



A mixed methods study of perceived barriers to physical activity, geriatric syndromes, and physical activity levels among older adults with peripheral artery disease and diabetes

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Previous studies suggest a myriad of factors prevent individuals from engaging in physical activity; however, less is known about barriers faced by individuals with multiple chronic conditions, such as peripheral artery disease (PAD) and type 2 diabetes, and how these barriers may impact engagement in physical activity. To date, there are no studies that integrate simultaneous assessment of perceived barriers to physical activity and engagement in physical activity in older adults with PAD and diabetes. This integration is key to understanding the implications of barriers to physical activity and to developing strategies to address those barriers. Therefore, this study investigated the unique physical activity experiences of older adults with PAD and diabetes. This study used a concurrent mixed methods design. Ten adults aged 65 years and older with PAD and diabetes completed semistructured interviews about experiences with physical activity, self-reported questionnaires assessing quality of life and fear of falling, and measures of physical function (eg, 6-minute walk test, chair stand, gait speed). Physical activity was measured objectively with accelerometry. Inductive content analysis was used to identify themes, and integrated analysis was performed to evaluate patterns among qualitative and quantitative variables. On average, participants were 74 years old and spent 10% of their time in moderate or vigorous physical activity (range: 3%–18%); 80% of participants were men. Barriers to physical activity identified through qualitative interviews included lack of accessibility, lack of enjoyment of activity, lack of motivation, and pain and physical health. Facilitators to physical activity were social support, accessibility and convenience, and enjoyment of the activity. Participants with more sedentary time and less moderate or vigorous physical activity tended to report greater fear of falling and greater barriers to physical activity and achieved lower distances in 6-minute walk tests. This research provides insight into both the nature of perceived barriers to physical activity and engagement in physical activity among older adults with PAD and diabetes. The integration of self-reported measures and objective measures facilitates our understanding of the lived experiences of individuals with these conditions. Study findings can be used to support further investigation into factors that influence engagement in physical activity in individuals with PAD and diabetes and to assist in the development of strategies to address identified barriers. (J Vasc Nurs 2019;37:91-105)

Peripheral artery disease (PAD), a progressive condition characterized by obstruction of blood flow to the lower extrem-

ities, is a significant problem among older adults. The prevalence of PAD increases with age, with 10%–15% of Americans older than 65 years of age having a diagnosis of PAD.¹ The hallmark of PAD is exercise-induced limb ischemia, or claudication, which can cause significant pain, walking impairment, and reduced quality of life.² In addition to functional impairment, PAD is also associated with significant risk of cardiovascular morbidity and mortality. Older adults with symptomatic PAD have a 2- to 3.5-fold greater all-cause mortality risk than healthy older adults.³ Diabetes is a significant risk factor for PAD, and estimates suggest that 20%–30% of older adults with PAD have diabetes.^{4–7}

The combination of diabetes and PAD puts individuals at greater risk of poor health outcomes than either condition alone,⁸ and this is particularly true in regard to cardiovascular complications. The risk of mortality is 2 times higher in adults with diabetes and PAD than in those with PAD alone.^{9,10} Walking

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exercise has been shown to improve walking distance and physical function among adults with PAD^{11,12} and may be protective against mortality.¹¹ Thus, determining strategies that could help improve adherence and responsiveness to exercise programs is critical.

Given that the majority of US older adults do not meet physical activity guidelines, a number of researchers have sought to examine barriers to physical activity that could be to blame.^{13–15} This body of work, which is primarily qualitative in nature, suggests that older adults frequently cite factors such as social influences, physical limitations, competing priorities, access difficulties, and personal beliefs regarding physical activity as barriers to physical activity.¹⁶ In addition to these factors, one of the most commonly cited barriers is health concerns.¹⁶ Interestingly, research has demonstrated 2 differing views on the role of health in exercise: some individuals see health concerns as their primary barrier to physical activity, whereas others see their health as a major motivator to engage in physical activity. Thus, it is likely that a similar health-related factor may serve as either a barrier or a facilitator (or neither) to physical activity, depending on the older adult and their chronic condition(s).

The social ecological model of McLeroy et al¹⁷ provides a useful overarching framework for understanding barriers and facilitators to physical activity because it not only considers individual characteristics but also interpersonal, community, and public policy factors that may promote or prevent physical activity. The social ecological model suggests that an individual's

behavior is integrated into this dynamic network such that intra-personal factors may influence community factors, and vice versa. Figure 1 provides a visual representation of some hypothesized barriers to physical activity experienced by older adults with PAD and diabetes.

Despite numerous studies investigating barriers to physical activity in a variety of groups of older adults, there are none that specifically examine barriers to physical activity among older adults with comorbid PAD and diabetes. In addition, there are no studies that collect and integrate assessments of both perceived barriers to physical activity and actual engagement in physical activity. Both subjectively assessed perceptions and objectively measured activity levels are key to understanding the impact of barriers to physical activity and developing strategies to address those barriers. Given the increased risk of morbidity and mortality faced by older adults with PAD and diabetes,⁹ it is important to better understand barriers to physical activity such as health status in this population. Exploration of the beliefs of older adults with respect to how health-care providers could be more effective in working with individuals to overcome barriers is also necessary because it will inform the development of strategies to reduce such barriers.

In addition to health status related to PAD and diabetes, geriatric syndromes may also play a role in older adults' willingness and ability to engage in physical activity. Geriatric syndromes refer to multifactorial health conditions caused by the accumulated effects of impairments in multiple systems. They cannot

