

# Physical Activity in Individuals Newly Diagnosed With Multiple Sclerosis Through the Lens of the COM-B Model

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## ABSTRACT

**BACKGROUND:** Physical activity (PA) is a promising intervention for disease modification and symptom management in multiple sclerosis (MS); however, there is a lack of research focusing on PA behavior change interventions for persons newly diagnosed with MS. Such PA behavior change interventions should be developed based on a strong empirical foundation of understanding the behavior and its determinants (ie, what to target for changes to occur). To that end, this qualitative study examined factors explaining PA in persons newly diagnosed with MS and identified potential targets for future behavior change intervention development based on the Capability-Opportunity-Motivation-Behavior (COM-B) model.

**METHODS:** Twenty individuals diagnosed with MS within the past 2 years underwent one-on-one semistructured interviews using questions developed based on the COM-B model. Data were analyzed using reflective thematic analysis, and the identified themes were then mapped with the COM-B model.

**RESULTS:** Factors explaining PA in the study sample were identified across the COM-B components. The typical factors include knowledge and skills to sufficiently engage in PA with appropriate approaches, ability to adapt and navigate through new environmental and social difficulties after diagnosis, and motivation resulting from a combination of factors, such as outcome expectation, belief of capabilities, role/identity, reinforcement, and emotions.

**CONCLUSIONS:** The COM-B model was applied successfully in this study to understand PA behavior and identify potential targets for behavior change in individuals newly diagnosed with MS. Future behavior change interventions should consider addressing these factors to generate effective PA behavior change in this population.

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**M**ultiple sclerosis (MS) is an immune-mediated disease of the central nervous system affecting nearly 1 million adults in the United States,<sup>1,2</sup> with more than 10,000 new cases of MS in the United States yearly.<sup>3</sup> Worldwide, approximately 1 person is diagnosed as having MS every 5 minutes.<sup>4</sup> MS is characterized by inflammatory demyelination and transection of axons resulting in lesions in the brain, brain stem, and spinal cord.<sup>1</sup> The location and damage to the central nervous system results in mobility impairment, cognitive dysfunctions, fatigue, pain, anxiety, depression, and, ultimately, reduced participation in activities of daily living and quality of life (QOL).<sup>5</sup> Of note, MS onset occurs between ages 20 and 40 years,<sup>6</sup> but the current life expectancy is 75.9 years due to the effectiveness of disease-modifying therapies (DMTs) and the management of comorbidities.<sup>7</sup> Treatment with DMTs is prioritized for MS; however, treatment limitations such as cost, effectiveness based on MS type, and adverse effects<sup>8</sup> suggest that individuals with MS may live a lifetime with progressively worsening health outcomes and limited treatment choice. We believe that researchers should identify lifestyle approaches for managing MS symptoms and progression early after disease onset.

Physical activity (PA) is one of the most effective lifestyle behaviors for disease modification and symptom management in MS.<sup>9,10</sup> The benefits include improved physiological fitness and QOL, reduced symptoms, and delayed disease progression.<sup>11,12</sup> Premorbid PA levels have predicted disability progression in MS,<sup>13</sup> which reinforces the notion that early PA initiation might yield a physiological reserve that withstands the lifelong effects of MS.<sup>9</sup>

