Current Fall Risk Detection and Prevention Interventions: An In-depth Analysis

Falls among older adults represent a significant public health concern, contributing to injuries, hospitalizations, and even fatalities. Consequently, considerable efforts have been invested in developing and implementing fall risk detection and prevention interventions. However, recent research suggests that while these interventions have shown some promise, their effectiveness remains only mildly effective.

Fall Risk Assessment Tools: A Flawed Landscape

Numerous fall risk assessment tools exist, ranging from simple questionnaires to complex biomechanical assessments. However, systematic reviews have consistently determined that these approaches are ineffective.

A systemic meta-analysis conducted by Gates et al. (2008) found that most of these tools discriminate poorly between fallers and non-fallers. The inconsistency and methodological variability across studies further complicate the identification of reliable tools. Similarly, Gade et al. (2021) noted a wide range in the discriminatory performance of prognostic models for falls, with all models exhibiting a high risk of bias, rendering them unreliable in clinical practice. Finally, Park's meta-analysis (2018) of fall risk assessment tools concluded that existing tools lack sufficiently high predictive validity for differentiating between high and low fall risks.

These three comprehensive studies, and others like them, demonstrate fundamental flaws in our current approach to identifying individuals at risk of falls. Some believe part of the issue is the failure of fall risk detection approaches to include combined motor-cognitive challenges or assessments. For now, at least, this suggests that everyone over 65, and especially everyone over 80, should be considered a potential fall risk regardless of their cognitive capabilities, level of activity, or prior experiences with falling.

Fall Prevention Interventions: Varied Success and Limited Impact

A myriad of fall prevention interventions has been explored, including physical therapy (**such as gait training**), group classes (i.e. Tai Chi, Otago, etc.), balance interventions (such as perturbation training[1]), home-based exercises (including digital MSK applications), environmental modifications (i.e., grab bars, lighting, etc.), assistive devices (i.e., rollators, eyeglasses, etc.), and medication management. These interventions can be provided as a single component, multi-component[2], or multifactorial[3]. However, their effectiveness remains inconsistent, with many studies reporting only modest reductions in fall rates.

[1] Repeated exposure to sudden perturbations aimed at improving reactive balance control
[2] Multicomponent is when the same combination of interventions is provided to all participants.
[3] Multifactorial is when two or more components are delivered based on an assessment of a person's risk factors for falling

For instance, Tinetti et al. (1994) implemented a multifactorial intervention in community-dwelling elderly individuals, including medication adjustments, environmental modifications, and exercise programs, resulting in only a 31% reduction in fall rates after 12 months. Similarly, Sherrington et al. (2020) found that various exercise programs, including balance and functional exercises, resistance training, and Tai Chi, led to reductions in fall rates ranging from 23% to 28%. However, the effects of interventions primarily involving resistance training, dance, or walking remain uncertain.

Furthermore, a Cochrane review by Hopewell et al. (2018) evaluated multifactorial and multiple component interventions and found that while multifactorial interventions reduced fall rates by 23%, they had little to no effect on falling, recurrent falls, or fall-related hospital admissions. Similarly, Bhasin et al. (2020) reported that a multifactorial strategy to prevent serious fall injuries had only a modest impact on the rate of fall injuries.

In summary, multiple peer-reviewed systemic reviews have found that all current standards of care for fall prevention are only mildly effective, with reported fall reduction rates averaging between 20 to 30% even when interventions were performed over a period of 12 months.

Adherence Challenges: A Barrier to Success

In addition to limited effectiveness, fall prevention programs face challenges related to adherence. Osho et al. (2017) conducted a meta-analysis of fall prevention exercise programs and found that average adherence in intervention groups was only 66%, with an overall attrition rate of 20%. Similarly, Nyman (2021) analyzed adherence data from Tai Chi trials and found median class attendance rates ranging from 63% to 81%. When adherence rates drop below 80%, some studies have even found the fall prevention ability can drop to single digits.

The Need for Real Solutions for Fall Prevention

The limitations of current fall risk detection and prevention interventions highlight the need for new and innovative approaches. Addressing the flaws in existing assessment tools, enhancing the implementation of interventions, and improving adherence rates are crucial steps in improving outcomes for older adults at risk of falls.

Increasingly, scientific research is showing that a specific type of gait training, called dual tasking or combined motor-cognitive training, is the most effective approach to fall prevention. This is based on the latest science that shows

- Cognitive capacity, specifically executive function, is key to successful walking[4,5,6,7,8,9,10,11,12]
- Dual tasking, specifically cognitive training with motor exercises, can improve cognitive capacity because it initiates neural plasticity.[13,14,15,16]

Current fall prevention interventions are challenged to implement these best practices because they are constrained by exercises that do not correlate with the real world, training that is hard to quantify and of limited intensity, and activities that are so repetitive, unengaging, and unpersonalized that dropout rates can be as high as 50%.

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Why GaitBetter?

The addition of semi-immersive virtual reality (VR) to gait training has been found to reduce fall risk by 2X to 3X more than current standards of care.

In one study, 302 older adults (>65 years old) were randomly assigned to either treadmill training plus semi-immersive VR (n=154) or treadmill training[17] alone (n=148).[18] Data from 282 (93%) participants were included in the prespecified, modified intention-to-treat analysis. Before training, the incident rate of falls was similar in both groups (10.7 [SD 35.6] falls per 6 months for treadmill training alone vs 11.9 [39.5] falls per 6 months for treadmill training plus VR). In the 6 months after training, the incident rate was significantly lower in the treadmill training plus VR group than it had been before training (6.00 [95% CI 4.36–8.25] falls per 6 months; p<0·0001 vs before training), whereas the incident rate did not decrease significantly in the treadmill training alone group (8.27 [5.55–12.31] falls per 6 months; p=0·49). 6 months after the end of training, the incident rate of falls was also significantly lower in the treadmill training plus VR group than in the treadmill training group (incident rate ratio 0.58, 95% CI 0.36–0.96; p=0.033).

In a second unpublished study[19], 182 older adults who were identified as having a moderate or high risk of falling[20] were assigned 15 sessions of semi-immersive VR treadmill training for fall prevention. 113 participants participated in the training and the six-month follow-up. Before training, the incident rate of falls was 2.09 falls per 6 months. After treatment, the number of falls decreased by 71%, number of ER visits decreased by 46%, and number of hospitalization days decreased by 34%.

Conclusion

The addition of a semi-immersive VR component to treadmill training (also known as VR-facilitated gait training) has a proven benefit -- VR training leads to improvements in walking speed, balance, fall risk, ER visits/hospitalizations and overall quality of life for all older adults, whether living in their homes, in independent living, assisted living, or even skilled nursing.

[17] Treadmill training is a standard gait training modality

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[20] Moderate or high risk is defined as 2 or more falls in the past year, 1 or more falls with injury, fear of falling, difficulty walking, or performing a timed up and go (TUG) in more than 12 seconds