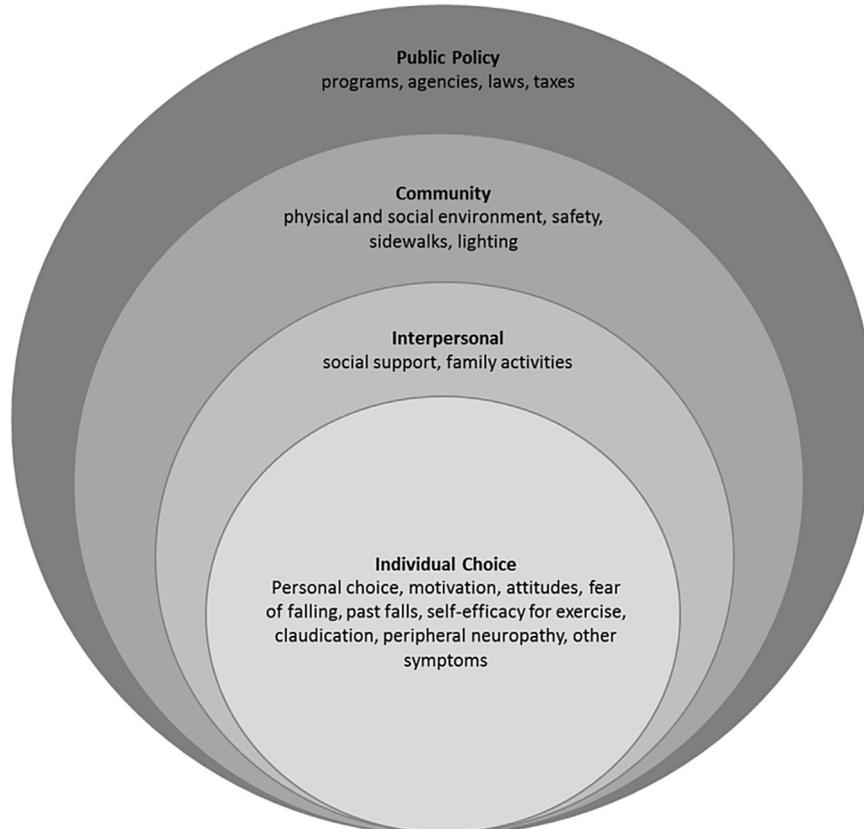


Figure 1. Social ecological framework model of hypothesized barriers and facilitators to physical activity for older adults with PAD and diabetes. PAD = peripheral artery disease.

be classified as, or attributed to, a single disease. Examples include falls, dizziness, frailty, cognitive impairment, and urinary incontinence. Such conditions are highly prevalent among older adults in the United States and are associated with significant morbidity and poor health outcomes.¹⁸ Fear of falling, frailty, and functional limitations could significantly influence an older adult's ability to engage in regular physical activity.¹⁹

THE CURRENT STUDY

Given the dearth of information related to barriers to and engagement in physical activity among older adults with PAD and diabetes, we conducted a mixed methods study investigating these phenomena. Although there is some qualitative work addressing barriers to physical activity in a variety of adult populations, including individuals with PAD,^{13-15,20,21} there are no studies that integrate simultaneous assessment of both

perceived barriers to physical activity and the actual degree of engagement in physical activity among older adults with PAD and diabetes. This type of integration is key to understanding the impact of barriers on physical activity and developing strategies to address those barriers.

As these issues could not be adequately addressed through the use of only qualitative or only quantitative techniques, we conducted a mixed methods study. Mixed methods, which can be defined as intentionally combining both qualitative and quantitative methods at some stage in the data collection, analysis, or interpretation of a given research study,²² provided a unique opportunity to understand the impact of PAD and diabetes on an individual and the barriers to physical activity that he or she encounters. The purpose of this mixed methods study was to investigate the unique experiences of older adults with PAD and diabetes related to physical activity. We sought to address the following overarching question: How does having PAD and diabetes shape older adults'

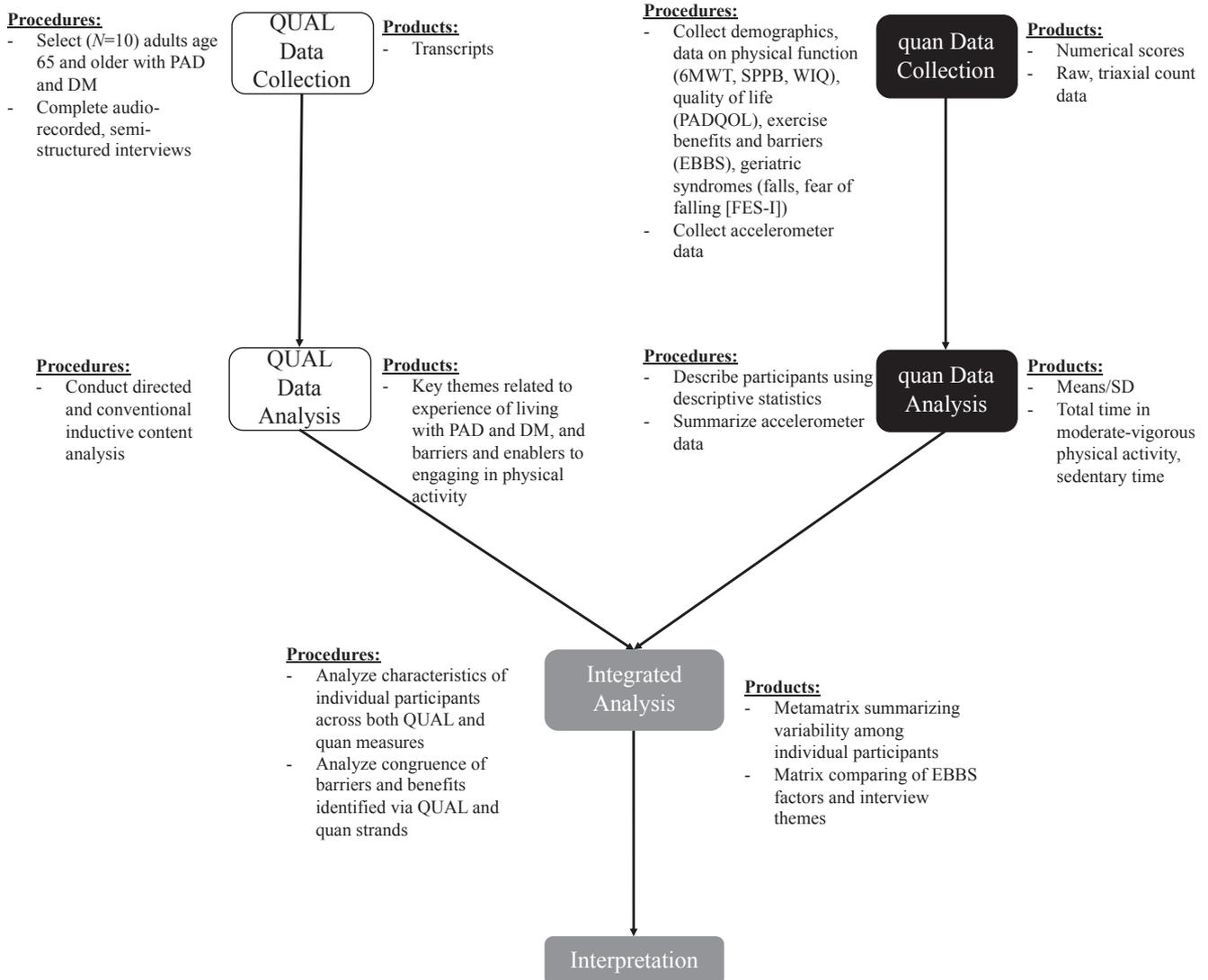


Figure 2. Study diagram showing data collection and analysis and points of integration of the QUAL (qualitative) and quan (quantitative) strands. 6MWT = 6-minute walk test; DM = diabetes mellitus; FES-I = falls efficacy scale–international; PAD = peripheral artery disease; PADQOL = PAD-specific quality of life questionnaire; SD = standard deviation; SPPB = short physical performance battery; WIQ = walking impairment questionnaire.

perceptions of and engagement in physical activity? More specifically, we sought to answer the following questions:

- 1) How do older adults with PAD and diabetes describe their challenges toward engaging in physical activity?
- 2) How important are geriatric syndromes, such as falls, fear of falling, and decreased muscle strength, to perceptions of ability to engage in physical activity among older adults with PAD and diabetes?
- 3) What types of patterns of objectively measured barriers, physical activity levels, and sedentary time are present among older adults with PAD and diabetes?