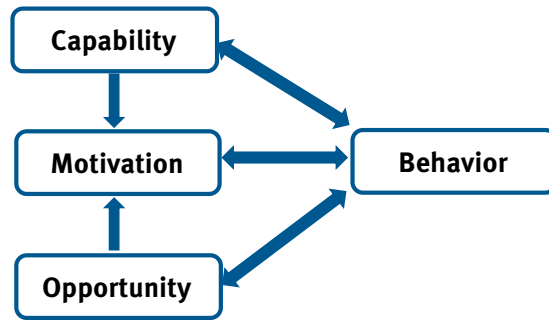
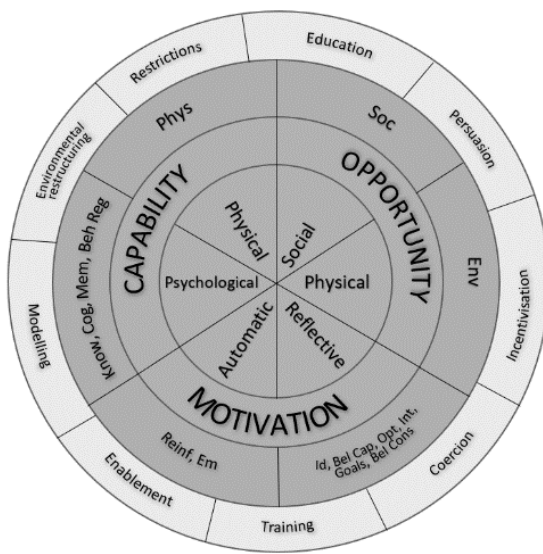
Nevertheless, there is a lack of research examining PA as a lifestyle approach in individuals newly diagnosed with MS (IND-MS). Theory-based PA behavior change interventions predominantly focus on individuals diagnosed with MS for approximately 7 years or longer. Individuals diagnosed with MS for less than 5 years have not been a focal population in this research.<sup>14</sup> This lack of priority for PA behavior change

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**FIGURE 1.** The Behavior Change Wheel (left), the Capability-Opportunity-Motivation-Behavior Model (top right), the Theoretical Domains Framework (middle right), and the Intervention Functions (bottom right)



**Theoretical Domains Framework:** Soc: Social influences; Env: Environmental context and resources; Id: Social/professional role and identify; Bel Cap: Beliefs about capabilities; Opt: Optimism; Int: Intention; Bel Cons: Beliefs about consequences; Reinf: Reinforcement; Em: Emotion; Know: Knowledge; Cog: Cognitive and interpersonal skills; Mem: Memory, attention, and decision processes; Beh Reg: Behavioral regulation; Phys: Physical skills.

**Intervention functions:** Education; Persuasion; Incentivization; Coercion; Training; Enablement; Modeling; Environmental restructuring; Restrictions.

Note: Adapted from Michie et al.<sup>21</sup>

interventions that include early MS participants could stem from the low impact of disability and minor need for lifestyle adjustments after diagnosis.<sup>14,15</sup> However, a small cross-sectional study of 118 participants with MS reported that 38% of those stopped engaging in PA soon after diagnosis.<sup>16</sup> Broadening our understanding of PA behavior and its determinants among IND-MS would provide a better road map for designing behavior change interventions for them.

Behavior change interventions based on theoretical frameworks are ideal to understand behaviors, identify what to change, and guide the intervention development process.<sup>17</sup> Using behavioral theories to design interventions may enhance the likelihood of behavior change,<sup>17,18</sup> and multiple studies regarding theory-based PA behavior change interventions in MS and Parkinson disease found positive effects for this approach.<sup>19,20</sup> One of the first steps in the behavior change intervention development process is identifying a suitable and comprehensive framework that best explains the target behavior.<sup>17</sup>

The Behavior Change Wheel (BCW) and Capability-Opportunity-Motivation-Behavior (COM-B) model provide a promising theoretical basis for understanding PA determinants in the context of IND-MS (FIGURE 1). The BCW, based on 19 behavioral theories and frameworks, is a practical and comprehensive framework to guide the design and evaluation of behavior change interventions.<sup>21</sup> The COM-B model is located at the core of the BCW, and consists of 3 components: *Capability*, *Opportunity*, and *Motivation*. This model posits that behavior is formed by the interaction of

these components (ie, sources of behavior). *Capability* is specified as the individual's psychological and physical ability, which usually comprises knowledge, necessary mental processes, and physical skills, to perform the target behavior. *Opportunity* refers to all external factors that enable or prompt the behavior. *Motivation* is defined as the brain processes for stimulating and navigating behavior, including intention, beliefs about capability and consequences, emotional reactions, desires, habitual processes, and analytical evaluations.<sup>22</sup> The COM-B model is further linked with the Theoretical Domains Framework (TDF), intervention functions, and behavior change techniques (BCTs) (Figure 1). The understanding of these theoretical connections is an important empirical foundation to guide future intervention development to facilitate PA behavior change in IND-MS based on understanding what behavior to change and how to change it.

