

Gender Differences in Stroke Recovery

Gayaneh Nazarian B.S¹, Vardan T. Karamyan Ph.D²

Oakland University William Beaumont School of Medicine

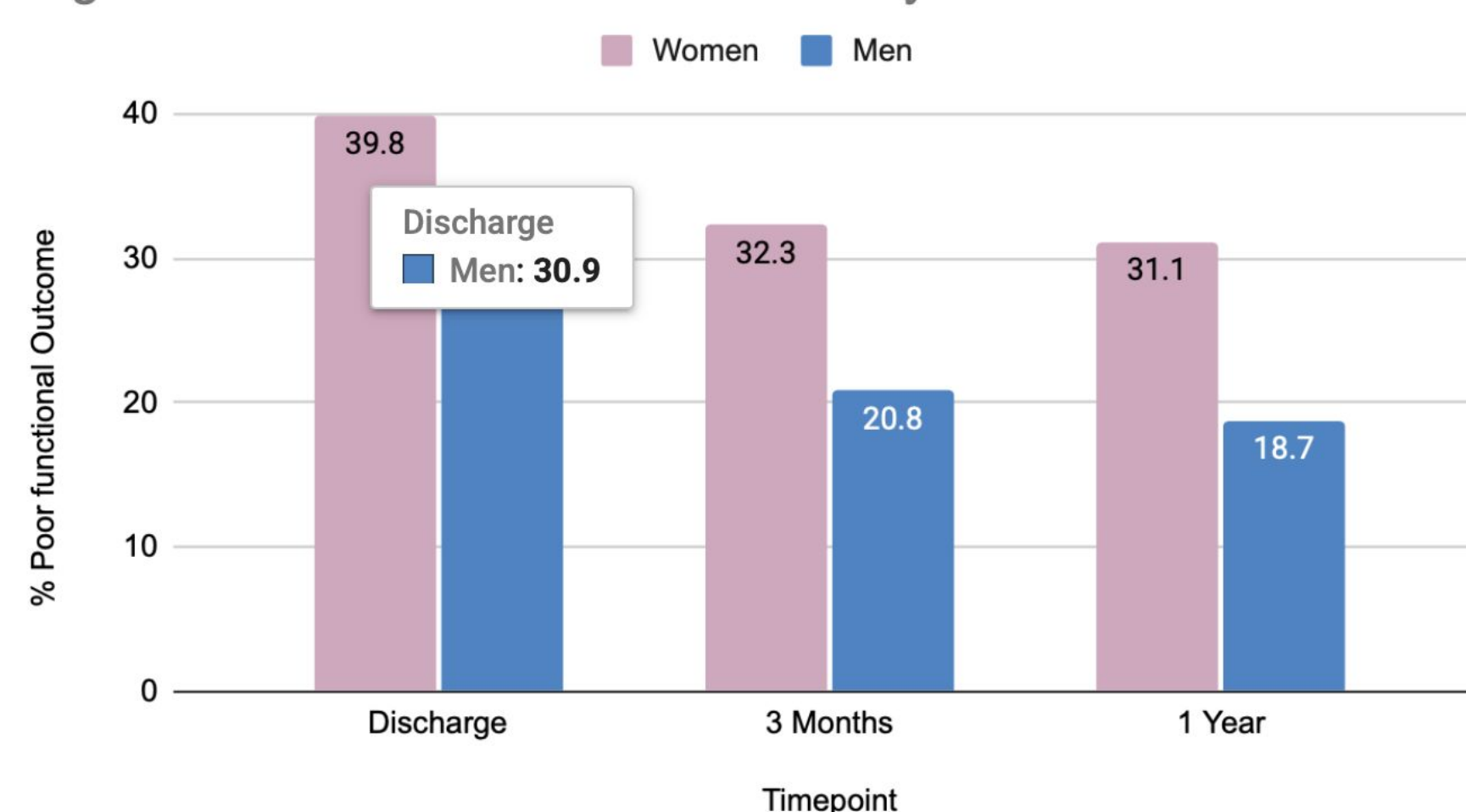
Introduction

- Stroke is the world's **2nd leading cause of long-term disability**, with **>13 million new cases** and **5.5 million deaths annually**^{1,2}.
- Despite advances in acute care, **~50% of survivors** face lasting functional challenges³.
- Recovery **differs between men and women**, influenced by **biological and social factors**^{4,5}.
- This study explores **gender disparities** in functional outcomes, rehabilitation responses, and **emerging neurorestorative therapies**⁶⁻⁸.