METHOD

Design

A concurrent mixed methods multiple-case study design was used for the purposes of complementarity and completeness.^{23–25} This design was appropriate for the present study because a single method (eg, qualitative or quantitative) was deemed insufficient to fully evaluate barriers to physical activity and engagement in physical activity among older adults with PAD and diabetes. A multiple case study was used because it provides a rich description that allows researchers to seek out both what is common and what is particular about the case,²⁴ enabling the understanding of barriers and beliefs related to physical activity of older adults who may have differing views.

For this study, priority (emphasis) was given to the qualitative (QUAL) strand. Quantitative (quan) data were used to enhance understanding and contribute to overall completeness. Figure 2 illustrates the study design, including points of integration.

Participants

Participants were identified through convenience sampling. Patients who were enrolled in a supervised exercise program for PAD offered through the University of Minnesota who met study eligibility criteria were invited to participate. In addition, individuals with PAD who were currently engaged in or had completed previous studies of exercise programs conducted by the University of Minnesota were invited to participate. Pseudonyms are used to refer to individual participants throughout the manuscript.

Inclusion criteria for the study were having lifestyle-limiting claudication with activity due to PAD, having type 2 diabetes, being aged 65 years or older, and being able to speak and read English. There were no exclusionary criteria because it was deemed important to include all eligible participants to gain a variety of perspectives on exercise benefits and barriers.

This study was reviewed and approved by the University of Minnesota Institutional Review Board. All participants provided written informed consent. Participants received \$50 for the time and inconvenience associated with data collection and were provided with a parking pass for the duration of their visit.

Data collection and measures

All qualitative and quantitative data were collected during the same encounter. Participants completed a semistructured interview; measures of balance, lower body strength, and physical

function; and several self-reported measures of perceived benefits and barriers to exercise, geriatric syndromes, and quality of life during one visit to the University of Minnesota. As PAD severity may impact physical function, the most recent ankle-brachial index (ABI) was obtained (if available) for each participant via medical record review. Participants were also sent home with an accelerometer for assessment of physical activity and sedentary time for 2 weeks. Potential biases were limited by the use of a detailed audit trail.^{26,27}

Assessment of barriers and benefits to physical activity. Perceived barriers and benefits to physical activity were assessed using 2 methods, a semistructured interview and administration of the Exercise Benefits and Barriers Scale (EBBS),²⁸ to obtain both open-ended qualitative and quantitative data on these constructs. In addition, to enable comparisons with previous research in older adults with PAD, facilitators of physical activity were also assessed.

Each semistructured interview was conducted by the lead author MOW and lasted between 16 and 55 minutes (mean: 37.8 minutes, standard deviation [SD]: 12.1 minutes). The interview guide can be found in Table 1. Interviews were audio recorded and transcribed verbatim before analysis. All participants completed the interview before the quantitative survey measures to reduce the potential influence of the measures on the content of the interviews.

The EBBS contains 43 items composing 9 factors (5 benefits and 4 barriers).²⁸ Participants were asked to rate each of the items on a 4-point scale (strongly agree, agree, disagree, and strongly disagree). Exercise benefits factors included life enhancement (7 items), physical performance (9 items), psychological outlook (6 items), social interaction (4 items), and preventive health (3 items). Exercise barriers factors included exercise milieu (6 items), time expenditure (3 items), physical exertion (3 items), and family encouragement (2 items). Sample items included “I am too embarrassed to exercise” (exercise milieu), “I will live longer if I exercise” (preventive health), and “exercise is hard work for me” (physical exertion). The EBBS has been used in a variety of populations, including older adults, and has good psychometric properties.²⁸

Measures of balance, strength, and physical function. Participants completed several performance-based measures of balance, lower body strength, and physical function after completion of the interview. These functional measures took approximately 30 minutes to complete.

The Short Physical Performance Battery assesses 3 components of physical function: standing balance, 4-meter walking velocity, and repeated chair rises.²⁹ For the test of standing balance, participants stand in 3 positions: feet together (side-by-side position), semitandem position, and tandem position. For each position, participants are timed to a maximum of 10 seconds. Walking speed is assessed by asking participants to walk at their usual pace over a 4-meter distance. Finally, participants are asked to rise from a straight back chair without using their arms 5 times in a row as quickly as possible. The 4-meter walk and chair stand tests were each completed twice, with the mean of the 2 times used for all analyses. The Short Physical Performance Battery has been used extensively with older adults to evaluate functional status and in adults with PAD.^{30,31} This battery has been shown to be effective in characterizing physical function across a broad spectrum of functional status and predictive of mortality and institutionalization across this spectrum.²⁹

TABLE 1

SEMISTRUCTURED INTERVIEW GUIDE

- 1 Tell me about when your PAD and DM started and how they have influenced your life.
Probes: Has having PAD and DM changed your perception of your health? Which condition came first? Did the diagnosis of the second condition change your perspective?
- 2 Have you sought out information about lifestyle changes since you developed PAD and DM, and if so, where do you go for information? What information has been meaningful for you?
- 3 What role do exercise or physical activity have in your health? Give me examples of things that you have tried and how they work or do not work for you? What works best for you?
Probes: What is it like to try and exercise regularly? What makes it easier or harder? What kinds of activities are you engaging in and how satisfying do you find those activities?
- 4 Tell me about your exercise habits in the past.
Probes: What were your exercise habits earlier in life? Were you an athlete? Did that change, and if so, when did it change?
- 5 If you have had a discussion with health care provider about increasing exercise or physical activity, how did that discussion go?
Probes: What types of activities did you discuss? How did the provider get your input?
- 6 How do you think increasing your physical activity has or would influence your health?
Probes: What types of benefits do you see to exercise? What types of negative effects or consequences of exercise have you or are you concerned about experiencing? For example, low blood sugar, dizziness?
- 7 What types of things keep you from exercising?
Probes: Is claudication a barrier? What else prevents you from exercising or exercising as much as you would like to? Other than symptoms related to PAD or DM, are there other things that prevent you from exercising? Do you have someone who would exercise with you or supports you in exercise? Does exercise affect your mood or relationships with others?
- 8 How do these barriers compare to one another?
Probes: Are some more significant for you than others? Which ones are the most limiting? In what way?
- 9 What things could help you or do help you exercise?
- 10 Do you have goals related to exercise? If so, what are they?
Probes: How do you feel you are doing at achieving those goals? What could your health care provider do to help you achieve those goals?

