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Key considerations and recommendations for recruiting older adults in physical activity studies

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Abstract

Background Despite substantial evidence supporting the benefits of physical activity (PA) for older adults, participation rates remain low due to physical, psychological, social, and institutional barriers. Recruiting older adults for PA studies thus presents significant challenges, particularly for socially vulnerable populations and those facing digital literacy limitations in technology-assisted PA interventions. The present study aimed to articulate and establish a consensus among multidisciplinary and multinational PA experts regarding key considerations and requirements for designing and implementing recruitment of older adults for PA studies.

Methods This study employed a mixed-methods consensus approach integrating a structured formal consensus process with a two-round Delphi survey. Through face-to-face and online discussions, an expert panel group formulated 104 initial recommendations regarding the recruitment of older adults for PA studies. In the first Delphi round, 42 external experts assessed the relevance of each recommendation, and recommendations with a $\geq 70\%$ agreement threshold were considered consensual. The second round included 60 refined recommendations that were evaluated by 31 experts. A final consensus was reached through iterative expert panel discussions.

Results Of the 104 initial recommendations, 52 (50%) met the inclusion threshold during the first round. In the second round of Delphi, 36 of the 60 revised recommendations (60%) achieved consensus, with agreement ranging from 71.0 to 96.8%. The final consensus process established 34 key recommendations categorized into four domains: (1) ethical principles (71.7–93.5%), (2) informed consent (71.0–96.8%), (3) stakeholder engagement (61.3–83.9%), and (4) recruitment strategies for technology-assisted PA interventions (74.2–87.1%). However, there remains a lack of consensus on the extent to which sociocultural diversity and differences in sample representation should be addressed.

Conclusions This study provides expert-driven, consensus-based recommendations to improve the recruitment of older adults for PA studies. Adherence to ethical considerations, informed consent procedures, stakeholder collaboration, and tailored strategies for technology-assisted interventions were highlighted. These findings offer

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practical guidance for researchers and practitioners in planning and obtaining adequate participation in PA studies involving older adults.

Keywords Physical activity research, Recruitment strategies, Older adults, Expert consensus, Delphi method

Background

Despite substantial evidence highlighting the benefits of physical activity (PA) in older adults, a considerable proportion of this population fails to meet the recommended PA level. Disparities in PA among older adults are attributed to the unique adversities they face, which impede their willingness and capacity to participate [1–4]. Barriers exist across multiple levels: individual (e.g. physical limitations and fear); social and environmental (e.g. restricted access to facilities, lack of support, and limited transportation); and cultural and institutional (e.g. inadequate funding, healthcare system constraints, and ageism). PA studies, i.e. research studies on PA in old age with or without intervention, often struggle to adequately address this complexity, frequently labelling those with greater constraints as hard-to-reach or incapable of meeting expected PA tasks. As a result, older adults, particularly those from socially vulnerable groups such as individuals with low socioeconomic status, minority backgrounds, or chronic disabilities, are often under-represented in PA studies [5–7]. The intersectionality of these constraints further complicates research settings, making the recruitment of older adults for PA studies more challenging.

Over recent decades, digital solutions—platforms or devices/equipment—have been increasingly adopted in PA interventions, and research has documented their potential in promoting PA among older adults [8]. However, this can present additional challenges for older adults, particularly those who lack digital literacy or access to technology. For these individuals, technology-based (PA) interventions are more exclusive than inclusive. When combined with PA assignments, technology can pose a dual burden, potentially exacerbating barriers to participation. Similarly, increased preferences and acceptance for recruiting study participants using online platforms, health applications, or massive social media campaigns, while reducing the burden of recruitment efforts, can introduce selection bias, as those who do not use such services are initially disregarded, impeding their access or opportunity to engage in research and interventions. Therefore, researchers and health professionals designing and implementing PA studies targeting older adults must carefully address these gaps.

Previous review studies have identified recruitment strategies and practices that facilitate the enrollment and retention rates of older participants [9–13]. For instance, in societies with a higher proportion of ethnic minorities, targeting these groups requires a deep understanding

of their cultural contexts and the integration of these insights into the design of recruitment methods and implementation of interventions [12, 14]. Furthermore, recruitment tools and materials should be developed to accommodate varying levels of literacy among older adults, including digital literacy [10, 15]. However, many of these reviews focused on specific clinical settings or individuals with particular diagnoses [16], whereas others adopted an overly broad scope, including general health promotion or research [17], thereby limiting their applicability to the recruitment of older adults for PA studies. According to Mackenzie-Stewart, et al. [11], recruitment in PA interventions is not merely a process of inviting interested participants for participation but should also serve to actively engage less motivated and inactive individuals. This emphasizes the importance of developing standardized, inclusive recruitment strategies to better assist researchers in achieving representative sampling while also facilitating broader participation and sustained engagement of older adults in PA interventions.

