

# Trajectories and predictors of adherence to the StandingTall digital exercise program

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## BACKGROUND

Falls are a leading cause of injury in older people. Meta-analyses show balance exercise reduces fall rates by 21-42%, yet **real-world adherence remains persistently low**, limiting clinical impact. Remote technology-based programs achieve 69% dose adherence versus 21% session adherence for conventional home-based programs, yet the factors influencing long-term engagement remains poorly understood.

**StandingTall** is a home-based digital balance exercise program, providing tailored, progressive balance training with automated dose progression and continuous adherence monitoring. It reduces injurious falls by **20% in community-living older people** and by **42% in those at high fall risk** (Delbaere, et al. 2021 BMJ; van Schooten, et al. 2026 submitted). Yet these benefits depend on sustained adherence.

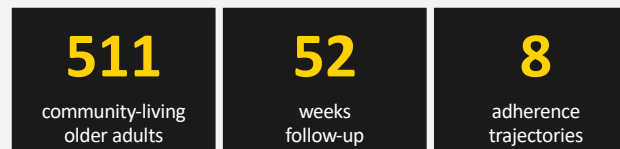
Traditional adherence metrics (average rates, dropout) mask meaningful behavioural heterogeneity. People may follow distinct adherence trajectories, such as delayed uptake, 'boom-and-bust' cycles, or gradual decline, with different predictors and clinical implications.

Understanding **who is at risk of dropping off, when behaviour starts to change, and why** is essential to designing timely, targeted support in digital health programs.

## AIMS & OBJECTIVES

1. To characterise trajectories of long-term adherence to a home-based digital balance exercise program in older people
2. To identify cognitive, physical, demographic and psychological predictors predictors of trajectory group membership, mapped to COM-B domains

## STUDY DESIGN & PARTICIPANTS



**Design:** Pooled data from two RCTs (StandingTall and StandingTall+)  
**Population:** 511 older people · mean age 75.3 yr · 71.6% women  
**Intervention:** balance exercise app · 52 weeks · 2-3 hr/week dose  
**Adherence:** % of target dose, objectively recorded via the app

## PREDICTORS OF ADHERENCE

Multinomial adaptive lasso penalised regression identified only two significant clinical predictors of adherence trajectory membership:

<p><b>Executive function</b> (Trail Making Test B, sec)</p> <ul style="list-style-type: none"> <li>• Poorer executive function → 'boom-and-bust' (overachievers, early attrition, steady decliners)</li> <li>• Better executive function → fairly steady pattern (intermittent)</li> </ul>	<p><b>Standing balance</b> (Total stance time, sec)</p> <ul style="list-style-type: none"> <li>• Poorer balance → higher adherence (overachievers, consistent).</li> <li>• Very poor balance → early attrition</li> <li>• Better balance → intermittent, steady decliners, non-adherers</li> </ul>
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**Combined effect:** Poor executive function co-occurring with good balance was linked to disengagement (steady decliners, non-adherers), likely reflecting underestimation of personal need for balance training

**NOT significant:** Age, sex, BMI, education, comorbidities, MoCA, concerns about falling, TUG and SPPB

Classification accuracy was low, highlighting the multifactorial nature of long-term adherence

## CLINICAL IMPLICATIONS

**⚠ Critical window: weeks 10–15**

Adherence declined most steeply in weeks 10-15, despite support calls, highlighting an unmet need for structured behavioural intervention during the early weeks

Behaviour stabilised by week 40, suggesting limited benefit of re-engagement after this point

1. **Monitor adherence dynamically**, not as a static average, enabling early identification of individuals at risk of disengagement
2. **Screen executive function and balance at baseline** to stratify users by behavioural risk and personalise support intensity
3. **Embed structured behavioural support in weeks 1-15** (prompts, coaching, digital nudges) to harness the critical habit-formation window
4. **Personalise feedback and reinforce relevance**, those with good balance may underestimate their need, increasing disengagement risk

**Adherence to digital exercise is dynamic, predicted by executive function and balance, not age or comorbidity. The first 10-15 weeks are a critical window for targeted behavioural support.**

## TRAJECTORIES OF ADHERENCE OVER 52 WEEKS