DM = diabetes mellitus; PAD = peripheral artery disease.

The 6-minute walk test (6MWT) has been used extensively in cardiovascular and pulmonary disease research, including individuals with PAD, as a method of monitoring disease status and intervention effectiveness.³² To complete the 6MWT, participants are instructed to walk back and forth in a 100-foot, level hallway, covering as much distance as possible in 6 minutes.³³ Scores are calculated as the number of feet the participant walks during the 6 minutes.

Grip strength was measured as the mean of 3 trials of each hand using a Jamar digital hand dynamometer (Patterson Medical Corp, St. Paul, Minnesota) according to the American Society of Hand Therapists guidelines for measurement of grip strength.³⁴

Measures of walking impairment and quality of life. Three questionnaires were used to assess walking impairment and quality of life related to PAD: the Walking Impairment Questionnaire (WIQ), the PAD-Specific Quality of Life Questionnaire (PAD-QOL), and the Short Form 36 (SF-36). The WIQ consists of 3 subscales—walking distance, speed, and stair climbing—and was developed specifically for patients with PAD.³⁵ WIQ scores range from 0 to 100, with 100 representing no impairment and

0 being complete impairment. This questionnaire has been shown to correlate well with treadmill walking distance and to be sensitive to change over time.³⁵

The PADQOL is a 38-item questionnaire developed by.³⁶ The PADQOL contains 5 factors: social relationships and interactions, self-concept and feelings, symptoms and limitations in physical functioning, fear and uncertainty, and positive adaptation. Total scores on the PADQOL range from 0 to 100, with 100 reflecting better quality of life.

The SF-36 is a 36-item health survey designed to assess different aspects of physical, psychological, and social quality of life.^{37,38} The SF-36 yields a profile of functional health and quality of life, as well as standardized physical and mental health summary scores. For all subscales and the 2 composite scales, higher scores are indicative of better quality of life. The SF-36 has been used extensively in clinical research³⁸ and in patients with PAD.³⁹

Assessment of selected geriatric syndromes related to falling. Participants completed 2 short measures to assess for the presence of geriatric syndromes. To assess falls, participants were asked “In the past month, have you had a fall, slip, or

trip, in which you lost your balance and landed on the floor, ground, or lower level?"⁴⁰ If the individual reported they had experienced a fall, the study investigator probed for further details of the circumstances surrounding the fall(s) and whether the fall resulted in injury. Fear of falling was assessed using the Falls Efficacy Scale-International (FES-I). The FES-I contains 16 items that assess how concerned a person is about falling in a variety of situations, including walking on a slippery surface, going up and down the stairs, or when visiting a friend or relative.⁴¹ Higher scores indicate greater fear of falling.

Measurement of physical activity and sedentary time. Physical activity and sedentary time were measured using the ActiGraph wGTX3-BT (ActiGraph Corp, Pensacola, Florida). Participants were given the device at the completion of the in-person visit and asked to wear the device 24 hours a day on their nondominant wrist (except when bathing or swimming) for 14 days. The device was used to capture physical activity time, sedentary time, and length of bouts of sedentary behavior in minutes, as well as the number of breaks in sedentary time. Minutes in each type of activity were divided by the total time the participant wore the device while awake to yield percent time in each activity. Participants were provided with a postage-paid envelope by which to return the device.

Data integration and analysis

Qualitative and quantitative data were initially analyzed separately for descriptive purposes (described in the following paragraphs), as well as in conjunction with one another.

Qualitative analysis. Both directed and conventional inductive content analyses were used to identify themes.⁴² After transcription, audio recordings and transcripts were reviewed to ensure the accuracy of transcription. Transcripts were then imported into Atlas.ti (version 8; Scientific Software Development GmbH, Berlin, Germany) and first read multiple times to obtain a sense of the interviews as a whole. Interviews were then read individually, and directed content analysis was used to identify themes. First-cycle coding was conducted using descriptive coding.⁴³ Basic labels were assigned to sections of text to provide an overview of the topics using the social ecological framework as a guide (Figure 1). Coding was conducted using Atlas.ti. In addition, we used elaborative coding, a second-cycle coding method,⁴³ to identify additional categories that appeared to represent key concepts or ideas that were not included in the social ecological framework. This second-cycle method was more typical of conventional inductive content analysis.⁴² Exemplar quotes were used to illustrate themes identified through the interviews.

Quantitative analysis. Descriptive statistics (mean, median, standard deviation, and percent) were used to summarize scores on quality of life and walking impairment instruments, barriers to exercise questionnaire, and the presence and severity of geriatric syndromes. ActiGraph data were downloaded and processed using ActiLife (version 9.0.0; ActiGraph Corp, Pensacola, Florida) and the wrist-specific adaptation of the Troiano adult cut points to identify sedentary, light, moderate, and vigorous activity (≤ 99 , 100–2,019, 2,020–5,998, and $\geq 5,999$ counts per minute, respectively). SPSS Statistics (version 25; IBM Corp, Armonk, New York) was used to analyze quantitative data.

Integrated analysis. Integrated analysis was used to describe participants and evaluate patterns of qualitative themes and quantitative variables among participants. Relevant demographic variables; ABI; percent time spent in sedentary, light, moderate, and vigorous physical activity; and key qualitative themes identified through the interviews were summarized for each individual using a meta-matrix.^{22,44} The meta-matrix was examined for variability among individual participants and potential patterns related to perceived barriers to physical activity and volume of physical activity and sedentary time.

We also evaluated the congruence of themes identified through the qualitative responses with survey responses on the individual factors of the EBBS through the use of a second meta-matrix to explore how representative the questions on the EBBS were, with respect to the barriers reported by individuals during the qualitative interviews. Themes identified in the interviews were "quantized" according to whether or not they were present to allow for examination of patterns in the data,⁴⁵ and the mean score on each factor was reported for both the entire sample and only individuals in whose interviews each theme was identified.

RESULTS

A total of 10 participants were enrolled in the study and completed all study procedures (except for one participant who did not complete the 6MWT due to time constraints). Participants were aged, on average, 74.2 years (SD: 4.3), married (70%), and self-identified as non-Hispanic white. Most participants were men (80%). The mean ABI (lowest leg) was 0.67 (range: 0.32 to 0.91).