Building on this, the current study sought to articulate and establish a consensus among multidisciplinary PA experts regarding the requirements and strategies for planning the recruitment of older adults for PA studies. This expert consensus will enrich the current knowledge base by incorporating experiential knowledge and perspectives, consequently helping in the interpretation and practical guidance in areas where empirical evidence is lacking and where more nuanced explanations are needed across various PA intervention settings.

Methods

Study design

This study employed a mixed consensus methodology that combined a structured, discussion-based *formal consensus process* with the *Delphi method*. The formal consensus process involved both face-to-face and online discussions among panel experts, with the objective of developing initial recommendations and achieving a final consensus. To facilitate an effective consensus-building process, participants referred to several consensus guidelines [18, 19]. The Delphi method, a specific consensus development tool, was then used to collect anonymous feedback on the recommendations through a two-round Delphi survey, providing external validation and prioritization. We adopted a modified Delphi method to develop the scales and consensus rules most appropriate for our scope of recommendations, guided by extant literature [20–22]. This two-track consensus approach ensures a

well-rounded perspective and promotes expert agreement, with each approach complementing the other.

Participants

Participants were recruited using the EU COST Action—CA20104 Network on evidence-based physical activity in old age (PhysAgeNet) membership database. PhysAgeNet unites experts from diverse disciplines, research backgrounds, varying years of experience, and regions across Europe and elsewhere. These experts, encompassing a mix of academic, clinical, and practical expertise, represent various stakeholders in fields relevant to PA interventions. Detailed information about PhysAgeNet, including current membership details, is available on the publicly accessible network website: <https://physagene.t.eu/>. At the time the invitations were distributed, PhysAgeNet comprised 399 members from 51 countries. All members were invited to participate via email in July 2023, with a reminder email sent two weeks after the initial invitation. The invitation outlined the purpose of developing recommendations, and the roles and responsibilities associated with each working group (Steering Group, Panel of Experts Group, and External Review Group), requiring participants to register for one group of interest. Out of respect for each member's varying expertise and experience, no additional eligibility criteria were applied. We encouraged the inclusion of experts from different regions and career stages, whose scientific

activities and interests are closely related to PA research and intervention. To minimize any form of selection bias or manipulation, participation remained entirely voluntary. Recruitment was completed in August 2023.

The Steering Group ($N=6$) was responsible for coordinating the consensus procedures. The tasks included formulating key questions for the expert panel, gathering expert panel members' inputs through semi-structured surveys and discussions, facilitating consensus-building sessions, and preparing dissemination documents.

The Panel of Experts ($N=12$) was tasked with formulating the initial recommendations and achieving consensus on the final selection, incorporating feedback from an external review group. The panel predominantly comprised academics specializing in fields relevant to PA research across varying contexts. These individuals possess extensive professional experience working with older populations, including conducting research projects focused on older adults, such as engaging in studies on health-promoting behaviors among this demographic. The expert panel also reflected diversity in gender (42% female; $N=5$), years of experience (ranging from 4 to 35 years), geography (9 countries from Europe and its neighbors), and areas of practice (see Table 1).

The External Review Group ($N=42$; 23 countries) conducted a peer review of the proposed recommendations and evaluated their relevance and importance through a 2-round Delphi survey. With the consent of the

Table 1 Panel experts' background and qualifications

Identification	Country	Gender	Title	Fields of experts/disciplines	Year of experience
Expert 1	Poland	F	Assistant Professor	Digital and modern technologies (e.g. VR/AR and gamification) in physical activity, sports, and physiotherapy	7
Expert 2	Türkiye	M	Associate Professor	Biomedical signals and systems, biomechanics, clinic decision-support systems, electrophysiology, and electromyography	15
Expert 3	Germany	M	Professor	Sport and exercise science; mathematics implementation science; physical activity in old age	25
Expert 4	France	M	Associate Professor	Technology-assisted physical activity for prevention of cognitive decline and falling older adults	7
Expert 5	Cyprus	F	Assistant Professor	Chronic illness, illness perceptions, illness management, and adaptation	12
Expert 6	Azerbaijan	M	Research Fellow	Primary and secondary prevention of cardiovascular disease risk factors	30
Expert 7	Türkiye	F	Professor	Public health; ageing population health	35
Expert 8	Türkiye	F	Associate Professor	Physical and psychosocial health in older adults	12
Expert 9	France	M	Assistant Professor	Effect of non-pharmacological interventions on mobility and cognition in older adults	11
Expert 10	Switzerland	F	Postdoctoral Researcher	Cognitive and mental health promotion through non-pharmacological interventions	4
Expert 11	Portugal	M	Researcher/Superior technician	Dual-task interventions for older adults; fall risk reduction and physical interventions	8
Expert 12	Italy	M	Assistant Professor	life-course epidemiology, vaccine-preventable diseases, healthy ageing	6

All panel experts hold either a PhD or a relevant professional doctorate (e.g. Doctor or Medicine) and are affiliated with either higher education institutions (i.e., universities) or research organizations

participants, a comprehensive list of external reviewers is available in the Supplementary Materials. Participants were informed about the study via email and invited to take part. Informed consent was obtained from all participants before completing the first round of the Delphi survey, in accordance with the Declaration of Helsinki (2018). Given the nature of the study, which relies exclusively on expert opinions and does not involve interventions, biomedical procedures, or collection of personal or identifiable information, the ethics committees at the authors' institutions waived the need for ethical approval.

