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CLOSING THE KNOW-DO GAP: A SOCIO- ECOLOGICAL AND BEHAVIOURAL REVIEW OF PHYSICAL ACTIVITY ADHERENCE IN COMMUNITY-DWELLING OLDER ADULTS

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ABSTRACT
Despite robust clinical evidence demonstrating that regular exercise preserves functional independence and mitigates chronic disease burden in late life, a profound "know–do gap" persists between global physical activity recommendations and real-world behavioral adherence among community-dwelling older adults. This short review examines the multifaceted reasons underlying this widespread behavioral drop-off, shifting the focus from idealized clinical prescription to complex real-world determinants. Utilizing the Socio-Ecological Model and behavioral frameworks like the COM-B model, we synthesize how intrapersonal psychological barriers such as a cyclical fear of falling, low self-efficacy, and subclinical depression are actively amplified by interpersonal social isolation, hostile built environments, and fragmented healthcare referral pathways. The review highlights that passive family encouragement often proves insufficient, underscoring the critical necessity for active, structured community interpersonal support. We argue that sustainable behavioral change cannot be achieved through isolated medical directives; instead, healthcare systems must integrate with local social infrastructures through multi-component community volunteer frameworks and peer-companionship models. Finally, we identify a profound geographic gap in current literature, calling for targeted socio-ecological research in low- and middle-income countries (LMICs) where rapid population aging collides with unique structural and economic challenges. Ultimately, resolving late-life physical inactivity requires transitioning from individual-focused clinical mandates toward community-anchored, sustainable support networks.

KEYWORDS: Physical Activity; Adherence; Aging; Socio-Ecological Model; Self-Efficacy; Peer Support; Low- and Middle-Income Countries (LMICs).

1. INTRODUCTION

The global demographic shift toward an aging population has intensified the urgency to address chronic disease burden and maintain functional independence in older age. Physical inactivity is widely recognized as a leading, modifiable risk factor for global mortality, contributing significantly to the onset of non-communicable diseases, accelerated sarcopenia (age-related muscle wasting), and metabolic dysfunction. To counter this, the World Health Organization (WHO) explicitly recommends that community-dwelling older adults aged 65 and above engage in at least 150 to 300 minutes of moderate-intensity aerobic physical activity per week, alongside multicomponent balance and strength training on three or more days.[1,2] Ample clinical evidence confirms that adhering to these guidelines yields profound health outcomes, including preserved cognitive plasticity, reduced risk of cardiovascular events, improved musculoskeletal density, and a lower incidence of debilitating falls.[2,3]

Despite this robust evidence base, a profound and persistent gap remains between public health recommendations and real-world behavioral adherence. Globally, a vast majority of community-dwelling older adults remain consistently underactive, with sedentary behaviors rising sharply with advancing age, often exceeding nine to ten hours of daily sitting time.[3] While clinical guidelines successfully define *what* exercise are beneficial, they often fail to address *how* older adults can navigate the complex behavioral, personal, and logistical shifts required to maintain these habits within their daily lives. Consequently, the primary challenge in geriatric health is no longer the clinical formulation of exercise parameters but rather behavioral sustainability outside of controlled environments.[4]

The purpose of this review is to examine why community-dwelling older adults struggle to maintain physical activity, shifting the focus from clinical prescription to behavioral realities. By analyzing the intrapersonal, psychological, social, environmental, and health system determinants of physical activity, this review aims to synthesize how these multifaceted layers interact to influence long-term behavior. Ultimately, we provide an integrated perspective on shifting from isolated

clinical interventions toward sustainable, community-driven support frameworks.

2. EXERCISE PRESCRIPTION IS NECESSARY BUT NOT SUFFICIENT: THE "KNOW–DO" GAP

The clinical parameters for prescribing exercise to older adults are well-established and highly structured, detailing exact frequencies, intensities, types, and durations of physical activity required to achieve therapeutic outcomes.[1,5] In controlled or clinical research settings, supervised exercise programs consistently demonstrate high efficacy, yielding significant improvements in physical performance metrics such as the Chair Sit and Reach (CSR) test for lower-body flexibility, timed up-and-go (TUG) tests for mobility, and grip strength.[5,6] However, these clinical trials function under idealized conditions characterized by high-touch oversight, professional monitoring, free transportation, and structured accountability elements that are conspicuously absent when older adults return to independent living within their communities.

