

Research

Best Practices for Adapting and Delivering Community-Based Yoga for People with Traumatic Brain Injury in the United States and Canada

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Abstract

Emerging benefits of yoga for traumatic brain injury (TBI) suggest that broader accessibility to community-based yoga programming is important. This cross-sectional, mixed methods study sought to identify best practices for adapting and delivering community-based yoga to people with TBI. An online survey was sent to 175 yoga teachers trained to teach LoveYourBrain Yoga, a community-based, 6-week, manualized program for people with TBI and their caregivers. The survey instrument included open- and closed-text questions assessing teachers' perspectives on the most and least helpful adaptations for asana, meditation, pranayama, and group discussion, and on the LoveYourBrain Yoga training and support. Responses were analyzed using descriptive statistics and qualitative content analysis. Eighty-six teachers (50%) responded. Best practices for adapting yoga for TBI revealed six themes: (1) simple, slow, and repeated; (2) creating a safe space; (3) position of the head and neck; (4) demonstration; (5) importance of props; and (6) special considerations for yoga studios. Three themes emerged for yoga program delivery: (1) structured yet flexible; (2) acceptability of compensation; and (3) time management. Eighty-nine percent of teachers reported that the program manual was very/extremely helpful, yet nearly half (49%) adapted the manual content often/always. To deliver community-based yoga services for TBI, we recommend an environment with props, low light and noise, and sufficient space, along with the facilitation of consistent instruction with a manual that allows for flexibility. We recommend that yoga teachers have skills in physical modifications for the head and neck; slow, simple, and repeated cueing to facilitate cognitive processing; managing challenging behaviors through redirection techniques; and promoting safety through inclusivity, compassion, and personal agency.

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Introduction

In the United States, 2.8 million people experience a traumatic brain injury (TBI) each year,¹ and as many as 5.3 million people are living with TBI-related disability.²⁻⁴ A TBI is a chronic health condition defined by a range of physical, emotional, and behavioral symptoms and can vary in severity from mild (including concussions) to severe.⁵ Across all severity levels, people with TBI often experience impairments to their cognition (e.g., attention, memory, executive functions),⁶ psychosocial health (e.g., anxiety, depression),⁷ and physical functioning (e.g., balance, gait, overall weakness); these effects can compromise functional independence in daily living and impede participation in employment, recreation, and community activities.⁸ Family members also experience adverse effects from the demands of serving in a caregiving role, including anxiety, depression, and poor physical health.⁹

Given the chronic nature of TBI, individuals who experience this injury require a continuum of care that supports their transition to living in the community.¹⁰ A Cochrane Review found that patients with brain injury discharged from inpatient rehabilitation significantly benefit from access to community-based services appropriate to their needs.¹¹ However, people with TBI often experience difficulty identifying and accessing TBI-specific community services, a problem that can significantly undermine their quality of life.^{12,13}

The LoveYourBrain Foundation has sought to address the lack of holistic community-based services by offering a free, 6-week yoga and psychoeducation program for groups of people with TBI and caregivers in yoga studios across the United States and Canada.¹⁴ Yoga, which encompasses physical movement (*asana*), breathing exercises (*pranayama*), meditation practices, and moral principles,^{15,16} has been shown to improve outcomes for people with TBI, including physical functioning,¹⁷ emotional regulation,¹⁸ psychological well-being,¹⁹ and quality of life.²⁰ Each weekly class in the LoveYourBrain Yoga program is designed to include multiple components: 10 minutes of pranayama to enhance nervous system regulation and attention control; 45 minutes of gentle yoga to improve strength, flexibility, and balance; 15 minutes of guided meditation to enhance attention control, mood, and nervous system regulation; and 20 minutes of facilitated discussion with psychoeducation to build community connection and skills in resilience. A recent study evaluating the feasibility, acceptability, and effectiveness of the LoveYourBrain Yoga program in 45 yoga studios in 18 states and 3 Canadian provinces found high satisfaction and significant improvements in quality of life, resilience, positive affect and well-being, and cognition among 705 people with TBI.²¹

The emerging benefits of yoga for TBI suggest that broader accessibility to community-based yoga programming has potential to facilitate ongoing rehabilitation and community integration. However, best practices for adapting and delivering yoga services for people with TBI in community settings remain understudied. Although some principles for adapting yoga for other neurological conditions (e.g., stroke,²² multiple sclerosis, Parkinson's Disease²³) and trauma (e.g., posttraumatic stress disorder [PTSD]²⁴) may apply to TBI, the complexity and heterogeneity of symptoms in TBI require separate investigation to understand best practices for safely adapting yoga for this population.

The few studies that have identified important TBI-specific modifications for yoga (e.g., avoiding forward folds, minimizing movement of the head, using landmarks instead of “left” and “right” direction cues, slow and repeated instruction, ignoring/reorienting misbehavior, using props for transitions)^{14,17,25} and community-based yoga programming (e.g., travel distance, psychosocial environment, scheduling, free of cost)¹⁴ have focused on clinicians' and patients' perspectives, which likely differ from the perspective of yoga teachers with specific training and expertise in how to effectively offer yoga for TBI in community settings. Thus, there is opportunity to leverage the large network of yoga teachers implementing the LoveYourBrain Yoga program to better understand their perceptions of best practices for safely adapting yoga for TBI and the barriers and facili-

tators to implementing a large-scale community-based yoga intervention for this underserved population.

