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BEST PRACTICE PAPER

Establishing global standards on wearable technology for measuring mobility in ageing populations: an international consensus exercise

Marla K. Beauchamp[1,2], Cassandra D'Amore[3,4,5], Parminder Raina[2,6,7], William McIlroy[8], Nurudeen Adesina[9,10], Matthew Ahmadi[11,12], Lisa Alcock[13,14], Clemens Becker[15], Aiden Doherty[16], Alan Donnelly[17], Dale W. Esliger[18,19,20], Sally A.M. Fenton[21,22], Daniel Fuller[23], Judith Garcia-Aymerich[24,25,26], Jeffery M. Hausdorff[27,28,29], Katie Hesketh[21], Melvyn Hillsdon[30], Stephanie A. Prince[31,32], Julie Richardson[1,2,6], Jennifer A. Schrack[33,34], Emmanuel Stamatakis[11,12], Karen Van Ooteghem[8], Thomas W. Wainwright[35,36], Amal A. Wanigatunga[33,34,37], Max James Western[38], Afroditi Stathi[21], Consensus Facilitator Group collaborative author group[‡]

[1]Faculty of Health Sciences, School of Rehabilitation Sciences, McMaster University, Hamilton, Ontario, Canada
[2]McMaster Institute for Research on Aging, McMaster University, Hamilton, Ontario, Canada
[3]Department of Physical Therapy, The University of British Columbia, Vancouver, British Columbia, Canada
[4]Djavad Mowafaghian Centre for Brain Health, Vancouver Coastal Health Research Institute, Vancouver, British Columbia, Canada
[5]Centre for Aging SMART at Vancouver Coastal Health, Vancouver Coastal Health Research Institute, Vancouver, British Columbia, Canada
[6]Department of Health Research Methods, Evidence, and Impact, McMaster University, Hamilton, Ontario, Canada
[7]Labarge Centre for Mobility in Aging, McMaster University, Hamilton, Ontario, Canada
[8]Department of Kinesiology and Health Sciences, University of Waterloo, Waterloo, Ontario, Canada
[9]Health and Care Research Centre, Anglia Ruskin University, Cambridge, UK
[10]Department of Public Health, Anglia Ruskin University, Chelmsford, UK
[11]School of Health Sciences, Faculty of Medicine and Health, University of Sydney, Sydney, New South Wales, Australia
[12]Mackenzie Wearables Research Hub, Charles Perkins Centre, The University of Sydney, Sydney, New South Wales, Australia
[13]Faculty of Medical Sciences, Translational and Clinical Research Institute, Newcastle University, Newcastle upon Tyne, Tyne and Wear, UK
[14]National Institute for Health and Care Research (NIHR) Newcastle Biomedical Research Centre (BRC), Newcastle University and The Newcastle upon Tyne Hospitals NHS Foundation Trust, Newcastle upon Tyne, Tyne and Wear, UK
[15]Unit Digitale Geriatrie, UniversitätsKlinikum Heidelberg, Heidelberg, BW, Germany
[16]Nuffield Department of Population Health, University of Oxford, Oxford, UK
[17]Health Research Institute, University of Limerick, Limerick, County Limerick, Ireland
[18]School of Sport, Exercise and Health Sciences, Loughborough University, Loughborough, UK
[19]NIHR Leicester Biomedical Research Centre, Leicester, UK
[20]HealthTech Research Centre for Rehabilitation, NIHR, Nottingham, UK
[21]School of Sport, Exercise and Rehabilitation Sciences, University of Birmingham, Birmingham, UK
[22]NIHR Birmingham Biomedical Research Centre, University Hospitals Birmingham and University of Birmingham, Birmingham, UK
[23]Department of Community Health and Epidemiology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada
[24]NCDs and Environment, ISGlobal, Barcelona, Catalonia, Spain
[25]Faculty of Health and Life Sciences, Universitat Pompeu Fabra, Barcelona, Spain
[26]CIBER Epidemiología y Salud Pública, Madrid, Spain
[27]Center for the Study of Movement, Cognition, and Mobility, Neurological Institute, Tel Aviv Sourasky Medical Center, Tel Aviv, Israel

