REVIEW ARTICLE

Barriers to Physical Activity Among Stroke Survivors: A Scoping Review

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Keywords
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ABSTRACT

Barriers to physical activity (PA) experienced by stroke survivors may contribute to low PA participation. This review aims to update the existing review report on barriers to PA among stroke survivors. We conducted electronic searches across three databases (PubMed, Scopus, and Web of Science) between January 2011 and January 2023. Keywords related to barriers, physical activity, and stroke survivors were used to identify relevant studies. Eighteen studies were included. The identified barriers to PA among stroke survivors were physical impairments, fatigue, and issues with training venues and facilities. These barriers were categorized using the Theory Domain Framework, revealing nine domains, with environmental context and resources being the most common. Clinicians can develop individualized programs to address barriers, improving adherence to PA among stroke survivors and contributing to a better quality of life while reducing the risk of stroke recurrence.

INTRODUCTION

Stroke causes 143 million disability-adjusted life years (DALYs).[1] The majority of stroke survivors experience a disability that results in deconditioning, reduced fitness, and decreased functional capacity.[2,3] Complications such as muscle weakness, spasticity, and a lack of cardiovascular fitness contribute to the decline.[4] In recent studies, stroke survivors are 75% sedentary and engage in low physical activity (PA), averaging 1389 to 7379 steps per day, which is below recommended levels.[5–7] This sedentary lifestyle can lead to secondary health problems such as cardiovascular disease, obesity, and diabetes. As a result, enhancing PA is critical for improving stroke survivors' health and quality of life.

PA is an umbrella term for functional activities and community participation.[8] PA and exercise have been proven to be effective in enhancing physical fitness and functional capacity in stroke. The American Heart Association/American Stroke Association suggests at least 150 minutes of moderate-intensity aerobic activity each week, as well as strength, neuromuscular, and flexibility exercises 2-3 times per week.[3,9] This recommendation is supported by a systematic review conducted by Saunders et al. (2016), which found that physical fitness training for stroke increased cardiovascular fitness, muscle strength, and walkability.[10] Promoting PA should prioritise low-to-moderate intensity aerobic activity, muscle strengthening, minimising sedentary behaviour, and risk management to avoid secondary problems. However, stroke survivors often face barriers to PA, including personal, social, and environmental factors.[11] Understanding those barriers and developing effective models of behaviour changes can help promote PA and exercise among stroke survivors.

Stroke survivors often face barriers in PA due to various factors. Those barriers include physical deconditioning, lack of motivation, fear of injury, and many more.[3] Not only that, they also might have experienced post-stroke neuropsychiatric disorders such as post-stroke depression, anxiety, and stress.[12] These problems are the common complications experienced by most stroke survivors. Additionally, stroke survivors may encounter

personal and social barriers, such as lack of social support, transportation issues, and financial constraints.[11] Those barriers can hinder stroke survivors from participating in regular PA and exercise, which are crucial for improving their well-being.

Adherence to physical activity (PA) among stroke survivors is closely linked to their behaviours. The Theory Domain Framework (TDF) integrates various psychological theories to help understand these behaviours.[13] Hence, using the TDF is a successful approach in several scenarios such as stroke survivors' behaviour towards PA. This study used the TDF to identify PA barriers because it covers a wide range of domains, including individual factors like knowledge and skills, social factors like support, and environmental factors like treatment costs. A study that was conducted to identify the barriers to PA using the TDF found that the commonly reported domains were belief about capabilities, environmental context and resources, and social influence.[13]

Barriers to PA among stroke survivors were reported by a systematic review.[14] The review results showed that the most common barriers were environmental barriers (such as access, transport, and cost), health problems, impairments, embarrassment, and fear of a stroke recurrence.[14] However, the previous review covered papers from 2006 to 2010, which may not reflect the current situation regarding the topic. Additionally, the previous review did not thoroughly examine the stroke-specific questionnaires used to identify barriers to PA among stroke survivors. [14] Therefore, this scoping review aimed to provide an update on barriers to PA among stroke survivors. This scoping review would also update practitioners' knowledge regarding the barriers commonly experienced by stroke survivors and help understand their preferences regarding PA at home.