Qualitative interview themes

Several themes were identified through analysis of the qualitative interviews related to barriers, facilitators, and benefits of physical activity. Each of these categories and the themes identified in each are discussed in detail in the following sections.

Barriers

Barriers to physical activity reported by participants are shown in Figure 3. The barriers most commonly identified by participants were lack of accessibility, lack of enjoyment of activity, lack of motivation, and pain and physical health.

Accessibility. Accessibility of safe and comfortable places to exercise was a common concern of participants ($n = 6$). As Darla stated, "I could go to the arthritis (water exercise) class, but that meets right away at 9. I have to take the freeways to get there; that's bad freeway time. I don't want to be on the road really." This concern about safe transportation to and from exercise limited Darla's ability to engage in an exercise program she enjoyed. In addition, participants expressed concern about access to equipment: "I don't have the equipment. I did (when on vacation) go out and do some walking, but I didn't have the weights and bike ... If you go so long (without exercising), then you don't feel guilty any more, and you don't get started right up again." (Frank). For participants, accessibility was related to both obtaining transportation and having a location they perceived as accessible given their health concerns. As Jack stated when thinking

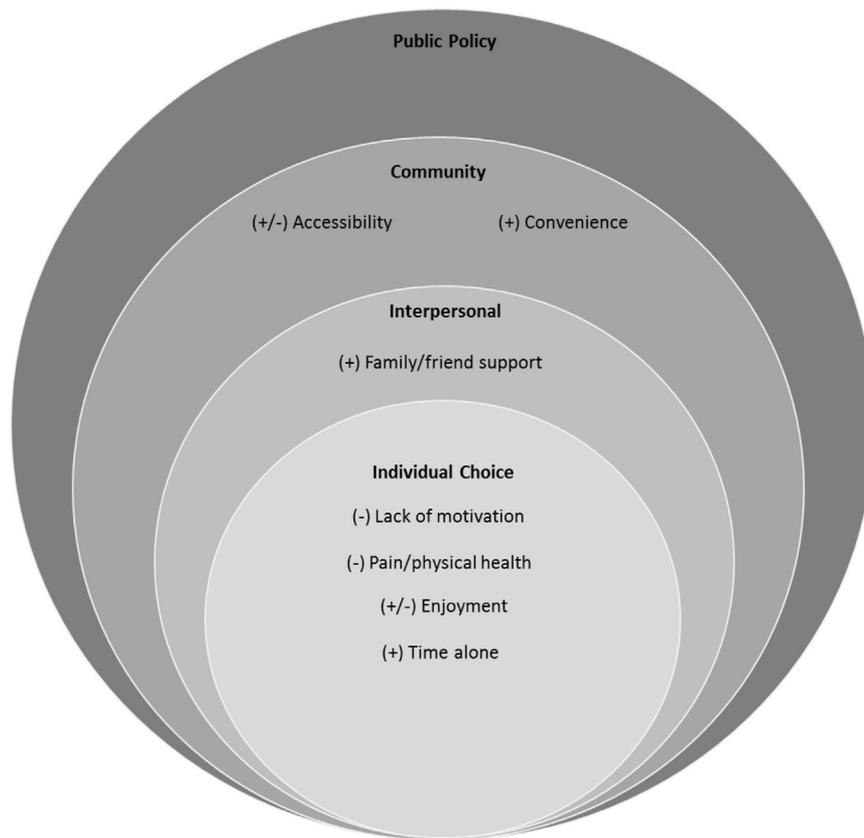


Figure 3. Social ecological model with categories of barriers and facilitators of physical activity identified through qualitative interviews. Note: (–) denotes barrier; (+) denotes facilitator.

about a local gym to which he had a membership but was somewhat hesitant to use,

“I always watched (the parking lot at the gym) and usually between 2 and 3:30 it was pretty quiet in there, so then I’d go in. Otherwise, the parking lot had quite a few cars and I said, nah, I ain’t gonna go in there and do my wimpy stuff ... I just thought you’ve got all these people running 5 miles on the treadmill and doing all that other stuff and I’m just in there getting in their way, so I just wait and bide my time and go in there when I can feel more comfortable.”

Therefore, it is clear that accessibility of a location was not only related to transportation and timing of the facility but also feeling comfortable in their surroundings.

Lack of enjoyment. Lack of enjoyment of the activity was also a barrier, cited by 4 participants. As Cindy said, “Hey, I’m honest. Exercising’s not fun, for the most part. It’s work. If I can make myself happier making a batch of homemade cookies, I’m going to do the cookies. Besides, I get to eat them.” This sentiment was echoed by another participant who stated simply, “Sometimes I want to be doing something else.” (Clyde). This lack of enjoyment of the activity is tied closely to motivation.

Motivation. Motivation was a significant barrier to exercise for 7 participants. As one participant stated, “There has to be a certain amount of motivation (to exercise), and the desire to really put your mind to it is probably a good idea. I don’t do

that.” (Fred). Cindy shared a similar sentiment, “All you can do is to make it available. You can’t make me exercise; I have to be the one to do that ... It has to be within every individual. You could want us to want to exercise, but you can’t make us want to exercise, and that’s the whole thing.” Similarly, Clyde expressed the barrier of lack of motivation well, “If it ain’t in the body, it ain’t anywhere, so if you’ve got it in your mind to do it—it’s like quitting smoking or anything. If you don’t want to, there’s no way in hell you’re going to quit.”

Pain and physical health. Pain and physical health were also commonly expressed barriers; 6 participants reported that their physical health impacted their ability to exercise. Lloyd expressed this concern simply: “Pain is a barrier. Why would I wanna do something that hurts me?” And, as Darla stated, “You can’t walk when you hurt.” Several participants expressed that arthritis (typically knee or hip pain) was a major limitation to their exercise, suggesting that comorbid conditions may play a role in exercise engagement, sometimes to a greater degree than PAD. Despite being distinct themes, there seemed to be a close relationship between lack of motivation and pain as a barrier to exercise for some participants. As Fred stated,

“Our health insurance says I could go to (a gym) and have a free membership there to do whatever I wanted to do ... I don’t have the desire to do that. I’m not saying I’m lazy, but I just ... I think if I could improve my walking, that would probably be the best for me, but then I sit and think,

oh God, my legs are going to get tired. What if I only go so far and all of the sudden I can't get back?"

Concerns about physical ability and a safe place to exercise, given their level of ability, were significant and, according to participants, had a significant effect on the amount of exercise in which they engaged.

Facilitators

Facilitators to physical activity reported by participants were distilled into 3 themes: social support, accessibility and convenience, and enjoyment of the activity (Figure 3).