To that end, this qualitative study asked, "Based on the COM-B model, what factors might explain PA behavior among IND-MS?" A novel endeavor, the findings of this study will allow a better understanding of PA behavior and guide the selection of intervention functions and BCTs to inform a tailored intervention package for promoting PA in IND-MS.

## METHODS

### *Philosophical Assumptions, Study Design, and Author Reflection*

This study was guided by ontological relativism and epistemological constructionism (ie, interpretivist paradigm). We

recognize the belief in multiple realities posited by relativist ontology. The impact of the authors on data collection, analysis, and interpretation is also acknowledged, consistent with constructionist epistemology.<sup>23</sup> Reflecting on the assumptions of this study, we believe that the PA experiences and perceptions of IND-MS could vary among participants; however, we seek more understanding regarding PA determinants in this subpopulation via shared knowledge and experiences. In addition, the research itself plays a vital role in constructing and shaping the understanding. Of note, the first author (TLTH) is a PhD candidate in rehabilitation science with a master's degree in public health and professional training in behavioral theories and qualitative research. As an international researcher who has more than 4 years of experience working with individuals with MS in the southeast United States, she brings an outsider perspective to the study, yet was able to ask in-depth questions. In addition, the other authors (WNN, EAB, RWM) are US citizens and experts in MS and PA research and provided additional contextual and cultural perspectives for analyzing and interpreting the data. The study used reflective thematic analysis (RTA) to explore the rich and in-depth data set and establish a fundamental understanding of PA determinants in this MS subpopulation, which could also inform PA promotion intervention design.

### Participants

The recruitment process is presented in **FIGURE S1**. The study purposefully recruited participants who were (1) diagnosed with MS within the past 2 years and (2) 18 years or older. The study flyer was distributed by the National Multiple Sclerosis Society across the United States. Interested participants contacted the research staff via email. The participants were screened and interviewed until there was no new information or patterns acquired through the course of interviewing. Of 60 potential participants who contacted the research staff, 39 were screened for eligibility, 10 did not meet the study criteria (ie, diagnosed with MS for >2 years), and 9 individuals declined to participate. The final sample included 20 participants, 16 women and 4 men, who were IND-MS (**TABLE 1**). The mean  $\pm$  SD age was  $38.5 \pm 9.8$  years (range, 24-64 years). Most participants reported having relapsing-remitting MS (90%) with a mean  $\pm$  SD disease duration of  $11 \pm 5.1$  months (range, 5-23 months) and being ambulatory without or with assistance (ie, walking with a cane). Participants mainly identified as White (95%), married (60%), and employed (60%).

### Study Procedure and Data Collection

The study was approved by the institutional review board of the University of Alabama at Birmingham. Data were collected online through semistructured, one-on-one interviews conducted between February 2022 and June 2022. This approach allowed us to recruit and collect in-depth data from participants with diverse experiences from multiple geographical regions. After agreeing to participate, participants received an information sheet describing the purposes and procedures of the study and a Zoom link to the

## PRACTICE POINTS



Physical activity (PA) behavior among individuals newly diagnosed with multiple sclerosis (MS) can be explained via the components of the Capability-Opportunity-Motivation-Behavior model.

It is important to provide newly diagnosed individuals with PA guidelines, disability-specific approaches, and behavioral regulation techniques to help them overcome mobility limitations, as well as new environmental and social changes, to foster PA engagement after MS diagnosis.

Researchers and health care providers could target the identified PA-influencing factors to develop behavior change interventions promoting PA for individuals newly diagnosed with MS. ■

interview. Verbal consent was obtained from each participant before conducting the interview, which lasted no longer than 2 hours (mean  $\pm$  SD duration,  $80.9 \pm 21.9$  minutes; range, 44-118 minutes). The interview questions (**TABLE S1**) were constructed based on the COM-B model. Raw data were transcribed verbatim by an external entity (Rev.com). Each audio recording was deidentified and assigned a unique study code before transcription.