[28]Department of Physical Therapy, Gray Faculty of Medical & Health Sciences and Sagol School of Neuroscience, Tel Aviv University, Tel Aviv-Yafo, Tel Aviv District, Israel
[29]Rush Alzheimer's Disease Center and Department of Orthopaedic Surgery, Rush University Medical Center, Chicago, IL, USA
[30]Department of Public Health & Sports Sciences, University of Exeter, Exeter, UK
[31]Centre for Surveillance and Applied Research, Public Health Agency of Canada, Ottawa, Ontario, Canada
[32]School of Epidemiology and Public Health, Faculty of Medicine, University of Ottawa, Ottawa, Ontario, Canada
[33]Department of Epidemiology, Johns Hopkins University Bloomberg School of Public Health, Baltimore, MD, USA
[34]Center on Aging and Health, Johns Hopkins University, Baltimore, MD, USA
[35]Orthopaedic Research Institute, Bournemouth University, Poole, UK
[36]University Hospitals Dorset NHS Foundation Trust, Poole, UK
[37]Division of Geriatric Medicine and Gerontology, Johns Hopkins School of Medicine, Baltimore, MD, USA
[38]Centre for Motivation and Behaviour Change, Department for Health, University of Bath, Bath, UK

Address correspondence to: Marla K. Beauchamp, McMaster University Faculty of Health Sciences, School of Rehabilitation Sciences, Hamilton, Ontario, Canada. Email: beaucm1@mcmaster.ca
[‡]Acknowledgement of Collaborative Authors: The Consensus Facilitator Group members are: Kit B. Beyer, Paul Blazey, Ben F. Cornish, Cody Cooper, Renata Kirkwood and Audrey Patocs.

Abstract

Background: Mobility, defined as movement in all its forms, is a hallmark of healthy ageing. As wearable technologies become increasingly integrated into population health surveillance and ageing research, the absence of standardised terminology, measurement protocols and reporting practices presents a major barrier to progress. This consensus exercise aimed to establish minimum standards for measuring mobility with wearable technology in ageing populations and set priorities for future research in the field.
Methods: A two-day, in-person consensus meeting was convened with 24 international experts in ageing, mobility and digital health. Using a modified nominal group technique facilitated by a trained moderator, participants engaged in structured small-group brainstorming, followed by iterative large-group discussions. Consensus was achieved through anonymised digital voting on proposed measures, principles and priorities.
Findings: Consensus ($\geq$80% agreement) was reached on 20 core device-derived mobility measures and 30 guiding principles for the optimal use of wearable technology in older populations. Experts also identified and ranked 16 priority areas for future research, with the top five including: (i) longitudinal studies and data collection, (ii) digital biomarkers and health outcomes, (iii) contextual data capture, (iv) algorithm development and validation and (v) integration with healthcare systems.
Interpretations: These consensus-based standards provide a foundational framework for the consistent and transparent use of wearable devices in ageing research and practice. They can inform the development of regulations and guidelines, support harmonisation across studies and chart a path for future research to enhance the utility and impact of wearable technologies in ageing populations.

Keywords: accelerometers; digital biomarker; gait; physical activity; step count; older people

Key points

- Twenty-four international experts convened to establish minimum standards for the use of wearables in measuring late-life mobility.
- The group identified 20 core device-derived mobility measures across six subdomains of mobility.
- Thirty guiding principles were developed to inform the selection, protocols and interpretation of wearable data in older adults.
- Sixteen priority areas were identified for advancing research on late-life mobility and healthy ageing.
- Results can be used to guide wearable mobility assessments in older adults and promote consistent research practices.

Background

The World Health Organization (WHO) describes mobility as 'movement in all its forms, whether powered by the body or a vehicle' [1, 2]. Over the last decade, mobility has emerged as one of the most consistent predictors of frailty, healthcare costs and mortality in community-dwelling older adults [3–6]. Accordingly, mobility is often referred to as a cornerstone of healthy ageing. Although there is a plethora of outcome measures designed to assess mobility, existing measures tend to focus on discrete aspects of mobility assessed at a single point in time, measured in a laboratory or clinical environment [7]. Wearable technology provides the unique opportunity to measure older people's actual 'real-world' mobility in their homes and communities over extended periods of time in day-to-day life. Nonetheless, there are barriers to using wearable devices for mobility monitoring in older adults—in clinical studies, healthcare and as part of population health surveillance—that continue to limit their widespread usefulness and application [8, 9].

Wearable technology used in mobility research encompasses a variety of devices and sensor types that include, among others, accelerometers (e.g. ActiGraph, Axivity, GENEActiv), global positioning systems and consumer-grade devices (e.g. smartwatches, mobile phones). Currently, there is a lack of standardised methods across studies regarding terminology, outcome measures and device features and data processing algorithms, making interpretation of results challenging [10]. Importantly, these methodological considerations can affect the validity of device-derived mobility measures in older adults. For instance, the location where an accelerometer is worn influences what metrics can be extracted from the data (such as body posture versus physical activity intensity) [11, 12]. Furthermore, older adults tend to walk more slowly and may use gait aids that can impact the reliability and validity of some device-derived measures [13, 14]. More recently, there have been calls for better reporting of methods including algorithms used to take the raw data from these devices and derive the outcomes reported. Algorithm reporting is further complicated by the use of consumer-grade wearables, where researchers do not always have access to the raw data or the proprietary algorithms used to report or confirm validity of the algorithm for use in their population of interest [9].

