# Advancing Falls Prevention Research in People with Multiple Sclerosis

**Libak Abou, PhD, MPT**

Assistant Professor in PMR

**September 29, 2026**

# Disclosures







September is
Falls Prevention
Awareness Month
ACL
Administration for Community Living
#FallsPrevention
acl.gov/falls-prevention-month


Falls Prevention
Awareness Month
TAKE ACTION
THIS SEPTEMBER
#FallsPrevention
acl.gov/falls-prevention-month
ACL
Administration for Community Living

# Background






**Population:** about 15 million

**Language:** French (official), Fon and Yoruba (local).

# Background

NMSS Postdoc Fellow
MS Symptoms

Fall Prevention
Spinal Cord Injury
Multiple Sclerosis

Illinois
Michigan

Cuba

PT School
Interest in Neurorehab

Benin

Brazil

Spinal Cord Injury
Gait and Balance
Fall



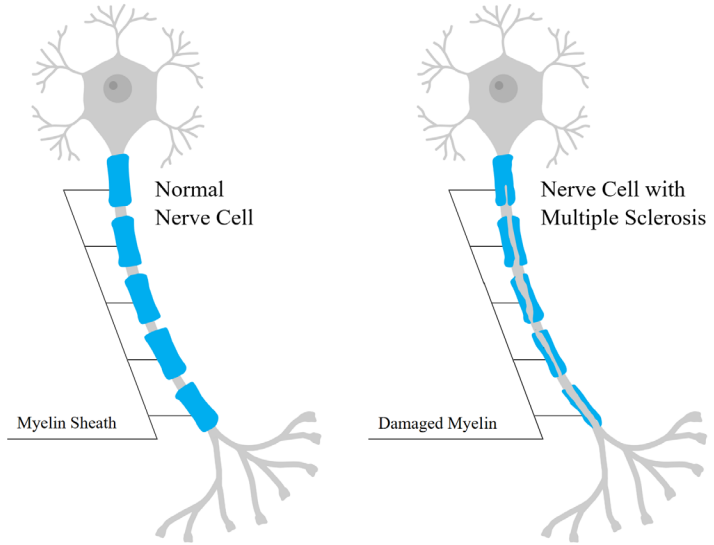


# Multiple Sclerosis

A chronic autoimmune disease of the central nervous system where the immune system mistakenly attacks the protective myelin sheath covering nerve fibers.

It is estimated that someone in the world is **diagnosed with MS every 5 min** (Walton et al 2020)

**Symptoms:** Balance and gait dysfunctions, muscle weakness, extreme fatigue and dizziness, mood changes, vision changes, pain or numbness, and cognitive impairments.

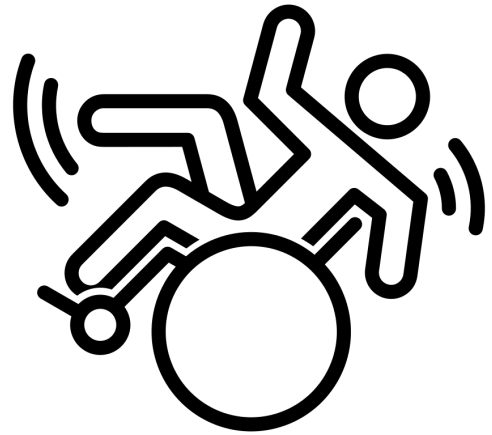


# Facts about Falls

## Falls are a Public Health Concern (WHO)

- 1 in 4 older adults falls each year, but fewer than half tell their doctor.
- 1 in 5 falls causes a serious injury, such as broken bones or a head injury.
- Each year, **3 million older people** are treated in emergency departments for fall injuries.



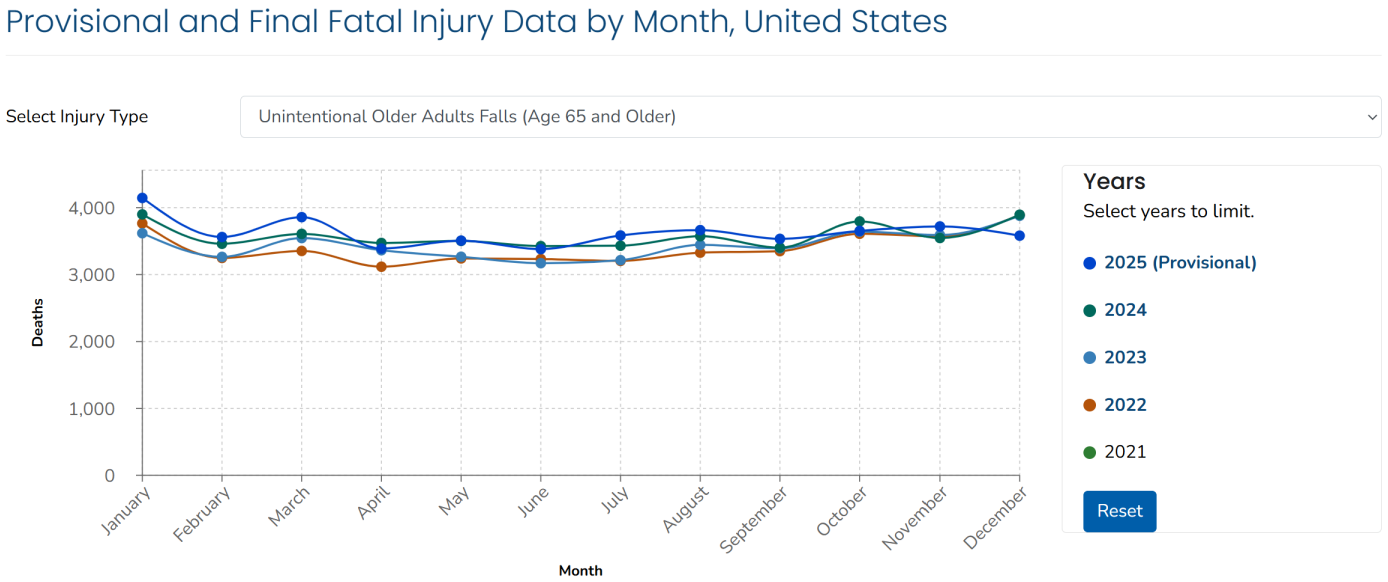


(CDC, 2024)

