Impact of Massage Therapy on Fatigue, Pain, and Spasticity in People with Multiple Sclerosis: a Pilot Study

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INTRODUCTION

Multiple sclerosis (MS) is a chronic, immune-mediated, inflammatory disease of the central nervous system affecting over two million people worldwide. (1) The different patterns of inflammation, scarring, demyelination, and axonal damage that occur throughout the brain and spinal cord lead to varying symptoms that ultimately limit function and lead to disability. The resulting loss of independence and restrictions on recreational, vocational, and social activities, leads to a progressive decline in quality of life. While disease-modifying therapies may prevent or slow the progression of the disease, many symptoms remain, even with the use of these medications. (2)

Fatigue, pain, and spasticity are three disruptive symptoms in people with MS. Fatigue is the most commonly reported and affects daily activities and employment in over half of people with MS, ranging from 53%–87%. (3-9) Pain, too, affects a large number of people with MS, anywhere from 30% to 90%, depending on the study and the participant characteristics. (10-13) About 80% of people with MS report they have spasticity, or an increase in response to stretch and movement that is disruptive to everyday function, personal care, and mobility. (14-16) As fatigue, pain, and spasticity increase in people with MS, mobility and everyday tasks become more difficult and quality of life (QOL) decreases. (17-19) Interventions are needed to address these symptoms without side effects, in order to improve QOL in people with MS, especially given that they are expected to live a nearly full lifespan with this chronic condition. (20)

Approximately a third of surveyed individuals with MS report they use massage therapy (MT) as an adjunct to their medical treatment, often because conventional treatments are not effective in managing their symptoms. (20,21) While various lines of research demonstrate that MT can improve QOL in people with MS, (21-25) and decrease fatigue, pain, and spasticity in other patient populations, (26-33) there is little empirical...
Participants were recruited by word of mouth, RRC–approved fliers, and through the patient database at the Shepherd Center in Atlanta, Georgia. We aimed to enroll 25 participants; thus, if a participant dropped out of the study, we recruited another in order to complete data collection on 25 people with MS. All participants received the intervention.

**Outcome Measures**

The following outcome measures were collected before and after completion of the six-week intervention phase, but not immediately after a massage session. All were collected by the study coordinator, except for the Modified Ashworth Scale (MAS), which was performed by a trained physical therapist.

The primary outcome measures were the Modified Fatigue Index Scale (MFIS), the Modified Ashworth Scale (MAS; spasticity), and the MOS Pain Effects Scale. Secondary outcome measures included assessment of perception of health and quality of life using subscales of the MS QLI. Outcome measures are described in Table 1.

**Massage Therapy Intervention**

A specific routine of MT was designed by two study investigators who are licensed physical therapists and licensed massage therapists. Tables 2 and 3 provide details regarding the specific routine. In general, the MT routine consisted of a combination of effleurage, petrissage, friction, and static compression strokes. Effleurage (E) was defined as using a...
gliding stroke of superficial pressure performed with palmar surface of hands at a consistent rhythm with a smooth, continuous motion that did not lose contact with the skin until completion of a described stroke. Hand-over-hand effleurage (E, hand-over-hand) was applied according to this same description, but further defined as rhythmic alternation of hands at more rapid rate of speed (approximately one second each hand). Petrissage (P) was defined as a lifting/kneading motion using a lumbrical grip of moderate pressure, resulting in the shifting of different muscular structures against one another, and/or of muscle tissue being lifted from underlying structures. Friction was applied using either linear friction (LF) or cross-fiber friction (XFF). LF was defined as deep pressure using pad of thumbs with compressive force along length of muscle; XFF was defined as deep pressure using pad of thumbs or fingers bidirectionally across the grain of musculature, superficial layers of tissue moving over deeper muscles. Static Compression (SC) was applied using deep pressure with the pad of thumbs statically, intended to pin a trigger point nodule, adhered tissue, or otherwise identified area of tissue dysfunction against deeper tissue or bone. SC was generally held for 8–12 s, but longer and shorter duration holds were performed at therapist discretion. Participants received this specific routine of MT for approximately 1 hr each week, for six weeks, in a quiet room, on a massage table, by a licensed massage therapist (LMT). Two primary LMTs and one investigator were trained in the MT routine. Two of the study investigators, also LMTs, filmed a video of delivery.