Several groups are working independently to address concerns around validation of device-derived mobility measures for clinical populations (e.g. Mobilise-D) [15] and to improve standardisation of wear protocols and algorithms for various device measures (e.g. LABDA, NiMBaLWear, ProPASS consortium) [16–18]. Standardising terminology and data collection approaches across efforts is crucial for data harmonisation and accurate interpretation of results, especially as many major organisations, including the WHO [19], work to revise health surveillance and movement guidelines based on wearable data [19]. As population-based ageing cohorts around the world increasingly integrate wearable technology into data collection protocols (e.g. Canadian Longitudinal Study on Aging, China Kadoorie Biobank, National Health and Aging Trend Study, UK Biobank) [20–23], it is essential to consider the unique needs and age-related changes of older adults.

This paper describes the outcomes of an international consensus exercise on wearable technology for measuring mobility in ageing populations worldwide. The 2-day consensus meeting aimed to (i) establish minimum standards for measuring mobility with wearable technology in ageing populations and (ii) identify critical knowledge gaps and set priorities for future research to advance the field.

Methods

In November 2024, a group of 24 researchers, including the steering committee, with international expertise in wearable technologies and ageing populations, convened for a 2-day in-person meeting in Burlington, Canada. The steering committee (M.B., A.S., B.M. and P.R.) identified and invited experts based on their publication record and recognised contributions to the field of wearable technology for assessing mobility or physical activity in older adults. Potential individuals were invited by email, and in some cases, additional names were raised by invitees (i.e. snowball sampling). Prior to the meeting, attendees received relevant pre-readings (identified through systematic searches in Medline, reference list screening and expert consultation). They were also provided with a summary document outlining key concepts, such as the definition of mobility and its proposed subdomains, and were asked to complete a pre-meeting survey (Appendix E). This study is reported in accordance with the ACcurate COnsensus Reporting Document (ACCORD) guidelines [24].

Mobility definition and operationalisation

We adopted the WHO's definition of mobility, mobility in all forms including: 'Getting up from a chair or moving from a bed to a chair, walking for leisure, exercising, completing daily tasks, driving a car and using public transport' [1, 2]. To guide the discussions on standards for wearable-derived measures of mobility and their associated collection methods, the following six nonmutually exclusive subdomains of mobility were proposed based on discussion of the definition among the steering committee and expert feedback during the pre-meeting survey: (i) walking, (ii) physical activity, (iii) body posture, (iv) transitions, (v) life space and (vi) transportation (Box 1).

Consensus exercise

The consensus meeting was facilitated by a trained group facilitator from Queens University Executive Decision Center at the Smith School of Business and a senior scientist with expertise in mobility and consensus work (J.R.). For this consensus exercise, we used a modified Nominal Group

Box 1. Proposed subdomains based on the World Health Organization's mobility definition

Subdomain	Examples of included movements and behaviours
Body Posture	Body position (lying, sitting, standing) and sedentary behaviour
Walking	Dynamic balance and walking-related activities like turning and stairs
Physical Activity	Structured exercise such as walking or running on a treadmill
Transportation	Includes the option for active transportation
Life Space	Interaction with the environment, social mobility and consideration of locations encouraging social interaction like parks, community centres, etc.
Transitions[a]	Changes in body position such as getting up from a chair or bed

[a]The subdomain of transitions was added based on experts' feedback in the premeeting survey

Technique (NGT) approach [25] that employed traditional facilitation and group decision support technology ('the Decision Centre', Smith School of Business at Queen's University, Kingston, Canada) to generate ideas and determine priorities. The NGT approach iteratively generates individual opinions, clustering similar ideas and generating a group consensus [25]. Modifications were made to accommodate the number of participants. Individual experts did not provide ideas/concepts in a round robin format; rather, experts were divided into small groups ($n = 5$) to collect ideas and then rejoined the large group for discussion, ideas/concept refinement (i.e. identify missed or redundant concepts/items) and anonymised voting. Groups were created based on pre-meeting survey responses to ensure a diversity of expertise and years of experience in each small group. A facilitation team was created ($n = 8$), and a member was present in each group to record discussions and facilitate item generation using the digital support technology.

An *a priori* consensus threshold was set at 80% with the option for further discussion of items 'on the margin' (50%–79%) [26, 27]. Below, we outline the questions posed during the meeting and the corresponding methods for each. Anonymised voting results (counts and percentages) were shared with the group in visual form immediately following.