# Facts about Falls

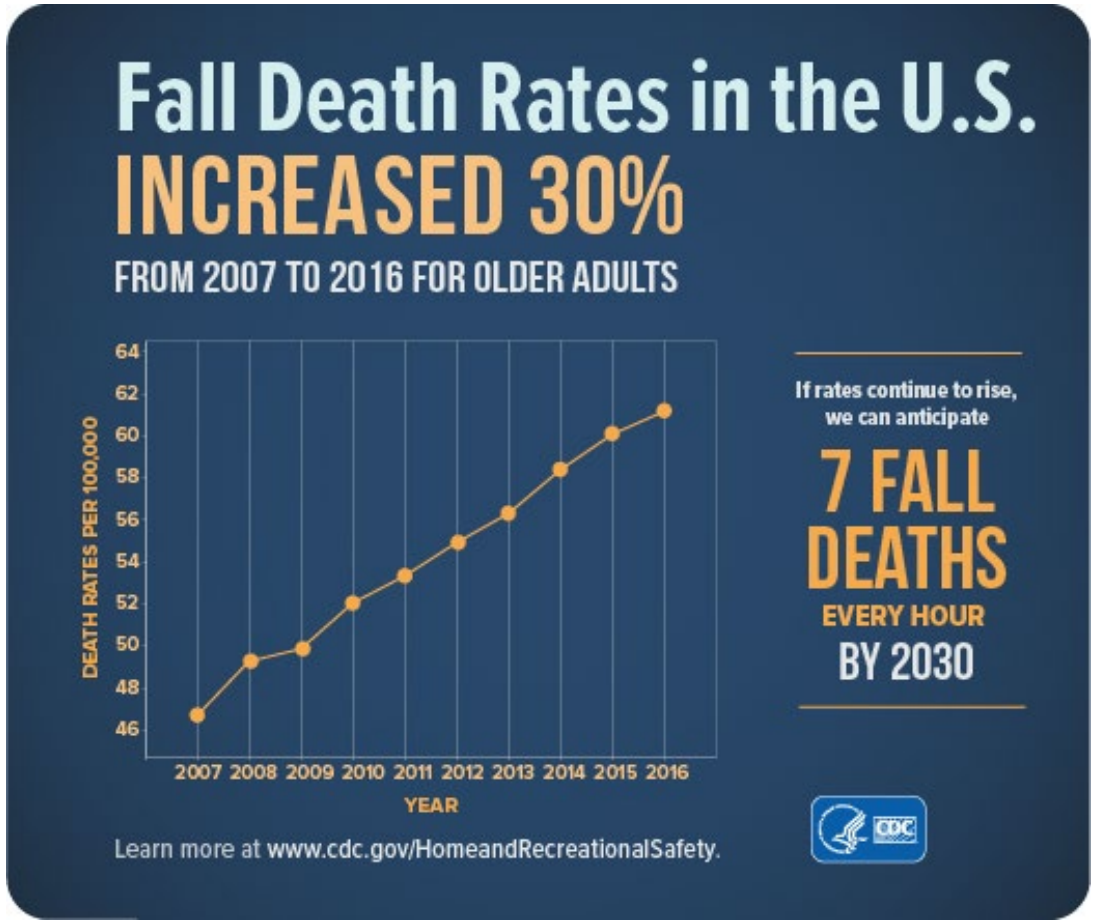
- **In 2015,** the total medical costs for falls totaled more than **$50 billion**. **Medicare and Medicaid** covered **75%** of these costs.

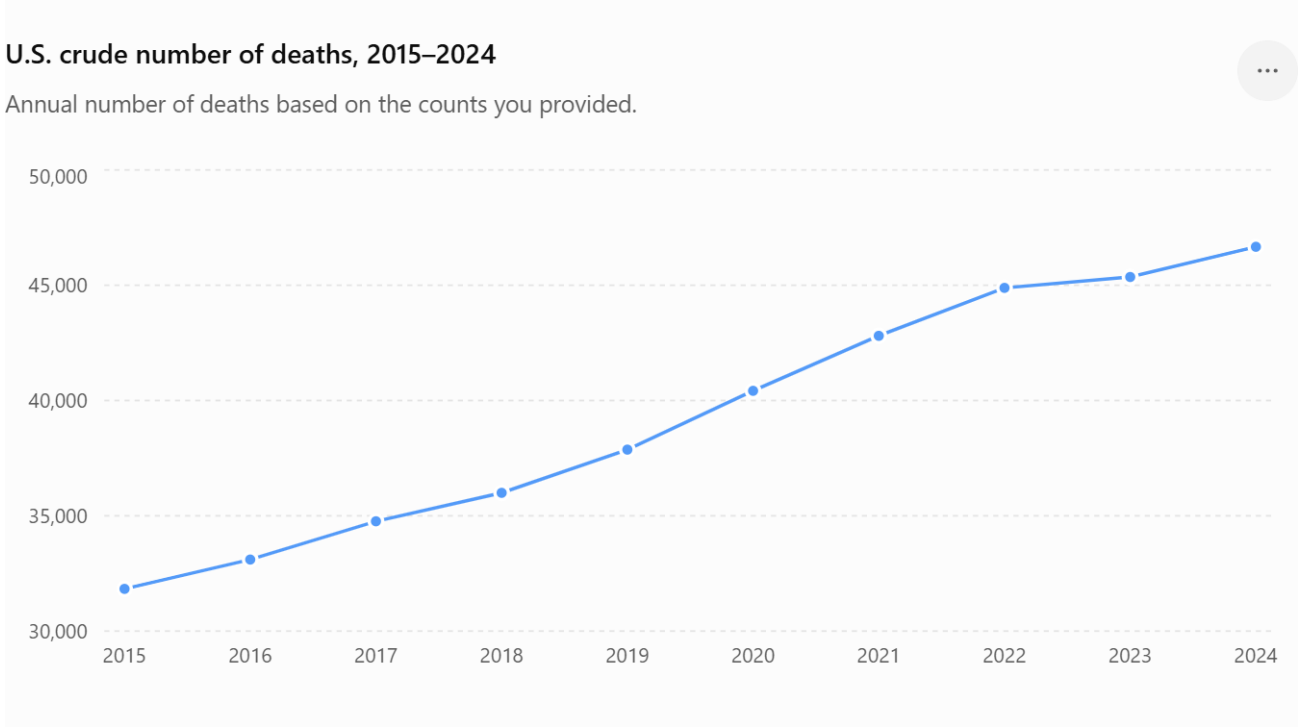
- **In 2030,** if trends continue, the expense of treating injuries due to falls will have risen to more than **$100 billion in the US** alone.




(CDC, 2026)

# Facts about falls



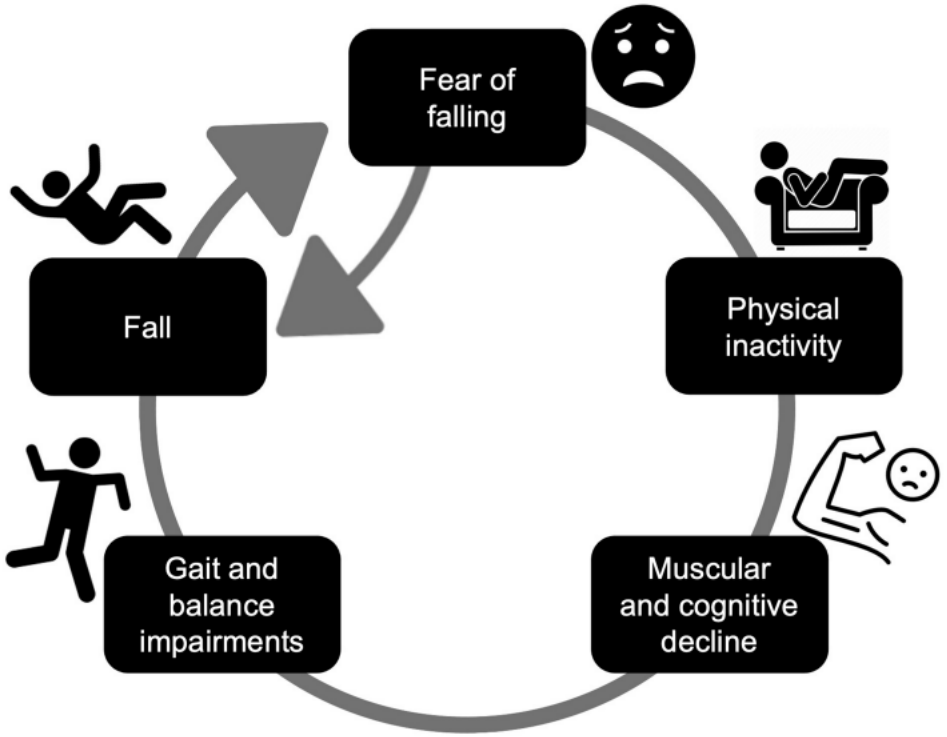

**The risk of falling among people with MS is double of that aged-matched adults.**

(CDC, 2022; Morrison et al. 2016; Mazumder et al. 2014)