### Table 2. Massage Routine in Prone (Participant positioned in prone, or in as close approximation to prone as possible within given comfort and ROM restrictions, bolster support as appropriate (4” foam wedge under ankles))

| Body Part (Time in min) | Stroke/Location | Details |
|-------------------------|-----------------|---------|
| Back (15)               | E, caudally beginning on superior aspect of shoulders, descending to iliac crest | 5 strokes |
|                         | E, hand-over-hand caudally on R side of back from superior aspect of shoulders to iliac crest, followed by cephalically on R side of back from iliac crest to superior aspect of shoulders | 5 passes |
|                         | P, R side of back from iliac crest to superior scapula | 5 passes |
|                         | P, R upper trapezius from acromioclavicular joint to base of cervical spine | 5 passes |
|                         | P, perisplinal musculature from base of cervical spine (C7) to occiput | 5 passes |
|                         | LF, caudally along lamina groove on R side from C7 to iliac crest | 5 strokes |
|                         | LF, from junction of lumbar spine (L5) and iliac crest to lat edge of quadratus lumborum, R side | 5 strokes |
|                         | E, hand-over-hand caudally on L side of back from superior aspect of shoulders to iliac crest, followed by cephalically on L side of back from iliac crest to superior aspect of shoulders | 5 passes |
|                         | P, L side of back from iliac crest to superior scapula | 5 passes |
|                         | P, L upper trapezius from acromioclavicular joint to base of cervical spine | 5 passes |
|                         | P, perisplinal musculature from base of cervical spine (C7) to occiput | 5 passes |
|                         | LF, caudally along lamina groove on L side from C7 to iliac crest | 5 strokes |
|                         | LF, from junction of L5 and iliac crest to lat edge of quadratus lumborum, L side | 5 strokes |
| Post RLE (7)            | E, from Achilles tendon to hamstring attachment | 5 strokes |
|                         | P, on gastroc/soleus from Achilles tendon to 1” inferior to popliteal fossa | 5 passes |
|                         | E, hand-over-hand along med post thigh from med femoral condyle to 2” inferior to pubic symphysis (adductors/hamstrings) | 5 passes |
|                         | P, med post thigh from med femoral condyle to 2” inferior to pubic symphysis (adductors/hamstrings) | 5 passes |
|                         | E, hand-over-hand along lat post thigh from lat femoral condyle to greater trochanter (hamstrings/IT band) | 5 passes |
|                         | P, lat post thigh from lat femoral condyle to greater trochanter (hamstrings/IT band) | 5 passes |
| Post LLE (7)            | E, from Achilles tendon to hamstring attachment | 5 strokes |
|                         | P, gastroc/soleus from Achilles tendon to 1” inferior to popliteal fossa | 5 passes |
|                         | E, hand-over-hand med post thigh from med femoral condyle to 2” inferior to pubic symphysis (adductors/hamstrings) | 5 passes |
|                         | P, med post thigh from med femoral condyle to 2” inferior to pubic symphysis (adductors/hamstrings) | 5 passes |
|                         | E, hand-over-hand lat post thigh from lat femoral condyle to greater trochanter (hamstrings/IT band) | 5 passes |
|                         | P, lat post thigh from lat femoral condyle to greater trochanter (hamstrings/IT band) | 5 passes |
Table 3. Massage Routine in Supine (Participant positioned in supine, or in as close approximation to supine as possible within given comfort and ROM restrictions, bolster support as appropriate (4” foam wedge under knees). Five minutes allowed for transition from prone to supine.)