1. Which device-derived measures can be used to assess the various mobility subdomains?

For each mobility subdomain, attendees began by brainstorming ideas in small groups. Following the large group discussion, each participant was asked to select 'the most critical device-derived measures to characterize this subdomain of mobility' and instructed to anonymously vote for each item they deemed critical on their individual laptop computer. Additional discussions took place for items on the margin, and after discussion, the same prompt was used to vote on these items.

2a. Regardless of the subdomain/measure of interest, what are some general best practices that we can all agree on that should be followed when selecting and using a wearable device for mobility measurement in older people?

In their small groups, experts brainstormed ideas and then selected their top five or six ideas to move forward to the large group discussion. The chair of the steering committee (M.K.B.), with assistance from the senior facilitator (J.R.), then organised ideas into six phases of research that were identified in the large group discussion: preplanning, choice of device features, data collection, processing, analytics and reporting. Individuals were then asked to vote yes/no 'I agree this is an essential principle', for each idea. Additional discussions were held for items on the margin and voted on again using the same prompt.

2b. In addition to the general best practices, do any of the subdomains or critical measures/outcomes as per question 1 require specific additional considerations for measurement via wearables (e.g. wear location, analytical considerations)?

Ideas were generated in the large group, but discussions highlighted the complexity of the question, which required more time than the meeting allowed. As a result, this was treated as a brainstorming exercise, with no voting or ranking taking place.

3. What are the priorities for future research on wearable technology in ageing populations?

As part of the pre-meeting survey, attendees were asked to identify future research priorities that the steering committee organised into eight themes. A large group discussion was held to determine if any additional ideas had emerged over the course of the consensus meeting. All ideas were reviewed and consolidated, and attendees selected their top six research priorities. Finally, attendees self-selected a small group based on the top five themes to brainstorm ways to move the area forward.

Consensus evaluation

In concluding the meeting, attendees were asked to discuss next steps for this work and to complete an anonymised evaluation of the consensus process (i.e. ratings on agreement with conclusions, satisfaction with discussions and understanding of what was done).

Role of funding source

One of the funding sources could only be used to support travel for UK-based experts. Neither funding source was

involved in the study design or interpretation/presentation of results.

Results

A total of 24 researchers with decades of experience gathered from 20 institutions across Australia ($n=2$), Canada ($n=6$), Ireland ($n=1$), Israel ($n=1$), Germany ($n=1$), Spain ($n=1$), the UK ($n=10$) and the USA ($n=2$). The majority of participants (63%) had over 10 years of experience in wearable technology research (63%), with 21% having 6–10 years and 17% having 3–5 years of experience. Most attendees (92%) had a background in health and clinical sciences, and 63% were male. The group brought together complementary expertise—including data science, exercise physiology and epidemiology—and represented key research consortia such as Mobilise-D, PROPASS and the UK Biobank. Participation in voting and ranking exercises ranged from 22 to 24 individuals, with 20 completing the final evaluation. During the introductory session, participants agreed to define 'ageing' as beginning at age 60 or older, aligning with the WHO's Decade of Healthy Ageing, to guide all subsequent discussions [28].

Device-derived measures for mobility subdomains

All mobility subdomains had at least three measures that reached consensus (≥80% agreement). In total, 20 device-derived measures were endorsed across the six subdomains: walking ($n=4$; 33%), physical activity ($n=5$; 50%), body posture ($n=2$; 25%), transitions ($n=3$; 25%), life space ($n=3$; 21%) and transportation ($n=4$; 40%). Voting results are displayed in Figure 1, and measures not reaching consensus are listed in Appendix A, Tables A1–A6. For physical activity and transportation, a secondary discussion and vote were held for measures on the margin. This process resulted in the inclusion of three additional measures for physical activity (totalling five), while no further measures for transportation achieved consensus.

Guiding principles for optimal mobility measurement in older people

During discussions, attendees determined that 'guiding principles' were more practical than 'general best practices'. Over 70 guiding principles were identified in small groups and categorised into six phases of the research process. Of these, 30 guiding principles reached consensus (Table 1). Three principles received 100% agreement: (i) the data collection period should be appropriate to the study goals, (ii) the need for quality control checks (data and device) and (iii) where possible, data and code should be placed in an open access repository. Three principles from choice of device features and one from analytics reached consensus during a secondary vote. The remaining 26 guiding principles did not reach consensus (Appendix B, Tables B1–B6). Ideas generated during the brainstorming exercise for question 2b are summarised in Supplementary Table B7.