# Consequences of falls in persons with MS

## What can happen after a fall in persons with MS?

- Physical injuries
- Fear of falling again
- Restriction of daily living activities performance
- Physical deconditioning
- More exposure to future falls
- Social isolation
- Poor quality of life




(Takla et al. 2024)

# Falls in persons with MS

Due to the relevance of the problems of falls in MS, research interest in this area has grown up considerably in the past 2 decades.

Emphasis has been placed on:

- Factors associated with falls in MS
- The role of mobility impairments in falls (received the most attention)
- Predicting who is at high risk of falls
- Interventions to reduce falls

(Coote et al. 2020)

# National Survey on Falls

- We created a survey to investigate updated metrics on falls and factors associated with falls.
- Distributed with the National MS Society.
- Adults (at least 18 years old) with MS.
- No other eligibility criteria was set.



# National Survey on Falls

**Falls** and **Injurious Falls** in previous 6 months

**Concerns about Falling** and **Activities Curtailment**

**PROMIS:**

1. Depressive symptoms
2. Pain Interference
3. Physical Function

**Fatigue Severity Scale**

# Falls in Persons with MS

RESEARCH ARTICLE

## A nationwide update on prevalence of falls, injurious falls, concerns about falling, and fall prevention in persons with multiple sclerosis

Abou, Libak PhD, MPT, PT[1]; McCloskey, Chloe MD[2]; Wernimont, Cory MD[1]; Fritz, Nora E. PhD, PT, DPT, NCS[3]; Kratz, Anna L. PhD[1]

Author Information

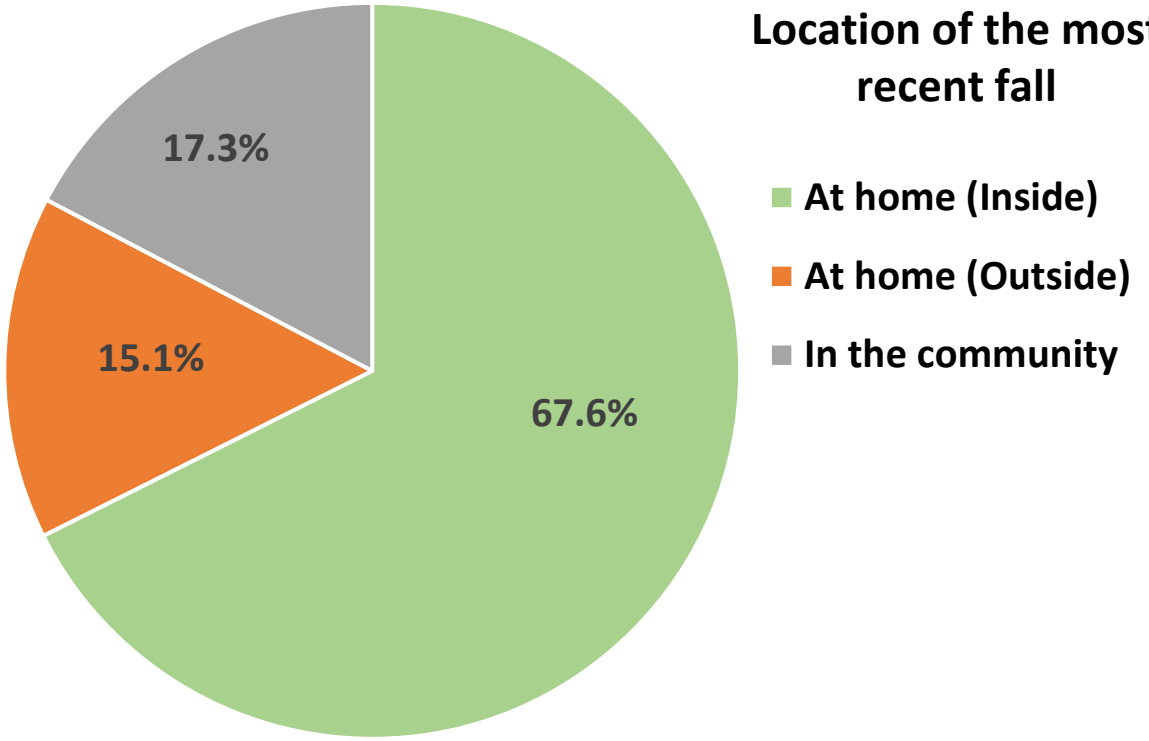
*American Journal of Physical Medicine & Rehabilitation* ():10.1097/PHM.0000000000002454, March 1, 2024. | **DOI:** 10.1097/PHM.0000000000002454

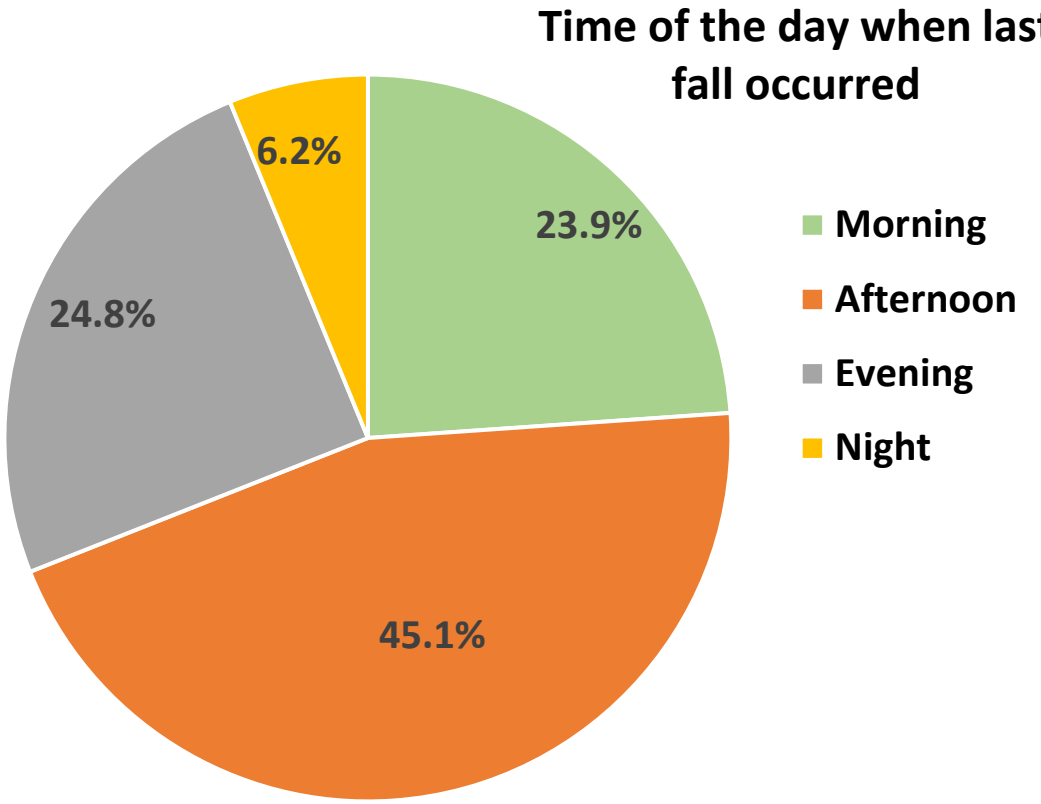
**Demographics:** Age: 54.3 ± 12.7 years; 79% Female; and 84% White