Aims and Objectives

- Examine **gender differences** in stroke recovery.
- Evaluate **functional outcomes, rehabilitation responses, and neurorestorative therapies**.
- Highlight **biological and social factors** influencing recovery disparities.

Figure 1: Poor Functional Outcomes by Gender



Methods

- Narrative systematic review:** population-based studies, prospective cohorts, systematic reviews, RCTs^{1,4,7-9}.
- Focus areas:** post-stroke function, physical activity, rehabilitation effectiveness, quality of life^{10,11}.
- Neurorestorative interventions:** vagus nerve stimulation (VNS), non-invasive brain stimulation, task-specific motor therapy, pharmacologic adjuncts^{10,11}.
- Population:** ischemic and hemorrhagic strokes to reflect real-world recovery⁷.

Figure 2: Physical Activity Trajectories

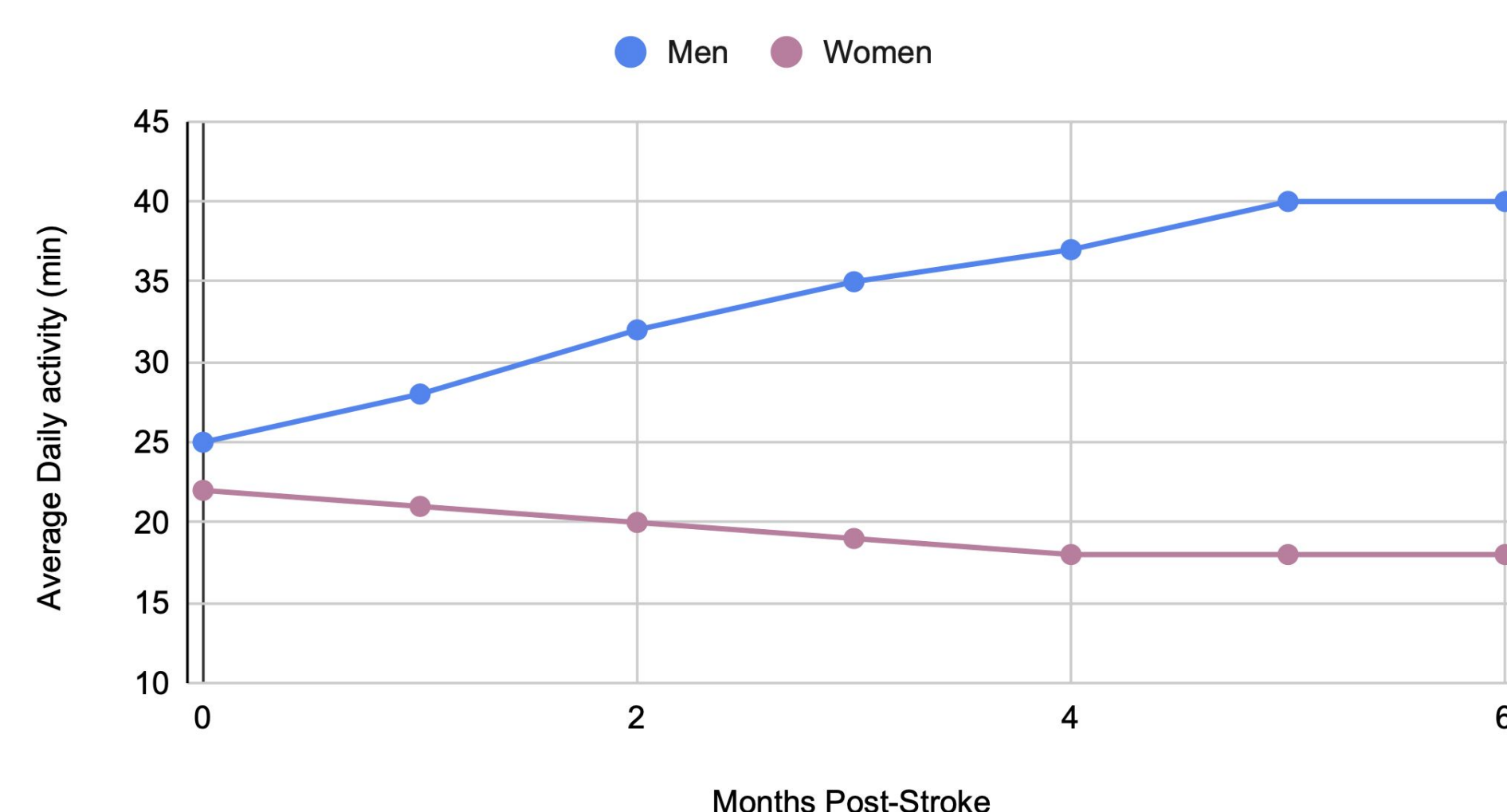
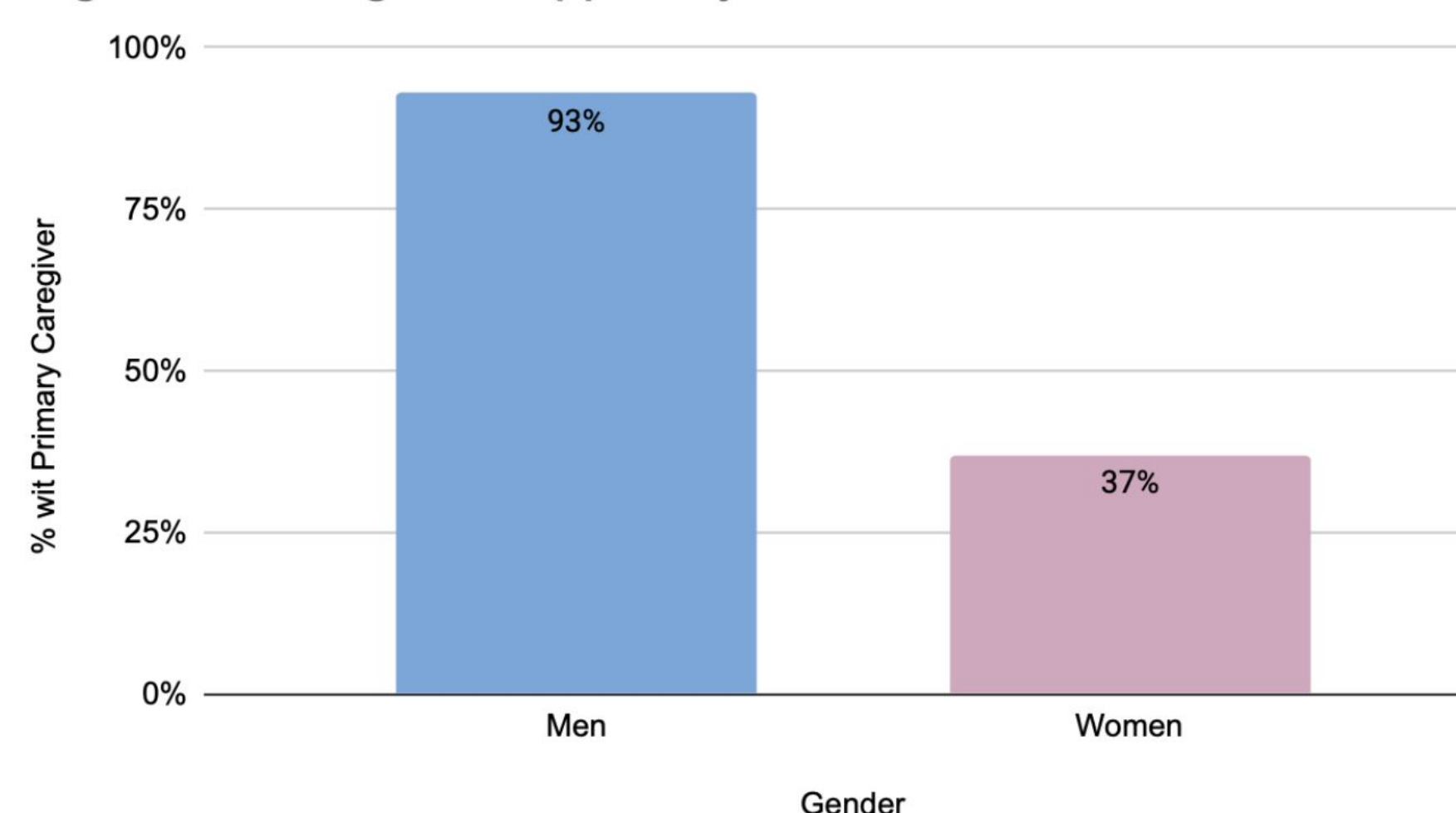


Figure 3: Caregiver Support by Gender



Results

Functional Recovery

- Women have **poorer outcomes** despite similar survival.
- Poor functional outcomes at discharge (40% vs 31%), 3 months (32% vs 21%), 1 year (31% vs 19%)⁷ [Figure 1].
- Women experience **higher pain scores** and persistent deficits after rehab¹².