MATERIAL AND METHODOLOGY

This review protocol was registered on the Open Science Framework (https://osf.io/wvk5g). This scoping review utilized the updated methodology presented by Peters et al. (2020).[15] No quality assessment of individual studies was required, as the review aimed to scope the barriers to PA among stroke survivors. The primary research question was, "What are the barriers to PA among stroke survivors?" The sub-questions addressed were: (i) "What are the TDF domains based on the identified barriers?" and (ii) "What are the outcome measures used to identify barriers to PA among stroke survivors?"

Electronic searches were conducted across three databases (PubMed, Scopus, and Web of Science) from January 2011 to January 2023 to identify barriers to PA among stroke survivors. Medical Subject Headings (MeSH) terms and keywords such as 'barriers', 'obstacle', 'limitations', 'physical activity', 'exercise', 'physical exercise', 'leisure time physical activity', 'stroke survivor', 'community-dwelling stroke survivor', 'individual with post-stroke, and 'post-stroke population' were employed in the search process. Boolean operators such as 'AND' and 'OR' were used to separate the keywords.

For inclusion in this review, studies should have involved stroke survivors and discussed barriers or inhibitors to PA. All types of quantitative or qualitative studies were considered, whereas review articles, opinion articles, and editorials were excluded. Studies that were not written in English were also excluded. All identified studies from the databases were imported into Mendeley, duplicates were removed, and the remaining studies were extracted into an Excel sheet for selection based on the suitability of their title and abstract according to the inclusion and exclusion criteria.

In the subsequent step, we collected full-text publications for studies that satisfied the selection criteria or could not be rejected based solely on the title and abstract. These articles were then evaluated using the selection criteria. Disagreements among reviewers were addressed through discussion and contact with a third reviewer. The selected articles were documented in a table to extract relevant data, including author(s), year of publication, country, method/study design, sample size, participant characteristics (age, gender, time since stroke, severity of stroke, diagnostic information), outcome measures of barriers to physical activity, and study results. An independent reviewer evaluated the study's findings,

while additional reviewers analyzed the extracted data to identify any problems.

This scoping review examined both qualitative and quantitative studies. Descriptive statistics was used to describe the characteristics of the studies and data. The data were then mapped into the TDF, which has 14 domains. The findings were summarised in charts and tables, with a focus on the barriers to PA among stroke survivors, the relevant TDF domains, and the outcome measures used to identify these barriers.

RESULT

A PRISMA-ScR flow diagram in Figure 1 illustrates the stages of screening and article selection. Initially, a database search yielded 793 entries, but after removing duplicates, 776 articles remained. Screening of titles and abstracts led to the exclusion of 756 studies due to irrelevant titles, unrelated objectives, or review article status. After screening full-text articles, two more articles were eliminated. Ultimately, the review included 18 articles for data extraction. Among these, 12 were quantitative[16–27], 5 were qualitative [28–32], and one mixed method[33] study design. Data from the mixed-method article were categorized based on the quantitative data and the qualitative data will be analysed separately.

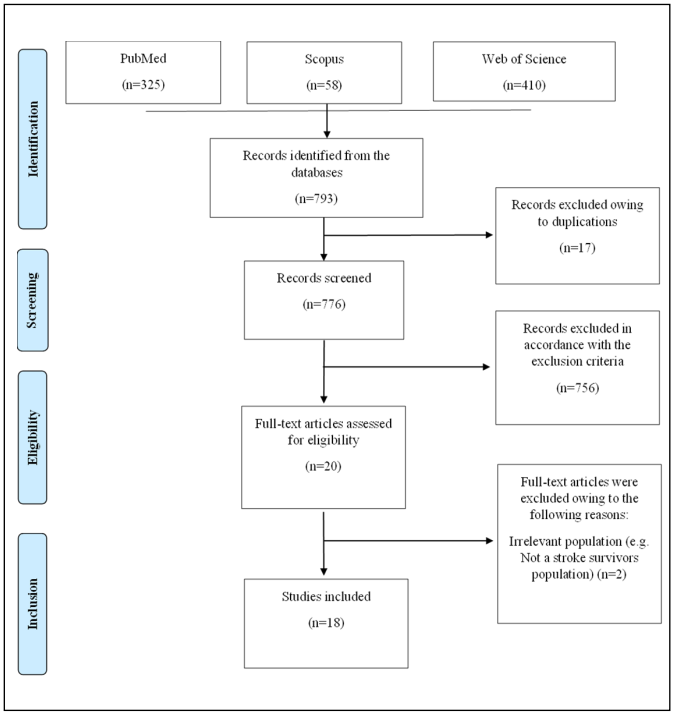

Figure 1: PRISMA-ScR flowchart of the scoping review.