**Falls:** 56% reported at least one fall in the past 6 months.

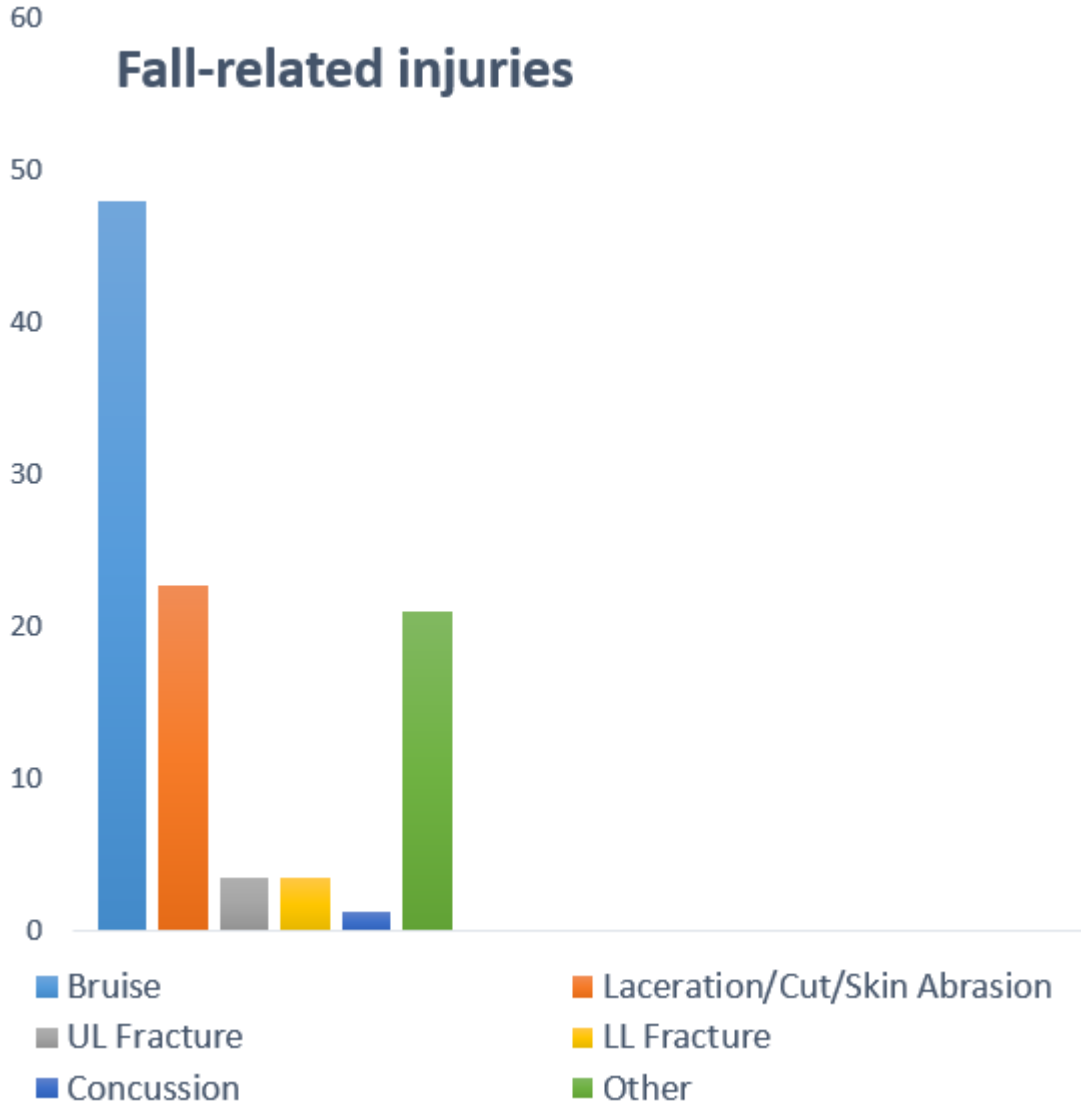
**Injurious falls:** 30% reported an injury due to falls.

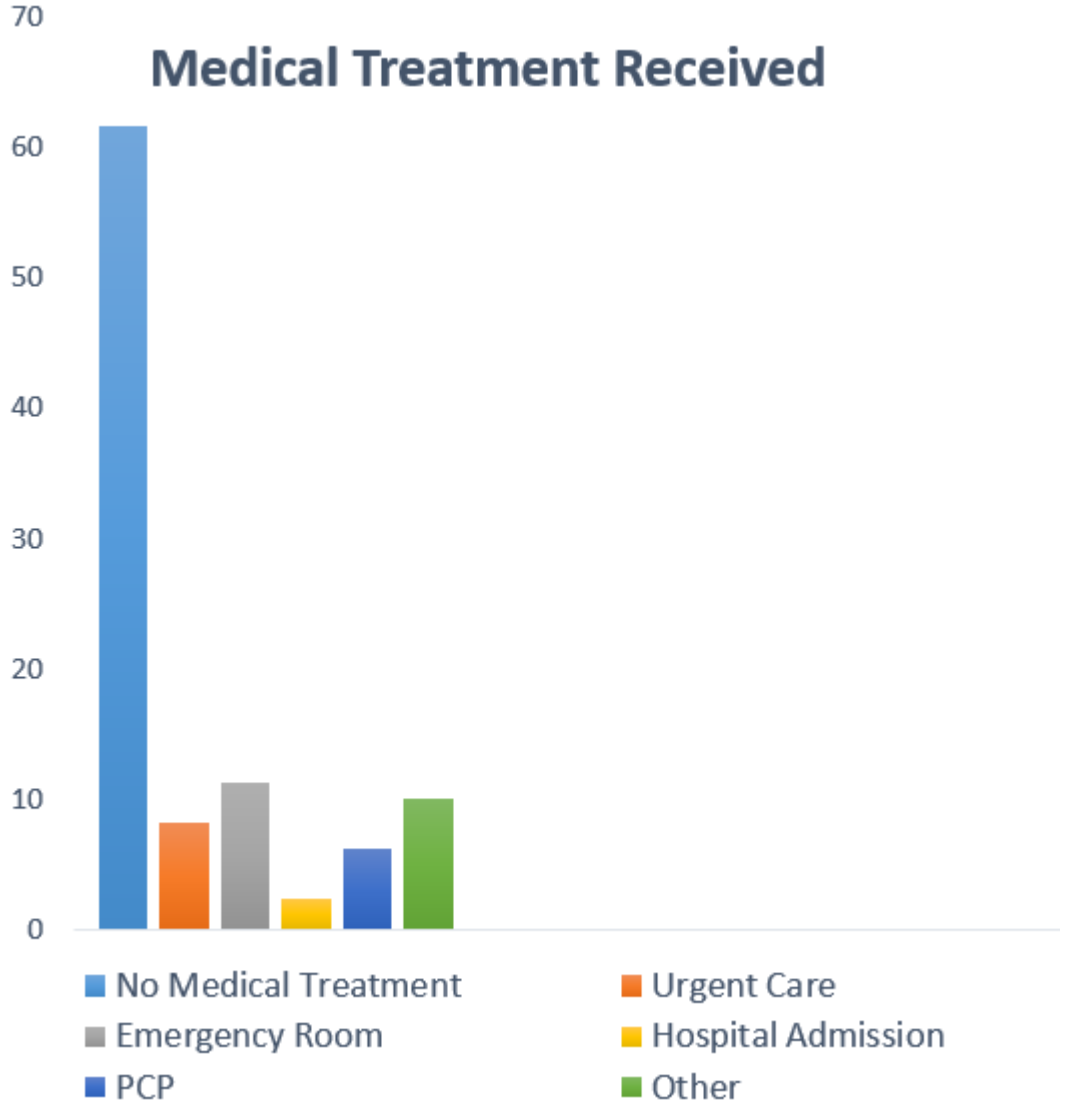
(Abou et al. 2024)