Priorities for future research on wearable technology in ageing populations

During the large-group discussion, participants contributed over 20 additional ideas to the eight thematic areas identified in the pre-meeting survey. These were refined into 16 distinct research priorities (Appendix C, Table C1). Longitudinal studies and data collection emerged as the top-ranked priority (19 out of 23 votes), followed by digital biomarkers and health outcomes ($n=15$), contextual data capture ($n=14$), algorithm development and validation ($n=12$) and integration with healthcare systems ($n=11$). Other priorities included standardisation of metrics and protocols ($n=10$), creation and implementation of shared standard datasets ($n=8$), user-centred design ($n=8$), development of data visualisation methods ($n=7$) and defining minimum datasets for digital biomarkers ($n=6$). Additional lower-ranked priorities included understanding low-intensity movement ($n=6$), engagement with commercial wearable manufacturers ($n=4$), development or adoption of collaborative platforms ($n=4$) and establishing a monetary value proposition. Descriptions of the top five priorities are shown in Table 2.

During the small group brainstorming sessions focused on the top five research priorities, several key areas for future investigation were identified. For (i) *Longitudinal Studies and Data Collection*, participants emphasised the need for research in low- and middle-income countries and the importance of repeated measures to capture mobility trajectories over time. *For* (ii) *Digital Mobility Biomarkers and Health Outcomes*, discussions highlighted the necessity of validating biomarkers by assessing measurement error, cost-effectiveness and data collection efficiency. In (iii) *Contextual Data Capture*, participants explored methodological approaches such as multi-modal sensing and the use of ecological momentary assessment (EMA) triggers. For (iv) *Algorithm Development and Validation*, concerns were raised about the current reliance on wrist-worn accelerometers and the need for broader validation across devices and populations. Finally, for (v) *Integration with Health Systems*, discussions centred on the importance of training healthcare professionals and creating appropriate incentives for adoption. Summaries of these discussions are provided in Supplementary Table C2.

Consensus evaluation

Twenty attendees (80%) completed a five-item survey, with response options ranging from 1 strongly disagree to 5 strongly agree. Attendees' responses showed a high level of understanding and agreement with the content from the meeting, with a median value of 5 (IQR 2–5) for 'I understand what we have developed here' and a median of 4 (IQR 2–4) for 'I am satisfied with the discussion and covered what we needed to'. Importantly, attendees demonstrated