| Body Part (Time in min) | Stroke/Location | Details |
|-------------------------|-----------------|---------|
| Ant RLE (7)             | E, 1” superior to med/lat malleoli to ASIS | 5 strokes |
|                         | LF, along tibialis ant | 5 strokes |
|                         | E, hand-over-hand, med thigh from 1” superior to med femoral condyle to 2” inferior to pubic symphysis | 5 passes |
|                         | P, med ant thigh from med femoral condyle to 2” below pubic symphysis (adductors/quadriceps) | 5 passes |
|                         | E hand-over-hand, lat thigh from 1” superior to lat femoral condyle to ASIS | 5 passes |
|                         | P, lat ant thigh from lat femoral condyle to greater trochanter (quadriceps/IT band) | 5 passes |
| Ant LLE (7)             | E from 1” superior to med/lat malleoli to ASIS | 5 strokes |
|                         | LF, along tibialis ant | 5 strokes |
|                         | E, hand-over-hand, med thigh from 1” superior to med femoral condyle to 2” inferior to pubic symphysis | 5 passes |
|                         | P, med ant thigh from med femoral condyle to 2” below pubic symphysis (adductors/quadriceps) | 5 passes |
|                         | E, hand-over-hand, lat thigh from 1” superior to lat femoral condyle to ASIS | 5 passes |
|                         | P, lat ant thigh from lat femoral condyle to greater trochanter (quadriceps/IT band) | 5 passes |
| RUE (7)                 | E, forearm from wrist crease to 1” inferior to cubital fossa, alternating hands to cover full ant/post surfaces of forearm | 5 strokes each side |
|                         | P, using single hand on forearm from wrist crease to 1” inferior to cubital fossa (opposing hand stabilizes arm) | 5 passes |
|                         | E, prox arm from 1” superior to cubital fossa to humeral head, alternating hands to cover full ant/post surfaces of prox arm | 5 strokes each side |
|                         | P, using single hand on prox arm from 1” superior to cubital fossa to humeral head | 5 passes |
|                         | E along pectoralis major/ant surface of arm from inferior to clavicle to hand | 5 strokes |
|                         | Light kneading pressure using pad of thumbs on palmar surface of hand (hand supported on therapist’s hands) | 30 s |
| LUE (7)                 | E, forearm from wrist crease to 1” inferior to cubital fossa, alternating hands to cover full ant/post surfaces of forearm | 5 strokes each side |
|                         | P using single hand on forearm from wrist crease to 1” inferior to cubital fossa (opposing hand stabilizes arm) | 5 passes |
|                         | E, prox arm from 1” superior to cubital fossa to humeral head, alternating hands to cover full ant/post surfaces of prox arm | 5 passes |
|                         | P, using single hand on prox arm from 1” superior to cubital fossa to humeral head | 5 passes |
|                         | E along pectoralis major/ant surface of arm from inferior to clavicle to hand | 5 strokes |
|                         | Light kneading pressure using pad of thumbs on palmar surface of hand (hand supported on therapist’s hands) | 30 s |
| Neck/Head and Shoulders (8) | E, occiput to acromioclavicular joint on the R | 5 strokes |
|                         | LF, occiput to C7 | 5 strokes |
|                         | LF, C7 to acromioclavicular joint | 5 strokes |
|                         | XFF to sub-occipitals on the R | 15 s |
|                         | SC to sub-occipitals on R | 15 s |
|                         | E, occiput to acromioclavicular joint on the L | 5 strokes |
|                         | LF, occiput to C7 | 5 strokes |
|                         | LF, C7 to acromioclavicular joint | 5 strokes |
|                         | XFF to suboccipitals on the R | 15 s |
|                         | SC to suboccipitals on L | 15 s |
|                         | Positional Elongation/Passive stretching into cervical side-bending to L (stretching to upper trapezius and middle scalene) | 30 s |
|                         | Positional Elongation/Passive stretching into cervical side-bending to R (stretching to upper trapezius and middle scalene) | 30 s |

* If subject is able, arm positioned behind head with shoulder flexion and elbow flexion; if unable, arm remains by side.

Ant = anterior; LF = linear friction; E = effleurage; H = hand-over-hand = effleurage, hand-over-hand; L = left; Lat = lateral; LE = lower extremity; Med = medial; Min = minutes; P = Petrissage; XFF = Cross-fiber friction; SC = static compression; Post = posterior; Prox = proximal; R = right; s = seconds.
of the specified routine for training. The LMTs first viewed this video and, once familiar with the routine, they performed it on two volunteers. One investigator observed the session to assess adherence to the routine and to provide feedback related to timing and sequencing. Once the LMTs demonstrated competency with the routine, the LMTs began providing this routine to participants for the study. Specific instructions were not given regarding speed of strokes; the speed of each stroke was implied in the overall time period associated with the body area addressed. Level of pressure was determined relative to participant tolerance, particularly with the techniques of petrissage, linear friction, and static compression. All attempts were made to assure that the same primary LMT administered all six massages on a given participant. However, if a primary LMT was not available for some reason, the other primary LMT or the trained investigator administered the MT for that session.

