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The Neurologist as an Agent of Exercise Rehabilitation in Multiple Sclerosis

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Abstract

This review hypothesizes that the neurologist represents the linchpin of exercise behavior change within comprehensive multiple sclerosis (MS) care settings. This is based on a series of recent papers that developed actionable practice models for accomplishing such behavior change through the neurologist as the primary agent. This provides tangible, next steps for exercise promotion in MS.

Summary

This review highlights recent, cutting-edge research for implementing exercise promotion into the neurologist's clinical armamentarium for multiple sclerosis patients.

Key Points

- There is proliferating evidence supporting pleiotropic exercise benefits in multiple sclerosis (MS) patients, yet physical inactivity is rampant.
- This quandary inspired a paradigm shift that systematically focuses on the patient-provider interaction as a critical locus of exercise promotion in comprehensive MS care; such research positions neurologists as agents of exercise rehabilitation in MS.
- This review highlights recent, cutting-edge research on the development and optimization of conceptual frameworks and practice models as powerful resources for implementing exercise promotion into the neurologist's clinical armamentarium.
- This represents a major opportunity for large-scale exercise promotion for managing MS and its manifestations.

Key words: Exercise; Multiple Sclerosis; Neurologists; Clinical Practice; Physical Activity

INTRODUCTION

Exercise, defined as planned, structured, and repetitive physical activity for maintaining or improving one's physical fitness (1), has been identified as one of the most important tools in the clinical armamentarium of healthcare providers in the management of multiple sclerosis (MS) patients (2). This is important as there are over 1 million persons living with MS in the United States (3) and 2.5 million worldwide (4). MS is characterized as an immune-mediated disease of the central nervous system that initially involves inflammatory processes resulting in demyelination and transection of axons, followed by neurodegeneration resulting in loss of neurons (5). This damage results in irreversible disability, symptomatic fatigue and depression, and declines in mobility, balance, and cognition (6). First-line treatments for MS involve the application of disease-modifying therapies (e.g., interferons, immunosuppressants, B-cell therapies). Those first-line therapies slow disease and disability progression, yet are not designed for managing symptoms and declines in function in MS patients (7). Collectively, this underscores the importance of applying other approaches for managing the unmitigated manifestations of MS, and one non-pharmacological approach involves exercise training (8-10).

One recent review paper provided a comprehensive overview of the pleiotropic benefits associated with exercise training in MS (11). The overview was largely based on meta-analyses, and indicated that exercise training reliably and meaningfully improves aerobic power and muscle strength, walking mobility and performance, balance, cognition, fatigue, depressive symptoms, and quality of life (11). **That body of evidence was generated over the past quarter century and has supported the development of consensus guidelines that represent a prescription of the minimal volume of exercise associated with achieving beneficial**

outcomes for persons with MS (12). The recommendation indicates that such a minimal prescription involves engaging in at least 30 minutes of moderate intensity aerobic exercise such as walking on 2-3 days/week as well as 2-3 days/week of resistance or weight training exercise for major muscle groups (13); we further note that the overall evidence indicates that exercise training is safe in MS (14).

Nevertheless, persons with MS do not engage in sufficient amounts of physical activity for health benefits (15). Indeed, meta-analyses indicate that persons with MS engage in substantially less physical activity overall and fewer minutes of moderate-to-vigorous physical activity per day than healthy controls (16-18). There is additional meta-analytic evidence that levels of physical inactivity in MS are comparable with those in other neuromuscular disease conditions, such as muscular dystrophy, joint/connective tissue disease, etc. ($g = 0.08$) (17). Other large-scale research indicates that, on average, persons with MS take fewer than 6,000 steps per day (19), which is similar to physical activity levels in persons with other chronic diseases such as cardiovascular disease (20), obesity (21, 22), type 2 diabetes (23), and chronic obstructive pulmonary disease (24). By extension, persons with MS take upwards of 40% fewer steps per day than healthy controls (18, 19, 25), and report high levels of sitting as a marker of sedentary behavior (26).