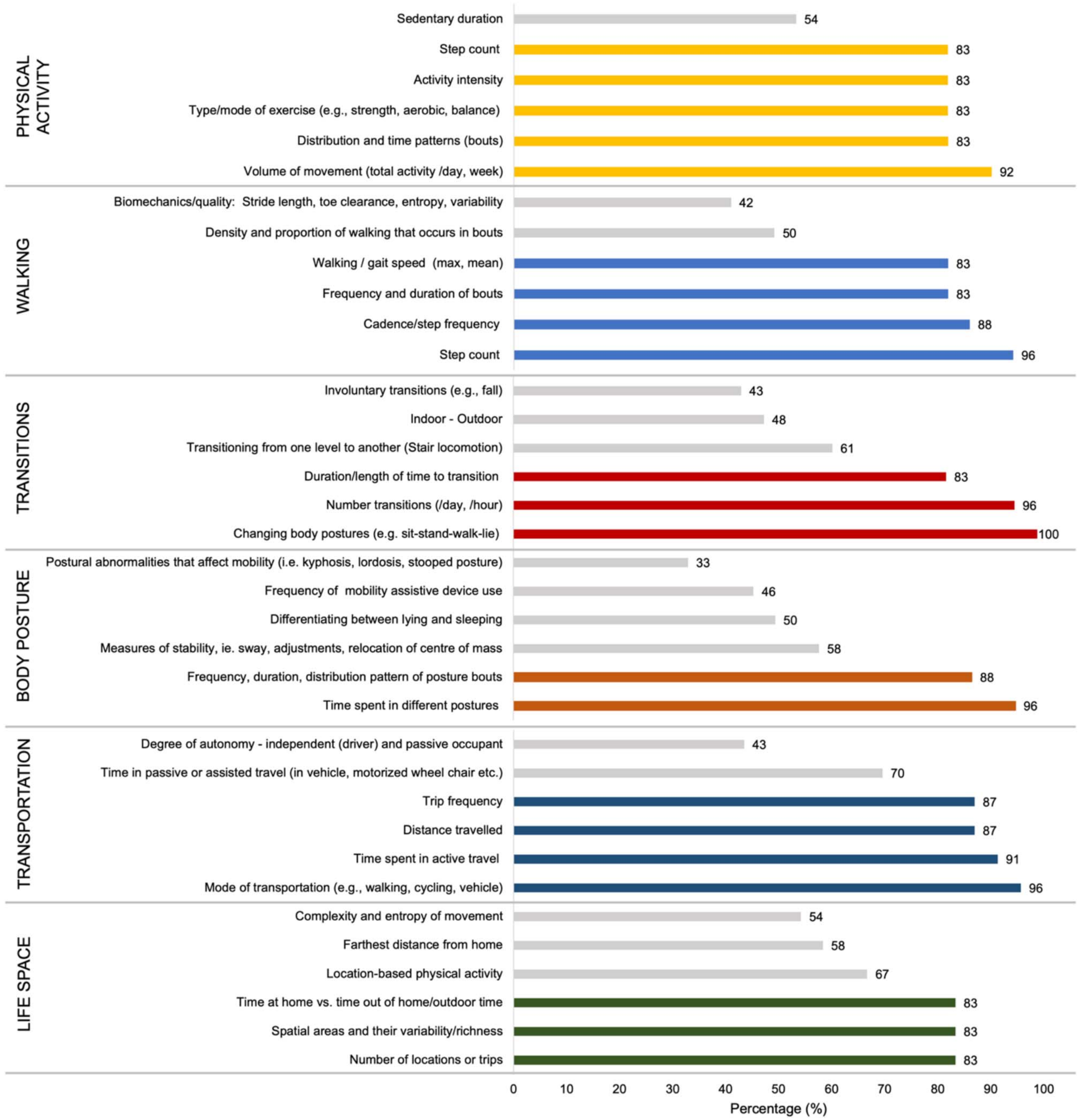

Figure 1. Voting results for the top six critical device–derived mobility measures for each mobility subdomain. Critical device–derived measures are those that reached 80% agreement or more. Not all measures voted upon are shown here. For a full list of the measures that did not reach consensus, see Appendix A, Tables A1–A6.

belief in and commitment to what was developed in this meeting with median scores to 'I believe we will be successful in implementing these priorities' and 'I agree with and am committed to what we have developed' of 4 (IQR 2–4) and 5 (IQR 3–5), respectively (Appendix D).

Discussion

This was the first international consensus meeting specifically convened to address the use of wearable technology for mobility measurement in ageing populations. Over the course of 2 days, 24 experts achieved consensus on 20 critical device-derived measures for the six subdomains of mobility, developed 30 guiding principles for the implementation of wearable-based mobility assessment in older people, and identified 16 key research priorities to advance the field. The outcomes of this initiative provide a foundational framework to guide mobility measurement in ageing research and clinical practice, inform the development of regulatory standards and guidelines, enhance methodological transparency

Table 1. Guiding principles for optimal device-based mobility measurement in older people

Pre-planning phase [22 voters]:

1. Consider data protection/security issues **[86%]**
2. Choose sensor wear configuration [e.g. multi-modal sensors, wear location(s)] based on research question/context of use **[86%]**
3. Consider usability and feasibility of device (will people actually wear it?) **[86%]**
4. Choose body wear location depending on measures of interest in cohorts **[83%]**
5. Consider the cost—including support staff, development/analytics and data transmission/cloud services **[82%]**

Selecting device features [22 voters]:

1. Consider access to data (privacy & anonymity): if using a commercial wearable, it is important to be aware of country regulations on who has access **[96%]**[a]
2. Access to raw data on selected device(s) is preferable **[95%]**
3. Choose longer battery life for continuous monitoring **[91%]**
4. Consider data ownership (commercial vs. research) **[86%]**
5. Consider flexibility of configuration options—balance length of monitoring and granularity (highest resolution you can afford) **[86%]**
6. Consider the trade-offs with commercially available devices vs. research devices **[83%]**[a]
7. Consider user acceptability **[83%]**[a]

Data collection phase [23 voters]:

1. The data collection period should be appropriate to the study goals (for longitudinal studies with ageing populations, a minimum of 7 days should be considered to capture mobility on weekdays and weekends) **[100%]**
2. Perform quality control checks—data & device (i.e. sensor location/reorientation, quantify wear & nonwear time, routine checks of sensor quality/maintenance) **[100%]**
3. Collect with the highest resolution you can afford (time, battery life) **[87%]**
4. Consider how to minimise loss of data throughout **[87%]**
5. Consider the device return process (ease of return, burden, cost) **[83%]**

Data processing phase [23 voters]:

1. Perform calibration quality checks **[96%]**
2. Periods of nonwear need to be identified **[96%]**
3. Use appropriate open-source software for processing **[91%]**
4. Use the most population-appropriate validated algorithm for processing of all data **[91%]**
5. Use validated measures or, at minimum, transparent access to data and transformations to support reproducibility/validity **[91%]**
6. Consider temporal synchronisation **[83%]**

Analytics phase [23 voters]:

1. Provide transparent access to data and transformations to support reproducibility/validity and review of pipeline code **[96%]**
2. Method protocols & algorithms should be validated (technically and clinically) and evaluated in terms of reliability **[91%]**
3. Analytical pipelines should aim to be device agnostic **[91%]**[b]

Reporting phase [22 voters]:

1. Place data and code in an open-access repository where possible (consider ethics) **[100%]**
2. Clearly report approaches to data aggregation (e.g. for processing and summarising data outcomes to enable replication and aid interpretation) **[95%]**
3. Provide comprehensive reporting of methodology **[91%]**
4. Standardise reporting of methodology (develop appropriate checklist for guidelines) **[82%]**

Agreed upon guiding principles are presented according to research phase. The percent agreement reached for each guiding principle is shown in the brackets. [a]Agreement was reached during the secondary vote, which had 23 voters. [b]Agreement was reached during the secondary vote, which had 22 voters.

and reproducibility, and shape future research directions in this rapidly evolving area.

The growing use of wearable technologies offers researchers and healthcare professionals new opportunities to assess key components of healthy ageing. As researchers, organisations and commercial companies race to incorporate these new tools, a variety of methods and outcomes are reported, often lacking the detail required to ensure transparency and reproducibility. While some wearable-derived measures have been used for decades (e.g. the Canadian Health Measures Survey has been collecting accelerometry data on physical activity since 2007) [29], only recently have efforts begun to standardise and harmonise these methods. In 2023, the WHO held a planning meeting on physical activity measurement and surveillance in adults, discussing the inclusion of wearables, associated challenges and future research needs [19]. This consensus exercise builds on the WHO's work by considering all subdomains of mobility (i.e. beyond physical activity) and, importantly, addresses the unique needs (e.g. mobility limitations, skin sensitivities) of the older adult population [12].

This consensus exercise identified the most critical measures for ensuring that key aspects of later-life mobility are consistently and accurately captured by wearable devices. Of

Table 2. Top five priorities (ranked) for future research on wearable technology in ageing populations

1. Longitudinal Studies and Data Collection (83%): Support the development of longitudinal datasets that link wearable data with health outcomes over time. This research should focus on understanding mobility trajectories, the impact of behaviours on health and the effectiveness of interventions based on real-time data.
2. Digital Biomarkers and Health Outcomes (65%): Explore the identification and use of digital biomarkers (e.g. gait speed, balance metrics) for diagnosing and monitoring age-related diseases. Research should aim to clarify how these biomarkers can inform clinical practice and enhance understanding of disease progression.
3. Contextual Data Capture (61%): Investigate methods for capturing contextual information related to mobility and activities in real time, such as location, social interactions and environmental factors that may influence physical activity in older adults.
4. Algorithm Development and Validation (52%): Focus on creating and validating algorithms and standards tailored specifically for older adults with varying functional capacities. This includes ensuring the accuracy and clinical utility of wearable metrics.
5. Integration with Healthcare Systems (48%): Investigate methods for effectively integrating wearable technology data into existing healthcare systems. This includes exploring how wearable data can enhance clinical monitoring and decision-making processes.

the six mobility subdomains, physical activity had the most agreed-upon core measures ($n = 5$) and body postures had the fewest ($n = 2$). This disparity may be partly attributed to not only the core expertise of the consensus participants (i.e. leaning more towards physical activity) but also the complexity of the subdomain (i.e. physical activity covers a broad range of outcomes that have been extensively studied in multiple populations). There is currently a lack of consensus and standardised definitions regarding the specific subdomains and categorical hierarchy of mobility. Future work to formally define and structure these concepts is vital for efforts to harmonise research and identify gaps. For the purpose of this work, to support current and ongoing research, we proposed six mobility subdomains to provide structure for the discussions and reflect the diversity of constructs found in the WHO's mobility definition. These subdomains were somewhat ambiguous and not necessarily mutually exclusive, meaning proposed measures for each could overlap.

Notably, step count was considered a critical device-derived measure for both the walking and physical activity subdomains. While the importance of step count was made clear by these votes, there were points of contention and in-depth dialogue during discussions. Discourse included what is being reported as a step and the need for more transparency on analytic approaches for deriving step count (e.g. step vs. stride, stepping vs. walking), as well as the data collection methods that could impact the validity of step count measurement (e.g. device type and wear location). Specifically, from an ageing lens, concerns were raised around detecting steps in individuals with slower and/or altered gait or those using a gait aid, and applying algorithms with step identification thresholds developed in younger age groups. Therefore, although step count had one of the highest levels of agreement (96% for walking), even this widely endorsed measure requires further investigation for ageing populations.