This cross-sectional, mixed methods study sought to identify yoga teachers' perceptions of the best practices for adapting and delivering yoga for people with TBI in communities across the United States and Canada through the LoveYourBrain Yoga program. Such insights will have important implications on the design and implementation of yoga programming to support ongoing rehabilitation and community integration for people affected by TBI and other specialized populations more broadly.

Methods

The study received approval from the Dartmouth College Committee for the Protection of Human Subjects. We adhered to the Strengthening the Reporting of Observational Studies in Epidemiology standards.²⁶

Study Design and Participants

This cross-sectional, mixed methods study collected both quantitative and qualitative data concurrently via an online survey. Qualitative data were collected to contextualize and provide a richer understanding of the quantitative data. Individuals were eligible to participate in this study if they were 18 years or older, comfortable reading and writing in English, had been trained by the LoveYourBrain Foundation to offer the LoveYourBrain Yoga program, and consented to participate in the study.

LoveYourBrain Yoga Program

Since 2015, the LoveYourBrain Foundation has implemented the LoveYourBrain Yoga program, a free, 6-week, community-based yoga program for groups of individuals with TBI and their caregivers. The LoveYourBrain Foundation partners with yoga studios across the United States and Canada and trains yoga teachers to offer this program, with specific goals of promoting community integration and resilience. Each program includes 7 to 13 students and is offered on a quarterly basis. Yoga teachers are eligible to become partner teachers if they have a minimum of 200 hours of yoga teacher training; experience teaching gentle yoga, meditation, and pranayama; experience or a strong interest in teaching people with TBI and physical and/or cognitive limitations; and yoga teacher liability insurance. Each program is taught by a lead yoga teacher and an assistant yoga teacher whom (at the time of this study) the LoveYourBrain Foundation pays \$50 and \$25 per class, respectively. To facilitate teachers' preparation and enhance teaching fidelity, LoveYourBrain requires that each teacher submit an audiorecording of themselves mock teaching the first class and then provides constructive feedback.

LoveYourBrain also schedules mentorship calls with each teacher after the first, fourth, and final classes to provide support and to workshop challenges during program delivery.

A yoga teacher who is also a Certified Brain Injury Specialist and expert in health services research leads the 18-hour training. The training includes both didactic and experiential learning components designed to increase trainees' knowledge around neuroanatomy, neurophysiology, and neuroplasticity; TBI causes, consequences, and rehabilitation strategies; and TBI-specific modifications for asana, meditation, pranayama, and facilitated group discussion. Trainees attend lecture and participate in role playing to build skills around effectively delivering the LoveYourBrain Yoga program curriculum. The curriculum (available from the authors on request) is outlined in a manual that teachers from partner studios use to guide each class. Each class consists of asana, meditation, pranayama, and psychoeducation in the form of guided group discussion. More information about the development and content of the LoveYourBrain Yoga program curriculum has been published elsewhere.^{14,21}

Recruitment

Participants were recruited via an email list of 175 yoga teachers who had been trained to offer the LoveYourBrain Yoga program from 2015 to 2018 and previously consented to receive emails about opportunities related to the yoga program. We sent email invitations that included information about the purpose of the study and a link to the survey. Prospective participants were first presented with an information sheet and asked to provide informed consent before continuing to the survey. Three follow-up emails were sent to recruit further participants until saturation was achieved. Recruitment was conducted and data were collected for 3 weeks in February 2019.

Measures and Data Collection

We developed an online survey in Qualtrics that comprised both closed- and open-text responses. Participants were first oriented to the purpose of the survey with the opening statement, "We want to learn about the 'best practices' for adapting yoga, meditation, and pranayama for TBI. This way, we can better prepare other yoga teachers to make their classes more accessible for this population." Subsequently, participants were asked to respond to separate questions about what they found the most helpful to enable students to successfully practice asana, meditation, pranayama, and group discussion, respectively. They were also asked to respond to what they found the least helpful in each of these areas.

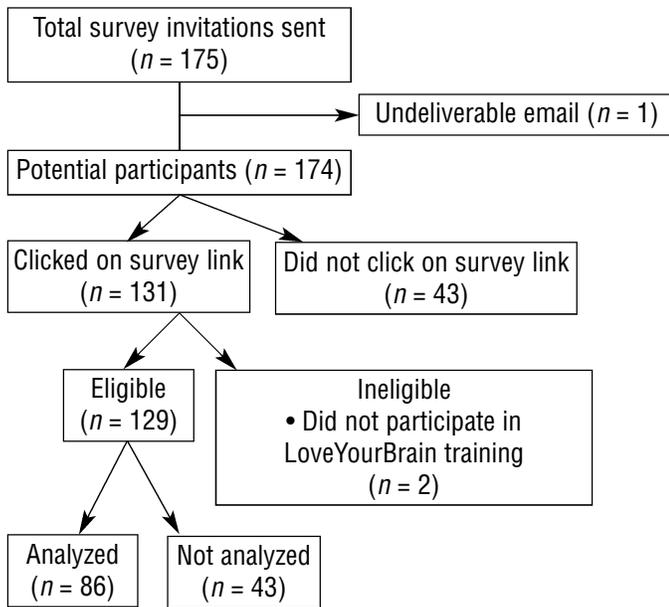
Then, participants were oriented to the second aim of