The tension between benefits, safety, and prescription, yet overall lack of participation has forced researchers and clinicians into considering and identifying new avenues for promoting and sustaining exercise behavior change in MS (11). The field requires a paradigm shift wherein we consider new approaches for addressing the continuing saga of physical inactivity in MS. We

have systematically focused on the patient-provider interaction as a critical locus of exercise promotion in comprehensive MS care over the past five years. That line of research is particularly important as it permits better implementation of exercise promotion into MS clinical practice, whereby the aforementioned benefits may be realized among a far greater number of patients with MS. One basis of such a highly-promising approach involves accounting for the influence of a ‘credible messenger’ for exerting a positive impact on the adoption of exercise behavior. Credible messengers are individuals who are trusted and respected sources of information, and who have a positive relationship with the individual receiving the information (27). Within comprehensive MS care, patients identify the ‘credible messenger’ as the neurologist (27, 28).

Neurologists represent the linchpin for promoting exercise among MS patients (29, 30), and neurologists seek out opportunities for exercise promotion within MS clinical practice (31). However, neurologists require additional resources for successful exercise promotion (29). To that end, the current review represents such a resource for neurologists, as this paper will provide the rationale, concept, and practical approach for promoting exercise within comprehensive MS care settings. To do so, we provide a comprehensive overview of recent, cutting-edge formative research on the systematic development and optimization of conceptual frameworks and practice models for directly implementing exercise promotion into comprehensive MS care across the disability spectrum. Such research underscores the importance of the neurologist as an agent of exercise behavior change in MS. We note that MS is a heterogeneous disease, and frameworks and models do not advocate for the delivery of individualized programs within neurological clinical practice, but rather are consistent with recently published exercise guidelines based on

disability level from the National MS Society (13). We further discuss paradigmatic challenges associated with the focus on the patient-provider interaction within this context. The facilitation of exercise promotion among persons with MS in the neurology clinic represents a major opportunity for large-scale promotion of physical activity for managing changes in disease, function, and symptoms; this likely has even broader application in other neurological conditions such as Parkinson's disease (32) and stroke (33).

EXERCISE PROMOTION IN MS CARE VIA THE PATIENT-PROVIDER INTERACTION

The systematic development of exercise promotion through the patient-provider interaction has evolved extensively through a series of nine papers by our group over the last five years (29-31, 34-39) that are buttressed by formative research from others on this topic (40-45). This line of research was designed using a novel approach whereby we implemented a 'bottom-up' strategy focusing on the needs and wants of patients with MS as a foundation (40). Such an approach was essential as persons with MS have a deeply informed understanding of the disease and represent the authority regarding personal needs for exercise through comprehensive MS care (41). The initial focus on patients further is consistent with tenets of knowledge translation (46) and implementation science, and has been proposed as an important forefront of future exercise research in MS (11). This has even been recognized in a recent position paper by the National Multiple Sclerosis Society (13).

The first study in this line of research involved conducting semi-structured interviews with 50 persons with MS who were purposefully sampled across the physical activity and disability

spectrums (29, 30). The study reported that MS patients specifically wanted information on exercise, including its benefits, strategies for adoption and prescription that was presented by a healthcare provider, preferably a neurologist (29, 30). The MS patients further indicated that such information should be tailored based on disability level (29,42) and that receiving this information would be particularly beneficial if it were delivered via in-person consultation with print media distributions, including pamphlets and brochures, and ongoing support using electronic media, such as websites and email (30). Such research underscores the importance of the neurologist as an agent of exercise behavior change in MS (see section “*The Neurologist as an Agent of Exercise Rehabilitation in Ms: Challenges And Solutions*”).