Physical Activity

- Men increase and maintain activity; women's activity **declines**, linking to worse recovery¹³ [Figure 2].

Long-Term Outcomes

- Women report **lower quality of life**, higher care needs, and greater likelihood of **long-term institutionalization**^{13,14}.

Neurorestorative Therapies

- VNS + rehab** improves motor function⁷.
- Other therapies (VR, task-specific rehab) show **mixed results**; few studies examine **sex-specific responses**¹².

Biological & Social Factors

- Hormonal changes and **lower caregiver support** worsen outcomes.
- Only 37% of women vs 93% of men** have a primary caregiver⁵ [Figure 3].

Conclusions

- Functional recovery remains a **major challenge** for stroke survivors, despite improved survival.
- Women experience worse outcomes**, slower recovery, and lower long-term quality of life.
- Gender differences in recovery** are underrecognized and need more research.
- Sex-specific analyses** in clinical trials and **targeted rehabilitation** addressing hormonal and social factors may **improve recovery** and reduce long-term disability.

References

- Katan M, Luft A. Global burden of stroke. *Semin Neurol*. 2018;38(2):208–211. doi:10.1055/s-0038-1649503
- GBD 2016 Stroke Collaborators. Global, regional, and national burden of stroke, 1990–2016: a systematic analysis for the Global Burden of Disease Study 2016.
- Kim JS, Lee KB, Roh H, Ahn MY, Hwang HW. Gender differences in the functional recovery after acute stroke. *J Clin Neurol*. 2010;6(4):183–188. doi:10.3988/jcn.2010.6.4.183
- Langhorne P, Coupar F, Pollock A. Motor recovery after stroke: a systematic review. *Stroke*. 2009;40(6):2348–2355. doi:10.1161/STROKEAHA.109.192064
- Roth DL, Haley WE, Clay OJ, et al. Race and gender differences in 1-year outcomes for community-dwelling stroke survivors with family caregivers. *Stroke*. 2011;42(3):626–631. doi:10.1161/STROKEAHA.110.595322
- Buvarp D, Viktorisson A, Axelsson F, et al. Physical activity trajectories and functional recovery after acute stroke among adults in Sweden. *JAMA Netw Open*.
- Kim JS, Lee KB, Roh H, Ahn MY, Hwang HW. Gender differences in the functional recovery after acute stroke. *J Clin Neurol*. 2010;6(4):183–188.
- Circulation Research. Sex differences in post-stroke outcomes and recovery. 2021. doi:10.1161/CIRCRESAHA.121.319915
- Buvarp D, Viktorisson A, Axelsson F, et al. Physical activity trajectories and functional recovery after acute stroke among adults in Sweden. *JAMA Netw Open*. 2023;6(5):e2310919. doi:10.1001/jamanetworkopen.2023.10919
- Dawson J, Liu CY, Francisco GE, et al. Vagus nerve stimulation paired with rehabilitation for upper limb motor function after ischemic stroke (VNS-REHAB): a randomized, blinded trial. *Lancet*. 2021;397:1545–1553. doi:10.1016/S0140-6736(21)00575-2
- Saposnik G, Cohen LG, Mamdani M, et al. Efficacy of non-immersive virtual reality rehabilitation in patients with chronic stroke. *Stroke*. 2016;47:1020–1026. doi:10.1161/STROKEAHA.115.011616
- Kautzky-Willer A, Harreiter J, Thomas A, et al. Women with cerebral infarction feature worse clinical profiles at admission but comparable success to men during long-term inpatient neurorehabilitation. *Front Aging Neurosci*. 2021;13:663215. doi:10.3389/fnagi.2021.663215
- Ahmadi J, et al. Sex differences in long-term quality of life among survivors after stroke. *Stroke*. 2018;49:1171–1179. doi:10.1161/STROKEAHA.118.024437
- Yu AYY, MacLagan LC, Diong C, et al. Sex differences in care need and survival in patients admitted to nursing home poststroke. *Can J Neurol Sci*. 2020;47(2):153–159.
- Branyan TE, Sohrabji F. Sex differences in stroke comorbidities. *Exp Neurol*. 2020;332:113384. doi:10.1016/j.expneurol.2020.113384

Acknowledgements

Oakland University William Beaumont
School of Medicine