At the completion of each session, the LMT completed the Process Evaluation Form (Table 4), to indicate any deviation from the routine during that session. The Process Evaluation Forms were reviewed by a coinvestigator weekly to ascertain the routine was followed by the LMT. If there were any deviations to the protocol, the coinvestigator followed up with the LMT to discuss and resolve any issues. In addition, the study coordinator and a coinvestigator reviewed these data sheets regularly to make sure that all data points were complete. If a data point was missing, the study coordinator contacted the LMT to determine if the data point could be captured, and the principal investigator was notified. In all cases, the data were retrieved from the LMT and documented.

If a massage was stopped for any reason and the participant had received less than 30 min of the 1-hour massage, they were rescheduled for another session. If the massage lasted for at least 30 consecutive minutes, the massage was deemed complete and another session was not scheduled. If a participant missed a session, every attempt was made to reschedule this session during the same week of the missed session. If that was not possible, then the massage was rescheduled at the end of all of the sessions. All six sessions for massage were completed within an eight-week period. If a participant withdrew or dropped out of the study, another participant was recruited to replace them. The only exception was that one of the last participants dropped out of the study at the time of her final massage and would not return for testing. Another participant was not recruited given that the study time period (one year) had ended.

**Analysis**

All data were collected on paper forms and kept in a locked cabinet. Data were entered into an Excel spreadsheet and a statistical software program (SPSS version 15.0 for Windows) by a study co-investigator and checked for quality and completeness by the principal investigator.

We employed descriptive statistics to evaluate means and standard deviations. Paired *t* tests were used to determine statistically significant differences pre- and postintervention in fatigue (MFIS), pain (MOS Pain) and spasticity (MAS), perception of health (MHI), and QOL (HSQ). Correlational analyses were conducted to examine the relationship between fatigue, pain, and spasticity, perception of health (MHI) and QOL (HSQ). We employed Spearman’s rho correlation coefficients to estimate correlation coefficients to determine if there was

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**Table 4. Process Evaluation Form**

| Massage Weekly Process Evaluation Form |
|----------------------------------------|
| Therapist ________  Session Number ________  Date ________ |

1) Effects of last massage / “subjective”
2) Current Pain level: VAS and location prior to massage
3) Was patient position altered from standard prone and supine?  **No Yes** *(if yes how)*
4) Massage routine: sequence change?  **No Yes** *(if yes, please note how and why)*
5) Massage routine: pacing change?  **No Yes** *(if yes, please note how and why)*
6) Massage routine: skip items?  **No Yes** *(if yes, please note how and why)*
7) Did you complete the massage routine?  **No Yes** *(if no, please describe why)*
8) Deviation from protocol (something added?)  **No Yes** *(if yes, please note below)*
9) Session ends on time  **No Yes**
10) Please note anything else pertinent to the session evaluation that may not have been covered in the previous questions.
11) Current Pain level: VAS and location post to massage

**Before say goodbye**

Next appointment date confirmed  **No Yes**

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a relationship between changes in symptoms and participant reports of health and QOL. Statistical significance was determined with a value equal to or less than alpha level of 0.05.

In addition, we analyzed the data to assess clinically meaningful change, using the definition: “Clinically meaningful change can be defined as a noticeable, appreciable difference that is of value to the patient or the health professional, and that exceeds variation attributable to chance.” Based on Cohen, effect sizes of 0.2 are considered small, 0.5–0.6 are considered medium, and 0.8 are considered large.

RESULTS

Participants

Twenty-eight individuals with MS were enrolled in this study, and 24 completed all MT sessions and outcome measures. The majority (n = 22) were female, the mean age was 47.38 years (range = 24–71, standard deviation (SD) = 13.05), and the mean time since diagnosis was 12.68 years (range = 2–25 years, SD = 6.13). Two participants did not know the time since diagnosis. Two participants dropped from the study due to transportation or family issues, one due to medical reasons, and a fourth was dropped due to no longer meeting the enrollment criteria after being enrolled. There were no adverse events in this study.

Table 4 presents the findings from the paired t tests. Twenty-two of the 24 participants reported a decrease in fatigue. There was a significant decrease in MFIS scores from pre- to post-testing (p < .01), indicating a decrease in self-reported fatigue after the intervention.