The reality of the aforementioned interest by patients in exercise promotion by healthcare providers is tenuous, unless it aligns with the needs and interests of providers (i.e., neurologists, nurses, physical therapists, and occupational therapists) for undertaking exercise promotion, as the needs and wants of patients might not be feasible for delivery within MS clinical care settings. To that end, other studies have recently been published on the provider’s perspective of exercise promotion in MS (34, 43-45). For example, one study involved semi-structured interviews with 44 healthcare providers that included similar numbers of neurologists, nurse practitioners, physical therapists, and occupational therapists (34). That study indicated that successful exercise promotion among MS patients should take place within the healthcare system via consistent communication with the comprehensive MS care team. Providers underscored the importance of improving clinical education regarding evidence of exercise benefits in MS based on professional training and service learning opportunities. Providers further described a need for the development of specific resources for promoting exercise among patients that could provide

information on specific exercise prescriptions, as well as on local facilities or outside exercise professionals that could be accessible among patients (34). Relatedly, other research suggests that the implementation of such resources, in conjunction with behavior change strategies, might improve the value of exercise within the context of comprehensive MS clinical practice (44, 45). Within that context, it has been suggested that the clarification of conflicting terminology regarding exercise in MS further might enhance the promotion of exercise by providers (43). For instance, MS patients have reported confusion with the terms ‘physical activity’ and ‘exercise’ being used interchangeably (43), as those terms have different definitions, considering that exercise is a subset of physical activity with different expected outcomes (1).

The research on the needs of patients and providers was wed into the development of a novel, multilevel conceptual model that outlined the promotion of exercise in MS through the interaction between patients and healthcare providers, particularly neurologists, in comprehensive MS care (35). This model was previously published (35) and involved a three-layer, pyramidal structure. Such a pyramid consisted of a foundation or base-layer of healthcare provider training and support; this involved the provision of professional training, service learning opportunities, protocols for promoting exercise. The middle-layer of the pyramid represents the patient-provider interaction that outlined a process for consultation and potential referrals for appropriate exercise resources. Finally, the top-layer or capstone of the pyramid consisted of patient exercise engagement, involving the actual use of exercise resources by patients for initiating and maintaining physical activity behavior that were delivered via providers. The three pyramidal layers further were linked bidirectionally within the context of the model, such that the patient-provider interaction serves as an intermediary between provider

training and support and patient exercise engagement. This conceptual model aligned with driver diagrams for both patients and providers for guiding and optimizing opportunities for exercise promotion in MS within clinical settings (835).

The aforementioned initial conceptual model was subsequently vetted by MS patients across the disability spectrum (36) and healthcare providers (37) for gaining further insight, evaluation, and refinement of the model. Indeed, the consultation of stakeholders represents a critical component for developing and implementing tools for behavior change in real-world settings. This resulted in substantive revisions of the conceptual framework. Briefly, the primary revisions noted by patients involved re-naming each of the layers in a manner that better reflected processes of behavior change as well as an increased emphasis on the patient-provider interaction (i.e., consultation) as the locus of meaningful, individualized exercise promotion (36). The secondary revisions noted by the providers included improving the conceptualization of comprehensive MS care which consists of multiple, interconnected healthcare providers as opposed to a single provider, and capitalizing upon the opportunity to represent a translation from concept to actual practice (i.e., providing avenues for how providers can actually promote exercise in MS clinical practice) (37). This resulted in the final hierarchical conceptual model depicted in Figure 1 as previously published (37).

The aforementioned formative research on the patient-provider interaction directly informed the generation of practice models and guidelines as actual products for promoting exercise in the clinical setting, and such resources are tailored for persons with MS based on levels of neurological disability status (38). Those practice models focused on the promotion of exercise