### Data Analysis and Rigor Ensuring

In this study, qualitative data were analyzed using RTA, an approach that embeds the awareness, subjectivity, and reflexivity of the researchers into the exploration and development of patterns across the data set.<sup>24</sup> RTA allows for the application of both inductive- and deductive-oriented approaches, generating codes and themes that aligned with the COM-B components. The theoretical flexibility of RTA facilitates the application of comprehensive theoretical frameworks, such as the BCW and the COM-B model, to inform the interpretation of the results. This approach leads to a more nuanced understanding of the internal and external factors that explain the PA behavior of participants based on the COM-B model. The data analysis followed 6 phases of RTA. The first author (TLTH) listened to the audio recordings, read and reread the transcripts, took notes to become familiar with the data, and began searching for potential patterns and meanings. She took

**TABLE 1. Participant Characteristics**

Age, y	Sex	Race	Location	Marital status	Employment	Disease type	Disease duration, mo
38	M	White	Oregon	Married	Employed	RRMS	15
32	F	White	California	Married	Employed	RRMS	8
43	F	White	Oregon	Married	Unemployed	RRMS	12
24	F	White	New York	Single	Unemployed	RRMS	19
31	F	White	New York	Partnership	Employed	RRMS	18
32	F	White	New York	Married	Employed	RRMS	18
41	F	White	California	Married	Unemployed	RRMS	7
41	F	White	California	Married	Unemployed	RRMS	11
47	F	White	Oregon	Married	Unemployed	RRMS	6
64	M	White	Washington	Married	Retired	PPMS	8
40	M	White	Washington	Married	Employed	RRMS	12
26	F	White	New York	Single	Employed	RRMS	23
42	F	White	New York	Single	Employed	RRMS	10
48	F	White	California	Married	Unemployed	RRMS	12
33	F	White	California	Married	Unemployed	RRMS	9
28	F	White	New York	Single	Employed	RRMS	10
26	F	White	New York	Single	Employed	RRMS	10
45	F	Black	California	Single	Employed	RRMS	5
49	M	White	Ohio	Married	Employed	PPMS	6
40	F	White	Florida	Partnership	Employed	RRMS	5

F, female; M, male; PPMS, primary progressive multiple sclerosis; RRMS, relapsing-remitting multiple sclerosis.

notes regarding analytic ideas, potential codes, patterns, thoughts, and emotions emerging while reading the transcriptions. Next, she independently coded and assigned initial code names regarding PA experiences and positive and negative determinants for the cohort. The codes were then collapsed into initial themes and subthemes by compiling clusters of codes that overlapped, interacted, or reflected a core topic or concept that could meaningfully address the research question and potentially link to the COM-B components and TDF domains. All the authors then reviewed and discussed the codes and themes based on the descriptions of codes, themes, and subthemes generated by the first author. Finally, the authors defined, named, renamed, and realigned the identified themes with the COM-B components and TDF domains before reporting the findings.

**RESULTS**

We briefly describe the PA behavior of the participants via 3 themes: (1) difficulty engaging in PA since MS diagnosis, (2)

engaging in light to moderate levels of PA after a break, and (3) regularly engaging in PA after MS diagnosis. We also present the factors explaining participant PA behavior via the 3 COM-B components: *Capability, Opportunity, and Motivation*.

**PA Behaviors of IND-MS**

The first study question was, “Can you tell me about your current experiences with PA?” The themes of PA patterns after MS diagnosis and representative quotes are presented in **TABLE S2**. The main types of PAs that participants engaged in are presented in **TABLE S3**. Many participants mentioned having difficulty engaging in PA after their diagnosis because of persistent negative health outcomes. Others reported engaging in light to moderate PA after taking a break after diagnosis. These participants had experienced a short period of walking difficulty due to symptoms yet recovered and adjusted their behavior due to new body limitations. Some participants reported regularly engaging in PA, either structured exercise or lifestyle activities. These

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participants were still physically active and had experienced minor or no symptoms.

### **Factors Explaining PA Behavior Based on the COM-B Model**

Study subthemes identified from the data analysis were mapped to the COM-B components and TDF domains and are presented in brackets and parentheses in the text (COM-B [TDF]) and in **TABLE S4**. This mapping exercise revealed that the factors hindering and/or facilitating PA touched on all the COM-B components. Many key subthemes reflect the dichotomous facilitators or hindrances to PA, depending on the participants and their contexts. For example, regarding physical ability, participants with more severe symptoms and physical limitations perceived barriers to PA; however, it was easier for other participants with mild symptoms or no symptoms to be physically active.