(Abou et al. 2024)




(Abou et al. 2024)

# Falls in Persons with MS

**TABLE 3.** Prevalence and 95% CI of concerns about falling, activity restriction due to concerns about falling, and information about fall prevention by fall status in a sample of PwMS ($N$ = **965**)

| | Total | | Fallers | | Nonfallers | |
|---|---|---|---|---|---|---|
| **Outcome** | ***n*** | **% (95% CI)** | ***n*** | **% (95% CI)** | ***n*** | **% (95% CI)** |
| Concerns about falling | | | | | | |
| Yes | 833 | 87.1 (84.8–89.1) | 497 | 93.6 (91.2–95.5) | 336 | 78.9 (74.7–82.7) |
| No | 124 | 12.9 (10.9–15.2) | 34 | 6.4 (4.5–8.8) | 90 | 21.1 (17.3–25.3) |
| Missing | 8 | | 8 | | 0 | |
| Activity restriction | | | | | | |
| Yes | 561 | 67.5 (64.2–70.7) | 361 | 73.1 (68.9–76.9) | 200 | 59.5 (54.1–64.8) |
| No | 186 | 22.5 (18.5–25.5) | 85 | 17.2 (14.0–20.8) | 101 | 30.1 (25.2–35.3) |
| Not sure | 83 | 10.0 (8.0–12.2) | 48 | 9.7 (7.3–12.7) | 35 | 10.4 (7.4–14.2) |
| Missing | 135 | | 45 | | 90 | |
| Information about FP | | | | | | |
| Yes | 619 | 65.0 (61.9–68.0) | 369 | 69.8 (65.6–73.6) | 250 | 59.1 (54.2–63.8) |
| No | 333 | 35.0 (32.0–38.1) | 160 | 30.2 (26.4–34.4) | 173 | 40.9 (36.2–45.8) |
| Missing | 13 | | 10 | | 3 | |

(Abou et al. 2024)

# Falls in Persons with MS

**Frequency of falls:** More than 50% of people with MS report falling over a 6-month period (Cattaneo et al. 2002; Matsuda et al. 2011; Coote et al. 2013; Finlayson et al. 2006).

**Our Finding:** Approximately 56%

**Frequency of injurious falls:** About 25% of falls result in injuries (Matsuda et al. 2011; Peterson et al. 2008).

**Our Finding: 30%**

**Falls and their consequences are still very common among people with MS.**

# Factors associated with falls

- **Self-reported causes of falls:** Participants provided information about factors that caused their falls.
- **Additional Analysis:** Regression Analysis to investigate symptoms severity and function associated with falls and injurious falls.

ACRM
AMERICAN CONGRESS OF REHABILITATION MEDICINE

Archives of Physical Medicine and Rehabilitation

journal homepage: www.archives-pmr.org

Archives of Physical Medicine and Rehabilitation 2023;000: 1–8



ORIGINAL RESEARCH

## Examination of Risk Factors Associated With Falls and Injurious Falls in People With Multiple Sclerosis: An Updated Nationwide Study

Libak Abou, PhD, MPT, PT,[a] Chloe McCloskey, MD,[b] Cory Wernimont, MD,[a] Nora E. Fritz, PhD, PT, DPT, NCS,[c] Anna L. Kratz, PhD[a]

*From the [a]Department of Physical Medicine & Rehabilitation, Michigan Medicine, University of Michigan, Ann Arbor, MI; [b]Department of Physical Medicine and Rehabilitation, Kaiser Permanente Health System, Redwood City, CA; and [c]Departments of Health Care Sciences & Neurology, Wayne State University, Detroit, MI.*

# Factors associated with falls

**Table 2** Factors associated with falls categorized in personal, environmental, and activities-related

| Factor | Number | % of Cases |
|---|---|---|
| ***Personal*** (n=537) | | |
| Poor balance | 404 | 75% |
| Muscle weakness | 288 | 54% |
| Fatigue | 186 | 35% |
| In a hurr | | |
| Distracte | | |
| Dizziness | | |
| Abnorma | | |
| Confusio | | |
| Other (fo | | |
| ***Environmental*** (n=498) | | |
| Uneven ground/carpeting/surface condition | 151 | 30% |
| Other people talking | 131 | 26% |
| Steps- up or down | 70 | 14% |
| Walking aids/wheel | | |
| Slippery surface (eg | | |
| Pets/children/othe | | |
| In a crowd | | |
| Narrow/wide space | | |
| Other (weather, poc | | |
| ***Activities-related*** (n=498) | | |
| Urgent activity | 174 | 35% |
| Multitasking (more than 1 activity) | 136 | 27% |
| Time of the day activity occurred | 135 | 27% |
| Carrying something | 104 | 21% |
| Long duration activity | 71 | 14% |
| New or unfamiliar activity | 33 | 7% |
| High effect activity | 11 | 2% |
| Other (getting in/out of a car, turning) | 92 | 19% |

(Abou et al. 2024)

# Factors associated with falls

**Table 3** Summary of binary logistic regression analysis of symptoms severity and functional factors predicting falls status (Yes/No) and injurious falls (Yes/No)

| | Fall Status (Yes/No) | | Injurious Falls (Yes/No) | |
|---|---|---|---|---|
| ***Adjusted models***‡ | | | | |
| PROMIS Depression | 1.00 (0.99 – 1.02) | .78 | 1.03 (1.00 – 1.05) | .05 |
| PROMIS Pain Interference | **1.02 (1.00 – 1.04)** | **.03*** | 0.98 (0.95 – 1.00) | .08 |
| PROMIS Physical Function | 0.98 (0.96 – 1.01) | .21 | 1.02 (0.98 – 1.06) | .37 |
| FSS | **1.19 (1.06 – 1.34)** | **<.01*** | 1.20 (0.99 – 1.46) | .06 |
| Concerns about falling (Ref: No) | | | | |
| Somewhat | **2.78 (1.62 – 4.78)** | **<.01*** | 3.89 (0.85 – 17.77) | .06 |
| Fairly | **3.90 (2.06 – 7.39)** | **<.01*** | **5.17 (1.08 - 24.62)** | **.04*** |
| Very | **3.95 (2.04 – 7.65)** | **<.01*** | **10.26 (2.09 – 50.23)** | **.01*** |

Abbreviations: CI, confidence interval; OR, odds ratio.