Study procedure

The consensus process comprised three stages: (1) a pre-consultation in which the expert panel developed an initial list of recommendations pertinent to recruitment, (2) a two-round Delphi survey to ascertain consensus on the relevance and significance of the proposals, and (3) expert panel meetings to finalize the consensus. Figure 1 presents the procedure followed in this methodology.

Development of recommendations

Through iterative online meetings, expert panel members identified research and practice gaps, shared objectives, defined key concepts, and established consensus rules as of October 2023. While a series of meetings were introduced, geographic and time constraints posed significant challenges to interactive discussions and consensus development among all panel members. To address these challenges, and importantly, to mitigate potential biases that may arise in face-to-face discussions, while effectively integrating diverse perspectives, the steering group developed open-ended, semi-structured questions based on key themes from the pre-consultation meetings. The online questionnaire was distributed to each panel member, asking them to articulate relevant recommendations, recruitment strategies, and techniques that can facilitate older adults' participation in PA studies. This approach

afforded all panel members sufficient time to reflect on their knowledge and unique experiences. All expert panel members completed the survey in January 2024. Examples of questions included:

Can you provide any good practices for obtaining informed consent from older participants, especially those with cognitive impairments or communication difficulties? Please provide 2 to 3 actionable suggestions.

Please list the top 3 to 5 challenges or barriers when recruiting older adults for physical interventions that most frequently observed in your area of expertise or research. Do you have any specific recommendations or good recruitment practice for addressing challenges or barriers you indicated above? Please provide 3 to 5 actionable suggestions.

How can we facilitate successful collaborations among potential stakeholders that have influenced the recruitment process? Please provide 3 to 5 actionable suggestions.

Upon completion of the survey, a total of 104 recommendations were put together. Despite the presence of some redundant responses among the experts, the panel and steering group opted to retain all responses for external review, without eliminating duplicates. This decision was informed by the understanding that variations in terminology could lead to differences in interpretation or nuance during the review process. Additionally, even among similar items, one might achieve a stronger consensus than another, thereby helping to identify clearer and more concrete recommendations. Consequently, all initial recommendations were preserved and subsequently refined into a set of questionnaire items using Google Forms for the external review.

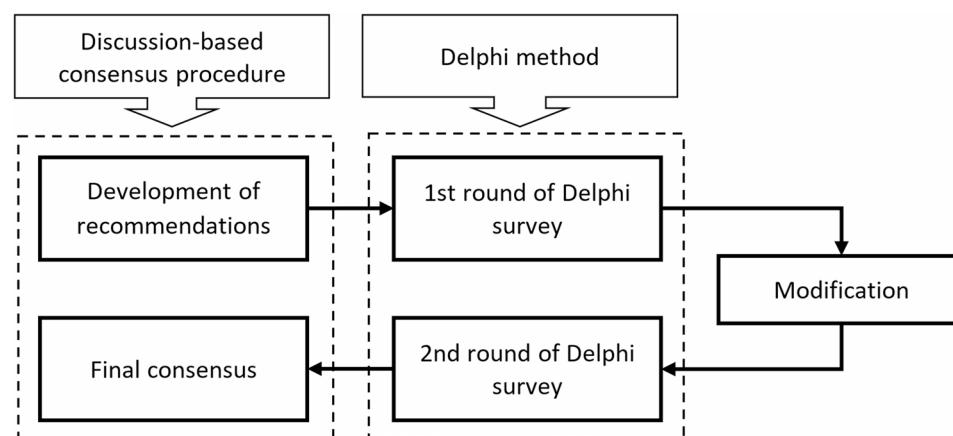


Fig. 1 Procedure for developing recommendations using a formal consensus approach and the Delphi method

Two-round Delphi survey

The first-round Delphi survey comprised (1) study introduction, (2) consent statement and respondent background, (3) evaluation items, and (4) open-ended questions for feedback. The initial Delphi survey included 104 items, each assessed considering two aspects: relevance and importance. Respondents were first asked to indicate whether proposed recommendation was relevant for facilitating the recruitment of older adults in PA studies and should therefore be included. They rated this on a 3-point scale (relevant, somewhat relevant, or not relevant). Next, they were asked to rate the importance of the recommendation on a 10-point Likert scale (1 = least important, 10 = most important). A total of 42 experts from the external review completed the first Delphi survey. Responses were obtained between April and May 2024.