#### **Capability**

*Capability* is the physical and psychological ability to perform a behavior.<sup>22</sup> Through RTA, 4 key subthemes explaining PA in IND-MS were identified under this COM-B component: (1) knowledge and perception of PA, (2) awareness of new physical limitations, (3) challenges in PA self-monitoring, and (4) impact of fluctuating symptoms and mobility limitations.

**Knowledge and perception of PA (psychological capability [knowledge]).** Participants' knowledge and perception of PA were both barriers and facilitators to PA engagement after diagnosis. Participants reported a lack of information on appropriate PA guidelines and approaches for their diverse symptoms and disability statuses as IND-MS. This prevented them from timely initiation of and safe engagement in PA. In addition, lack of knowledge of PA and mild early MS symptoms could result in making PA a lower priority compared with other matters after diagnosis, including learning about MS symptoms and medications and family duties. On the other hand, participants reported that sufficient awareness of the potential benefits of PA for MS management facilitated PA engagement. Knowledge of PA benefits in MS could raise participants' expectations and motivation to participate in PA.

**Awareness of new physical limitations (psychological capability [memory, attention, and decision processes]).** This subtheme reflects the negative or positive impact of body awareness on the participants' PA engagement decision-making process. Some revealed that they were unaware of their body limits during PA engagement, intentionally pushed through their symptoms to keep up with others, or self-denied the diagnosis. On the contrary, other participants became more aware, embraced their new physical limitations, and were more willing to adjust to safer PA levels.

**Challenges in PA self-monitoring (psychological capability [behavior regulation]).** Participants reported that the ability to overcome challenges in self-monitoring PA behavior

could either hinder or facilitate PA engagement after MS diagnosis. Some participants perceived difficulties (eg, they were unfamiliar with or uninterested in using journaling or smart devices to monitor PA); some said that their PA levels were too low to monitor. In contrast, others felt that being able to monitor PA behavior and develop strategies to overcome related challenges increased their motivation and confidence in PA engagement.

**Impact of fluctuating symptoms and mobility limitations (physical capability [physical skills, strength, and stamina]).** This subtheme reflects the impact of the perceived illness and its limitation on participants' PA engagement. After diagnosis, participants typically experienced difficulty engaging in PA due to the influence of diverse MS symptoms, including fatigue, walking and balance problems, and adverse effects from medications. Conversely, participants with mild symptoms or no adverse effects from medication experienced a low effect on PA engagement after diagnosis.

#### **Opportunity**

*Opportunity* is defined as the conditions in the physical and social environments for the behavior to occur.<sup>19</sup> Two main subthemes that negatively and/or positively explain PA behavior under this component were identified: (1) environmental resources and (2) interpersonal support in PA engagement.

**Environmental resources (physical opportunity [environmental context and resources]).** Participants identified new environmental obstacles due to MS-related physical impairments after diagnosis as important determinants of their PA participation. These obstacles included a lack of space, busy areas, or uneven ground, all of which could pose risks and difficulties for daily activities, particularly walking. Time management between PA and other important life responsibilities, such as work, family, and medical appointments, was also identified as a barrier to PA participation in early MS. Occupation features (eg, a desk job) and lack of financial stability to access appropriate PA options (eg, gym membership, equipment) were also barriers. On the contrary, access to a PA-conducive environment, financial stability, and time for PA were identified as important factors that could positively influence PA engagement. Some participants also said that online resources helped provide knowledge on PA benefits in those with MS and appropriate PA approaches for their disability levels.

**Interpersonal support in PA engagement (social opportunity [social influences]).** The subtheme highlights the contrasting effects of social support in early-stage MS. The lack of interpersonal support, such as from health care providers and MS peers, was identified as a barrier to PA engagement after diagnosis. Participants reported receiving insufficient information about or support for PA in MS from their neurologists. However, other participants emphasized that interpersonal support from family, friends, and health care providers,

including information provision and encouragement, could facilitate PA engagement. Furthermore, observing severe MS outcomes among other persons who live longer with MS caused stress and fear in the early stages of MS. Participants suggested that support from peers with MS at the same stage could be more helpful in overcoming denial and fear and facilitating their learning about PA in early MS.

