritised: group exercise ¥, social and educational components. Importance of adaptation for stroke survivors Setting prioritised: in-person¥; community setting accessible to stroke survivors Staff: continuity important, PREP staff; physiotherapist then specially trained exercise professional to ensure experience with delivering exercise post-stroke ¥.
2	Co-design intervention structure	Presentation Performance measures and practical considerations Group discussion – Important outcomes, intervention dose and intensity	Intervention components supporting PA maintenance: self-monitoring such as step counters; goal setting (behaviour and outcome goals); reminders during and after structured programme¥ Intervention dose: duration of structured programme with ongoing maintenance boosters e.g. reminders Intensity: importance of individualised plans and adaptations¥; circuit-based class suitable for this.
3	Co-design intervention materials	Presentation - Example intervention materials from previous studies Group discussion – feedback on study materials	Further feedback supporting PREP Maintain structure and delivery as described above. Feedback to refine study materials such as activity diary and exercise record forms.

Key: ¥- core intervention component or characteristic.

Workshop findings

Across the workshops, participants discussed essential components for a PA maintenance programme, including setting, staff involvement, delivery methods, referral, duration, and social elements (Table 2). Participants reiterated high levels of satisfaction with the currently provided PREP programme and were keen to bring some of the components forward into the PREP Maintain programme; for example, the group exercise class. Participants were encouraged to focus on ways to make the programme sustainable and strategies to encourage participants to continue to be physically active after the structured exercise component of the intervention finished. Preferences for the programme setting were linked to considerations around the personnel delivering the intervention. Broadly participants were supportive that the intervention would be delivered in a community setting, such as a gym or community hall; however, they expressed concerns about the fitness staff lacking the expertise to support stroke survivors. This highlighted the need for qualified instructors, particularly physiotherapists, to lead or oversee the programme to ensure safety and understanding.

Participants expressed a preference for weekly structured group exercise classes delivered over 6–12 weeks as an appropriate follow-on after they completed the PREP programme. Some strategies proposed to promote long-term engagement with PA after completing the structured programme included goal setting, self-monitoring using a diary and/or device and prompts both during and outside classes, such as reminders or messaging. An additional suggestion was to include an optional gym induction for those who may like to continue to be active in this setting.

Social interaction was consistently identified as a key motivator, with participants valuing the sense of community fostered through group-based activities. When discussing the target age group for the programme, participants suggested that a shared experience of stroke was more important than age-based grouping in determining programme suitability. Delivery format was also explored, with a clear preference expressed for in-person sessions over remote delivery. Participants reflected on their experiences during the COVID-19 pandemic, noting that although online classes offered convenience, most preferred returning to face-to-face sessions. Overall, there was unanimous agreement that incorporating a social component alongside exercise was essential for promoting sustained engagement and social connection. Suggested approaches included integrating social games into sessions or providing dedicated time for participants to interact after exercise.

Discussion

This co-design study resulted in the development of an initial prototype PA maintenance programme for people living with stroke, which is currently undergoing further evaluation and refinement within the prototyping stage of the Decipher co-development framework. The co-design process involved three key stakeholder groups, stroke survivors and their carers, PREP staff, and health professionals, across two stages, providing insight into the preferences and requirements for supporting people to maintain PA following a stroke. The findings highlighted some key considerations for future PA maintenance interventions: the importance of social support; the need for appropriate provider expertise; and the value of co-design for developing person-centred interventions.

A prominent finding was that participants consistently identified social interaction as an important facilitator supporting long-term PA maintenance. In particular, participants described exercising alongside others with shared stroke experiences as a key source of motivation, confidence, and enjoyment. This aligns with previous research demonstrating that group-based exercise promotes peer support, social connection, improved wellbeing, and greater adherence to PA among stroke survivors [36–39]. The existing PREP programme already facilitates social interaction through refreshments and educational sessions following the exercise component, while volunteers who have previously completed the programme provide practical assistance and serve as relatable role models. Consistent with previous studies, these peer interactions appear to reduce isolation, enhance confidence, and encourage continued participation in PA [9,40,41]. These findings suggest that opportunities for social engagement, time for informal conversation before or after exercise sessions, peer-led support, and group-based activities, should be considered a core component of future PA maintenance programmes rather than an additional feature.

A second key finding was the importance of stroke-specific knowledge and experience among those involved with programme delivery. Participants consistently reported that instructors should have appropriate knowledge, training, and experience to safely adapt exercises and manage stroke-related impairments. This reflects previous evidence identifying limited professional guidance as a barrier to sustained PA participation [39,42,43]. Although exercise professionals involved in this study had relevant experience, they also highlighted the wider shortage of appropriately trained instructors and the need for accessible education and professional development. These findings support the development of structured training pathways and interdisciplinary collaboration between physiotherapists and exercise professionals to ensure community-based programmes can be delivered safely and confidently while maintaining sustainability.

Finally, this study demonstrates the value of co-design in developing interventions that reflect the priorities of those who will deliver and use them. Involving multiple stakeholder groups enabled barriers and facilitators to be explored from diverse perspectives. This served to ensure the intervention prototype addressed the practical challenges faced by stroke survivors after completing PREP. Using the DECIPHer framework provided methodological rigour throughout the development process. Although recruitment of physiotherapists exceeded that of exercise professionals, this reflects the current shortage of instructors with specialist stroke expertise and reinforces the need for workforce development. Overall, participants consistently identified an unmet need for a structured PA maintenance programme following PREP. These findings provide a strong foundation for refinement and pilot testing of the intervention while highlighting the importance of embedding social support, peer engagement, and appropriately trained staff within future community-based stroke rehabilitation services.

Conclusion

This co-design study successfully developed an initial prototype PA maintenance programme informed by the perspectives of stroke survivors, carers, exercise professionals, and healthcare professionals. Although barriers to maintaining PA after stroke are well established, this study demonstrates that they remain persistent and should be addressed through interventions that prioritise social connection, and delivery by exercise professionals with stroke-specific knowledge. Addressing gaps in training opportunities for providers will be essential to improve access to safe, community-based PA opportunities and support the successful implementation of future maintenance programmes. These findings provide a strong foundation for the next stage of intervention refinement and pilot testing, with the ultimate aim of improving long-term PA participation and quality of life for people living with stroke.

Acknowledgements

We would like to thank all participants for their valuable input into this study.

Author contributions

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Disclosure statement

Noelene Hughes, Zoe Campbell, and Andrew Bell work for NICHs that oversee the PREP groups. All other authors have no conflicts of interest.

Ethics approval

This study has been approved by **REC/24/0044**. This study involves human participants and was approved by Health and Social Care Research Ethics Committee A. Participants gave informed consent to participate in the study before taking part

Funding

This study was funded by Northern Ireland Chest Heart and Stroke (NICHs), grant number 2023_01. Jemma Hawkins works for the Centre for Development, Evaluation, Complexity and Implementation in Public Health Improvement (DECIPHER) which is funded by Welsh Government through Health and Care Research Wales. For the purpose of open access, the authors have applied a Creative Commons Attribution (CC BY) licence to any Author Accepted Manuscript version arising from this submission.

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Data availability statement

Any datasets used and/or analysis for this study are available from the corresponding author.

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