One participant reported no change after the intervention, and one reported a slight increase (total score 13 pre and 15 post). There also was a significant 18% decrease in pain (p < .01) as indicated by the MOS Pain scores after the intervention.

A complete MAS was collected on 19 of the 24 participants. Five participants were not assessed due to timing of the assessment, transportation issues, and evaluator unavailability. Only 16 of those 19 reported any spasticity at the onset of the study, with scores ranging from 1 (slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of the range of motion when the affected part(s) is moved in flexion or extension) to 3 (considerable increase in muscle tone, passive movement difficult) for these participants. There was no significant increase or decrease in the MAS in this group after the intervention in either the left or right leg (p = .17 and .23, respectively).

Effect sizes (ES) for measures of fatigue, pain, and spasticity are found in Table 5. There was a large negative ES for MFIS and MOS Pain, and a small negative ES for MAS, both right and left leg.

Fatigue, Pain, and Spasticity

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Perception of Health and Quality of Life

All participants (n = 24) completed the MHI and HSQ. There was a significant increase in the total MHI (p < .01) and in all subscales of the MHI as well, indicating an overall improvement in mental health. However, there were some participants who did not improve on the anxiety subscale (n = 3), depression subscale (n = 1), and the positive affect subscale (n = 3). Two experienced a decrease in both the Behavior Control and Positive Affect subscale.

There was a significant increase in the Role-Physical (p < .01), Bodily Pain (p < .01), Role-Emotional (p = .01), Vitality (p < .01), Mental Health (p < .01), and Social Functioning (p = .02) subscales of the HSQ, indicating an improvement in these aspects of QOL.

There was a large ES for the MHI and all subscales of the HSQ, except for the HSQ General Health and Physical subscales, which were small, and the Emotional and Social subscales, which were medium.

Relationships Between Measures

Table 6 provides details regarding the correlations between measures. Significant correlations include change in total MFIS score being positively correlated with total MOS Pain change score (r = 0.532, p = .01). Furthermore, change in MFIS score was negatively correlated with total MHI change (r = 0.647, p < .01) and the change scores for the Physical Functioning (r = 0.544, p = .01), Role-Physical (r = 0.576, p < .01), Bodily Pain (r = 0.57, p < .01), Role-Emotional (r = 0.543, p = .01) and Social (r = 0.519, p = .01) subscales of the HSQ. This indicates that as fatigue decreased, these measures of QOL increased (i.e., improved). Change in total MOS Pain score was negatively correlated with total MHI score (r = -0.584, p < .01) and Role-Physical subscale of the HSQ (r = -0.599, p < .01), also indicating that as pain decreased, these measures of QOL increased. There were no other statistically significant relationships between fatigue (MFIS), pain (MOS Pain), and health (MHI) or QOL (HSQ) measures.

| MFIS | MOS Pain | MHI | Physical Function | Role-Physical | Bodily Pain | Role-Emotional | Vitality | Mental Health | Social Function |
|------|----------|-----|-------------------|---------------|-------------|---------------|---------|---------------|-----------------|
|      | .532a    |     | -647a             | -544a         | -576a       | -572a         | -543a   | -619a         | -245            | -519a           |
| MOS Pain |        | -584a | -197             | -599a         | -361        | -363          | -158    | -208          | -385            |
| MHI  | .375     | .561a | .308             | .576a         | .487b       | .686a         | .670a   |               |                 |

Table 6. Correlations Between Measures

DISCUSSION

This pilot study is the first to demonstrate the positive impact of a standardized massage therapy (MT) routine on fatigue and pain, as well as perception of health and quality of life (QOL) in individuals with MS. These findings are meaningful given the prevalence of fatigue and pain in people with MS, and the extent to which these symptoms impact an individual’s perception of health and QOL. We failed to find a similar reduction of spasticity after MT in our participants with MS.

Our finding that fatigue and pain were both significantly decreased in our participants with MS after MT is not surprising given that MT has been shown to decrease fatigue and pain in people with chronic fatigue syndrome and fibromyalgia syndrome, both chronic diseases significantly impacting the health and well-being of individuals in a fashion similar to MS.