Once formal supervision or clinical trial interventions terminate, long-term adherence rates plummet sharply, with longitudinal data indicating that up to 50% of participants drop out within the first six months post-intervention.[6,7] This rapid decline underscores a critical vulnerability: short-term compliance driven by external clinical oversight does not automatically translate into internal habit formation. The transition from a structured, facility-based program to self-directed, home- or community-based physical activity represents a major failure point in geriatric care. Older adults frequently struggle to translate clinical instructions into independent, lasting habits when faced with competing daily priorities. This phenomenon creates a critical "know–do gap" in public health: an expansive divide between what clinical guidelines prove to be necessary and what older individuals can actually sustain in their daily routines.[7]

This persistent gap underscores that a precise exercise prescription is a necessary prerequisite, but it is fundamentally insufficient on its own to drive sustained behavior change. To build successful, long-term interventions, public health strategies must move beyond treating physical inactivity as a simple knowledge deficit. Instead, we must investigate the complex behavioral, social, and structural infrastructure required to support an older adult's transition from short-term compliance to lifelong physical activity adherence.[8]

3. INTRAPERSONAL AND PSYCHOLOGICAL DETERMINANTS

At the most immediate level of behavior, physical activity adherence is heavily dictated by an older adult's intrapersonal state a complex intersection of psychological well-being and individualized cognitive health beliefs. Among these, exercise self-efficacy, defined as an individual's confidence in their capability to execute physical activity safely under varying conditions, acts as a primary behavioral driver.[9] Older adults with low self-efficacy are significantly less likely to initiate or maintain exercise habits, often viewing physical exertion as an existential risk rather than a health-promoting behavior.[9,10] This lack of confidence is closely bound to personal health beliefs and outcome expectations; if an individual perceives that physical decline and frailty are inevitable, untreatable consequences of biological aging, their internal motivation to exercise drops sharply, leading to learned helplessness regarding their physical health.[10,11]

This cognitive vulnerability is profoundly magnified by distinct psychological barriers, chief among which is the **fear of falling (FOF)**.[9,12] Even in community-dwelling older adults without a clinical history of actual falls, FOF triggers a severe behavioral "avoidance cycle".[12] To prevent perceived injury, individuals deliberately restrict their daily mobility and community ambulation. This restriction paradoxically accelerates muscle deconditioning, reduces functional balance, worsens joint stiffness, and ultimately lowers their actual physical capability, making a future fall far more likely.[11,12]

Furthermore, subclinical or clinical mental health conditions such as **depression, anxiety, and late-life loneliness** function as restrictive psychological anchors. Depression directly depletes the emotional energy, executive functioning, and intrinsic motivation required to engage in regular physical movement, while anxiety amplifies the perceived physical dangers of outdoor environments.[10,13] Similarly, early-stage cognitive impairment often reduces an individual's spatial navigation confidence and visual processing, stripping away the simple enjoyment of exercise and replacing it with confusion or agitation.[13] These intrapersonal psychological barriers do not operate in a vacuum; they interact dynamically, turning what should be a routine health choice into an emotionally and cognitively overwhelming task that many choose to avoid entirely.

4. INTERPERSONAL AND SOCIAL DETERMINANTS

Beyond internal psychological states, an older adult's physical activity behavior is profoundly shaped by their immediate social environment. Interpersonal networks comprising family, friends, neighbors, and caregivers act as powerful facilitators or inhibitors of behavior. Passive family encouragement, while well-intentioned, often proves insufficient to drive long-term adherence.[14] In fact, overprotective family dynamics or well-meaning caregiver support can sometimes inadvertently foster dependency. When relatives discourage physical exertion, climbing stairs, or walking to local markets out of an exaggerated fear for the older adult's safety, they accelerate functional decline.[14,15] Conversely, strong peer relationships and active social networks directly reinforce positive behavioral norms, transforming physical activity from an isolated, tedious chore into a meaningful social outlet that preserves identity.

The presence of persistent social isolation and loneliness in community-dwelling older adults stands as a critical barrier to regular exercise. When an older individual lacks meaningful social connections, the emotional activation energy required to initiate physical activity rises exponentially.[15,16] To counter this, empirical literature increasingly highlights the value of structured community participation and group exercise formats. Group-based activities offer built-in accountability, shared enjoyment, and a collective sense of purpose, which together significantly enhance long-term behavioral compliance and reduce attrition rates.[16,17]

Crucially, recent evidence emphasizes that social support must evolve from passive verbal approval into active, structured

companionship to be truly effective. This is where **peer-led intervention frameworks and community volunteer support models** play an essential role.[17,18] Deploying a dedicated community exercise partner or volunteer companion modeled conceptually as a structural social anchor addresses multiple behavioral bottlenecks simultaneously. Rather than leaving the older adult to exercise in isolation, a trained peer companion provides direct tactical support. This active presence alleviates the fear of navigating unpredictable outdoor environments, counters day-to-day loneliness, and systematically rebuilds an older adult's self-efficacy through shared experience, peer modeling, and verbal reinforcement.[14,18] By integrating structured social prescription into routine geriatric care, public health networks can create a highly accessible interpersonal bridge that effectively closes the real-world adherence gap.