Articles characteristics

Table 4 shows the characteristics of the included studies. The quantitative studies consist of a total of 1343 participants who had a stroke with 64% of them being males. Four out of 12 studies included participants who were 18 years or older[16,18,20,26] while one study included participants who were 20 years or older.[22] However, the rest of the studies did not determine the age requirement of the included sample. The duration of stroke in these studies ranged from 12 days to 7 years.

The qualitative data group of five studies included 1109 stroke survivors and the majority were also males (54.6%). Only two studies stated the age requirement of 18 years or older[32] and 20 years or older[33] while the remaining studies did not mention the age requirement. The duration of stroke for these studies was between 4 months and 8 years. Based on the regional chart in Figure 2 for all included studies, 28% of these studies were carried out in South America[18,22,24,27,29] and 28% were carried out in Europe.[16,17,28,32,33] The rest of the studies were conducted in North America (17%)[20,23,30], East Asia (11%)[19,31], Africa [21,26] and South Asia (6%).[25]

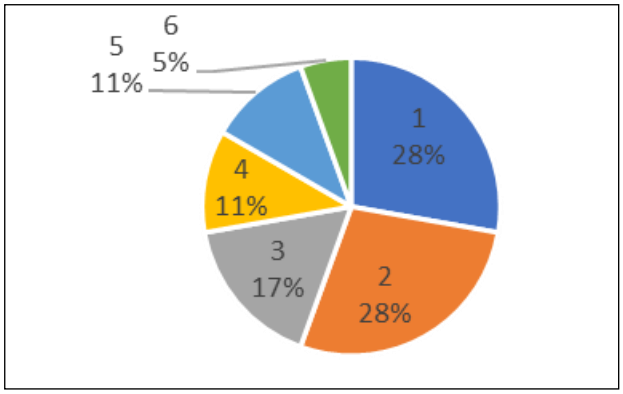

Figure 2: Distribution of studies according to geographical

From Table 4, five studies reported that the requirement to participate in the study was to be able to walk independently with or without a walking aid[16,17,24,27,28], two studies stated that the requirement to participate in the study was to have no to mild disability based on the modified Rankin Scale (mRS).[26,32] While two studies included only community walkers[22,23], and one study

included at least home walkers according to their walking speed.[18]

Barriers to physical activity

There is a total of 31 barriers were identified from the 18 studies.[17–20,22–35] These barriers are divided into internal and external barriers. Based on Table 1, the most reported group of internal barriers to PA was physical impairments such as spasticity[16–20,24,30–33] and this barrier became the most reported overall barrier. Other reported internal barriers included fatigue[17,20,22,25,32,33], fear of fall[18,20,24,25,33], cognitive and psychological issues[18,24,30,32,33], fear of injury/ damage to health[17,18,20], personal issues[18,27,28], and lacked self-confidence/ feeling embarrassed.[21,29,33] On the other hand, the least reported internal barrier was loss of independence[32,33], activity limitation[18,30], hidden disability[32], pain[18], having other medical conditions[17], communication problems[18], people with exercise clothes look funny[21], and life commitments.[18]

In addition, the most reported external barrier based on Table 2 was a lack of PA knowledge and skills[18,22–24,26,33], exercise location and facilities[18,20–22,24,30], and lack of support and motivation.[18,19,24,26,28,33] This is then followed by transportation problems[26–28,30,33], financial restrictions[16,21,27,30], unavailability of companion/lack of help[18,19,22,23], and poor weather.[18,24,33] Furthermore, the least reported external barrier was physical environment[33], delay or lack of healthcare provision[32], exercise instructors who spoke too quickly[30], negative affect[28], time restraint[18], lack of knowledge in gadgets/ internet[18], pandemic-related issues[18], policy barriers[19], and vague and complex regulations.[31]

Barrier to physical activity mapped into TDF

The identified barriers from this review were then mapped into the TDF which can be seen in Table 3. After mapping, nine domains were identified: skills, environmental context and resources, emotions, belief in capabilities, social/professional role, knowledge, social influence, memory, attention, and decision process, and behavior regulation. The most common domains mapped were environmental context and resources followed by emotion and skills. Whereas, the least common domains mapped were knowledge, social/professional role, memory, attention, and decision process, social influence, and behavioral regulation.