in persons with MS based on the patient-provider interaction using three separate scenarios that are likely to occur within comprehensive MS care settings. The scenarios are based on a patient's current activity level, disability status, **and insurance status**, and essentially provide decision-trees for different healthcare providers within MS clinical practice including neurologists, nurse practitioners, physical therapists, and occupational therapists for promoting appropriate exercise prescriptions (38). Those models were then refined by feedback from multiple groups of neurologists and other healthcare providers (i.e., nurse practitioners, physical therapists, occupational therapists). Such feedback accounted for other economic and social barriers and directly resulted in actionable process models, as well as improved clarity and characterizations of the roles of different healthcare providers in exercise promotion, and a better reflection of real-world, comprehensive MS care (38, 39). Indeed, the consideration of specific roles and perspectives of each member within the comprehensive MS care team, particularly those of the neurologist (31), can serve to catalyze the actual promotion of exercise in MS clinical practice. One of the final practice models, depicting the scenario wherein the MS patient is interested in exercise, but requires short-term physical/occupational therapy as a comprehensive partnership for comprehensive MS care is presented in Figure 2 as previously published (39). Other published practice models account for scenarios wherein MS patients are interested in exercise and do not require physical/occupational therapy and where patients require long-term physical/occupational therapy, respectively (39). For each scenario, the practice model uniquely addresses issues associated with patient disability and activity level, provider training and resources, patient screening and insurance issues, exercise promotion itself, the provision of an exercise toolkit, who delivers the exercise rehabilitation intervention, as well as patient engagement and external support (39).

Collectively, research on exercise promotion within MS clinical practice provides a new opportunity for addressing the high rates of physical inactivity among patients, despite strong evidence supporting exercise benefits from over 275 trials (47). The provision of formative data from patients and providers yielded a conceptual model that supports an actual product (i.e., practice models for clinicians) that has undergone comprehensive vetting and quality improvement by both patients and healthcare providers; this product is now ripe for application in the clinical setting. Researchers have acknowledged that such practice models, along with the inclusion of an exercise toolkit (i.e., supportive exercise program), has the potential to substantially reduce physical inactivity in MS via the patient-provider interaction (35). This research is particularly exciting, whereby the neurologist might serve as the agent of exercise behavior change in MS, possibly resulting in the large-scale promotion of physical activity, and downstream benefits on disease-related manifestations in this population.

THE NEUROLOGIST AS AN AGENT OF EXERCISE REHABILITATION IN MS: CHALLENGES AND SOLUTIONS

The Table summarizes different challenges and solutions associated with exercise promotion among persons with MS through neurologists; we describe such challenges and solutions in more detail. The promotion of exercise in MS clinical practice is not a simple process, as comprehensive MS care involves multiple, bidirectional channels of communication between patients and providers, as well as among a multidisciplinary team of healthcare providers. The aforementioned conceptual framework and accompanying practice models uniquely account for this by aligning processes of behavior change with the different roles of members of the

comprehensive MS care team (38, 39). To capitalize upon such interconnections among patients and providers, the neurologist represents the primary agent of exercise behavior change in MS, whereby he/she can introduce the beneficial effects of exercise during dialogue with patients across the disability spectrum via in-person consultation. Of note, this too can occur remotely, given recent challenges associated with pandemics such as COVID-19. Such initial dialogue and advice from the neurologist is a critical starting point based on the priorities identified by MS patients themselves (29, 30). After an initial consultation with patients regarding exercise, neurologists can then facilitate more in-depth consultations between patients and nurse practitioners or other members of the comprehensive MS care team on behavior change strategies for adopting exercise behavior. Neurologists further can partner with local physical and occupational therapists, and perhaps physical medicine and rehabilitation physicians, who can reliably facilitate exercise-related rehabilitation of impaired physical and mental functions via referrals. Although the neurologist is not directly delivering behavior change strategies or exercise training itself among patients, within this context, he/she has the opportunity to be the facilitator of the entire process, essentially serving as a chief executive for championing exercise rehabilitation in MS. Such an opportunistic role is entirely consistent with research on the perspectives of both patients and neurologists regarding exercise promotion in MS (29-31) and has the potential to deliver a powerful impact upon the lives of persons with MS. Indeed, future research efforts might systematically focus on various Centers for Medicare and Medicaid Services (CMS) codes that neurologists can use for referrals. This might maximize the impact of their role as the primary facilitator of exercise rehabilitation within comprehensive MS care settings. Beyond comprehensive MS care settings, neurologists may opt to partner with exercise physiologists for delivering exercise rehabilitation in community or gym settings, given that

exercise physiologists tend not to be included as frequently in physical/occupational therapy clinics.

