EE460

A Budget Impact Model to Evaluate the Budget Impact of Treating Walking Impairment in Chronic Stroke, a US Perspective

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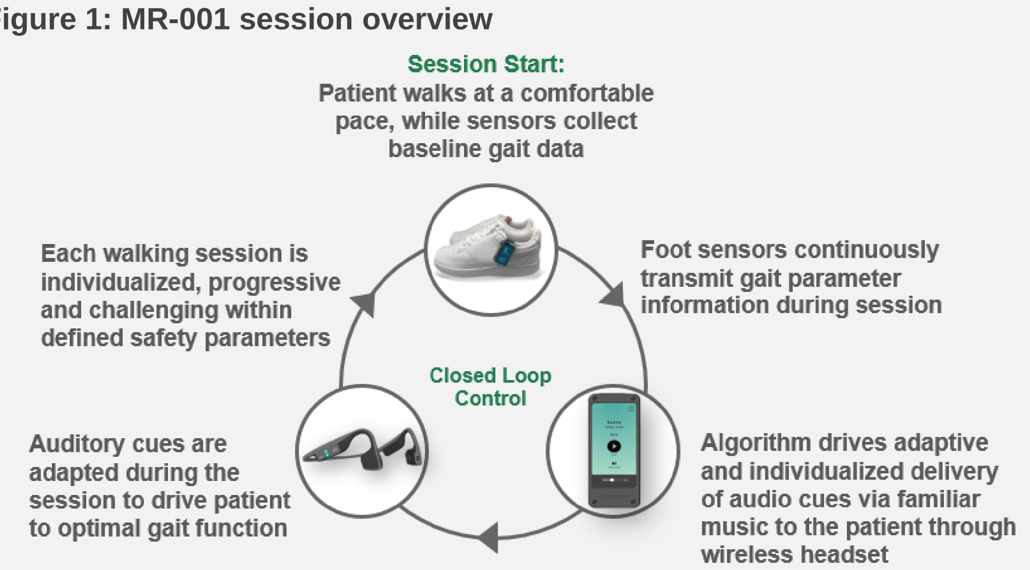
Background

- Stroke is the second-leading cause of death and third-leading cause of adult disability in the United States (US).[1]
- Nearly half of patients with chronic stroke (≥ 6 months post-stroke) have walking impairment, which is associated with high healthcare resource utilization (HCRU) costs.[2]
- Slower walking speeds can reduce independence and mobility outside of the home, as well as increase cognitive decline and risk of falls.[3]
  - Without the ability to walk at least 0.8 m/s, the threshold for community ambulation, many stroke survivors cannot safely navigate their communities (or are unable to independently leave their homes).[3]
- There is an unmet need for an effective rehabilitation method for patients with chronic stroke walking impairment.[4]
  - Clinical practice guidelines recommend physical activity, physical therapy, and rhythmic auditory stimulation (RAS) for the long-term rehabilitation of individuals post-stroke.[5-7]
  - Despite clinical guidelines, there are functional, social, and perceptual barriers to participating in such activities[7-9] and survivors of stroke spend 78% of their waking hours sedentarily.[10]
- RAS is a form of neurologic music therapy that utilizes auditory motor entrainment in the rehabilitation of movements that are naturally rhythmic (such as walking).[11] Although decades of research support the effectiveness of RAS, this intervention is traditionally administered by Neurologic Music Therapists (NMTs);[12] with less than 1,000 credentialed NMTs in the US,[13] patient accessibility to RAS is limited.
- MR-001 is an investigational prescription neurorehabilitation system intended to improve walking and ambulation status in adults with chronic stroke.
- MR-001 delivers an intervention based on the principles of RAS for use at home and/or in the community environment.

Figure 1: MR-001 session overview



Objective

- To estimate the budget impact, from a US payer perspective, associated with the reimbursement of MR-001 for the treatment of chronic stroke walking impairment.

Methods

- A budget impact model (BIM) was developed using Microsoft Excel® following the International Society for Pharmacoeconomics and Outcomes Research (ISPOR) best practice guidelines.[14]
- The patient population included adults aged ≥ 18 years with chronic stroke walking impairment.
- Interventions captured in this analysis were 'MR-001' (30 min walking sessions with MR-001, 3x per week for 2 months), 'No Treatment' (no treatment for walking impairment), 'Therapeutic Exercise' (30 min walking sessions, 3x per week for 2 months), and 'Physical Therapy' (24 physical therapy sessions per year related to walking rehabilitation).
- All patients were assumed to fully adhere to their prescribed interventions (i.e., 100% adherence).