Social support. Social support, including support of family and friends and the presence of positive role models, was a facilitator identified by 6 participants. As Cindy said,

"[One of the] side benefits is socialization. I've met some really nice people, and we all have a lot of things in common: bad hearts and falling-apart bodies that we're just trying to keep going. It's just absolutely amazing."

Darla expressed similar feelings, describing a group of women with whom she used to attend water therapy classes for arthritis. Not only was there the physical support of having others who "look like me" but also the psychological support. As Darla stated, "It's a group that understands... We're all in the same boat; we've all had a lot of the same thing." Positive role models were also valuable facilitators. As Jim said,

"I got some friends in their 80s now and a few in their 90s: they're spry as anything. I have a sister 11 years older than I am; in her 80s already, and she drives, she goes to exercise. She's very active. I said 'hey that's what I gotta do.' I just gotta keep going."

Having family and friends who have experienced similar challenges in engaging in exercise and can provide support that "we're in this together" was a key facilitator for participants who had and currently engaged in regular exercise.

Accessibility and convenience. Accessibility and convenience of opportunities to engage in exercise were mentioned as facilitators by half of the participants. As Jack said of a local gym he attends, "They've got the equipment that I kind of like and have got people to advise you on what you should be doing", which helps facilitate exercising. Similarly, as Jim said, "I think being a member somewhere is very helpful. Paying the money; you might as well make use of it." The feeling that he has made a commitment was of particular importance to Clyde, "If I say I'm going to do it [exercise], I'll do it ... If I commit to something, then fine, I'm going to do it, stay with it until it's done." This sense of accountability and availability of resources to promote exercise (particularly in the setting of a research study for several of the participants) helped motivate them to engage in exercise that they, in their perspective, committed to doing.

Enjoyment. Finally, enjoyment of the activity was a facilitator of activity mentioned by 4 participants. As Cindy said, "When you exercise—and I don't care if it's exercise-exercise, or if it's doing a sport you enjoy doing; it can be something as innocuous as even shuffleboard or ping pong, bocce ball—if it's something you enjoy doing, you're still active."

To Cindy and several other participants, finding a type of exercise that was not only suitable given their health issues (eg, knee or hip arthritis, back pain) but also enjoyable was a key facilitator and defining factor in whether or not they would engage in that exercise regularly.

Benefits

Three themes were identified with respect to benefits of exercise: energy, mobility and physical health, and sense of accomplishment.

Energy. Forty percent of participants indicated that they felt exercise gave them more energy. For example, Darla said,

"It puts me in a better mood all over. I feel more positive about everything, and maybe when I do come home, I won't do a lot, but I will do a few little things around the house, maybe move things around or go do something in the kitchen or something like that, write some notes that I'm supposed to write."

Mobility and physical health. For Darla, exercise enabled her to do more activities around the house and better engage in life with her family. Another benefit of exercise reported by participants was improved mobility. As Cindy stated,

"For me, it's like I told my daughter. I said, "You may not see it as much of an improvement, but I do." I mean, if I can go from walking 150 feet to 300 feet without stopping, that, for me, is an improvement. That's one less stop I have to make. That's one less bench I have to sit down on so that I can let the blood flow get back into the legs. I'll take every one of those minor increments I can get. It may not sound like much."

Improved overall health was also a perceived benefit to 6 participants: "I breathe better. My sleep, I fall asleep right away. I get the blood flow going and even down to my legs, it's beneficial. Plus, it makes me stronger." (Jim). This feeling of improved energy and function were not only benefits of exercise but also important factors cited by participants that encouraged them to continue engaging in exercise.

Sense of accomplishment. Finally, 4 participants also reported that exercise gave them a sense of accomplishment. "I go [exercise]. And I feel better for it." (Jim). Similarly, Frank said, "I just felt, okay, I'm doing something I should be doing, and it's for my own good." This sense of accomplishment was also manifested in improved mobility. As Lloyd stated, the ability of staff at the exercise program in which he participates to say "Look, this is where you were, this is where you are now." was incredibly helpful, showing him the progress he has made. This feeling that the exercise was helping them in some way was important in motivating participants to continue with exercise in spite of the barriers they encountered.

Quantitative outcomes

Mean (SD) scores on self-reported questionnaires and physical function tests are reported in Table 2. On average, participants spent 66.9% (range: 53%–78%) of their time in sedentary behavior and 10.2% (range: 3%–18%) of their time

TABLE 2

MEAN (STANDARD DEVIATION [SD]) SCORES ON SELF-REPORT QUESTIONNAIRES AND PHYSICAL FUNCTION ASSESSMENTS

<i>Measure</i>	<i>Mean (SD)</i>	<i>Range</i>
Self-report questionnaires		
WIQ		
Distance	35.7 (34.7)	4.3–100
Speed	37.6 (28.3)	3.3–89.1
Stairs	49.5 (39.9)	0–100
FES-I	26.0 (8.2)	18.0–46.0
PADQOL		
Factor 1: social relationships and interactions	66.7 (22.3)	24.4–97.8
Factor 2: self-concept and feelings	72.9 (23.1)	28.6–100
Factor 3: symptoms and limitations in physical functioning	39.0 (22.7)	10–80
Factor 4: fear and uncertainty	63.0 (20.4)	30–90
Factor 5: positive adaptations	64.0 (14.6)	37.1–85.7
SF-36		
Physical composite	36.3 (10.6)	16.4–51.5
Mental composite	59.3 (5.4)	50.6–66.6
EBBS benefits		
Life enhancement	65.2 (14.2)	47.6–100
Physical performance	68.9 (13.1)	48.2–100
Psychological outlook	64.4 (17.2)	50.0–100
Social interaction	51.7 (16.1)	33.3–75.0
Preventive health	63.3 (20.3)	33.3–100
Overall	64.1 (13.7)	47.1–96.6
EBBS barriers		
Exercise milieu	28.9 (18.8)	0–61.1
Time expenditure	40.0 (19.7)	11.1–77.8
Physical exertion	63.3 (16.6)	33.3–88.9
Family encouragement	24.2 (18.6)	0–66.7
Overall	38.0 (15.4)	14.3–69.1
Physical function assessments		
SPPB		
Balance	3.6 (0.5)	3–4
4-Meter walk	4.42 (1.01)	3.01–6.19
Chair stand	11.2 (2.9)	6.6–14.5

(Continued)

TABLE 2

CONTINUED

<i>Measure</i>	<i>Mean (SD)</i>	<i>Range</i>
Grip strength		
Nondominant	28.8 (9.6)	15.7–44.2
Dominant	29.2 (9.8)	16.3–45.5

EBBS = exercise benefits and barriers scale; FES-I = falls efficacy scale–international; PADQOL = peripheral artery disease quality of life questionnaire; SD = standard deviation; SF-36 = short form 36; SPPB = short physical performance battery; WIQ = walking impairment questionnaire.

in moderate to vigorous physical activity (MVPA). Degree of impairment in walking distances, speed, and climbing stairs as measured by the WIQ varied greatly among participants, as did scores on the PADQOL. On average, participants endorsed benefits from exercise more than barriers to exercise as measured using the EBBS, with mean scores of 64.1 and 38.0 for benefits and barriers, respectively. Physical exertion was the most strongly endorsed exercise barrier, with a percentile score of 47.5.