Table 1: Internal barriers to physical activity in stroke survivors as identified through the review

Authors / Barrier	Gagnon et al. (2022)	Débora Pacheco et al. (2021)	Sánchez-Sánchez et al. (2021)	Torriani-Pasin et al. (2021)	Nicholson et al. (2017)	Idowu et al. (2015)	Jackson et al. (2015)	Zalewski & Dvorak (2011)	Aguiar et al. (2022)	Babbar et al. (2021)	Harrison et al. (2022)	Nicholson et al. (2014)	Noukpo et al. (2023)	Simpson et al. (2011)	Zhang et al. (2018)	Blonski et al. (2014)	Jarbandhan et al. (2022)	Zhang et al. (2015)
Physical impairment (10)	√		√	√	√		√		√		√				√	√		√
Hidden disability (1)											√							
Fear of injury/ damage to health (3)	√			√	√													
Fear of fall (5)	√			√			√		√	√								
Pain (1)				√														
Other medical condition (1)					√													
Fatigue (6)	√	√			√		√			√	√							
Self-confidence/ embarrassment (3)						√	√							√				
Loss of independence (2)							√				√							
Cognitive and psychological issues (5)				√			√		√		√					√		
Personal issue (3)				√								√					√	
Communication problem (1)				√														
People with exercise clothes look funny (1)						√												
Activity limitation (2)				√												√		
Life commitment (1)				√														

Table 2: External barriers to physical activity in stroke survivors as identified through the review

Authors / Barrier	Gagu on et al. (2022)	Débora Pachec o et al. (2021)	Sánchez - Sánchez et al. (2021)	Torriani -Pasin et al. (2021)	Nichols on et al. (2017)	Idowu et al. (2015)	Jackson et al. (2015)	Zalewsk i & Dvorak (2011)	Aguiar et al. (2022)	Babbar et al. (2021)	Harriso n et al. (2022)	Nichols on et al. (2014)	Noukp o et al. (2023)	Simpso n et al. (2011)	Zhang et al. (2018)	Blouski et al. (2014)	Jarbandi han et al. (2022)	Zhang et al. (2015)
Problem with transportation (5)							√					√	√			√	√	
Lack of financial resources (4)			√			√										√	√	
Exercise location and facilities (6)	√	√		√		√			√							√		
Physical environment (1)							√											
No companion/ lack of help (4)		√		√				√										√
Lack of knowledge and skills about exercise (6)		√		√			√	√	√				√					
Delay or lack of healthcare provision (1)											√							
Lack of support and motivation (6)				√			√		√			√	√					√
Exercise instructor speak too quickly (1)																√		
Negative affect (1)												√						
Weather (3)				√			√		√									
Time restraint (1)				√														
Lack of knowledge in gadget/ internet (1)				√														
Pandemic related (1)				√														
Policy barrier (1)																		√
Vague and complex regulation (1)															√			

Table 3: Barriers to physical activity in stroke survivors according to TDF domains

No	TDF Domain	Barrier
1	Knowledge	Lack of knowledge about exercise[18,22–24,26,33]
		Lack of knowledge of gadgets/internet[18]
2	**Skills**	Physical difficulties/ impairment[16–20,24,30–33]
		Hidden disabilities[32]
		Activity limitation[18,30]
		Lack of skill and ability[33]
3	Social/Professional Role	Delay or lack of healthcare provision[32]
		Exercise instructor speaks too quickly[30]
4	Beliefs about Capabilities	Loss of independence[32,33]
		Self-confidence and embarrasment[21,29,33]
5	Optimism	No study reported
6	Belief about Consequences	No study reported
7	Reinforcement	No study reported
8	Intentions	No study reported
9	Goals	No study reported
10	Memory, Attention, and Decision Process	Cognitive and psychological issues[18,24,30,32,33]
11	**Environmental Context & Resources**	Transportation problem[26–28,30,33]
		Exercise program location and facilities[18,20–22,24,30]
		Lack of financial resources[16,21,27,30]
		Weather[18,24,33]
		Physical environment- poor maintenance of pavement[33]
		Pandemic related[18]
		Policy barrier[19]
		Communication problem[18]
		Life commitment[18]
12	Social Influence	Lack of professional support on discharge from hospital and follow-up[28]
		Exercise instructor speaks too quickly, impatience[30]
13	**Emotion**	Fatigue[17,20,22,25,32,33]
		Psychological difficulties[18,24,30,32,33]
		Lack of control[28]
		Negative affect[28]
		Fear of falling[18,20,24,25,33]
		Fear of injury/ damage health[17,18,20]
		Pain[18]
14	Behavioral Regulation	Vague and complex regulation[31]