the survey with the opening statement, "We also want to learn about the 'best practices' for delivering yoga service programming for the TBI community." Subsequently, they were asked to respond to closed- and open-text questions related to the perceived helpfulness of the training, infrastructure, compensation, and technical support provided by the LoveYourBrain Yoga program. Open-text questions were used to provide further elaboration on closed-text answers. For example, participants were first asked to respond to the question, "How helpful or unhelpful have you found the manual as a tool for guiding your classes?" Seven response options (*extremely, very, moderately, slightly, not at all, not applicable—I chose not to use the manual when I taught the classes, and not applicable—I have not taught the program yet*) were followed by an open-text question that asked participants to please explain their answer in greater detail. At the end of the survey, brief information on sociodemographic characteristics (age, sex, educational attainment, ethnicity, race,²⁷ and geographic region of practice), yoga training background (e.g., date of certification, type[s] of certification[s]), and specialized yoga teaching experience (e.g., clinical populations) were also collected. The survey was pilot tested for clarity and comprehension.

Analytic Strategy

We used Stata (version 15.0) to analyze quantitative data using descriptive statistics. We used Dedoose (version 8.2.14) to analyze open-text responses using inductive content analysis, a qualitative content analysis approach that classifies narrative text into broad categories or themes.²⁸ We intentionally convened a research team with distinct perspectives and qualifications, including a researcher with expertise in public health and previous experience participating in the LoveYourBrain Yoga program as a TBI survivor (NC); a researcher with expertise in nonprofit program administration for people with brain injury (SZ); and a researcher with expertise in survey methodology, qualitative research, and designing, teaching, and evaluating yoga interventions for people with neurological conditions, including the LoveYourBrain Yoga program (KZD). The research team met to code six initial transcripts and created a preliminary codebook to ensure consistency in the interpretation of the data. Subsequently, one researcher (NC) coded all the transcripts, and a second researcher (SZ) coded a subset. The research team met periodically to review, discuss, define, and refine candidate themes. Throughout data collection, the coding structure and emergent themes and subthemes were iteratively expanded based on emerging patterns across the dataset. To enhance the trustworthiness of our qualitative data analysis and interpretation, we maintained an audit trail to keep notes about decisions made during these processes.²⁹

Figure 1. Flow Diagram of Study Participants



Results

Participant Characteristics

Of the 175 teachers who were contacted, 174 had valid email addresses, 131 clicked on the study link, and 129 met inclusion criteria. Eighty-six people provided a response to the first question (Figure 1), which resulted in a 50% response rate.

The majority of participants were female, White, and ranged in age from 25 to over 65 years old (Table 1). Yoga teaching qualifications ranged from 200 to 1,300 hours of accumulated trainings. Nearly a quarter of teachers had more than 10 years of experience teaching yoga. Teachers had participated in the LoveYourBrain Yoga 18-hour training in 2019 (*n* = 1), 2018 (*n* = 35), 2017 (*n* = 30), 2016 (*n* = 14), and 2015 (*n* = 1). Prior to completing the LoveYourBrain Yoga training, 35% had previous experience teaching yoga to people with TBI, and 58% had experience teaching other clinical populations. Overall, participants rated the quality of the 18-hour training a median of 9 out of 10 (range 7–10), and a majority (78%, *n* = 64) reported that they felt “very prepared” or “extremely prepared” to teach yoga adapted for TBI upon completion. Teachers commonly reported that teaching in the LoveYourBrain Yoga program had increased their awareness of the “invisible injury” that is brain injury and enhanced their level of empathy. For example, some teachers mentioned that they are now more attentive to room stimuli and conscious that there could be individuals with TBI present in their other classes, and so have begun integrating TBI-specific modifications to ensure accessibility.

Table 1. Participant Characteristics and Teaching Experience (*n* = 86)

Characteristic	<i>n</i> (%) ^a
Sex	
Female	73 (92)
Male	6 (8)
Age (y)	
25–34	25 (29)
35–44	28 (33)
45–54	21 (24)
≥ 55	12 (14)
Education	
Less than bachelor’s degree	15 (19)
Bachelor’s degree in college (4-year)	33 (41)
More than bachelor’s degree	32 (40)
Race	
White	74 (93)
Black or African American	1 (1)
American Indian or Alaska Native	1 (1)
Two or more	2 (2.5)
Other	2 (2.5)
Ethnicity	
Non-Hispanic	74 (93)
Hispanic	6 (7)
Geographic region of practice	
U.S. Northeast	23 (29)
U.S. Midwest	18 (23)
U.S. South	11 (14)
U.S. West	20 (25)
Canada	7 (9)
Experience teaching yoga (y)	
< 5	26 (32)
5–10	35 (44)
> 10	19 (24)
Total training hours	
200–300	42 (52)
500	24 (30)
700–800	7 (9)
≥ 1,000	7 (9)
Previous experience teaching people with TBI	28 (35)
Previous experience teaching other clinical populations	46 (58)

^aNumbers differed across analyses due to occasional missing data. Sample sizes ranged from 79–86.

TBI = traumatic brain injury.