With respect to geriatric syndromes, 3 participants (30%) (Jack, Darla, and Clyde) reported one or more falls (range: 1–3) in the previous 3 months. Causes of falls included icy sidewalks, misjudging a curb, and household hazards (eg, furniture leg, rug). Several falls resulted in muscle soreness and bruising, but none resulted in serious injury. Concern about falling as measured using the FES-I varied substantially among participants; however, all participants expressed at least some concern, most frequently on the items “walking on a slippery surface” and “walking on an uneven surface.”

Integrated analysis

A meta-matrix outlining key participant characteristics, quantitative variables, and qualitative themes is displayed in Table 3. Participants with greater sedentary time and less MVPA tended to report greater fear of falling (higher FES-I score) and barriers to physical activity and had slower gait speeds, more difficulty with the chair rise, and lower 6MWT distances.

To examine the congruence of the themes identified in the interviews with the domains of the EBBS, we constructed matrices looking at the overlap of these components. Tables 4 and 5 display count data with the number of individuals who reported each interview theme and the average score on each EBBS factor for individuals who reported that theme among benefits and barriers, respectively.

Some patterns did emerge with respect to scores on the EBBS and qualitative themes. Participants who endorsed increased energy as a benefit of exercise in the interview tended to have higher scores on all the EBBS benefits domains (Table 4), as did participants who reported that exercise gave them a sense of accomplishment. With respect to barriers, physical exertion was reported as the greatest barrier to exercise according to the EBBS across all participants regardless of themes identified

TABLE 3

META-MATRIX SUMMARIZING KEY PARTICIPANT CHARACTERISTICS, PHYSICAL ACTIVITY, PERFORMANCE ON PHYSICAL FUNCTION MEASURES, AND REPORTED BARRIERS AND FACILITATORS OF PHYSICAL ACTIVITY

Case*	Age	ABI (Lowest Leg)	6-Min Walk (Feet)	Activity			SPPB			Grip Strength Dominant Hand (kg)	FES-I	Interview Themes	
				Sedentary (%)	Light (%)	MVPA (%)	Balance (Points Out of 4)	Repeated Chair Rise (sec)	4-Meter Walk (sec)			Barriers	Facilitators
Darla	72	0.91	480	77	18	5	3	11.66	3.44	16.3	46	<ul style="list-style-type: none"> • Accessibility • Motivation • Pain/physical health 	<ul style="list-style-type: none"> • Family/friend support
Cindy	69	0.57	750	74	19	7	4	14.52	3.61	19.4	21	<ul style="list-style-type: none"> • Enjoyment • Motivation • Pain/physical health 	<ul style="list-style-type: none"> • Accessibility • Enjoyment • Family/friend support
Jack	78	0.44	750	76	21	3	3	Unable to do	6.19	35.7	32	<ul style="list-style-type: none"> • Accessibility • Motivation 	<ul style="list-style-type: none"> • Accessibility • Enjoyment • Family/friend support • Time alone
Fred	78	0.90	902	78	16	5	3	Unable to do	5.33	31.8	27	<ul style="list-style-type: none"> • Enjoyment • Motivation 	
Clyde	80	0.32	1,077	63	29	8	3	Unable to do	4.85	24.8	27	<ul style="list-style-type: none"> • Enjoyment • Motivation 	
Jim	74	0.63	1,310	60	25	15	4	8.91	3.71	35.3	19	<ul style="list-style-type: none"> • Accessibility • Pain/physical health 	
Lloyd	76	‡	1,400	63	24	13	4	6.64	4.28	20.8	21	<ul style="list-style-type: none"> • Enjoyment • Motivation • Pain/physical health 	<ul style="list-style-type: none"> • Family/friend support • Time alone
Frank	76	0.70	1,470	65	24	11	4	13.02	3.01	40.2	18	<ul style="list-style-type: none"> • Accessibility • Motivation • Pain/physical health 	

Robert	73	0.87	1,615	61	23	16	4	12.31	4.41	22.7	23	• Accessibility	• Family/friend support
Darrell	66	†	†	53	29	18	4	Unable to do	5.35	45.5	26	• Accessibility • Pain/physical health	

ABI = Ankle-Brachial Index; FES-I = falls efficacy scale—international; MVPA = moderate to vigorous physical activity; SPPB = short physical performance battery.
 *Case names reported are pseudonyms.
 †Participant did not complete due to time constraints.
 ‡No ABI available.

from the qualitative interviews (Table 5). The theme “lack of accessibility” from the interviews corresponded most closely to the EBBS domain “exercise milieu,” with participants who expressed difficulty with accessibility in their interviews having higher scores on this subscale. Similarly, participants who reported that lack of enjoyment of the activity was a barrier tended to place more importance on the time expenditure involved in exercise as a barrier to activity.

DISCUSSION

This study provides rich descriptive data related to barriers to and engagement in physical activity among older adults with PAD and diabetes. The barriers and facilitators to physical activity identified here are similar to those identified in other qualitative studies in individuals with PAD. In one study, Galea et al²¹ found that personal motivation and leg discomfort were the most commonly cited barriers to physical activity. These are similar to the barriers of “lack of motivation” and “pain and physical health” identified in this study. In addition, these barriers are also similar to those commonly cited by older adults in general.¹⁶

Fear of falling was also a common concern among participants, which may present a barrier to physical activity. Previous studies have demonstrated that self-reported stumbling and unsteadiness are 86% more prevalent in those with PAD than in those without PAD⁴⁶ and that a history of falling is associated with impairments in physical function, including balance, in individuals with PAD.⁴⁷ In addition, diabetes is associated with increased fear of falling and fear-associated activity restriction.⁴⁸ Although fear of falling was not commonly reported in the qualitative interviews, all participants reported at least some concern about falling on the FES-I, and 3 reported recent falls. Therefore, consideration of concern about falling and ways to address such concerns is important when working with older adults with PAD and diabetes to promote increased physical activity.

