Automating Fall Risk Assessment with OneStep: Intervene in Time
Every second of every day, an older adult (age 65+) in the U.S. suffers a fall, making falls the leading cause of injury and injury death in this age group.¹ About 36 million falls are reported among senior citizens each year, and one out of every five falls causes an injury, such as broken bones or a head injury.² Falls can be physically and emotionally devastating to patients – and even fatal, resulting in more than 32,000 deaths per year. The consequences of falls transcend the individual patient, impacting caregivers and the entire healthcare system on a larger economic scale, with an estimated $50 billion spent each year on costs associated with non-fatal falls.³

A strong body of research⁴ supports the role of physical therapy in fall risk detection and prevention – what physical therapists do, works. But, at present, in-person fall risk assessment can be relatively limited and time-consuming.
And, since many patients receive physical therapy for a specific diagnosis, the fall risk assessment is likely only a component of the initial evaluation versus being the primary focus. Clinicians rely on tests including the Berg Balance Scale, Timed Up and Go, and Tinetti POMA, as well as on questionnaires such as the Morse Fall Scale. These outcome measures are standardized and supported by scientific research. However, this approach requires the physical therapist to devote significant time and attention to the process. Additionally, the data is only collected at certain points in time, in a controlled setting.

Recent years have seen several attempts to automate fall risk assessments. However, most of these methods have not made it beyond academia, likely due to increased costs associated with capital-intensive equipment and a lack of scalable solutions.

Fall risk assessment remains critical to providing patient-centered care. Early identification of increased fall risk enables physical therapists to adjust their treatment interventions and build effective home exercise programs or prescribe necessary assistive devices.

Routine fall risk assessment not only captures when individuals are at an increased risk for falls but also demonstrates the efficacy of current interventions at reducing fall risk and treating the underlying impairment. In addition to assessments, incorporating fall prevention programs helps patients stay functionally independent, mobile, and safe. However, these programs traditionally take time and require resources.
OneStep’s Solution: Objective Fall Risk Assessment Using Mobile Technology

OneStep uses smartphone motion sensors to continuously analyze movement in real-life conditions, providing validated gait and motion analysis data within seconds without the price tag or cumbersome equipment.

OneStep's FDA-listed digital platform equips clinicians with a full suite of remote tools that support high-quality virtual care and remote therapeutic monitoring. Clinicians receive heightened insight, enabling them to intervene proactively before a fall occurs – by assessing health status sooner, more holistically, and from anywhere with the addition of automatic notifications sent directly to them.
The technology works by analyzing five gait parameters: gait speed, stance asymmetry, step length asymmetry, double support asymmetry, and step similarity. Each time a walk is recorded and three or more of these parameters fall beyond predefined threshold values, the walk is flagged as potentially indicative of fall risk. If four or more walks over any 14-day period are flagged, the patient is considered at-risk, and their physical therapist is automatically notified.

In an observational study conducted by OneStep, the fall risk assessment technology demonstrated results similar to those achieved through traditional fall risk assessments. 44 patients participated in the study, each of them accompanied by a licensed physical therapist. Each patient recorded at least 20 walks using OneStep’s mobile application. Of the 44 patients, 15 were assessed by physical therapists as having a high or moderate risk of falling. OneStep's technology detected 14 of the 44 patients as being at risk on at least one day in the study period. However, these 14 patients did not completely overlap with the 15 assessed as at-risk by the physical therapists.
The performance of OneStep’s automatic fall risk assessment technology was evaluated per three key metrics:

**Sensitivity:** the percentage of at-risk patients identified correctly

**Specificity:** the percentage of patients not at risk that were correctly identified

**Precision:** the percentage of correctly identified at-risk patients in relation to all patients identified at-risk (both correctly and incorrectly)

Based on these metrics, OneStep’s technology can be a valuable supplement to physical therapists’ work in fall risk assessment and prevention.

OneStep's assessment had a sensitivity of 67% vs. the therapist assessment, meaning that two-thirds of the patients assessed by a physical therapist as being at risk were also detected by OneStep. In addition, the technology achieved a specificity of 83% vs. the therapist assessment, i.e., the vast majority of patients not at risk of falling (as assessed by a physical therapist) were also identified by the technology. OneStep’s precision was 54%; of all fall risk notifications generated, approximately half corresponded to patients who were assessed as being at-risk by their physical therapist.
The analysis also revealed that patients flagged as at-risk were more likely to be adherent to their plan of care than patients who were not flagged – indicating that patients who received notifications from OneStep were more likely to pay attention to their physical function and engage with their program. Specifically, the median engagement time of patients who were notified of potential fall risk was 77 days, compared to only 54 days for the non-at-risk patients. In addition, after three months of using the app, approximately half of the at-risk population were still actively exercising, compared to only about a third of the non-at-risk patients.

While future investigations utilizing a larger sample of patients are needed to address the limitations of this analysis, the initial results point to strong potential in the benefits of leveraging OneStep's technology. It is simple to use for patients, cost-effective, and offers clinicians unprecedented access to data that was once limited to select gait analysis labs.

Many leading clinics throughout the US are currently implementing OneStep’s innovative fall risk assessment technology into their practices. They have already been able to capture patients at risk for falls proactively and demonstrate patient improvement objectively – commending OneStep as a valuable digital fall risk tool for their clinicians.
References

6. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8875808/
7. Performing Fall Risk Assessment with OneStep - Long-form Scientific Version