I now offer several of the modifications I learnt for teaching people with TBIs in my regular classes, as everyone benefits from accessibility. I am more aware of students coming with their own stories, challenges, etc., that they may not even share with us, but we need to be mindful of. I think overall it has made me more compassionate, open-minded, and made me appreciate the power of community even more. [ID 119, 25–29 years of age, 5–10 years teaching experience, 200 hours of training]

Best Practices for Adapting Yoga for TBI

After reaching saturation, the following six themes emerged related to best practices for adapting yoga for TBI: (1) simple, slow, and repeated; (2) creating a safe space; (3) position of the head and neck; (4) demonstration; (5) importance of props; and (6) special considerations for yoga studios. Table 2 summarizes recommendations of best practices by theme.

Simple, Slow, and Repeated

Nearly all teachers commented on the importance of communicating through simple, clear, and concise language. For example, one teacher shared the importance of using “empowering cues with clear, simple language. It works best to avoid the poetic, flowery language that can sometimes be heard in yoga classes. Especially when referencing the body, e.g., ‘top of the head’ vs. ‘crown’” [ID 20, 30–34 years of age, 5–10 years teaching experience, 700 hours of training]. Other strategies for simplifying language included using landmarks instead of “left” and “right,” which teachers perceived were commonly confused by students, and avoiding the use of Sanskrit when possible to avoid confusion. As one teacher explained, “I tend to use more simple instruction and create spatial awareness with reference points” [ID 20]. Most teachers noted the importance of slower pacing and repetition of cues alongside slow movement to allow students to focus on the sensations of their bodies. One teacher commented on pace and tone by sharing that “a steady and calm voice leading the meditation, with ample pauses, helped keep everyone present . . . yet [allowed] room to process what was just said and follow the verbal instruction” [ID 123, 45–49 years of age, < 5 years teaching experience, 1,000 hours of training]. Teachers emphasized the value of slow movement to facilitate interoception and minimize cognitive fatigue from processing too much information.

Slowing each movement and instruction down and teaching small parts with repetition, rather than entire sequences. For example, introducing puppy pose as its own thing, separate from any sequence that it is usually a part of, and letting people slowly adjust to the feeling of the pose, breathing in the pose, settling and

Table 2. Summary of Recommendations of Best Practices for Adapting and Delivering Community-Based Yoga to People with TBI

Theme	Recommendations
Adapting yoga for TBI	
Simple, slow, and repeated	<ul style="list-style-type: none"> • Use clear, single-step instructions. • Use slow, mindful pacing. • Use concrete references for body parts (e.g., “top of the head” instead of “crown of the head”). • Use slow, step-by-step transitions between poses. • Use landmarks (e.g., “clock wall”) for directions instead of “right” and “left.” • Include repetition of movements and sequences. • Avoid offering too many options for modifications. • Avoid use of Sanskrit.
Creating a safe space	<ul style="list-style-type: none"> • Use encouraging, invitational language that supports agency and self-compassion (e.g., “do what feels right for you”). • Emphasize interoceptive awareness (e.g., “notice what sensations are most present”). • Give permission to take a break, stop, or continue with movement (e.g., “ask yourself if what would feel most supportive for you is to continue with rest or to continue with movement. Listen deeply from your caring heart. Honor what you need . . .”). • For group discussion, have students to sit in a circle. Empower them to listen or to speak as participation, and positively acknowledge those who decide to share. Explain time-management expectations upfront.
Position of the head and neck	<ul style="list-style-type: none"> • Avoid or modify inversions that put pressure on the head and neck (e.g., downward dog, child’s pose, puppy pose), such as by using a prop under the head or under the body to minimize the decline. • Avoid or modify inversions when the head drops below the heart (e.g., forward folds), such as by placing hands on blocks in a halfway lift posture instead of hands to the floor. • Avoid or modify movement of the head to minimize exacerbation of vestibular symptoms.

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Table 2. *continued*

Theme	Recommendations
Adapting yoga for TBI	
Position of the head and neck	<ul style="list-style-type: none"> • Avoid or modify all-fours postures to minimize strain on the head, neck, and/or shoulders from whiplash. • Modify supine postures to support the head and neck by using a blanket, bolster, or side-lying alternative. • Limit or modify up-and-down movement by sequencing poses strategically (e.g., group all supine, all-fours, and standing poses) and by including one or more additional breaths midway through transitions to and from standing.
Demonstration	<ul style="list-style-type: none"> • Demonstrate poses before giving verbal instruction. • Mirror students. • Include two teachers so that one can demonstrate while the other provides verbal cues to accommodate different cognitive processing abilities.
Importance of props	<ul style="list-style-type: none"> • Ensure that many different props are available (e.g., chairs for people with vestibular challenges, blankets for under the head and knees, wall for balance, eye masks for blocking light, bolsters for elevating supine positions, blocks for transitions).
Special considerations for yoga studios	<ul style="list-style-type: none"> • Limit the amount of light by dimming lights, using blinds, facing students away from windows, and/or encouraging use of sunglasses. • Limit the amount of sound by avoiding music or only using soft instrumental music. • Have adequate temperature regulation and avoid warmer temperatures. • Ensure sufficient space between mats for students, props, service dogs, etc.
Program delivery	
Structured yet flexible	<ul style="list-style-type: none"> • Use a manual to offer a structured format while allowing flexibility to tailor to different groups' abilities. • For group discussion, have specific, positively worded questions to keep the conversation focused.