Following the first-round Delphi survey, the expert panel conducted a review of the results to identify items for retention in the subsequent round. The panel prioritized percentage agreement as the primary inclusion criterion, specifically, focusing on the proportion of respondents who rated a recommendation *as relevant*. In establishing the consensus rules and methods, the panel considered the measures of two domains, *relevance* and *importance*, as complementary; an item is deemed more robust if it achieves sufficient consensus in both domains. However, it was observed that relevance often elicited greater variability across recommendations, whereas importance was consistently rated relatively high for most recommendations. Consequently, the expert panel prioritized relevance over importance as the primary criterion for inclusion.

A threshold of 70% consensus for relevance was set as the minimum for inclusion, aligning with documented standards [23, 24]. The strength of recommendation was categorized as follows: low consensus ($\geq 70\%$), moderate consensus ($\geq 80\%$), and strong consensus ($\geq 90\%$).

For recommendations below the threshold, the expert panel had two options: (1) exclude the recommendation or (2) propose revisions for a second-round review. In constructing the second-round survey, the expert panel refined the recommendations with high redundancy (e.g. merging the two recommendations, “using clear, straightforward language” and “providing clear and easy explanations”) and incorporating qualitative feedback from the first survey to address gaps in the initial recommendations.

The second-round Delphi survey included 60 items assessed for relevance and importance as in the preceding round. The external review group, which completed the first round, was invited to participate in the study. A total of 31 of the 42 experts completed the second Delphi

survey, yielding a response rate of 74%. Responses were obtained between May and June 2024.

Expert panel final consensus

An expert panel engaged in iterative online discussions to reach a final consensus on the proposals. The consensus process within the expert panel was guided by two considerations: (1) the outcomes from each round of the Delphi survey, particularly where external reviewers provided sufficient levels of agreement, and (2) the professional knowledge and practical experience of panel experts, as their insights provided more nuanced, contextual justification for the developed recommendations.

Results

The expert panel formulated 104 recommendations for the first round of the Delphi survey. Of these, 52 recommendations (50%) met the $\geq 70\%$ agreement threshold for relevance, with consensus rates ranging from 71.7 to 93.5%. The second-round Delphi survey included 60 recommendations. Following this round, 36 of the 60 recommendations (60%) achieved consensus ($\geq 70\%$), with agreement ranging from 71.0 to 96.8%. A full list of recommendations included in the two-round Delphi survey, along with the results from each round, is provided in Supplementary Materials (S-Tables 1 and 2).

During the final consensus stage, the majority of recommendations that attained the 70% consensus threshold were retained, whereas two recommendations, despite limited consensus levels, were included based on collective agreement among expert panel members (see Table 2), which will be discussed in the following section. For clarity and conciseness, duplicate statements were refined by panel members and the steering group.

As a result, 34 recommendations were outlined as the final recommendations, categorized into several key domains: adherence to ethical principles (recommendations 1–7; 80.6–93.5%), informed consent (recommendations 8–20; 71.0–96.8%), involvement of stakeholders (recommendations 21–27; 61.3–83.9%), and specific strategies in technology-assisted PA interventions (recommendations 28–34; 74.2–87.1%). Detailed information regarding the selected recommendations and experts’ agreement on relevance and ratings are provided in Table 2.

Discussion

This study aimed to synthesize multidisciplinary expert perspectives to develop recommendations for facilitating recruitment of older adults in PA studies by integrating complementary decision-making processes. Priorities and consensus were accorded to ethical principles, informed consent, and stakeholder engagement. Furthermore, recommendations pertinent to

Table 2 Recommendations and experts' agreement on relevance (%) and rated importance (Mean, SD)