Measurement tools

Table 4 shows that 12 studies measured barriers to PA using a questionnaire[16–27,33] while the remaining studies used an in-depth interview with an open-ended question[29,31,32] and other studies used a framework to guide the interview.[28,30,33] From that, it was found that two studies used the Exercise Benefits and Barriers Scale (EBBS)[21,22], one study used the Barrier to Being Active Quiz BBAQ)[23], one study used the Stroke Exercise Preference Inventory-13 (SEPI-13)[26] and one study used the Barrier to Physical Activity and Disability Questionnaire (BPAD).[27] Whereas, only one study used a specific questionnaire that asked about the barriers to PA specifically for stroke survivors, which is the Barrier to Physical Activity after Stroke Scale (BAPAS).[16] The remaining studies used a survey prepared based on previous studies and based on the theory-planned behavior framework to do a survey question.[18,24] Several studies used a 21-item survey[20], Mutrie scale[17], Adherence to Home Exercise Questionnaire[25], and Craig Hospital Inventory of Environmental Factors[19] ; however, those tools are not considered specific to the barriers of PA.

Table 4: Characteristics of the included study and measurement tools used

Authors	Study design	Country	Method	Participants characteristics						Outcome measure
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Sánchez-Sánchez et al. (2021)	Quantitative Cross-sectional study	Valencia, Spain	- recruited from the Brain Injury Association, physiotherapy outpatient services, and community exercise classes. -Face-to-face assessment	57	>18 years old	37 males (64.9%)	≥6 months from stroke onset	63.2% (36)-no disability or slight 36.8% (21)-moderate or severe disability	Chronic stroke survivors (community-dwelling)	BAPAS
Nicholson et al. (2017)	Quantitative	Edinburgh & Lothians (Scotland)	- recruited from hospital acute stroke units - ready to be discharged - completed two walk tests -After that, participants were asked to rate four possible barriers based on the Mutrie Scale.	50	72.4	29 females (58%) 21 males (42%)	12.5 days	Independently ambulatory (with/without walking aid)	Combination of ischemic & and hemorrhagic	Mutrie scale

BAPAS: Barrier to physical activity after stroke scale

Table 4. Continued

Authors	Study design	Country	Methods	Participant characteristic						Outcome measures
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Gagnon et al. (2022)	Quantitative, cross-sectional survey (online)	Quebec	-Recruit using direct email contact by researchers, stroke organizations, and healthcare professionals	29	18 years or older	15 % (4) males	At least one -year post-stroke	NA	Any type of stroke	21-item survey (5 sections): demographic information, duration, and frequency of PA, barriers, and motivators, sedentary behavior, and walking ability
Idowu et al. (2015)	Quantitative, cross-sectional study	Nigeria (South-west)	-Recruited from neurology and physiotherapy clinic - need to answer all the questionnaires.	121	51-60 years old	70% (85) males	4.26+- 3.14 years	NA	Chronic stroke	EBBS
(Débora Pacheco et al., 2021)	A quantitative, exploratory study	Metropolitan City, Brazil	-From the stroke unit of a public hospital in a metropolitan city in Brazil	95	Above 20 years old	64.2% (61) males	4 months (0.8)	Mild disability (community walking ability status (walk at speed >0.8 m/s with or without aids measured using a 5-meter walk test)	Sub-acute stroke (between 3–6 months onset hemorrhagic or ischemic stroke)-discharged	The Brazilian version of the Exercise Benefits/ Barriers Scale (EBBS-Brazil) – only takes the barrier subscale (14 items) An open-ended question about additional barriers based on the previous study

NA: Not address; EBBS: Exercise Benefit & Barriers Scale

Table 4. Continued

Authors	Authors	Authors	Authors	Authors						Authors
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)	Zalewski (2011)
Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)	Aguiar (2022)
Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)	Babbar (2021)