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Table 2. *continued*

Theme	Recommendations
Program delivery	
Acceptability of compensation	<ul style="list-style-type: none"> • Pay both a lead and assistant teacher for their time and unique contributions. • Manage teachers' expectations by acknowledging that time may be needed before and after class to answer questions from participants (e.g., about transportation issues).
Time management	<ul style="list-style-type: none"> • Use direct and compassionate communication about the expectation to arrive to class on time. • For group discussion, use redirection techniques to manage people who dominate conversation because of deficits in self-awareness and social awareness. • For group discussion, establish clear expectations up front that the teachers' role is a timekeeper who may need to interrupt people to ensure equal opportunities to participate.

TBI = traumatic brain injury.

adjusting, without instructing them to move right into another pose rapidly before and after. The simplicity of each pose in itself, going slowly and limiting the number of flows, seems to help my students more than attempting to keep up with a set of sequenced instructions that is more difficult for processing. [ID 123]

Although slow and repetitive cues were important for processing, a few teachers noted that although students should be provided with options to modify or adapt asana, providing too many options was not ideal because it can promote “decision paralysis or decision fatigue” [ID 27, 25–29 years of age, 5–10 years teaching experience, 200 hours of training].

Creating a Safe Space

Nearly all teachers commented on the importance of creating a “safe space.” Many teachers commented that encouraging and invitational language allowed students to practice in a way that fostered exploration and creativity while remaining safe and accessible. Teachers also shared that it was important to often give permission to take a break or stop and to provide reminders that asana, meditation, and pranayama do not have to be performed in any specific way to empower students to choose a level of practice that is right for them. For example, a teacher shared that she would offer the following cue in her classes: “[I]f it feels best for

your body and mind to stay in this resting place, please make the empowering choice to honor that, and if it feels good for you to continue moving, please also honor that and continue on” [ID 68, 35–39 years of age, 5–10 years teaching experience, 700 hours of training].

When it came to group discussion, many teachers believed that inviting participants to sit in a circle, using props for physical comfort, and balancing sharing their own experiences with stepping back to allow students to voice their perspectives helped to create a safe space and sense of community. For example, one teacher shared, “[T]he physical environment/setting is important (e.g., be in a circle), to be a facilitator [who] takes less and less place (we hold the space for people to share amongst themselves . . .)” [ID 126, 30–34 years of age, > 10 years teaching experience, 500 hours of training]. Most teachers endorsed reiterating the idea that everyone has an equal opportunity to speak/share but does not need to if they do not feel comfortable. Some teachers noted that it was important to acknowledge individuals when they did share, and a few others suggested that breaking off into smaller groups facilitated further conversation.

Position of the Head and Neck

Many teachers shared that poses that place the head below the heart should be approached with caution. Specific inversions that were identified as problematic included forward folds, child’s pose, downward dog, and puppy pose because of problems stemming from the position of and/or pressure on the head and neck. Another pose that was mentioned as challenging for students was tabletop hands and knees, as many had difficulty placing weight on their wrists and knees and because looking up at the teacher from a floor-facing position can potentially introduce strain, fatigue, or pain in the head, neck, and/or shoulders:

[Three quarters] of people in my group experienced whiplash. Having the teacher in the front meant they were often looking directly forward, which is problematic for any prone or floor-facing poses (e.g., tabletop), because looking up towards the front of the room caused strain, fatigue, or pain in their head/neck/shoulders. [ID 79, 30–34 years of age, 5–10 years teaching experience, 500 hours of training]

Additionally, a few teachers commented that students sometimes struggled when practicing on their backs without support under the head and neck, such as from a blanket. Other teachers suggested giving students the option to lie on their sides to avoid pressure at the back of the head. Some teachers also commented on the sequencing of poses and suggested limiting excessive up-and-down motion. As

one teacher explained, “[S]ometimes . . . too much up and down in the sequencing . . . can be hard for dizziness, low energy levels, people with headaches, and people who are not accustomed to exercise” [ID 123]. In addition to the order of poses, a handful of teachers shared that transitions between poses should also be adapted. One teacher suggested that transitions should be “slow, thoughtful, and gentle since some students may not wish to hang their head in *uttanasana* [standing forward fold] or down dog” [ID 111, 25–29 years of age, < 5 years teaching experience, 500 hours of training].

Demonstration

Teachers often acknowledged the importance of using different modes of communication to instruct yoga postures because they felt some students processed visual information more easily than auditory information. In particular, many teachers noted that students with TBI benefited from seeing a pose demonstrated before performing a posture of movement.

Many also mentioned the use of mirroring to support students to more easily follow the movement patterns and avoid confusion with right and left. A handful of teachers underscored the benefit of having two teachers in the room so that one could demonstrate while the other provided verbal cues to meet the different learning needs of students: “Most helpful is working with an assistant who can demo the variations of poses while I provide the verbal cues. This enables both visual and auditory learners” [ID 55, 45–49 years of age, 5–10 years teaching experience, 200 hours of training].