### Motivation

Motivation is defined as reflective and automatic processes involving self-conscious planning, evaluations, desires, needs, impulses, and reflex responses.<sup>22</sup> Six subthemes that could have positive and/or negative effects on PA after diagnosis were identified under Reflective and Automatic Motivation: (1) perceived physical limitations impact confidence in PA engagement, (2) setting realistic PA goals in early MS, (3) self-identity in PA engagement, (4) positive outlook, (5) outcomes of PA engagement, and (6) role of emotions in PA engagement.

**Perceived physical limitations impact confidence in PA engagement (reflective motivation [beliefs about capabilities]).** This subtheme also captures the contrasting impact of the perceived limitations on the PA behavior of IND-MS. Participants experienced frustration and low confidence in PA engagement due to the perceived uncertainty of their symptoms and adverse events. On the contrary, other participants reported that perceived mild symptoms and limitations at early-stage MS facilitated PA behavior.

**Setting realistic PA goals in early MS (reflective motivation [goals and intentions]).** Participants perceived that new physical function limitations caused difficulty in setting and achieving goals. Others suggested that setting goals might limit their ability when they aimed to test their new physical limitations. However, other participants expressed that setting appropriate PA goals helped them improve PA and MS outcomes after diagnosis.

**Self-identity in PA engagement after diagnosis (reflective motivation [social/professional role and identity]).** This subtheme portrays 2 images of role/identity that facilitated or hindered PA for the participants. Some participants reported that their MS diagnosis confirmed their identity as physically inactive individuals due to the impact of the disease: There was low motivation for behavior change. Other participants self-identified as being physically active before diagnosis so they were motivated to continue to engage in PA to maintain this identity and their “normal” lives.

**Positive outlook (reflective motivation [optimism and belief of consequences]).** Participants underscored the positive impact of accepting their new status as someone with MS on their belief in positive outcomes of PA engagement. Some expressed an acceptance of their new health condition with an optimistic attitude. This acknowledgment positively influenced

PA engagement because participants felt more confident in their body's ability to adapt to the physical limitations and maintain PA engagement.

**Outcomes of PA engagement (automatic motivation [reinforcement]).** This subtheme highlighted the positive and negative impacts of the outcomes of PA engagement that reinforce PA behavior in IND-MS. Some participants reported that discomfort after PA engagement and fear of disease exacerbation were barriers to continuing PA participation. Others reported that the experiences of improved symptoms and functions resulted in high motivation for PA behavior after MS diagnosis.

**Role of emotions in PA engagement (automatic motivation [emotions]).** Some participants said that refusing to accept their MS diagnosis and depression symptoms prevented timely changes in their PA behavior. Other participants emphasized several feelings positively influencing their PA behavior after diagnosis. For example, they felt good physically and mentally, as well as had a sense of accomplishment and freedom after engaging in PA. Furthermore, the fear of disease progression and the potential of long-term disability motivated these participants to be more physically active in early MS.

## DISCUSSION

Current research suggests that the early application of PA after MS diagnosis might yield benefits for managing MS and improving QOL and comorbid health outcomes.<sup>25</sup> However, promoting PA behavior change in IND-MS necessitates an in-depth understanding of PA behavior and establishing factors that can be targeted to facilitate behavior change. Herein, we used the COM-B model to identify factors explaining PA behavior that can be used to develop interventions for IND-MS. Participants identified factors in all COM-B components that explain PA behavior after MS diagnosis. Many participants were aware of the benefits of PA for MS and were likely motivated to reengage in PA after diagnosis. However, participants expressed difficulties in being physically active after diagnosis due to the lack of knowledge and skills regarding PA guidelines, recommendations, and approaches appropriate for their current disability level at the early stages of MS; the impact of MS symptoms on physical and mental health; and the difficulty of navigating environmental and social opportunities for PA in context after diagnosis.