* *P* value<.05.

† Unadjusted model: n=808 for fall status and n=445 for injurious falls.

‡ Adjusted for age, sex, MS subtype, and PDDS; n=711 for falls status and n=394 for injurious falls.

(Abou et al. 2024)

# Summary of Findings

- We identified several modifiable risk factors for falls.
- **Personal factors** such as poor balance, muscle weakness, and fatigue may be targeted with **Exercise interventions.**
- **Environmental and activities related** factors may be addressed with **Education** on fall risks and **home modifications**.
- **Fatigue, Pain, and Concerns about Falling** may be managed with **Cognitive Behavioral Therapy**.

# Interventions to prevent falls in MS

Cochrane Library
Trusted evidence.
Informed decisions.
Better health.

Cochrane Database of Systematic Reviews

[Intervention Review]

## Interventions for preventing falls in people with multiple sclerosis

Sara Hayes[1], Rose Galvin[2], Catriona Kennedy[3], Marcia Finlayson[4], Christopher McGuigan[5], Cathal D Walsh[6], Susan Coote[2]

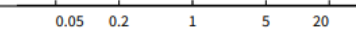
[1]School of Allied Health, Ageing Research Centre, Health Research Institute, University of Limerick, Limerick, Ireland. [2]Department of Clinical Therapies, Faculty of Education and Health Sciences, University of Limerick, Limerick, Ireland. [3]School of Nursing and Midwifery, Robert Gordon University, Aberdeen, UK. [4]School of Rehabilitation Therapy, Queen's University, Kingston, Canada. [5]Department of Neurology, St. Vincent's University Hospital & University College Dublin, Dublin, Ireland. [6]Health Research Institute (HRI) and MACSI, Department of Mathematics and Statistics, University of Limerick, Ireland

**Analysis 1.1. Comparison 1 Exercise versus control, Outcome 1 Falls rate.**

| Study or subgroup | Exercise N | Control group N | log[Rate Ratio] (SE) | Rate Ratio IV, Random, 95% CI | Weight | Rate Ratio IV, Random, 95% CI |
|---|---|---|---|---|---|---|
| Carling 2017 | 25 | 26 | -0.9 (0.195) | | 32.9% | 0.42[0.29,0.62] |
| Coote 2013 | 66 | 19 | 1.1 (0.735) | | 7.88% | 3[0.71,12.67] |
| Hoang 2016 | 28 | 22 | -0.4 (0.153) | | 36.24% | 0.64[0.47,0.86] |
| Lennon 2013 | 89 | 88 | 0.3 (2.101) | | 1.15% | 1.4[0.02,85.94] |
| Prosperini 2013 | 18 | 18 | -0.1 (0.344) | | 21.83% | 0.87[0.44,1.71] |
| **Total (95% CI)** | | | | | **100%** | **0.68[0.43,1.06]** |

Heterogeneity: Tau²=0.12; Chi²=9.66, df=4(P=0.05); I²=58.61%

Test for overall effect: Z=1.7(P=0.09)




Favours [exercise] Favours [control group]

**Author's conclusion:** Evidence regarding the effects of exercise for preventing falls in MS is sparse and uncertain.

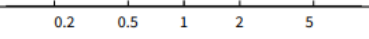
**Analysis 1.2. Comparison 1 Exercise versus control, Outcome 2 Number of fallers.**

| Study or subgroup | Exercise n/N | Control group n/N | Risk Ratio M-H, Random, 95% CI | Weight | Risk Ratio M-H, Random, 95% CI |
|---|---|---|---|---|---|
| Coote 2013 | 11/66 | 2/19 | | 10.34% | 1.58[0.38,6.53] |
| Carling 2017 | 6/25 | 3/26 | | 12.19% | 2.08[0.58,7.43] |
| Sosnoff 2015 | 3/11 | 6/9 | | 15.6% | 0.41[0.14,1.19] |
| Sosnoff 2014 | 5/10 | 11/12 | | 27.4% | 0.55[0.29,1.04] |
| Lennon 2013 | 26/89 | 25/88 | | 34.47% | 1.03[0.65,1.63] |
| **Total (95% CI)** | **201** | **154** | | **100%** | **0.85[0.51,1.43]** |

Total events: 51 (Exercise), 47 (Control group)

Heterogeneity: Tau²=0.14; Chi²=7.26, df=4(P=0.12); I²=44.87%

Test for overall effect: Z=0.61(P=0.54)




Favours [exercise] Favours [control group]

MICHIGAN MEDICINE
UNIVERSITY OF MICHIGAN

# Interventions to prevent falls in MS

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Prevention and Rehabilitation

The effectiveness of physical therapy interventions in reducing falls among people with multiple sclerosis: A systematic review and meta-analysis

Libak Abou [a], Kevin Qin [b], Aditya Alluri [c], Yiting Du [d], Laura A. Rice [a,*]

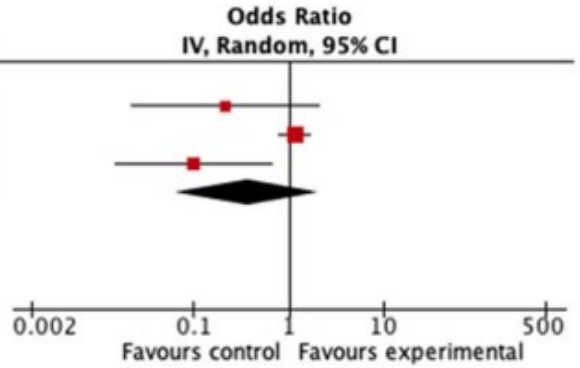
[a] Department of Kinesiology and Community Health, College of Applied Health Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, USA
[b] Department of Interdisciplinary Health Sciences, College of Applied Health Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, USA
[c] Department of Molecular and Cellular Biology, College of Liberal Arts & Sciences, University of Illinois at Urbana-Champaign, Urbana, IL, USA
[d] Department of Physical Therapy & Human Movement Science, Feinberg School of Medicine, Northwestern University, IL, USA

**Number of falls**

**a-**

| Study or Subgroup | log[Odds Ratio] | SE | Weight | Odds Ratio IV, Random, 95% CI |
|---|---|---|---|---|
| **2.1.1 Balance, motor and sensor rehabilitation VS Conventional therapy** | | | | |
| Cattaneo et al. 2007 | -1.53 | 1.15 | 25.8% | 0.22 [0.02, 2.06] |
| Cattaneo et al. 2019 | 0.15 | 0.19 | 44.6% | 1.16 [0.80, 1.69] |
| Gandolfi et al. 2015 | -2.3 | 0.97 | 29.5% | 0.10 [0.01, 0.67] |
| **Subtotal (95% CI)** | | | **100.0%** | **0.37 [0.06, 2.08]** |