Table 4. Continued

Authors	Study design	Country	Methods	Participant characteristic						Outcome measures
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Noukpo (2023)	Cross-sectional study (Quantitative)	Benin, a lower middle-income country	Participants were invited to the hospitals where the clinical data were collected, and the questionnaires were completed.	87	53 +- 10 years (mean) Adult >18 years old	52 men	meantime after a stroke of 11 months at least 3 months onset	(60%) were mildly disabled (score mRS ≤3)	Stroke survivors	Stroke Exercise Preference Inventory-13 (SEPI-13).
Torriani-Pasin (2021)	Longitudinal study (Quantitative)	Brazil	-Stroke patients from the community rehabilitation program in São Paulo, Brazil were invited to join the study during the COVID-19 pandemic. -Weekly phone calls assessed perceived exercise barriers using a questionnaire.	36	Above 18 years old	23 males	98 months (mean)	Walking speed >0.4 m/s (home walker)	Stroke survivors (ischemic and hemorrhagic) in the chronic phase	Two questionnaires (via weekly telephone calls) to identify attendance, barriers, safety, and overall experience related to the program. A 5-point Likert scale was applied based on the positive and negative statements
Zhang (2015)	Cross-sectional survey (quantitative)	Rural China	-Private interview -Standardized questions and response options to minimize bias.	639	69 +- 11 years Most are married (77%)	69% male (442)	>2 years	NA	Community-dwelling stroke survivors	Craig Hospital Inventory of Environmental Factors

NA: Not address

Table 4. Continued

Authors	Study design	Country	Methods	Participant characteristic						Outcome measures
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Jarbandhan (2022)	Cross-sectional study (Quantitative)	Suriname	Recruited from the database of the Rehabilitation Centre Paramaribo and from the local community	44	Mean age: 58.2 + -10 years	21 men	The median time post-stroke was 2.5 (range 0.5-16.6) years. last stroke >6 months ago	Walk independently or with supervision (Functional Ambulation Category score ≥3)	chronic stage after stroke Stroke survivors	BPAD questionnaire
Harrison (2022)	Sequential explanatory, mixed methods study (qualitative)	England, Wales and Northern Ireland	- recruited as in-patients or at post-stroke/ TIA clinic appointments by a Stroke Research Nurse. -Baseline questionnaire completed after consent. -Follow-up questionnaires mailed by LCTU at 6 months post-stroke/TIA. -Self-completed paper questionnaires returned to LCTU	1045	74	54.5 % (569)	NA	43.6% no disability, 40.5% slight to moderate disability A pre-stroke modified Rankin Scale (mRS) score of ≤3	Those with a clinical diagnosis of new first or recurrent stroke or TIA Stroke survivors	Open-text questions were asked about barriers and facilitators when returning to, or participating in, leisure activity. Responses were thematically analyzed and explored by participant characteristics, including the type of leisure activity undertaken.

TIA: Transcient Ischemic Attack; LCTU: Lancashire Clinical Trials Unit; NA: Not address; BPAD: Barriers to Physical Activity and Disability

Table 4. Continued

Authors	Study design	Country	Methods	Participant characteristic						Outcome measures
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Nicholson (2014)	Qualitative study (audio -recorded and tran-scribed verbatim)	Edin-burgh & Lothians (Scotland)	- conducted at the participants' homes. -Interviews were audio recorded and transcribed verbatim.	13	76 years (median age)	38.5% (5)	345 days (median time since stroke)	Able to walk independent-ly, with or without walking aids	Stroke survivor	Semi-structured interview using TDF
Simpson (2011)	Qualitative exploratory design	Columbia	- recruited from previous patients of a local rehabilitation center and through community notices. -Observer took notes and sessions were tape-recorded with participants' permission.	11	NA	8 males	Mean 8 +-3 years post-stroke At least one year post-stroke	NA	Community-dwelling stroke Living at home	Open-ended
Zhang (2018)	Qualitative content analysis	Rural China	-Stroke survivors who participated in the quantitative part of the study	18	Mean age: 69 years old All married	Male: female: 2:1 Male: 12	Since the first stroke ranged from four months to 13 years at least three months previous stroke	NA	Community-dwelling stroke survivors	In-depth interviewing in the participants' homes