Importance of Props

Nearly all teachers identified props as critical to students’ ability to find comfort, accessibility, and support in their practice. Teachers noted that props could be used for asana, meditation, pranayama, and even group discussion. In fact, many teachers noted the importance of physical comfort as a precursor for successful participation in all aspects of the class. When asked to think about best practices for meditation, teachers sometimes described that they noticed the students who struggled were those who were experiencing pain or tension in their body. In general, teachers identified the following props as useful for people with TBI: chairs for those with vestibular challenges (e.g., “offering a chair when students have balance or vestibular challenges, and demonstrating how to modify using the chair” [ID 88, 40–44 years of age, < 5 years teaching experience, 200 hours of training]); blankets for support under the head, neck, and knees; use of a nearby wall for help with balance; eye masks for blocking light during meditation; bolsters for sitting on or for lying on one’s back; and blocks for use throughout yoga

practice, particularly during transitions from the floor to standing and vice versa.

Our studio is fully equipped with props in order to accommodate our students, and we have found that they are a great asset of helping our [LoveYourBrain] students feel they are successful in a class. If they can't forward fold without getting dizzy, we give them a chair to put their hands on in a fold, which has helped a couple of our dizzy students. [ID 45, 45–49 years of age, > 10 years teaching experience, 800 hours of training]

Special Considerations for Yoga Studios

Many yoga teachers noted environmental accommodations in yoga studios that need to be considered for the TBI population, such as limiting the amount of light (i.e., dimming lights, using blinds, facing away from windows) and sound (i.e., no music or only “soft instrumental” music); adequate temperature regulation (i.e., avoiding warmer temperatures); and ensuring sufficient space for both students and many props. As one teacher explained, “[W]e have a very small space, so fitting everyone in comfortably (with props, service dogs, etc.) can be a challenge as well as dealing with issues like lighting, temperature, etc.” [ID 28, 45–49 years of age, > 10 years teaching experience, 200 hours of training].

Best Practices for Yoga Program Delivery

The following three themes emerged related to best practices for delivering a yoga program for people with TBI: (1) structured yet flexible, (2) acceptability of compensation, and (3) time management. Table 2 summarizes recommendations of best practices for each theme.

Structured Yet Flexible

Overall, teachers perceived the program's structured format to be highly valuable but indicated the importance of having flexibility to tailor it to their particular group's abilities. Specifically, the majority (89%) of teachers reported that the use of the LoveYourBrain Yoga program manual to guide their classes was extremely/very helpful, especially for guided meditation and group discussion (Table 3). For the group discussion, teachers felt having relevant, prewritten, and positively worded questions was useful. They believed the questions gave a focus to the discussion and helped everyone stay on track, but that a script should not be directly read from. A few teachers perceived that the manualized curriculum imposed rigidity, especially when it came to asana, and reflected that there was a learning curve to being comfortable teaching it. As one teacher described, “[A]lthough I am an experienced teacher I found it challenging to follow someone else's plan” [ID 8, 50–54 years of

Table 3. Perceived Helpfulness of Aspects of Community-Based Yoga Program Delivery to People with TBI ($n = 86$)

Perceived Helpfulness of Program Delivery	n (%) ^a
Perceived helpfulness of manual for guiding classes	
Extremely helpful	52 (65)
Very helpful	19 (24)
Moderately helpful	5 (6)
Slightly helpful	2 (2)
Not at all helpful	0 (0)
Not applicable—I chose not to use the manual	0 (0)
Not applicable—I have not taught the program yet	2 (3)
Frequency of modifying, omitting, or substituting parts of the manualized class	
Always	13 (16)
Often	26 (33)
Occasionally	29 (37)
Rarely	7 (9)
Never	4 (5)
Compensation structure for lead teachers	
Not enough	21 (26)
Just right	59 (74)
Too much	0 (0)
Compensation structure for assistant teachers	
Not enough	32 (40)
Just right	48 (60)
Too much	0 (0)
Did not submit audiorecording for feedback	29 (36)
Submitted audiorecording for feedback	51 (64)
<i>Perceived helpfulness of audiorecording feedback (n = 51)</i>	
Extremely helpful	19 (37)
Very helpful	15 (29)
Moderately helpful	6 (12)
Slightly helpful	1 (2)
Not at all helpful	1 (2)
Did not receive feedback	9 (18)
Did not participate in mentorship calls	21 (27)
Participated in mentorship calls	59 (73)
<i>Perceived helpfulness of mentorship calls (n = 59)</i>	
Extremely helpful	22 (37)
Very helpful	24 (41)
Moderately helpful	11 (19)
Slightly helpful	2 (3)
Not at all helpful	0 (0)

^aNumbers differed across analyses due to occasional missing data.

Sample sizes ranged from 79–86.

TBI = traumatic brain injury.

age, > 10 years teaching experience, 800 hours of training]. Some teachers remarked they must apply their own teaching experience and knowledge to better adapt to their students' needs.