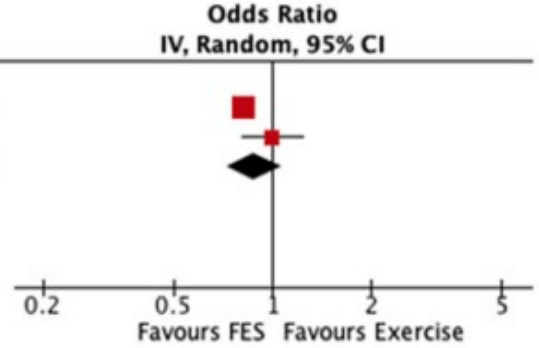
Heterogeneity: $Tau^2 = 1.73$; $Chi^2 = 8.01$, df = 2 (P = 0.02); $I^2 = 75\%$
Test for overall effect: Z = 1.13 (P = 0.26)




**b-**

| Study or Subgroup | log[Odds Ratio] | SE | Weight | Odds Ratio IV, Random, 95% CI |
|---|---|---|---|---|
| **2.2.1 Functional electrical stimulation VS Exercise** | | | | |
| Esnouf et al. 2010 | -0.2 | 0.037 | 63.4% | 0.82 [0.76, 0.88] |
| Taylor et al. 2014 | 0 | 0.11 | 36.6% | 1.00 [0.81, 1.24] |
| **Subtotal (95% CI)** | | | **100.0%** | **0.88 [0.73, 1.06]** |

Heterogeneity: $Tau^2 = 0.01$; $Chi^2 = 2.97$, df = 1 (P = 0.08); $I^2 = 66\%$
Test for overall effect: Z = 1.32 (P = 0.19)




**Conclusion:** PT interventions to reduce falls in people with MS are limited.

# Interventions to prevent falls in MS

MULTIPLE SCLEROSIS JOURNAL | MSJ

*Original Research Paper*

## A custom-built step exergame training programme to prevent falls in people with multiple sclerosis: A multicentre randomised controlled trial

Phu Hoang, Daina L Sturnieks, Anna Butler, Carly Chaplin, Cameron Hicks, Joanne Lo, Mayna Ratanapongleka, Sophie Robinson, Natassia Smith, Jessica Turner, Arun V Krishnan, Michael Barnett, Simon Gandevia, Stephen R Lord* and Jasmine C Menant*

### Conclusion

In summary, our study found that a 6-month step exergame training intervention is safe and feasible to be administered at home but did not reduce falls in high-functioning people with MS. To prevent falls in people with MS, it may be necessary to complement step training with strength training, functional exercises and reactive balance training and/or to include within targeted multifactorial interventions addressing fall risk factors across physical, psychological and environmental domains. Although there was no significant



**Figure 1.** Step exergame training system set-up.

**Conclusion:** The step exergame training programme did not reduce falls among people with MS. However, it significantly improved choice-stepping reaction time which is critical to ambulate safely in daily life environment.

# Summary of Current Evidence in MS

**Evidence indicates that:**

- More studies are needed to test fall prevention interventions.
- Current interventions **have not been effective** in reducing falls metrics.
- Most interventions target physiological risk factors associated with falls.
- **Multidisciplinary and multifactorial** falls prevention interventions are needed:

  - Physiological
  - Psychosocial
  - Environmental

# Current Projects

## Optimization and Pilot Testing of a Cognitive Behavioral based Physical Therapy Intervention to Address Falls in People with MS

- **Physical Therapy**: to improve physical function (e.g., balance, real-world gait function)
- **Cognitive Behavioral Therapy**: to help manage non-physical symptoms associated with falls (e.g., pain, fatigue, fear, anxiety, cognition)

# Current Projects

CBPT-Falls will promote safe functional movement through **PT** while incorporating **CBT** strategies to restructure unhelpful thoughts, improve cognitive processing and attention during dual-task activities, manage fatigue and concern/fear of falling, and strengthen coping skills to reduce pain interference and **overall fall risk**.

# Current Projects

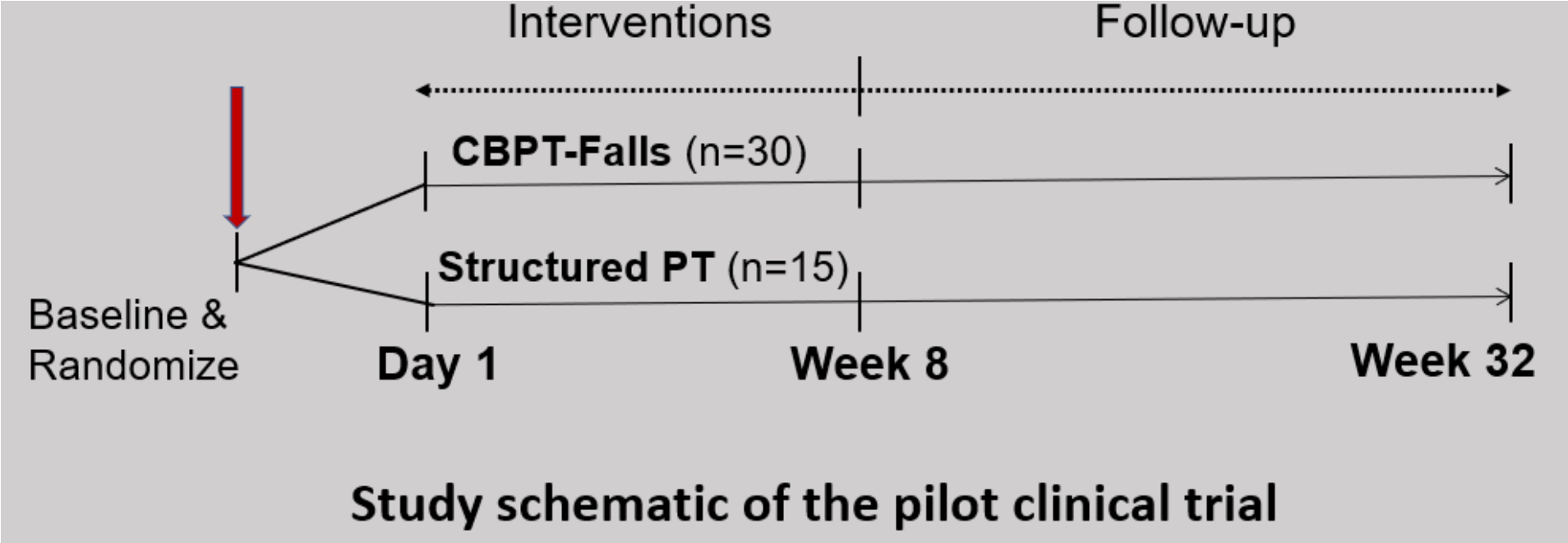
**Phase I:** Use qualitative methods to engage persons with MS and healthcare providers to adapt an existing CBPT program and develop a CBPT-Falls program.