NA: Not address; TDF: Theoretical Domains Framework

Table 4. Continued

Authors	Study design	Country	Methods	Participant characteristic						Outcome measures
				Total (N)	Age	Gender	Time since stroke	Ambulatory status	Diagnostic info	
Blonski (2014)	Qualitative descriptive study (Two focus groups)	Toronto, Canada	-Participants recruited from the AI in Toronto, Canada -In-depth, semi-structured face-to-face interviews conducted using SCA. -Interviews were audio recorded and transcribed verba-tim.	10	60–69 years	6 men (60%)	Median 3 years	NA	Stroke survivors (having aphasia)	In-depth, semi-structured face-to-face interviews using SCA.
Jackson (2015)	Mixed method (survey & focus group)-cohort study	South England	- identified from the database of patients admitted to the local hospital. The survey group received study packs with an invitation letter, information leaflet, questionnaire, and return envelope. -Focus group interviews conducted by principal researchers using a semi-structured format.	76 (survey) 12 (focus group)	75 years old Over 55 years of age	55.3% (49) males	42.1% - 12-23 months since stroke At least six months and not more than five years post-stroke	NA	Community-dwelling stroke survivors Living in a com-munity setting	The questionnaire was developed based on the Theory of Planned Behaviour Focus group – interview questions based on TDF

SCA: Supported Conversation for Adults with Aphasia; NA: Not address; TDF: Theoretical Domains Framework

DISCUSSION

This scoping review aimed to investigate barriers to PA among stroke survivors. The 18 reviewed studies employed different outcome measures to assess the barriers to PA, with some utilizing a qualitative approach. The barriers were then mapped into the TDF to find the main domains. Using the TDF provided this study with a strong approach to gain a comprehensive understanding of the barriers to PA among stroke survivors and identified the domains that can be targeted during the management of stroke survivors to improve their adherence to PA.

This review mapped 9 domains including skills, environmental context and resources, emotion, belief in capabilities, social/professional role, knowledge, social influence, memory, attention, and decision process and behavior regulation. Those findings underscore the importance of addressing physical impairments and providing a convenient environment and resources to increase the engagement of stroke survivors in PA.

Physical limitations are frequently mentioned as a barrier to physical activity (PA) for stroke survivors. According to prior research, these restrictions are a major source of inactivity.[16] A qualitative study revealed that even those who were physically active prior to a stroke are commonly unable to engage in physical exercise due to post-stroke physical limitations.[36] This demonstrates how physical impairments are disabling and influence adherence to PA. Approximately half of stroke survivors have motor deficiencies in their lower limbs, making it difficult to stand, walk, and climb stairs, further restricting their activity and participation.[37]

Stroke survivors also reported fatigue as a barrier to PA in this review.[17,20,22,25,32,33] A recent study confirmed that fatigue symptoms can limit PA in stroke survivors.[38] Furthermore, in a systematic review of longitudinal studies, fatigue frequency was found to range from 35% to 92% and can persist for at least 36 months after stroke.[39] This demonstrates that most stroke survivors experience fatigue, which limits their participation in PA and lowers their quality of life. Healthcare practitioners should recognize this symptom and customize exercise programs to patients' capacity and fatigue severity.

Stroke survivors have significant barriers to exercise, including location and facilities. This is consistent with a prior study, which identified environmental barriers including transportation as the most commonly reported barrier.[14] This is frequently due to insufficient public transit services and facilities for people with impairments, particularly in developing countries. Although some countries have provided special accommodations for disabled people, access remains limited.[40] Stroke survivors often have limited access to exercise facilities, particularly gyms, which are frequently on upper floors and require stair climbing—a difficult chore due to lower extremity limitations and exhaustion.[41] As a result, these barriers reduce stroke survivors' access to exercise facilities, leading to their inactivity.

Furthermore, this review also identified a lack of knowledge and skills as a barrier to PA. Many participants were unaware of the benefits of exercise for their functional abilities, as well as proper exercise techniques. Raising awareness among stroke survivors about the benefits of exercise is critical for avoiding consequences such as muscle atrophy, balance difficulties, falls, decreased cardiovascular fitness, and a deterioration in quality of life.[42] This barrier falls under the "skills" domain of the TDF, emphasizing the significance of physiotherapists having sufficient knowledge and awareness to assist stroke survivors in adhering to their exercise programs.