5. STRUCTURAL, ENVIRONMENTAL, AND HEALTH SYSTEM DETERMINANTS

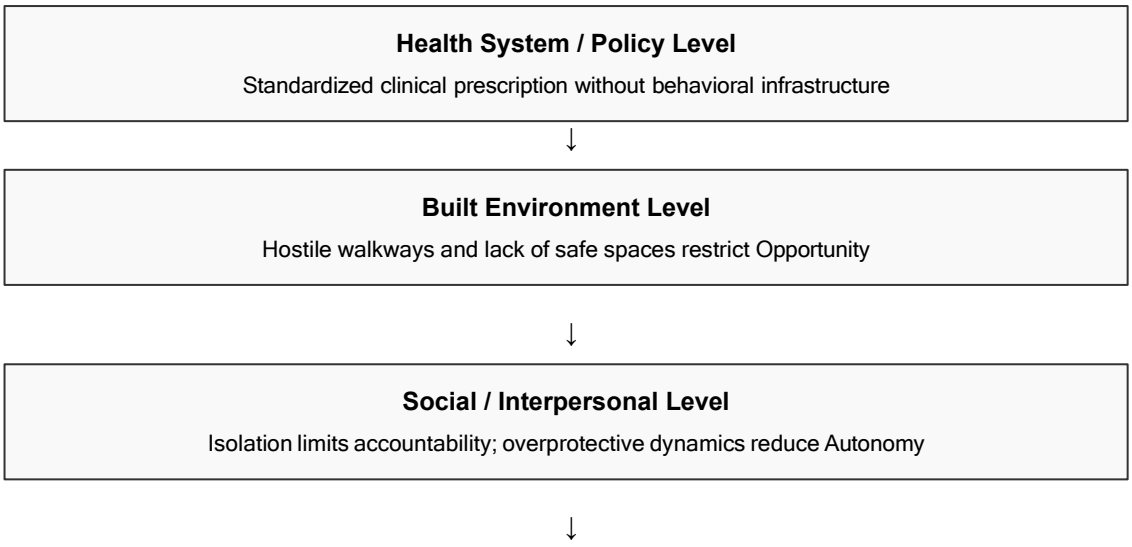
While individual motivation and social networks are foundational, physical activity behavior is ultimately bounded by external, structural realities. For community-dwelling older adults, the physical built environment can act as a profound physical barrier. Factors such as poor neighborhood walkability, uneven, broken, or absent footpaths, high curbs, insufficient street lighting, and a lack of accessible public parks directly amplify the risk of falls and heighten safety concerns.[19,20] Furthermore, inadequate or physically inaccessible public transport infrastructure forces many older individuals to remain homebound, while seasonal extreme weather conditions such as severe monsoons, sub-zero winters, or intense urban heatwaves routinely disrupt outdoor exercise routines for months at a time. These environmental limitations are severely compounded in rural versus urban settings; rural older adults face a near-total absence of dedicated exercise facilities, pedestrian-safe infrastructure, and paved walking areas, forcing them onto high-speed roads.[20]

This environmental vulnerability is closely tied to the design of the surrounding healthcare infrastructure. Within traditional health systems, physical activity is frequently underutilized due to fragmented care pathways and a lack of provider time. While brief physician counseling has been shown to spark initial patient awareness, rapid medical consultations rarely provide the detailed behavioral roadmap, personalized goal-setting, or long-term follow-up needed to permanently change lifelong habits.[21]

Formal exercise referral pathways to specialized fitness professionals or physical therapists are often cost-prohibitive, geographically inaccessible, or entirely missing from public health infrastructure. To address this breakdown in the continuity of care, community health worker (CHW) systems must be leveraged to act as a vital healthcare bridge.[21,22] Integrating physical activity promotion, routine mobility checks, and functional tracking into the scheduled home-visits of localized health workers ensures that exercise guidance transitions from an abstract, easily dismissed clinical prescription into an accessible, low-cost, and culturally tailored daily practice directly inside the patient's home environment.[22]