We acknowledge that exercise promotion likely does not represent the primary concern amongst neurologists when treating MS patients; however, the evidence base supporting its considerable promise as a non-pharmacological approach for managing manifestations of the disease is rapidly broadening and strengthening (11). Indeed, neurologists have cited lack of time as a barrier for promoting exercise in MS within clinical practice (31, 34). By extension, there is some uncertainty regarding how a neurologist is able to provide adequate resources and support for patients for initiating and maintaining exercise over time. One approach for addressing that issue involves the development of a clinical toolkit for promoting exercise among MS patients. This toolkit could involve evidence-based educational materials for patients and neurologists, as well as guidance for how to adopt and adhere to different exercise programs based on levels of neurological disability. For example, such a toolkit would provide a detailed, home-based exercise program for patients that can be individually tailored across different demographic and clinical characteristics (i.e., disability level) (48-50). Such a program might be delivered by neurologist-approved third parties or members of the comprehensive MS care team, and further would involve behavior change strategies for improving adherence, compliance, and other outcomes (51). The implementation of a clinical exercise toolkit must account for issues regarding insurance coverage for neurologist-driven exercise promotion among MS patients (38). In order for such a toolkit to be an effective means for exercise promotion in persons with MS, the development of the clinical toolkit should account for all stakeholders within comprehensive MS care settings. This includes the neurologist, nurse practitioners, physical/occupational

therapists, researchers, funders/policymakers, and the patients themselves. Nevertheless, the implementation of a toolkit represents an important opportunity for the widespread promotion of exercise among MS patients, and is prime for inclusion in future efficacy and effectiveness trials that take place within clinical practice settings. Ultimately, such large-scale evidence might warrant the eventual reassessment of physical activity rates in large segments of the MS population, as well as the large scale re-evaluation of the impact of physical activity on other endpoints. We note that such a toolkit has been developed internally, but further testing and refinement is needed prior to immediate implementation in large-scale research.

The aforementioned line of research on the clinical application of exercise promotion in MS has identified other salient challenges facing clinicians in this area. For example, clinicians, particularly neurologists, have noted an overall lack of resources for formal training and/or service learning opportunities on exercise benefits in persons with MS (i.e., lack of specific knowledge on the beneficial effects of exercise on functional and symptomatic outcomes) (31). Neurologists further have described difficulties associated with the implementation of appropriate pipelines for referring patients for undertaking exercise based on differing disability levels (31). Those challenges might be addressed via emerging research on knowledge translation and implementation science regarding exercise in MS (11). Such research aims to bridge the gap between research and clinical practice by providing critical information on what knowledge must be translated, how the knowledge should be translated, and who should translate the knowledge (42). Those research endeavors further should involve multidisciplinary research teams for providing different perspectives on knowledge translation regarding exercise in MS, and might provide opportunities for expanding professional networks among neurologists, nurse

practitioners, physical therapists, and occupational therapists.

Another major class of challenges in this area involves the application of the aforementioned line of research into clinical practice across comprehensive MS care centers in Europe and beyond. This is an obvious challenge as much of the emerging research on exercise promotion in clinical settings has been based on healthcare models and systems in North America (44, 45), yet comprehensive MS care is not a one-size-fits-all model across the world. Indeed, the roles, responsibilities, and degree of collaboration among clinicians likely vary across countries, perhaps based on different sociopolitical structures and governmental regulations. We note that different geographic regions present with different sociocultural landscapes that could influence exercise promotion among persons with MS within heterogeneous models of comprehensive MS care. To that end, research on the role of neurologists, in particular, for promoting exercise in MS patients across the disability spectrum must expand in reach across the globe.