There were also similarities in the facilitators to physical activity identified in this study compared with previous work. Social support and accessibility and convenience were particularly important, providing possible targets for future interventions to promote physical activity. For example, one of the most commonly cited disease-specific facilitators for exercise in the study by Galea et al²¹ was the availability of a supervised treadmill walking program. The recent Centers for Medicare and Medicaid Services determination to reimburse to the cost of exercise therapy for beneficiaries with symptomatic PAD provides a new opportunity to engage individuals with PAD in exercise therapy and for the growth of programs to make this effective therapy more readily available. In addition, social support was an important facilitator, something that could be considered when designing or planning exercise groups. Individuals with PAD may be self-conscious of or embarrassed by their walking ability, so having a group of supportive individuals who also have PAD could be an important component in adherence to and success with an exercise program.

Despite the small sample size, we did obtain a clear range of experiences among participants. Darla expressed some of the greatest impairments, both globally and related to PAD, with the lowest scores on several factors of the PADQOL, particularly

TABLE 4

COMPARISON OF INTERVIEW-IDENTIFIED BENEFITS WITH EBBS BENEFITS

<i>Interview theme</i>	<i>EBBS factors—benefits</i>				
	<i>Life enhancement</i>	<i>Physical performance</i>	<i>Psychological outlook</i>	<i>Social interaction</i>	<i>Preventive health</i>
Energy (n = 4*)	76.2	77.8	76.4	64.6	80.6
Mobility (n = 5*)	61.0	63.0	53.3	43.3	53.3
Physical health (n = 6*)	68.3	67.9	64.8	47.2	61.1
Sense of accomplishment (n = 4*)	73.8	75.0	65.3	56.3	75.0

EBBS = exercise benefits and barriers scale.

Higher scores indicate greater endorsement of exercise benefit. Scores reported are EBBS factor scores that have been transformed to percentages for ease of interpretation.

*Number of participants who expressed benefits related to the given theme.

related to social relationships and interactions, self-concept and feelings, symptoms and limitations, and physical functioning. She also had one of the lowest scores on the SF-36 mental composite score and the lowest physical composite. She expressed significant impairment in walking (had the lowest WIQ score on all 3 domains) and the shortest distance on the 6MWT. Interestingly, but perhaps not surprisingly, she expressed the greatest barriers to physical activity on the EBBS. Alternatively, Jim and Robert expressed substantially less impairment, with their scores on the WIQ, PADQOL, and SF-36 being some of the highest among the participants.

The barriers and facilitators to physical activity identified in this study are somewhat consistent with those that were hypothesized in the context of the social ecological model of McLeroy

et al.¹⁷ The identified themes are shown in Figure 3. Although many of the personal (eg, physical health, motivation, enjoyment) and interpersonal (eg, social support) levels were consistent with identified themes, few specific themes were identified related to community and public policy. This is perhaps because there were no specific questions included in the interview guide to probe for broader barriers and facilitators to physical activity, but also, it could be that participants felt that the personal and interpersonal levels had greater relevance to and bearing on their behavior. Future studies are needed to examine how community and public policy issues may serve as a barrier or facilitator to physical activity among older adults with PAD and diabetes.

The findings of this study also suggest that, in general, barriers are easier for participants to identify (or perhaps more

TABLE 5

COMPARISON OF INTERVIEW-IDENTIFIED BARRIERS WITH EBBS BARRIERS

<i>Interview theme</i>	<i>EBBS factors—barriers</i>			
	<i>Exercise milieu</i>	<i>Time expenditure</i>	<i>Physical exertion</i>	<i>Family encouragement</i>
Lack of accessibility (n = 6*)	30.6	37.0	59.3	26.5
Lack of enjoyment of activity (n = 4*)	26.4	44.4	69.4	20.8
Lack of motivation (n = 7*)	28.6	42.9	69.8	27.5
Pain, physical health (n = 6*)	35.2	40.7	61.1	30.6

EBBS = exercise benefits and barriers scale.

Higher scores indicate greater endorsement of exercise barrier. Scores reported are EBBS factor scores that have been transformed to percentages for ease of interpretation.

*Number of participants who expressed barriers related to the given theme.

similar between participants) compared with facilitators, where there were fewer commonalities. This could be related to the sample size and lack of saturation. We also found that, except for physical exertion (which was the most strongly endorsed barrier), benefits were more strongly endorsed for physical activity than were the barriers; however, this could be related to participants motivated by social desirability. We also found significant congruence between measures of physical function and engagement in physical activity, with participants who had the greatest impairments in physical function tending to engage in less physical activity overall and, in particular, less MVPA than their counterparts who had less difficulty with the physical function measures. Although this does not suggest that poor physical function leads to lower engagement in physical activity (or vice versa), it is an important consideration in designing physical activity interventions, as well as interventions that target reducing inactivity. Notably, there did not appear to be a relationship between resting ABI and physical activity levels or physical function as measured by the 6MWT among participants, suggesting that resting ABI alone may not be an important factor in engagement in and performance of physical activity for this sample.

This study has a number of strengths. First, the mixed methods design is unique from research currently being conducted in this population, in that it provided the opportunity for integrated analysis to examine the interrelationships of quantitative patterns of activity and physical function and qualitative investigation of barriers and facilitators to this activity. Second, the use of accelerometers to assess physical activity provided an objective method of measuring activity levels and quantifying sedentary time. Finally, the integration of both self-reported and objective measures of walking impairment and function was a strength as it enabled us to examine patterns of both types of measures in relationship to activity.

This study has several important limitations. First, the study sample was limited in scope. As the sample was drawn from current and former participants in exercise studies related to PAD, their views may not be representative of all individuals with PAD, particularly those who have never engaged in a formal exercise program. However, the views of individuals who have engaged in exercise studies for PAD are revealing, in that despite these programs, they express a number of significant barriers to exercise. In addition, this highlights that although program availability is important, it is not the sole barrier to engagement in exercise for individuals with PAD. A second limitation is the small sample size, particularly with regard to female participants ($n = 2$), and so we may not have reached saturation with respect to interview themes or full range of experiences. Third, we did not collect additional data on other comorbid health conditions, and not all participants had an ABI to quantify the severity of PAD, which may have enhanced our understanding of other limitations to physical function in addition to PAD. Finally, this study was cross-sectional in nature, and so, although we were able to examine patterns in physical activity and physical function at one point in time, we were unable to examine potential temporal relationships between activity levels, changes in function, and barriers and facilitators to exercise.

CONCLUSION

In conclusion, this mixed methods study provides rich insight into both the nature of barriers to physical activity and engagement in physical activity among older adults with PAD and diabetes. The integration of both self-reported and objective measures facilitates our understanding of the lived experiences of individuals with these conditions and provides opportunities for future research. The findings of this study can be used to support further investigation into factors that influence engagement in physical activity among individuals with PAD and diabetes and assist in the development of strategies to address perceived barriers, particularly as supervised exercise therapy programs for individuals with PAD become more widely available in clinical care.

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