**Proposed structure:** 8-week hybrid program, one session of 45-60 min/week, delivered by a trained PT.

| CBT Content | PT Content |
|---|---|
| Psychological and Symptom Evaluation | Functional Examination |
| Falls are a mind/body/environment event | Flexibility and Stretching |
| Cognitive Restructuring | Balance, Coordination, and Agility training |
| Mindful Mobility | Core and Lower Body Strengthening |
| Fear of Falling Management | Progress Evaluation |
| Pace and Balance your Activity | Gait Training |
| Wellness Strategies | Aerobic and Endurance Training |
| Planning for Success | Safe-Falling Strategies |

# Current Projects

**Phase II:** Conduct a pilot RCT to examine the feasibility and acceptability of CBPT-Falls program in persons with MS.




Study schematic of the pilot clinical trial

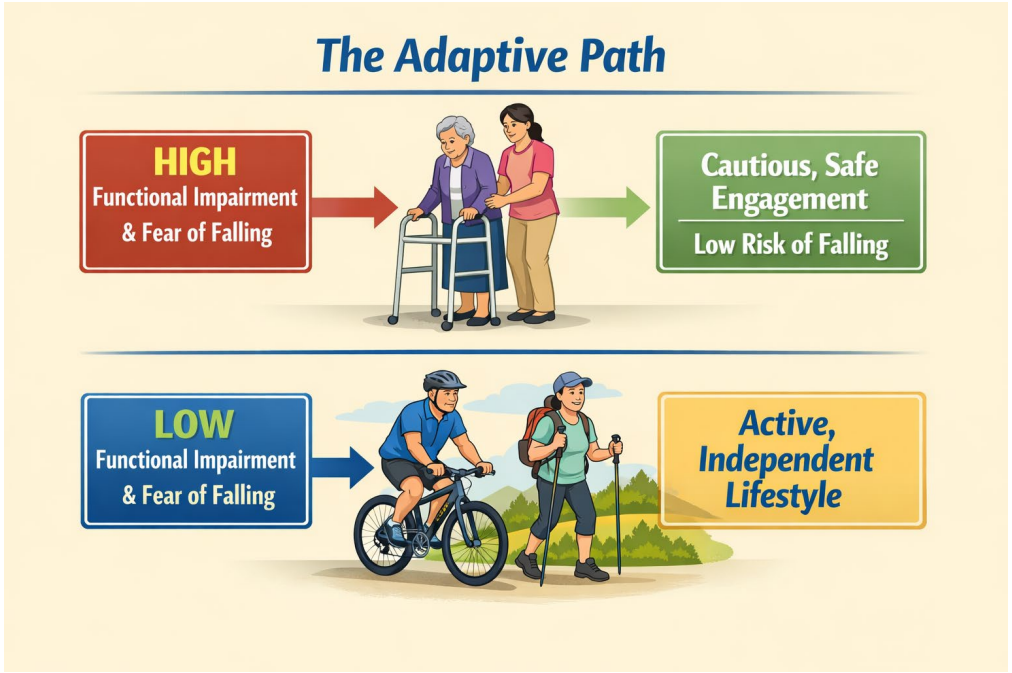
# Current Projects

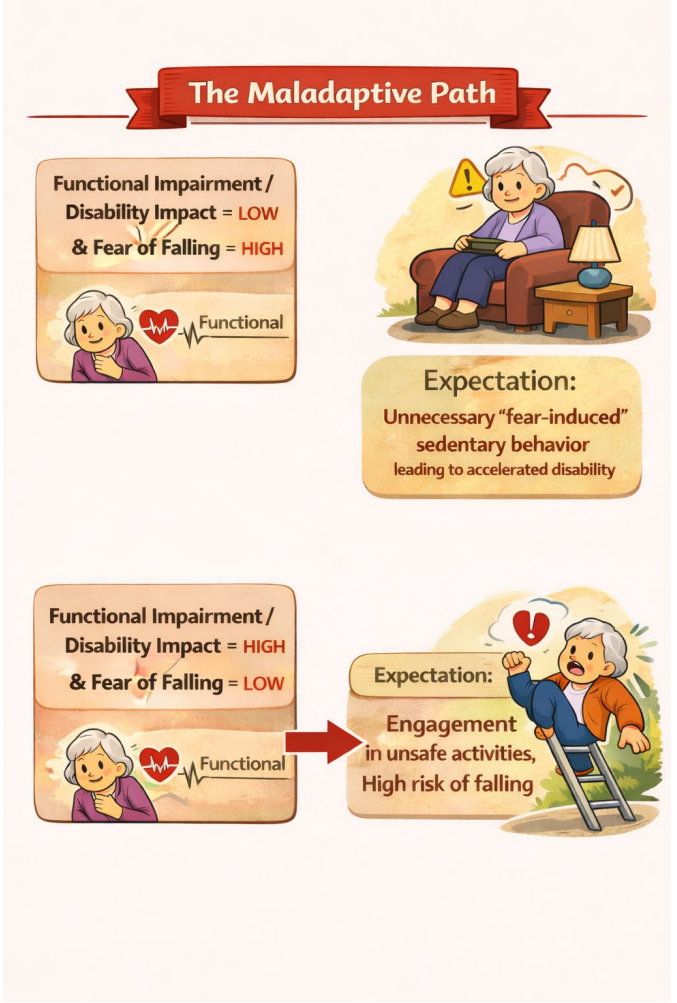
| Feasibility metrics and assessment approaches | |
|---|---|
| *Metric* | *Outcome and assessment approach* |
| **Process** | 1. Recruitment, eligibility, and refusal rates:<br>2. Retention and adherence rates |
| **Resource** | 1. Time required to prepare study material (in days)<br>2. Time for communication during recruitment and intervention<br>3. Monetary costs required for the study: Total cost |
| **Management** | 1. IRB approval procedures<br>2. Adverse events reporting procedure<br>3. Time, accuracy, and completeness of data collection and entry |
| **Safety** | 1. Adverse events, serious adverse events, and clinical emergencies<br>2. Participants' experiences and burdens during the study |

**Overall Goal:** Prepare the necessary materials for a subsequent efficacy RCT.

# Current Projects

## Development of a conceptual model and measure of the impact of fear of falling in multiple sclerosis



# Current Projects

## The fundamental problem is the lack of a function-focused assessment of FoF

### Falls Efficacy Scale-International (English)

I would like to ask some questions about how concerned you are about the possibility of falling. For each of the following activities, please circle the opinion closest to your own to show how concerned you are that you might fall if you did this activity. Please reply thinking about how you usually do the activity. If you currently don't do the activity (example: if someone does your shopping for you), please answer to show whether you think you would be concerned about falling IF you did the activity.

| | | Not at all concerned 1 | Somewhat concerned 2 | Fairly concerned 3 | Very concerned 4 |
|---|---|---|---|---|---|
| 1 | Cleaning the house (e.g. sweep, vacuum, dust) | | | | |
| 2 | Getting dressed or undressed | | | | |
| 3 | Preparing simple meals | | | | |
| 4 | Taking a bath or shower | | | | |
| 5 | Going to the shop | | | | |
| 6 | Getting in or out of a chair | | | | |
| 7 | Going up or down stairs | | | | |

**Score 4: We don't know if they stop or avoid going up or down stairs because of their FoF**

# Current Projects

**Aim 1:** Develop a conceptual model of FoF that reflects the relationship between FoF, MS Symptoms, falls, and daily activities.

**Aim 2:** Develop a Fear of Falling Impact Patient Reported Outcome (FOFI-PRO) following the NIH PROMIS standards.

# Current Projects

- The **FOFI-PRO** will give clinicians a clear understanding of whether their patients have stopped engaging in certain activities or groups of activities because of their FoF.
- **Low** Capacity + **High** Activities Avoidance due to FoF = **CBT** for FoF
- **High** Capacity + **Low** Activities Avoidance due to FoF = **PT**
- **High** Capacity + **High** Activities Avoidance due to FoF = **CBT + PT**

**Safety should not mean protecting people from movement. It should mean helping people move as safely as necessary to regain their lives.**




# Thank you!

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