A total of 30 guiding principles for the measurement of mobility using wearable technology in older adults reached consensus. The importance of transparency was reflected within the accepted principles—transparency in data access and selection of algorithms/pipelines, the use of open-source code and data repositories and clear reporting of data aggregation approaches. With the absence of a current standard for data processing (e.g. data cleaning, cut-points), these expert opinions emphasise the need for better reporting to help promote reproducibility and prevent misinterpretation and inappropriate aggregation of results. Consideration of the data collection period and sensor wear configuration principles also received high levels of agreement, 100% and 86%, respectively. However, they did not result in one standard but rather principles that reflected the importance of decisions matching the research question and context. For example, it was suggested that for longitudinal ageing studies, a period of at least 7 days should be selected to capture activities on weekdays and weekends. Based on current evidence and experience, more specific recommendations about the data collection period and sensor configuration were not viewed as feasible at this time.

Our findings highlight several future research priorities. Discussion regarding *Longitudinal Studies* emphasised the need to address the variability of measures over time (e.g. reliability of device-derived measures) and the frequency needed to capture the rapid changes in functional status that are often observed in older adults. Discussions also highlighted the need to support cohort studies in lower- and middle-income countries and address the costs and unique challenges of device-based measurement in these settings. The second priority area, *Digital Biomarkers and Health Outcomes*, underscored the need for reliable and valid measures of mobility with established minimal important change thresholds, robust normative values and further understanding of the relationships between digital biomarkers and health outcomes. In the remaining three priority areas, discussions focused on incorporating physical and social environmental factors into mobility assessments (e.g. different EMA triggers and what to capture in and outside the home), evaluating the role of wrist-worn accelerometers and the potential for additional sensor data (e.g. heart rate) to enhance outcome accuracy and underscoring the clinical utility of device-derived mobility metrics, including necessary training and implementation barriers.

This consensus exercise represents a significant step forward in standardising wearable-based mobility measurement in ageing populations. A key strength was the breadth and depth of expertise among participants, who brought decades of experience and represented major international consortia and initiatives. The methodology—featuring independent facilitation, iterative in-person discussions and anonymous digital voting—enabled real-time refinement of ideas while preserving participant autonomy and minimising bias. However, several limitations should be acknowledged. The expert panel was predominantly composed of individuals from high-income countries, particularly the UK and Canada, with limited representation from low- and middle-income settings. Future efforts should prioritise broader geographic and socioeconomic inclusion. Additionally, future work must incorporate perspectives from older adults themselves, industry stakeholders (including pharmaceutical and technology sectors) and regulatory agencies. Their input is essential to ensure that the consensus findings are both valid and implementable across real-world settings. While most voting exercises had high participation (10 out of 14 votes included over 90% of attendees), not all participants voted in every round. The panel comprised experts in their respective fields, but they brought diverse skill sets and experiences, meaning not all participants shared the same depth of knowledge across every topic discussed. This may help explain why, although general guiding principles were formally voted upon, the guiding principles for individual device-derived measures (Question 2b; Supplementary Table B7)—such as wear location for measuring walking—were not subject to voting or ranking, as extensive discussion was needed and consensus was not deemed feasible within the time available.

Building on this foundational work, further consensus efforts are needed to refine best practices for specific device-derived mobility measures. For example, while 83% of participants agreed that physical activity intensity is a critical measure for older adults, there was substantial discussion around the limitations of current classification methods (e.g. reliance on cut-points) and the need for validated, population-specific approaches. Future working groups should expand collaboration to include researchers focused on improving wearable data reporting and the development of standardised reporting guidelines. Broader engagement with the global research community will be essential to refine and adopt these recommendations. Additional consensus exercises may also be warranted to address emerging topics such as the integration of machine learning and artificial intelligence (AI) and the use of wearables as interventions to promote mobility.

Finally, to overcome persistent implementation barriers in clinical and public health practice, coordinated action across stakeholders is essential. Key areas for action include: (i) establishing standardised protocols and outcome definitions to support comparability and regulatory acceptance; (ii) fostering early collaboration among researchers, clinicians, industry and health authorities to ensure clinical relevance and scalability; (iii) promoting data sharing and transparent reporting to strengthen evidence synthesis; and (iv) advocating for inclusion of validated digital mobility measures in clinical guidelines and relevant regulatory or reimbursement frameworks. Advancing these steps will allow the research community to move beyond validation towards meaningful adoption and impact in real-world settings.

In summary, this study presents the first international consensus on wearable technology for mobility measurement in ageing populations. The resulting 20 consensus-based measures, 30 guiding principles and 16 research priorities offer a robust framework to harmonise research practices, inform regulatory development and shape future investigations. Policymakers can use these findings to develop guidelines for monitoring and promoting healthy ageing, while researchers can build on them to design more comparable, generalisable studies that deepen our understanding of mobility and health in later life.

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