	Strength of the recommendation: moderate to strong
Ensuring adherence to ethical principles	
Recommendation 1: Ensure anonymity and privacy are maintained when communicating with older adults.	93.5%, 9.23 (1.36)
Recommendation 2: Provide assurance of confidentiality to participants and explain data-handling protocols.	93.5%, 9.06 (1.36)
Recommendation 3: Respect older adults as autonomous individuals and avoid treating them in a patronizing manner.	87.1%, 9.23 (1.38)
Recommendation 4: Reassure participants about the privacy and security measures to build trust and reduce hesitancy related to data misuse, providing detailed information on data encryption, secure storage practices, and how their data will be used and accessed only by authorized personnel.	87.1%, 8.58 (1.31)
Recommendation 5: Assess participants' capacity to consent.	83.9%, 8.61 (1.45)
Recommendation 6: Ensure privacy when communicating information and assessing decision-making capacity.	83.9%, 8.58 (1.52)
Recommendation 7: Establish trust and clear communication channels with older adults.	80.6%, 8.77 (1.56)
Facilitating informed consent	Strength of the recommendation: moderate to strong
Recommendation 8: Make consent forms easier to understand by using clear, simple language instead of technical terms.	96.8%, 9.55 (0.85)
Recommendation 9: Guarantee clarity and easy access to consent materials.	96.8%, 9.32 (1.14)
Recommendation 10: Provide a clear description of the activities that older adults will undertake during their involvement in the research, from inclusion to conclusion.	96.8%, 9.00 (1.21)
Recommendation 11: Emphasize in a lay description the potential immediate, long-term individual, and group benefit(s) of the intervention.	96.8%, 8.97 (1.28)
Recommendation 12: Explain in lay language the challenges older adults might face while taking part in the intervention tasks (physical limitations, time constraints) and the benefits.	93.5%, 8.97 (1.22)
Recommendation 13: Tailor consent forms and informed sheets to a low literacy level, using clear, simple language instead of technical terms to ensure understanding.	90.3%, 9.00 (1.34)
Recommendation 14: Consent should be freely given and ongoing, without any negative consequences for withdrawal.	87.1%, 9.23 (1.31)
Recommendation 15: Improve accessibility for participants with impairments by using visual aids such as diagrams, pictures, videos, or audio presentations and by incorporating a large font size.	83.9%, 8.68 (1.45)
Recommendation 16: Ensure explicit consent is obtained for observation or recording in home settings.	80.6%, 8.71 (1.44)
Recommendation 17: Enhance written materials with face-to-face discussions that include verbal reiteration and explanations, opportunities for questions and clarifications, and encourage paraphrasing to ensure comprehension.	77.4%, 8.42 (1.73)
Recommendation 18: Ensure participants have sufficient time to consider their participation between giving informed consent and being included in the study.	77.4%, 8.32 (1.99)
Recommendation 19: Incorporate visual aids like pictures, diagrams, or pictograms into the informed sheet to enhance understanding.	71.0%, 8.58 (1.41)
Recommendation 20: When participants need additional help understanding or reviewing the consent form, provide them with opportunities to seek assistance from individuals not involved in the research (e.g. family members, caregivers, or trusted friends).	71.0%, 8.42 (1.46)
Involving stakeholders	Strength of the recommendation: low to moderate
Recommendation 21: Develop strong partnerships with local community organizations that serve the ageing population (e.g. leisure organizations, senior centers, nursing homes).	83.9%, 8.03 (1.47)
Recommendation 22: Use existing databases or registries related to electronic health records that are shared by both patients and health professionals.	74.2%, 8.16 (1.57)
Recommendation 23: Respect participant autonomy while allowing them to involve others for support.	74.2%, 8.81 (1.40)
Recommendation 24: involve caregivers <i>when necessary</i>	71.0%, 8.39 (1.41)
Recommendation 25: Set the recruitment methods incorporating the perspective of professionals such as caregivers, physiotherapists, local communities, and nursing homes.	71.0%, 7.77 (1.48)
Recommendation 26 ^a : Ensure that information reaches its target audience by providing informational sessions/workshops engaging key stakeholders involved in research at venues frequented by older adults.	67.7%, 7.81 (1.74)
Recommendation 27 ^a : Engage stakeholders, not only for recruitment but throughout all stages of the research procedure, including dissemination stages.	61.3%, 7.58 (1.59)
Leveraging technology-assisted approaches in PA interventions	Strength of the recommendation: moderate

Table 2 (continued)

Recommendation 28: Provide comprehensive training sessions and ongoing support throughout the protocol (e.g. step-by-step guides and a helpline for technology-related queries).	87.1%, 8.81 (1.28)
Recommendation 29: Take the time to thoroughly explain the study, its procedures, and the benefits of using technology.	87.1%, 8.71 (1.30)
Recommendation 30: Before beginning the intervention, gather any concerns older adults might have about completing the tasks, and try to provide them with strategies to address these challenges.	87.1%, 8.48 (1.43)
Recommendation 31: Prioritize technology-assisted interventions that utilize accessible tools, rather than opting for complex setups that could exclude certain groups of older adults.	80.6%, 8.58 (1.52)
Recommendation 32: Develop emergency protocols based on the individual health statuses of participants.	77.4%, 8.71 (1.44)
Recommendation 33: Simplify technology to better suit older adults with limited access or literacy.	77.4%, 8.68 (1.54)
Recommendation 34: Incorporate positive feedback in technology to support older adults during the intervention.	74.2%, 8.39 (1.36)

Each recommendation was evaluated for relevance and importance using a 3-point scale (relevant, somewhat relevant, or not relevant) and a 10-point scale (1 = least important, 10 = most important), respectively. ^aWhile items did not meet the inclusion threshold in the Delphi survey, the expert panel reached a consensus to include them during final consensus meetings

technology-assisted PA interventions were ascertained to achieve sufficient consensus among participating experts.

Ethical principles and informed consent

The importance of ethical principles and protocols during the recruitment process attained the highest level of consensus, emphasizing the need to counteract ageist assumptions and avoid patronizing behavior toward older adults involved in the study. Key recommendations include a clear demonstration of how older participants' privacy, anonymity, confidentiality, and safety will be warranted during and after interventions. Furthermore, these ethical considerations should be implemented not only during recruitment but also throughout the entire research process. Existing literature highlights that these considerations are particularly crucial when recruiting socially vulnerable populations, often including older adults with minority backgrounds or health disputes [25, 26]. Researchers should be familiar with the ethical requirements and protocols that align with their specific research goals and settings. In this respect, the expert panel emphasized the importance of institutional support and guidance in reinforcing ethical standards. Although most institutions establish ethics review committees and require mandatory research approval, their roles often remain passive. Continuous monitoring, along with education and relevant resources, can help research teams uphold ethical protocols.