6. SYNTHESIS AND THEORETICAL INTEGRATION

To truly understand why older adults struggle to remain physically active, we cannot view individual, social, or environmental barriers in isolation. Instead, health behavior must be analyzed through an integrated lens, such as the Socio-Ecological Model (SEM).[23] The SEM demonstrates that an older adult's physical activity is the result of a dynamic, nesting relationship across multiple levels of influence. For instance, a macro-level structural barrier (e.g., a broken, unlit footpath) directly restricts an individual's environmental *Opportunity* (per the COM-B model), which instantly triggers a micro-level psychological response elevating the fear of falling and shattering the individual's exercise self-efficacy.[23,24] Under the COM-B framework, behavior (B) occurs only when Capability (C), Opportunity (O), and Motivation (M) interact successfully. A breakdown at the opportunity level inevitably deconstructs internal motivation.



Individual / Psychological Level

Fear of falling lowers Self-Efficacy, driving dynamic avoidance cycles

This multi-tiered interaction explains why simple, knowledge-based clinical prescriptions consistently fail. When evaluated through Self-Determination Theory (SDT), long-term habit adherence relies heavily on satisfying three core psychological needs: *autonomy* (feeling in control of one's choices), *competence* (feeling capable of executing the task), and *relatedness* (feeling connected to and supported by others).[24,25] A traditional medical directive tells a patient *what* to do, but completely ignores *relatedness*, failing to ground the behavior in a supportive social context.

By integrating these behavioral theories, it becomes clear that sustainable interventions must target multiple levels of the SEM simultaneously. This theoretical intersection provides the empirical justification for structured, community-driven support frameworks. By deploying a localized peer-companion model, an intervention successfully satisfies *relatedness* (Social), systematically builds *competence* by mitigating the fear of falling (Psychological), and bypasses hostile infrastructure by providing navigated transport and physical support (Environmental). True behavioral sustainability is only achieved when community-level opportunities are intentionally designed to rescue individual motivation.

7. FUTURE DIRECTIONS AND CONCLUSION

Moving forward, closing the "know–do gap" in geriatric physical activity requires a paradigm shift away from isolated, top-down clinical prescriptions toward integrated, multi-component community frameworks. Future interventions must prioritize scalability and sustainability by intentionally bridging formal health systems with local social infrastructure. Rather than relying solely on clinical clinics or expensive fitness facilities, public health strategies should champion community-volunteer models and peer-companionship frameworks that tap into existing social capital.[17,26] These peer-led models can be significantly enhanced by combining them with simple, accessible digital support tools—such as automated mobile health (mHealth) reminders, localized weather alerts, or hybrid remote tracking via consumer-grade wearables to maintain engagement and provide visual feedback without imposing an overwhelming technical or financial burden on older adults.[26]

Crucially, there is a profound geographic imbalance in the existing literature that must be aggressively addressed. The vast majority of socio-ecological data regarding geriatric physical activity originates from high-income countries with well-developed municipal infrastructures and social safety nets. There remains a critical research gap in Low- and Middle-Income Countries (LMICs), where rapid population aging is colliding with unique, severe structural challenges including rapid, unplanned urbanization, high rates of absolute poverty, poorly maintained pedestrian walkways, and underfunded public primary care systems.[3,22,27] Furthermore, a shift in family structures in LMICs, where urban migration is splitting traditional multi-generational households, leaves many older adults facing unprecedented levels of isolation. Future research must aggressively document the distinct behavioral, financial, and cultural determinants within LMIC communities to build culturally tailored and economically viable interventions that do not rely on Western infrastructure.

In conclusion, why older adults do not remain physically active is a multifaceted problem that cannot be blamed on a lack of individual willpower or clinical knowledge. Physical inactivity in community-dwelling older adults is an engineered outcome resulting from a complex web of low self-efficacy, pervasive social isolation, hostile built environments, and fragmented healthcare pathways. Resolving this crisis requires a coordinated effort that treats older individuals not merely as clinical patients but as social beings embedded within a physical neighborhood. Only by deploying structured, community-anchored interpersonal support can we turn public health guidelines into sustainable, everyday realities.