Despite the perceived helpfulness of the manual, nearly half of teachers modified, omitted, or substituted parts of the manualized class either “often” (33%, $n = 26$) or “always” (16%, $n = 13$). Of this group, most modified the asana portion of the class to accommodate physical abilities or to meet the energy levels of those attending. As one teacher explained, modification

was dependent upon who was present for that series and what their current physical and mental capabilities were. We used the wall or maybe didn't use the wall for support. I would offer more challenging options to some if they wanted, or the opposite options to make it less challenging. [ID 57, 35–39 years of age, 5–10 years of teaching experience, 200 hours of training]

A handful of teachers suggested slowly building on students' capabilities and skills. One teacher explained, “I found jumping right into the full outlined practice Day One was sometimes too much for the students. So I started teaching it as a progression, adding on each week” [ID 97, 30–34 years of age, < 5 years teaching experience, 200 hours of training]. Another explained,

I always kept all portions of class, but would modify the asanas and maybe change the timing for each portion slightly to fit the schedule, depending if we started on time or spent more time on one portion than planned. I would go through asana movements [sic] less repetitions to save time. I would avoid movements that weren't working for most students. I would omit some movements repeated each week if more time was needed to get to new movements, while allowing more time for meditation/relaxation/discussion. [ID 86, 25–29 years of age, 5–10 years teaching experience, 200 hours of training]

Acceptability of Compensation

Overall, teachers felt that it was important to have two instructors guiding the classes to ensure safety and that both should receive compensation. More teachers reported that the compensation offered in the LoveYourBrain Yoga program for assistant teachers (\$25) was too low (40%) compared to those who reported that compensation for lead teachers (\$50) was too low (26%). No teachers thought either compensation amount was too much. Most teachers felt that assistants should receive less than the primary

teachers because assistants have less responsibility. However, some teachers acknowledged that assistants contribute in other ways (e.g., interacting with students before and after class, co-facilitating discussion, helping students modify poses), so increasing the pay closer to the lead teachers' may show that assistants are equally valued.

Teachers who were less satisfied with compensation explained that the amount did not seem appropriate for the time spent preparing for class, teaching the class, and tending to other responsibilities after class. For example, one participant noted “the number of emails from participants (much higher in volume than teaching a drop-in or non-specialized series class) . . . [and] mentorship calls” [ID 27]. Another teacher said that the additional effort outside of directly teaching the program affected their teaching team's morale. Despite the perceived burden among a few teachers, of the teachers who utilized the technical support from LoveYourBrain, a majority reported that submitting the audiorecording and receiving feedback was extremely/very helpful ($n = 34$, 66%) and that participating in mentorship calls was extremely/very helpful ($n = 46$, 78%). A few of the teachers who reported less satisfaction with compensation shared that they still found it very meaningful to be involved, but felt more like they were volunteering.

Time Management

Many teachers found behaviors that were related to time management most challenging for effectively delivering the program. Some teachers requested tools for addressing punctuality without singling students out or making them feel embarrassed, as many students arrived late and created disruption. Other teachers noted that they used redirection techniques to keep the group discussion on time when people exhibited verbosity. As one teacher explained,

[S]ome students had so much to share, but would dominate the group or get very off topic. Letting them keep going was not helpful, so I had to learn how to politely redirect and engage the others who hadn't had a chance to share yet. [ID 119]

A handful of yoga teachers noted the importance of allowing enough time for the 20-minute discussion or believed that more time would have been optimal because of the significant personal transformation that occurred from the peer support and group discussion topics. To do so, many teachers perceived that it was important to “set very clear guidelines on time” to normalize interruptions because some people spoke “excessively.” Teachers also noted the importance of allowing people time to think about the question asked before speaking.

Discussion

This study is the first to identify best practices for adapting and delivering community-based yoga to people with TBI in the United States and Canada. Our first recommendation for persons interested in offering adapted yoga for TBI in community settings is the incorporation of slow, single-step, and repeated cueing to facilitate cognitive processing³⁰ and minimize cognitive fatigue³¹ for a safer and more satisfying yoga experience. Slow pacing that gradually integrates more challenging postures may also facilitate the brain's adaptation to increased physiological demands of activity over time and allow people to begin regaining their physical fitness.³² Second, given that head trauma may also involve cervical spine injury,³³ we recommend use of physical modifications that minimize neck twisting, extension, and flexion³⁴ (which are common in yoga postures), and, to mitigate pain exacerbation, avoidance of hands-on assists to either the head or neck. Based on our results, we also recommend modifications for when the head could be inverted below the heart to mitigate blood pressure dysregulation and dizziness, such as in forward folds or in up-and-down transitions³⁵ and use of blankets under the head in supine or prone positions to alleviate pressure. Third, we recommend that yoga teachers learn skills in creating safe and nonjudgmental spaces (e.g., positive body language, self-compassion tools³⁶), especially given that many people with TBI often feel misunderstood and isolated and have high levels of self-criticism.³⁷ Although our theme of creating a safe space has parallels with research in adapting yoga for PTSD, one important distinction is that safety among the PTSD population refers to promoting personal boundaries, whereas our TBI-specific findings point more to a sense of safety from inclusivity, compassion, and personal agency.²⁴