Table 1: Reference case parameters and input values

Parameter	Value
Time horizon	1 year
Plan size	1,000,000
Annual incidence of chronic stroke in the US	0.20%*
Prevalence of chronic stroke in the US	3.2%[17]
Proportion of survivors of stroke with chronic walking impairment	50%[2]
Mean annual post-stroke healthcare costs	$11,214.66§[18]
Healthcare resource utilization cost reduction per every 0.10 m/s increase in walking speed	$2,026.89§[19]

*Calculated using the annual stroke incidence rate[15] and stroke mortality rate.[16]
§Values have been inflated to 2023 US Dollars.

Figure 2: Budget impact model structure

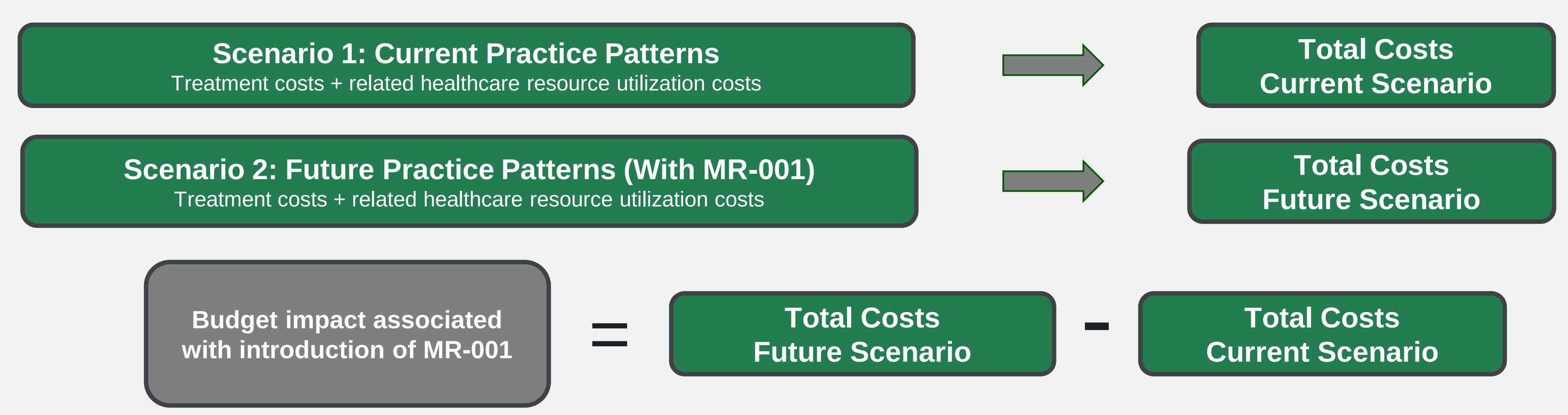


Table 2: Intervention-specific reference case parameters and input values

Parameter	MR-001	No Treatment	Therapeutic Exercise	Physical Therapy
Patient Shares: Current Scenario[20]	0%	56%	8%	36%
Patient Shares: Future Scenario[20]	5%	51%	8%	36%
Intervention price	~$1,500.00[20] (monthly rental)	$0.00	$0.00	$75.00[21-24] (per 30-minute session)
Intervention frequency (per year)	2 rental periods	N/A	24 sessions[25]	24 sessions[6,26-27]
Patient co-pay	20%[28]	N/A	N/A	22%*
Reimbursement amount	$1,160.00†	N/A	N/A	$58.18[29]
Walking speed increase	0.14 m/s[25]	0.00 m/s	0.06 m/s[25]	0.07 m/s[30]
Patients converted to community ambulators	47.5%[25]	0.00%	25.0%[25]	25.0%‡

*Calculated percentage equal to the remaining cost after the reimbursement amount (associated with HCPCS code 97110)[29] is deducted from the intervention price.
†Calculated remaining cost after the patient co-pay is deducted from the intervention price.
‡Assumed equivalent to Therapeutic Exercise.