REFERENCES

1. WHO guidelines on physical activity and sedentary behaviour [Internet]. [cited 2026 Jun 30]. Available from: https://www.who.int/publications/i/item/9789240015128
2. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on physical activity and sedentary behaviour. Br J Sports Med. 2020 Dec;54(24):1451–62. doi:10.1136/bjsports-2020-102955 PubMed PMID: 33239350; PubMed Central PMCID: PMC7719906.
3. Pengpid S, Peltzer K. Prevalence and associated factors of physical inactivity among middle-aged and older adults in India: results of a national cross-sectional community survey. BMJ Open. 2022 Aug 26;12(8):e058156. doi:10.1136/bmjopen-2021-058156 PubMed PMID: 36028277; PubMed Central PMCID: PMC9422873.
4. Langhammer B, Bergland A, Rydwik E. The Importance of Physical Activity Exercise among Older People. BioMed Res Int. 2018 Dec 5;2018:7856823. doi:10.1155/2018/7856823 PubMed PMID: 30627571; PubMed Central PMCID: PMC6304477.
5. Izquierdo M, Merchant RA, Morley JE, Anker SD, Aprahamian I, Arai H, et al. International Exercise Recommendations in Older Adults (ICFSR): Expert Consensus Guidelines. J Nutr Health Aging. 2021;25(7):824–53. doi:10.1007/s12603-021-1665-8 PubMed PMID: 34409961; PubMed Central PMCID: PMC12369211.
6. Zubala A, MacGillivray S, Frost H, Kroll T, Skelton DA, Gavine A, et al. Promotion of physical activity interventions for community dwelling older adults: A systematic review of reviews. PloS One. 2017;12(7):e0180902. doi:10.1371/journal.pone.0180902 PubMed PMID: 28700754; PubMed Central PMCID: PMC5507305.
7. Collado-Mateo D, Lavín-Pérez AM, Peñacoba C, Del Coso J, Leyton-Román M, Luque-Casado A, et al. Key Factors Associated with Adherence to Physical Exercise in Patients with Chronic Diseases and Older Adults: An Umbrella