The pathophysiology underlying fatigue in MS is unclear and each individual’s experience of fatigue is different and variable over the course of the disease. Putative mechanisms being explored in an effort to better understand the pathophysiology of MS fatigue include the influence of proinflammatory cytokines, central nervous system lesion load, cortical atrophy and abnormal patterns of cerebral activation, poor
endocrine influences and axonal injury. In addition, muscle fatigue has also been demonstrated in people with MS and may contribute to the overall fatigue reported by individuals with MS. Thus, this lack of clarity related to fatigue in MS makes it difficult to understand the potential mechanisms by which MT may have a positive impact on fatigue.

MT has also been shown to be effective for decreasing neuropathic pain in some people with spinal cord injury. Roberts reported that light to moderate massage led to a decrease in the gain of the spinal nociceptive reflexes, which are often elevated in chronic pain syndromes. Although we did not explore potential mechanisms for the changes seen in our participants with MS, MT may also be effective in decreasing pain in people with MS through mechanisms similar to those described by Roberts.

As fatigue and pain increase in people with MS, QOL decreases. The fact that we found that decreases in fatigue and pain are related to improvements in perception of health and QOL is meaningful, considering that at this time there is neither a cure for MS, nor an adequate treatment for fatigue or pain for people with MS. Furthermore, medications for management of fatigue and pain are costly, and MT may provide a relatively inexpensive and accessible option for decreasing these symptoms and, thereby, improve perception of health and QOL in people with MS.

Although others have demonstrated a decrease in spasticity after a massage intervention in individuals with neurological disorders, we did not find a significant decrease in spasticity in our participants with MS. One explanation is that earlier studies evaluated spasticity immediately or within 30 min following an MT session and we only assessed spasticity at the end of the six-week intervention period and not immediately following a single MT session. Furthermore, the MT routine appeared to be different than the one utilized for our study. For instance, although Malilia et al. reported a decrease in spasticity, they utilized a Thai massage; Goldberg et al. found benefits only with a deep tissue massage using a one-handed petrissage technique; Brouwer and de Andrade utilized slow stroking. The MT routine in our study employed both petrissage and effleurage techniques. Perhaps, had we used the same type of massage as employed in these earlier studies, we might have seen a different response in their spasticity. However, it is important to note that the literature related to massage and spasticity is small and the reports variable.

A significant finding from this study is that the MT routine provided did not increase spasticity in our participants. Only three of our participants actually reported spasticity at the onset of the study, and hence this may explain the lack of improvement. Another potential explanation for not finding a reduction in spasticity in our study participants is that the outcome measure we used to assess spasticity, the Modified Ashworth Scale, only assesses whether there is hypertonia or a velocity dependent resistance to stretch, whereas other studies utilized tests of H-reflex excitability or joint range of motion. The fact that our participants did not experience a significant decrease in spasticity may be because we did not use a targeted intervention to directly address the muscles having spasticity, which we have previously shown decreased spasticity in one person with spinal cord injury. Further research is warranted to assess the long-term effects on spasticity utilizing other MT approaches in people with MS.

Limitations of this study include the small size and the lack of a control group. In addition, while all attempts were made to standardize the delivery of the massage routine provided in this study, we did not control for the amount of pressure provided. This would be an important consideration for future studies, given that there is evidence that different amounts of pressure can elicit unique responses.

Other variables not studied in this study include depression and sleep disorders, both common symptoms reported by people with MS. Both have been shown to influence fatigue in people with MS, and both have been reported to decrease after MT in other patient populations. A careful consideration of depression and sleep disorders would be warranted in future studies.

CONCLUSION

These findings suggest that massage therapy is a safe and potentially beneficial intervention for people with MS. Considerations for clinical application include the ability to comfortably position individuals with mobility restrictions. Concerns related to MS often include the risk of causing an increase in symptoms, such as fatigue, pain or spasticity. However, this study showed that not only is MT safe for people with MS, but also that it may be an important adjunctive therapy, given that traditional approaches often do not ameliorate their symptoms.

If MT can decrease fatigue and pain in some people with MS, this would provide at least some people with MS improved well-being and QOL. Given the state of health care reimbursement, providing evidence to support the use of interventions is critical in order to get paid for those interventions. This issue is even more important for people with MS, who have a chronic disease and resulting long-term health care needs.

CONFLICT OF INTEREST NOTIFICATION

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