Results

- Reimbursing MR-001 for chronic stroke walking rehabilitation was associated with cost-savings for the payer of $439,954 over a one-year time horizon (**Table 3**).
- For patients treated with MR-001, the intervention cost was offset by the associated reduction in HCRU driven by improvement in walking speed (**Table 3**).
- Compared to the current scenario, an additional 2.4% of patients were expected to become community ambulators after the introduction, and subsequent uptake, of MR-001 (**Table 3**).
- Total HCRU costs per patient were lowest for MR-001 relative to the comparators in the analysis (**Table 4**).
- The robustness of model results were supported by multiple sensitivity analyses that also demonstrated cost savings to the public payer (**Table 5**).

Table 3: Reference case economic and patient outcomes for year one

Outcome	Current Scenario (without MR-001)	Future Scenario (with MR-001)	Incremental
Total budget impact for payers	$188,840,694	$188,400,739	-$439,954
Total costs PMPM	$15.74	$15.70	-$0.04
Total costs PIMPM	$925.77	$923.62	-$2.16
Patients converted to community ambulators	11.0%	13.4%	2.4%*

*Translates to an additional 404 individuals becoming community ambulators with the introduction of MR-001. In the reference case, 404 of the 850 patients treated with MR-001 were converted to community ambulators; as such, these patients would theoretically gain the ability to independently leave their homes and successfully navigate their communities.

Table 4: Reference case economic outcomes to the payer by intervention for year one

Outcome	MR-001	No Treatment	Therapeutic Exercise	Physical Therapy
Intervention cost per patient	$2,320.00	$0.00	$0.00	$1,396.32
Total HCRU cost per patient*	$8,377.02	$11,214.66	$9,998.53	$9,795.84

*Total HCRU cost per patient includes the annual HCRU cost to treat patients with chronic stroke minus the reduction in the annual HCRU cost associated with an increase in walking speed.

Table 5: Results of sensitivity analyses

Analysis	Intervention Costs (to payer)	HCRU Costs (to payer)	Total Costs (to payer)
Reference case	**$1,971,824**	**-$2,411,778**	**-$439,954**
Include recurrent stroke hospitalization costs and LTC costs*	$1,971,824	-$3,380,871	-$1,409,048
Increase HCRU reduction per 0.10 m/s increase in walking speed to $2,432.27†	$1,971,824	-$2,894,143	-$922,319
Decrease HCRU reduction per 0.10 m/s increase in walking speed to $1,621.51†	$1,971,824	-$1,929,425	$42,399
Increase patient shares for MR-001 to 10%	$3,943,648	-$4,823,556	-$879,909
Decrease patient shares for MR-001 to 2.5%	$985,912	-$1,205,889	-$219,977
Increase proportion of patients with chronic stroke and walking impairment to 70%	$2,760,554	-$3,376,490	-$615,936
Decrease proportion of patients with chronic stroke and walking impairment to 30%	$1,183,094	-$1,447,067	-$263,973

*Recurrent stroke hospitalization costs = $15,268.62[31]; annual LTC costs = $113,800.94[32]. Values have been inflated to 2023 US Dollars.
†This parameter was varied by ±20% to reflect uncertainty in its value.

Discussion

- Improvement in walking speed was observed for Physical Therapy, Therapeutic Exercise, and MR-001. Patients achieved a greater increase in walking speed using MR-001 than other comparators, resulting in the greatest reduction in HCRU costs for this treatment group.
- Strengths: Model was developed following ISPOR best practice guidelines and eligible patient population was highly representative of the patient population indicated for treatment with MR-001.
- Limitations: MR-001 assumptions were based on clinical trial data not real-world use, patient share distributions might not reflect actual uptake patterns (**Table 2**), HCRU cost reduction related to walking speed was based on non-stroke population data (**Table 1**), combination therapies were not included, and treatment adherence rates were assumed to be 100% for all interventions.

Conclusions

- There are significant clinical, humanistic, and economic burdens associated with walking impairment for patients with chronic stroke.
- Results from this budget impact analysis suggest that US payers should consider reimbursing MR-001 as a cost-saving intervention to improve walking and ambulation status in patients with chronic stroke.

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Abbreviations BIM = budget impact model; HCRU = healthcare resource utilization; ISPOR = International Society for Pharmacoeconomics and Outcomes Research; LTC = long-term care; m/s = meter per second; NMT = neurologic music therapist; N/A = not applicable; PIMPM = per-indicated-member per-month; PMPM = per-member per-month; RAS = rhythmic auditory stimulation; US = United States.

References

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