Relatedly, a strong consensus was reached on the importance of obtaining informed consent only when the researcher is confident that the participants fully understand the information provided. According to Seppet, et al. [25], ethical principles in research involving older adults require sufficient time and effort to ensure clear communication between the researchers and potential participants. Therefore, improving the accessibility of information and consent materials should be a priority for potential participants and their caregivers. The literature suggests that consent materials should be tailored for participants with low literacy using clear language

and a simplified structure, particularly to avoid jargon and technical terms that are difficult for non-medical individuals to understand [16, 27]. Importantly, consent should be freely provided and ongoing, allowing participants to withdraw at any time without experiencing adverse consequences. Well-prepared information sheets and consent forms not only facilitate participation but also play a pivotal role in practicing the ethical principles of the research.

Collaborative efforts involving various stakeholders

Consensus was reached regarding the engagement of various stakeholders in facilitating the recruitment process. Crozier, et al. [28] highlighted that various stakeholders' engagement in implementing PA interventions for older adults is crucial for success. Additionally, according to O'Regan, et al. [29], health professionals and local advocate groups within the community function as "key influencers" in delivering community-based physical activity programs. Developing recommendations, the expert panel identified four key stakeholder groups most relevant to PA interventions: older adults, health professionals (e.g. general practices, nurses), caregivers (i.e. family members or close individuals who provide informal, unpaid support/assistance to older adults), and community organizations. Collaboration with health professionals can facilitate access to existing databases or registries such as electronic health records, which can be used to screen potential participants who meet the study criteria. This enables more precise screening of eligibility within a limited time frame. Here, the expert panel emphasized the necessity of adhering to data usage protocols outlined in the relevant ethical guidelines they referenced as health data, including sensitive and personal information. Additionally, referrals from health professionals can enhance trust and credibility among older adults when promoting physical activity and exercise, while facilitating more targeted recruitment.

One highly endorsed recommendation was to establish strong partnerships with local community organizations

that serve ageing populations, such as senior centers, sports clubs, and nursing homes. Social workers and service providers who work closely with older residents might be well-informed about older adults' level of understanding and perception of research. Such collaborative efforts between researchers and practitioners can strengthen the credibility of the research [30, 31]. Their established relationships and trust with older adults make them key facilitators in recruiting older adults by supporting their decision-making process, fostering engagement, and encouraging participation. Moreover, local organizations and community leaders often possess comprehensive knowledge of local demographics and are better positioned to access individuals from minority or socioeconomically disadvantaged backgrounds. Collaborating with these local stakeholders can significantly enhance efforts to identify and reach underserved populations, making participation in PA studies more accessible and inclusive. In addition, although the Delphi survey did not provide sufficient levels of consensus, the expert panel agreed to include recommendations emphasizing the importance of providing informational sessions and workshops for key stakeholders involved in research. Furthermore, the panel suggested the necessity of engaging stakeholders not only in recruitment but also throughout the research process, from planning to dissemination. This approach can sustain long-term stakeholder engagement in research and further help close the gap between research and practice.

Noteworthy, while active collaboration with professional-level stakeholders was highly valued, the involvement of other types of stakeholders (e.g. caregivers) remained a topic of debate. For instance, recommendations concerning caregiver involvement merely met the inclusion threshold across the two rounds of the Delphi process. Open-ended responses to the survey revealed that some experts explicitly cautioned against caregiver engagement during recruitment. Indeed, many national and institutional ethical guidelines, such as those in the UK [32] and France [33], explicitly prohibit caregiver involvement in decision-making processes. These guidelines stipulate that caregivers should neither provide consent on behalf of older adults nor unduly influence their decision to participate, thereby ensuring participants' autonomy and volitional participation. However, the expert panel noted the potential role of caregivers in the recruitment process, particularly, when studies target individuals with cognitive impairments who have limited decision-making capacity and ability to provide informed consent. In such instances, caregivers can facilitate communication between recruiters and participants by conveying participants' preferences and needs; at the same time, any undue influence or threat on participants' willingness or consent to participate must be carefully

monitored to avoid. This approach enables greater participation from older adults facing difficulties in communication due to cognitive impairments or hearing loss or relying heavily on caregiver (functional) support. Acknowledging both concerns, the expert panel reached a consensus to incorporate recommendations 24, which states, "involve caregivers when necessary," with particular emphasis on the phrase "when necessary." This wording was deliberately left open to interpretation, as its applicability is highly context-dependent, for example, varying by study setting, target population, and specific circumstances, thereby avoiding a rigid 'do or do not' directive on this recommendation.