Our results also have important implications on the delivery of yoga services to support ongoing rehabilitation and community integration for people affected by TBI. Specifically, we recommend organizations seeking to deliver TBI-focused yoga programming (e.g., brain injury alliances and associations) use a manual that provides a structure for the teachers to use as a guide while allowing for flexibility. Not only does a manual enhance fidelity³⁸ and more reliable investigation of impact,³⁹ but it also facilitates repetition and a gradual progression of challenge, which people with TBI have reported as valuable in yoga programming.¹⁴ Furthermore, a manual coupled with ongoing technical support (e.g., mentorship calls) may also lower barriers to teachers feeling confident enough to teach the TBI population. We also recommend additional training for yoga teachers in behavior management skills (e.g., redirection,⁴⁰ identifying antecedents to the problem, and developing collaborative strategies⁴¹). Developing these skills is particular-

ly important, as such training is not a standard component of most 200- or 500-hour yoga teacher trainings,⁴² yet dysregulation is common postinjury and undermines community integration.⁴³ External triggers, such as increased level of stimulation, can also exacerbate behavioral problems, which underscores the importance of delivering the program in environments that can accommodate key factors noted by teachers, including low light and noise, sufficient space between mats,⁴⁴ availability of multiple types of props, and scheduling during less-busy times.³⁴ Finally, we suggest paying a lead and an assistant teacher, and that a rate of \$50 per class for the lead teacher is currently adequate, with a lower rate for an assistant being acceptable. In settings with budgetary constraints, our finding that teachers perceived increased empathy and broadly applicable skills from teaching yoga to people with TBI suggests that the professional development opportunity may offset dissatisfaction with suboptimal compensation.

Lastly, our results have implications on the delivery of integrative health services among the TBI population more broadly. Specifically, it is noteworthy that only 35% of teachers had previous experience working with TBI, which suggests that teachers with a broad range of experience levels can be effectively trained to deliver yoga to this clinical population. Given the large number of yoga studios and increasing popularity of this practice among people with neurological conditions,⁴⁵ training yoga teachers in best practices for TBI-specific yoga may be a strategic approach to meeting the gap for accessible community-based services⁴⁶ and enhancing service quality and outcomes in outpatient settings. For example, Schmid and colleagues⁴⁷ piloted an innovative 8-week yoga and group occupational therapy intervention led by a yoga teacher and an occupational therapist and showed improved balance, self-efficacy, and fall-risk management among patients with chronic stroke.

Finally, there is opportunity to explore the application of best practices for remotely delivering community-based, TBI-specific yoga,⁴⁸ given that fear of leaving home⁴⁹ and lack of transportation¹⁴ are barriers for people with TBI to access programs at the community level. Researchers have demonstrated high satisfaction and feasibility of yoga delivered through telehealth in veterans⁵⁰ and cancer patients,⁵¹ suggesting this topic as an important area of future research among the TBI population.

Limitations

Our study had a number of limitations. Although we intentionally designed the survey to collect anonymous data to enhance honesty and accuracy of responses and response rate,⁵² we were consequently unable to probe for clarification or elaboration on responses, which may have missed opportunities to develop more comprehensive

understanding of teachers' perspectives on best practices. Our study population was relatively homogenous in regard to sex, race, and ethnicity; thus, our findings may not be generalizable to underrepresented subgroups. However, the demographic characteristics of our sample were fairly representative of the national yoga teacher population, which is mostly female and White.⁵³ Because we did not survey program participants, we were unable to triangulate teachers' perspectives to more fully understand whether their perceptions aligned with students' experiences. Therefore, an important area of future research is to replicate this study among people with diverse levels of TBI severity.

The primary strengths of our study included recruiting a large sample of expert yoga teachers from diverse training and yoga teaching backgrounds, which supports the generalizability of our findings. Also, we designed the questions to avoid common sources of bias, such as by using transition statements to give respondents more time to gather their thoughts between questions and by asking for teachers' behaviors that enabled students to successfully practice asana, meditation, pranayama, and group discussion, respectively, instead of framing the question as hypothetical or a belief about best practices.⁵⁴

Finally, this study is the first to systematically identify best practices for adapting and delivering community-based yoga to people with TBI from expert yoga teachers' perspectives, which provides practical and actionable information for use in community-, medical-, and research-based yoga settings. We recommend that future research assess the comparative effectiveness of these best practices to better understand how to optimize yoga for TBI. For example, a large, multisite hybrid effectiveness-implementation randomized trial of LoveYourBrain Yoga may more rapidly identify the most effective implementation strategies for delivering community-based yoga for TBI survivors with different levels of severity while elucidating impact on important clinical outcomes⁵⁵ such as community integration.⁵⁶

Conclusions

To deliver accessible, community-based yoga services to the TBI population, we recommend choosing an environment that has diverse props, low light and noise, and sufficient space, and facilitating consistent instruction with a manual that allows for flexibility. We also recommend ensuring that yoga teachers have skills in offering physical modifications for the head and neck; slow, simple, and repeated cueing to facilitate cognitive processing; managing challenging behaviors through redirection techniques; and promoting safety through inclusivity, compassion, and personal agency. Training yoga teachers in best practices for TBI-specific

yoga may be a strategic approach to meeting the gap for accessible community-based services among this population.

Conflict-of-Interest Statement

All authors have reviewed the ICMJE uniform disclosure form and declare the following. KZD is employed by the LoveYourBrain Foundation, a nonprofit for which she led the design of the curriculum for the LoveYourBrain Yoga program. KZD is married to the executive director of the LoveYourBrain Foundation. SZ is employed by the LoveYourBrain Foundation. NC has no relationships or activities that could appear to have influenced the submitted work.

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NC led the conception and design of the study, data analysis, and interpretation, and drafted portions of the manuscript. KZD and SZ and contributed to data analysis and interpretation and drafted portions of the manuscript. KZD is the guarantor. All authors approved the final manuscript.

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