In addition, the lack of support and motivation was also one of the cited barriers in this review, which is consistent with the results of the systematic review conducted on stroke survivors.[14] According to AHA, one of the reasons for inactivity in stroke survivors is the lack of motivation and family and social support, which negatively affect their adherence to recommended PA.[3] Hall et al. (2020) reported that support from caregivers or family members when performing PA would increase stroke survivors' engagement.[43] Most stroke survivors also have psychological problems, such as being depressed and unmotivated to perform their regular

activities due to their impairments. Therefore, social support, especially from family members or spouse is essential in their functional recovery after stroke.[44]

Having physical impairments would lead to the psychological concern of fear of falling as one of the barriers to perform PA. Fear of falling can be a secondary complication of physical impairments experienced by stroke survivors and a previous fall which led to the risk of falls. This is shown by a study that found about one-quarter of stroke survivors suffer from balance disorders after discharge.[45] Stroke survivors might have a feeling of instability during walking, which may exacerbate their fear of falling and restrict their walking activity.[46] In addition to that, fear of falling among stroke survivors can also be induced by the perception and psychological influence resulting from previous falls.[47] Therefore, stroke survivors limit their activities and restrict their participation due to their fear avoidance beliefs.

In this review, we integrated the TDF in categorizing the barriers to identify its domains that might influence the behaviors of stroke survivors in performing their PA. The most common mapped domain using the TDF in this review was the environmental context and resources. This finding emphasizes the importance of the physical environment and available resources in shaping the behaviors of stroke survivors. Environmental context and resources were found the most important domain in one of the qualitative studies that identified barriers to PA in stroke survivors.[28] This indicates that one of the healthcare providers' aims should focus on improving the environment or allocating resources of exercise locations to stroke survivors.

Emotion was the second most common domain mapped in this review. Emotional states have a substantial impact on behavior modification, especially since many stroke survivors suffer from emotional disorders as a result of limitations in daily activities and job loss, which can reduce income and exacerbate mental distress. A 2021 study discovered a link between anxiety and mobility, with higher anxiety levels associated with larger mobility limits. The same study found that stroke survivors were at high risk of anxiety and depression.[12] Based on this review, psychological and emotional issues would influence their adherence rate to PA. As a result, recognizing and controlling emotional components is crucial for developing treatment regimens that meet these concerns and increase stroke survivors' adherence to PA.

The variability in the barriers reported in this review is related to the heterogeneity in the outcome measure used to assess barriers to PA. Some studies employed generic questionnaires, such as the Barrier Being Active Questionnaire (BBAQ) and the Exercise Benefit Barrier Scale (EBBS), while others conducted interviews, yielding a diverse set of results. The heterogeneity of selecting measuring instruments influenced the comparability of research findings. In this review, only one study employed a specific questionnaire, the Barriers to Physical Activity After Stroke Scale (BAPAS), which was recently created and validated for stroke survivors.[48] As a result, it is not yet widely used in most studies to identify barriers to PA among stroke survivors.

The strengths of the scoping review are its systematic and transparent approach, the adherence to the PRISMA-ScR guidelines, and the inclusion of studies from various geographic regions. By conducting an extensive search of electronic databases and applying stringent inclusion criteria, the review encompassed a wide range of studies, enabling a comprehensive investigation of barriers to PA in stroke survivors. Additionally, the review provides a comprehensive understanding of barriers from many perspectives by incorporating both quantitative and qualitative data.

Despite its benefits, this scoping review also has some limitations. It focused solely on barriers to PA in stroke survivors, not facilitators or strategies for overcoming these barriers. Future studies should look into ways to overcome these barriers and increase PA engagement. Furthermore, the majority of research examined were from Europe, North and South America, with fewer from Asia and Africa, limiting the generalizability of the findings. Future studies should include more varied groups to capture a broader spectrum of viewpoints. Finally, the outcome measures utilized to quantify PA barriers differed and were not specific to stroke survivors,

resulting in various findings. Standardizing these outcome measures would increase the consistency and comparability of future studies.

CONCLUSION

In summary, this scoping review provides an overview of updated barriers to PA in stroke survivors. The incorporation of the TDF into this scoping review provided a useful perspective for investigating the challenges of behavior change. The identification of barriers to PA faced by stroke survivors and the affected TDF domains may assist physiotherapists in the development of interventions and strategies that promote PA in this population. Future research should focus on evaluating the effectiveness of targeted tailored interventions to address these barriers and enhance adherence to PA in this population.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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