The findings indicate that the study cohort is aware of the benefits of PA, yet there was also a lack of knowledge about PA guidelines and appropriate PA approaches specific to those in the early stages of MS. One frequently mentioned was insufficient information from health care providers. With a lack of knowledge about PA in early MS, the diverse and unpredictable effects of new symptoms and physical limitations after diagnosis prevented the participants from reengaging in safe and sufficient levels of PA. These findings

are consistent with previous qualitative research in adults with MS that reported that not knowing appropriate exercises for levels of physical ability and lack of PA information from health care providers were the perceived barriers to PA and exercise in individuals with MS.<sup>26-28</sup> Therefore, the provision of more knowledge on the benefits of PA in MS and appropriate PA approaches based on physical ability after diagnosis would be helpful to equip individuals and motivate behavior change. Participants further revealed that knowing the skills to regulate PA behavior, set goals, and cope with limitations is extremely important to facilitate engagement after MS diagnosis. The results imply that more education and training regarding PA guidelines, approaches, benefits, and behavioral regulatory skills are needed. Consequently, outcome expectations, beliefs in capability, and motivation to engage in PA could also be promoted.<sup>21</sup>

Social influences and environmental context were also relevant to PA engagement among IND-MS. According to the participants, support from family and friends and information provided by health care providers and peers with MS helped them stay physically active during the chaotic period after diagnosis and increased opportunities for PA engagement. Particularly, social support might help participants develop strategies to improve time management and overcome some environmental barriers to suit their mobility limitations. Previous research has also found that the influences of social support on PA engagement are common among IND-MS.<sup>29</sup> Therefore, providing strategies to consolidate interpersonal support could be important to foster PA behavior change in this population.

The findings identify key targets for behavior change for promoting PA in persons newly diagnosed across 3 COM-B components and the TDF domains of knowledge; memory, attention, and decision process; behavior regulation; physical skills, strength, and stamina; environmental context and resources; social influences; goals; intentions; beliefs of capabilities; reinforcement; and emotions. These results align with a quantitative study identifying COM-B determinants of PA in adults with MS in the United States, except for knowledge.<sup>30,31</sup> We believe that these domains reasonably reflect the circumstances of IND-MS because the awareness about PA in MS and the opportunities for PA with new health conditions are significant. According to the identified TDF domains and intervention functions, potential interventions could target PA behavior change for those new to their diagnoses in the areas of education, training, and enablement. For instance, strategies targeting PA capability could include providing information about health consequences of physical inactivity and benefits of PA in MS from credible sources or behavioral regulation skills (eg, self-monitoring, goal setting, action planning, problem-solving). Other techniques could be applied to enhance opportunity and motivation to facilitate behavior change, including reviewing and giving feedback about PA behavior, verbal persuasion about capability, and adding objects to or restructuring the environment.<sup>21</sup> Future behavior

interventions are warranted to apply the identified intervention functions and BCTs to guide the development process to tailor PA behavior change interventions among IND-MS.

### Strengths and Limitations

One of the strengths of this study is the comprehensive approach used to explore the qualitative data, which allowed researchers to identify theory-based factors explaining PA behavior in IND-MS. By systematically applying the COM-B model, the TDF framework, and the BCW, we were able to pinpoint potential intervention targets that could be used for developing effective PA behavior change interventions for this cohort. As such, this study provides valuable qualitative evidence regarding the experiences and determinants of PA behavior in IND-MS.

Limitations of the present study should be acknowledged. The study participants were predominantly White individuals with relapsing-remitting MS and mainly located in 6 states. Given that experiences of individuals with MS may vary across cultural and geographic areas, future research should examine PA experiences and determinants of IND-MS on a wider scale. Furthermore, using Zoom interviewing has limitations, including potential distractions for participants and technical difficulties.<sup>32</sup> To minimize the impacts of these disadvantages, the interviewer discussed potential remedies with the participants before the interview, including scheduling a specific time and quiet place for the interview and setting up a backup plan in case of weak internet access.

### CONCLUSIONS

This qualitative study identified potential determinants of PA behavior among IND-MS. The results highlight multiple target areas for behavior change across the COM-B components and TDF domains: improving knowledge about PA guidelines and appropriate approaches to PA engagement, providing knowledge and skills on behavioral regulation for safe and sufficient PA, raising acceptance and confidence in capability to perform PA after diagnosis, and facilitating environmental and social supports. Consequently, potential BCTs could be identified as a foundation for future PA behavior change intervention development. Future studies could investigate the feasibility and effects of these strategies and interventions on improving PA in IND-MS. ■

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