CONCLUSION/SUMMARY

We believe that capitalizing upon the patient-provider interaction represents a key avenue for promoting and sustaining exercise behavior among the 80% of persons with MS who are physically inactive, and thereby maximizing the opportunity for the pleiotropic benefits from exercise participation. Recent research developments on conceptual frameworks and practice models suggest that the neurologist, in particular, represents the key agent of exercise behavior change in MS clinical practice. Indeed, neurologists may be the key catalyst in the promotion of exercise within comprehensive MS care settings. This will add a new and powerful tool into the clinical armamentarium of clinicians for managing symptomatic and functional manifestations of

the disease in a manner that is complementary of first-line pharmacological approaches.

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Figure 1: Conceptual Framework for Exercise Promotion in MS via the Patient-Provider Interaction as previously published (38)

Figure 2: Practice Models for Exercise Promotion in Comprehensive MS Clinical Care Settings as previously published (39)

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Figure 1

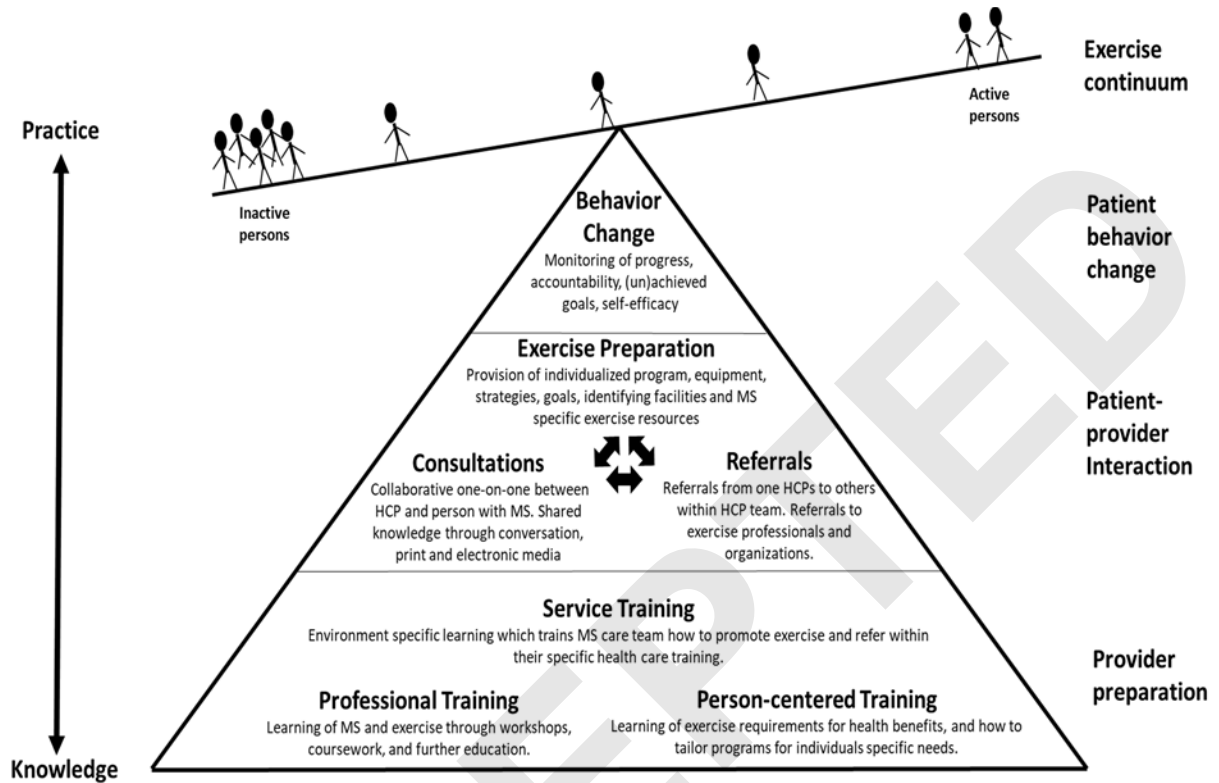


Figure 2

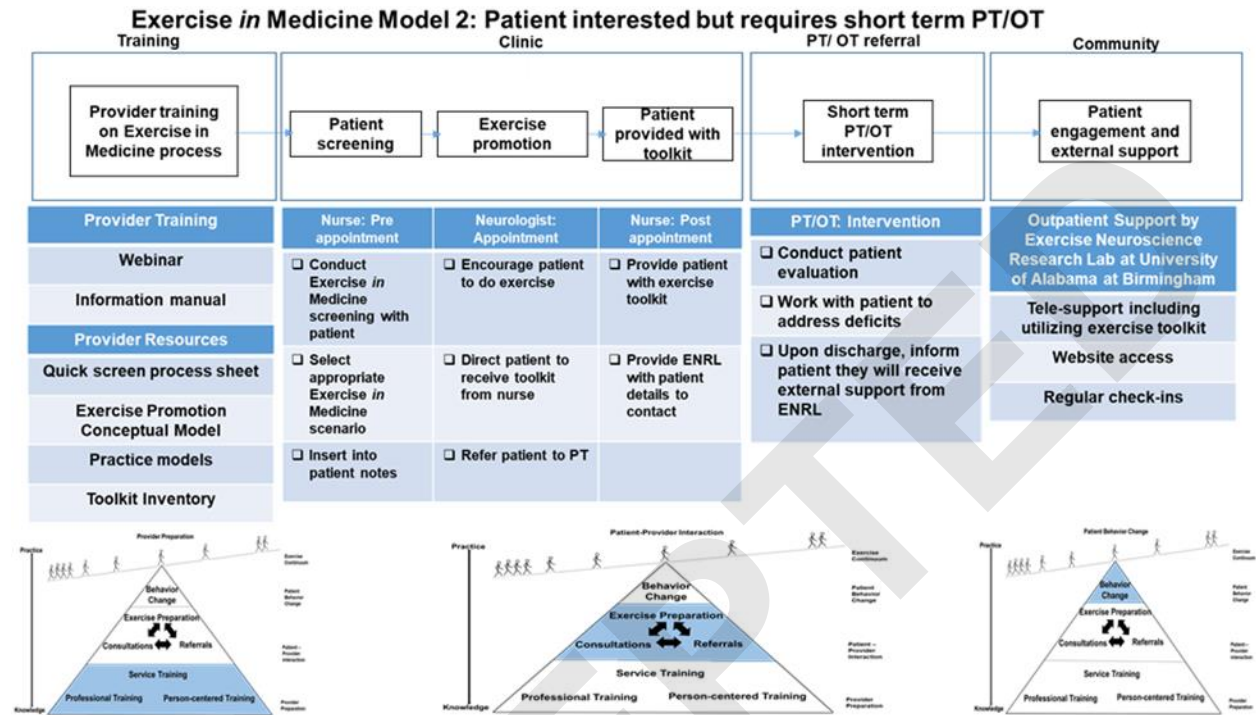


Table: Summary of challenges and possible solutions for the promotion of exercise in persons with MS by neurologists as the primary agents of behavior change.

Challenge(s)	Solution(s)
<ul style="list-style-type: none"> • Complex nature of comprehensive MS care 	<ul style="list-style-type: none"> • Neurologists can introduce beneficial effects of exercise to patient during an initial consultation, and can facilitate more in-depth conversations about exercise with other members of comprehensive MS care team • Neurologists can partner with physical or occupational therapists who can deliver exercise-related rehabilitation
<ul style="list-style-type: none"> • Exercise promotion is not primary concern of neurologists • Neurologists cite lack of time for exercise promotion 	<ul style="list-style-type: none"> • Development of clinical toolkit for exercise promotion, tailored across the MS disability spectrum, accounting for patient insurance issues
<ul style="list-style-type: none"> • Neurologists lack resources for exercise promotion 	<ul style="list-style-type: none"> • Improved research efforts on knowledge translation and implementation science
<ul style="list-style-type: none"> • Comprehensive MS care models differ across geographic regions 	<ul style="list-style-type: none"> • Expansion of international, collaborative research on exercise promotion through neurologists using different models of clinical MS care across North America, Europe, and beyond.