Additionally, as participatory approaches in research are increasingly emphasized in the existing literature [9, 34, 35], the role of older adults in developing research design, interventions, and recruitment strategies could be substantial. However, the relevant strategies have not been sufficiently addressed within the expert panel when developing recommendations. This might be attributed to the controlled nature of PA research, which prioritizes the precise evaluation of effectiveness, rendering person-centered tailoring or individual modifications rather restricted.

Strategies pertinent to technology-assisted PA interventions

During the pre-consultation meetings, emphasis was placed on addressing key barriers that impede older adults' engagement in physical activity or exercise. The expert panel noted that for older adults with physical and cognitive limitations, the increasing complexity of interventions, particularly those involving technological adaptations, can diminish their interest and confidence to engage [36, 37]. A recent review by Bertolazzi, et al. [36] identified the most prevalent barriers to adoption of health technology among older adults with chronic diseases, including among others, cognitive decline (poor learning skills and memory), skepticism or fear of using new technology, information overload, negative experiences with technology, and lack of social support. The review also suggested several facilitators to improve technology adaptations among older adults, such as continuous monitoring by healthcare providers and timely care, perceived user-friendliness, adequate training and instruction, well-organized and clear information, technical support services, and a sense of connection with healthcare professionals.

In the Delphi rounds, all seven items pertaining to this topic met sufficient consensus among experts. Strategies with strong consensus include training sessions, technical support, addressing concerns, providing strategies to overcome them, and ensuring that participants are well-informed about the benefits. Additionally, strategies such

as using accessible tools, developing emergency protocols based on the individual health statuses of participants, tailoring technology for older adults with limited access or literacy, and incorporating feedback from participants were recommended. However, these recommendations focus on the features of intervention design and implementation. The expert panel explicitly stated that technology-related information should be clearly presented and communicated during the recruitment process, considering the varying levels of e-literacy among the potential participants.

A lack of consensus on initial recommendations

During the initial stages of development, the expert panel considered social inclusion - seeking to incorporate diverse and underrepresented populations - as one of the guiding principles for recruitment. This is relevant as rising life expectancy and an increasingly heterogeneous ageing population require the adoption of more tailored approaches to address these differences and diverse needs [38–40]. The expert panel was particularly interested in addressing cultural diversity in sample representation as existing literature often highlights the importance of addressing ethnic minority representation and cultural diversity in PA research and interventions [41, 42]. However, throughout the Delphi process, recommendations addressing the inclusion of diverse populations and cultural sensitivity proved contentious with inconsistent levels of agreement (e.g. “developing culturally tailored recruitment materials and communication strategies adapting the language, culturally appropriate images” and “providing cultural learning and competence training for recruitment staff involved in participant outreach,” 74% vs. 54% consensus, respectively, for the first-round Delphi survey).

This lack of, and inconsistent consensus is largely attributable to the varying interpretations among the participating experts. Both expert panel and external reviewers included individuals from different European countries and beyond, some from relatively homogeneous cultural backgrounds (e.g. Poland, Turkey), while others are from culturally diverse contexts (e.g. France). Their research experiences and approaches to social inclusion may vary depending on the national, historical, and societal-cultural context. Therefore, in some regions where cultural homogeneity remains prevalent, these considerations and understandings may be less applicable. In such cases, certain recommendations (e.g. “accommodate variations in cultural practices, schedules, or preferences - cultural events, holidays, or community gatherings” and “well-trained translators and trained and motivational interviewers”) may have limited relevance. This makes it challenging to establish consensus among multinational experts. Furthermore, for PA studies or

interventions with highly specific target groups and circumscribed study scopes or those constrained by recruitment capability and resources, broad social inclusion may not always be a primary priority. Therefore, the expert panel concurred with the exclusion of recommendations that simply encourage cultural diversity in sampling.

For similar reasons, recommendations for defining inclusion and exclusion criteria were not considered following the first Delphi survey. Since inclusion and exclusion criteria must align with the research goals and target population and play a pivotal role in developing recruitment strategies, the expert panel recognized their limited applicability (e.g. “inclusion criteria should address minorities, men, low socioeconomic background, low education level, and more frail adults,” “integrating the required proportion of different age groups of older adults at the outset of the recruitment process as inclusion criteria” 65.2% and 60.9% consensus, respectively, for the first-round Delphi survey). Therefore, proposals related to defining the inclusion and exclusion criteria were not retained in the second-round Delphi survey.

Despite the absence of consensus among participants, which precluded the retention of some recommendations and limited guidance on recruiting underserved aging populations, several alternative suggestions were put forward during the final consensus meetings. The panel experts agreed on the need to employ recruitment strategies congruent with clearly defined target populations and intervention goals. To achieve this, researchers should be equipped with an in-depth understanding and detailed descriptive profile of their target population to refine and justify the inclusion and exclusion criteria. Additionally, if the target population includes a high proportion of individuals who are less accessible or considered hard to reach, recruitment approaches should be carefully designed to improve outreach and enhance sample representation.