Review. Int J Environ Res Public Health. 2021 Feb 19;18(4):2023. doi:10.3390/ijerph18042023 PubMed PMID: 33669679; PubMed Central PMCID: PMC7922504.
8. Behavioural insights at WHO - Behavioural Sciences for Better Health [Internet]. [cited 2026 Jun 30]. Available from: https://www.who.int/initiatives/behavioural-sciences
9. Okoye EC, Onwuakagba IU, Akile CC, Okonkwo UP, Akosile CO, Mgbeojedo UG, et al. Social Support, General Self-Efficacy, Fear of Falling, and Physical Activity Among Older Adults in a Middle-Income Country. Gerontol Geriatr Med. 2022;8:23337214221097750. doi:10.1177/23337214221097750 PubMed PMID: 35478850; PubMed Central PMCID: PMC9036325.
10. Chen Y, Shah S, Chen Y, Owen AJ, Ekegren CL, Ilic D, et al. Barriers to and facilitators of physical activity among community-dwelling older adults: a systematic review. BMJ Open. 2025 Aug 25;15(8):e095260. doi:10.1136/bmjopen-2024-095260 PubMed PMID: 40854831; PubMed Central PMCID: PMC12382567.
11. Perceived Barriers to Perform Physical Activity in Community-Dwelling Elderly- A Cross-Sectional Survey | International Journal of Environmental Sciences [Internet]. [cited 2026 Jun 30]. Available from: https://theaspd.com/index.php/ijes/article/view/7863
12. Arai T, Mangyo R. Relationship between fall experience and fear of falling, health literacy, and self-efficacy among community-dwelling older adults. J Phys Ther Sci. 2026 Feb;38(2):54–7. doi:10.1589/jpts.38.54 PubMed PMID: 41700152; PubMed Central PMCID: PMC12906964.
13. Huang X. Barriers and Facilitators to Physical Exercise Participation Among Community-Dwelling Older Adults: A Narrative Review Based on the Socio-Ecological Model. Acad J Manag Soc Sci. 2026 Mar 27;14(3):143–6. doi:10.54097/vgbj9e42
14. Steinhoff P, Reiner A. Physical activity and functional social support in community-dwelling older adults: a scoping review. BMC Public Health. 2024 May 20;24:1355. doi:10.1186/s12889-024-18863-6 PubMed PMID: 38769563; PubMed Central PMCID: PMC11103817.
15. Lindsay Smith G, Banting L, Eime R, O'Sullivan G, van Uffelen JGZ. The association between social support and physical activity in older adults: a systematic review. Int J Behav Nutr Phys Act. 2017 Apr 27;14(1):56. doi:10.1186/s12966-017-0509-8 PubMed PMID: 28449673; PubMed Central PMCID: PMC5408452.
16. National Academies of Sciences, Engineering, and Medicine; Division of Behavioral and Social Sciences and Education; Health and Medicine Division; Board on Behavioral, Cognitive, and Sensory Sciences; Board on Health Sciences Policy; Committee on the Health and Medical Dimensions of Social Isolation and Loneliness in Older Adults. Social Isolation and Loneliness in Older Adults: Opportunities for the Health Care System [Internet]. Washington (DC): National Academies Press (US); 2020 [cited 2026 Jun 30]. Available from: http://www.ncbi.nlm.nih.gov/books/NBK557974/ PubMed PMID: 32510896.
17. Stathi A, Withall J, Crone D, Hawley-Hague H, Playle R, Frew E, et al. A peer-volunteer led active ageing programme to prevent decline in physical function in older people at risk of mobility disability (Active, Connected, Engaged [ACE]): study protocol for a randomised controlled trial. Trials. 2023 Nov 29;24:772. doi:10.1186/s13063-023-07758-3 PubMed PMID: 38031101; PubMed Central PMCID: PMC10687817.
18. Lim SER, Cox NJ, Tan QY, Ibrahim K, Roberts HC. Volunteer-led physical activity interventions to improve health outcomes for community-dwelling older people: a systematic review. Aging Clin Exp Res. 2021;33(4):843–53. doi:10.1007/s40520-020-01556-6 PubMed PMID: 32356136; PubMed Central PMCID: PMC8084781.
19. Barnett DW, Barnett A, Nathan A, Van Cauwenberg J, Cerin E, Council on Environment and Physical Activity (CEPA) – Older Adults working group. Built environmental correlates of older adults' total physical activity and walking: a systematic review and meta-analysis. Int J Behav Nutr Phys Act. 2017 Aug 7;14(1):103. doi:10.1186/s12966-017-0558-z PubMed PMID: 28784183; PubMed Central PMCID: PMC5547528.
20. Cerin E, Nathan A, van Cauwenberg J, Barnett DW, Barnett A. The neighbourhood physical environment and active travel in older adults: a systematic review and meta-analysis. Int J Behav Nutr Phys Act. 2017 Feb 6;14:15. doi:10.1186/s12966-017-0471-5 PubMed PMID: 28166790; PubMed Central PMCID: PMC5294838.
21. Thornton JS, Frémont P, Khan K, Poirier P, Fowles J, Wells GD, et al. Physical activity prescription: a critical opportunity to address a modifiable risk factor for the prevention and management of chronic disease: a position statement by the Canadian Academy of Sport and Exercise Medicine. Consens Statement.
22. Kennedy MA, Hatchell KE, DiMilia PR, Kelly SM, Blunt HB, Bagley PJ, et al. Community Health Worker Interventions for Older Adults with Complex Health Needs: A Systematic Review. J Am Geriatr Soc. 2021 Jun;69(6):1670–82. doi:10.1111/jgs.17078 PubMed PMID: 33738803; PubMed Central PMCID: PMC8263299.
23. Meghani NAA, Hudson J, Stratton G, Mullins J. Older adults' perspectives on physical activity and sedentary behaviour within their home using socio-ecological model. PLOS ONE. 2023 Nov 20;18(11):e0294715. doi:10.1371/journal.pone.0294715 PubMed PMID: 37983222; PubMed Central PMCID: PMC10659182.
24. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci IS. 2011 Apr 23;6:42. doi:10.1186/1748-5908-6-42 PubMed PMID: 21513547; PubMed Central PMCID: PMC3096582.
25. Neufeld A. Flourishing by Design: Applying Self-Determination Theory and the Job Demands-Resources Model to Systems-Level Wellness in Medical Education. MedEdPublish. 2026 Jan 20;15:18. doi:10.12688/mep.20886.3 PubMed PMID: 41244712; PubMed Central PMCID: PMC12616115.
26. JMIR mHealth and uHealth - Older Adults' Experiences With Using Wearable Devices: Qualitative Systematic Review and Meta-synthesis [Internet]. [cited 2026 Jun 30]. Available from: https://mhealth.jmir.org/2021/6/e23832/citations

27. Ramírez Varela A, Martins J, Pratt M, Mejía-Grueso J, Cristão R, Onofre M, et al. The Global Observatory for Physical Activity (GoPA!) and Global Observatory for Physical Education (GoPE!) 2025 Country Cards. J Phys Act Health. 2026 Jan 1;23(S1):S1–54. doi:10.1123/jpah.2026-0089 PubMed PMID: 41806822.