Limitations and future directions

This study has several limitations. Although panel experts were carefully employed to minimize selection bias, the expert panel group may not fully represent all relevant fields of PA research. Thus, some perspectives, particularly those from underrepresented disciplines or regions, may be lacking, potentially limiting the applicability of these recommendations. Second, regarding the use of the Delphi technique, the 70% agreement threshold can be considered arbitrary and may not fully grasp the complexity of expert opinions. In addition, a single response could change either above or below the threshold. Furthermore, as the process prioritizes consensus through majority voting, some minority opinions, which are potentially valuable alternative perspectives, could be overlooked. For instance, while some experts advocated

the inclusion of diverse cultural backgrounds as a guiding principle, others (the majority) pointed out its limited relevance for PA studies that aim at specific populations. Therefore, while the importance of diversity and social inclusion is acknowledged, the debate over cultural diversity in sample representation remains unresolved and has not been included in the final list of recommendations.

The top-ranked consensus statements predominantly focused on ethical principles, which largely provided guidance on researchers' sensitivity and attitudes toward older adults. Although these principles are significant, researchers' interpretations of these recommendations and their applications in real-world settings may vary based on the context. Additionally, differences in national guidance, institutional policies, and cultural contexts can further affect the practice of recommendations. For instance, monetary incentives for research participation may be permitted or prohibited depending on local regulations. Moreover, the resulting recommendations provide a relatively limited consideration of practical constraints, such as time and funding, and challenges that are particularly significant for researchers or institutions with fewer resources.

The recommendations highlighted technology as an important and rapidly evolving component of PA interventions; however, other aspects—due to the variability within and across interventions—were not explored in depth. Relatedly, addressing barriers specific to intervention (e.g. lack of transportation to the intervention site) was given less emphasis in the development of the recommendation. Acknowledging this limitation, the expert panel stressed that, regardless of the type of intervention, key information such as intensity (e.g. moderate or vigorous) and delivery setting (e.g. home-based, community-based, or clinical) may significantly impact recruitment by introducing different barriers and challenges, and should therefore be clearly articulated and communicated to potential participants during the recruitment process.

While the study was designed to obtain methodological insights from experts with extensive experience in recruiting older adults, this focus excluded broader stakeholder participation, including older adults. Nevertheless, the perspectives of older adults were indirectly integrated in formulating the recommendations as the expert panel drew upon a well-established body of literature that documents the barriers and challenges faced by older adults in research participation. Future research would benefit from a more participatory design that includes direct input from older adults and other key stakeholders to further enrich the development and refinement of recruitment strategies. Finally, expert consensus alone might be insufficient to ensure the empirical validation of the recommendations. To address this

limitation, a companion study conducted a systematic review of existing literature to provide more evidence-based recruitment strategies. The review protocol was registered with PROSPERO (CRD42023488032) [43]. Combined with the present expert consensus study, this approach can help enhance the applicability and robustness of the outlined recommendations.

Conclusions

This study provides consensus-based recommendations and relevant practices for recruiting older adults for PA studies. The findings prioritize ethical considerations, appropriate processing of informed consent, and collaborative efforts involving stakeholders in the design and implementation of recruitment strategies. The employment of rigorous consensus methods that engaged international PA experts with diverse backgrounds and experiences ensures the qualification and justification of the included recommendations; on the other hand, however, this diversity also presented challenges in reaching concrete consensus on certain topics, which remain significant in recruitment. Our findings, together with the referenced literature, can serve as a basis for different stakeholders and roles in research: (1) for researchers studying or improving recruitment processes, to facilitate further discourse and refinement aimed at seeking broader agreement on unresolved issues; (2) for members of ethical committees: to carefully review information materials intended for study participants, not only whether the relevant issues are addressed, but also whether the target group can understand the content and which appropriate measures are planned to inform them; (3) for peer reviewers of manuscripts: to assess the explanation and documentation of recruitment procedures and results; and (4) for developers of funding calls and proposal evaluators: to provide the allocation of resources (time, budget) necessary for the development and implementation of effective recruitment strategies and materials.

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

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Authors' contributions

SL, MC, VA, AM, IP, and RS conceptualized the study, designed the methodology, and coordinated the consensus procedure. SL developed the Delphi survey, conducted data collection, and performed the analysis. MC, VA, MM, EE, AL, EA, SG, AI, ZG, and MB contributed equally to the literature review, development of recommendations, interpretation of Delphi results, and refinement of recommendations throughout the consensus meetings. SL, MC, VA, and AM wrote the first draft of the manuscript, with IP and RS providing support in writing and revisions. All authors contributed to manuscript revisions and approved the final version.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate

All participants were informed about the study via email and invited to take part. Informed consent was obtained by all participants before completing the first round of Delphi survey, in accordance with the Declaration of Helsinki (2018). Given the nature of the study, which relies solely on expert opinions and does not involve interventions, biomedical procedures, or the collection of personal or identifiable information, ethical approval was not required. The Ethics Committees at the authors' institutions formally waived the need for ethical approval.

Consent for publication

Consent for publication was obtained from all participants for manuscripts.

Competing interests

The authors declare no competing interests.

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