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ORIGINAL

Exercise barriers contributing to reduced physical activity in chronic stroke survivors in a multi-ethnic population: a cross-sectional study in Suriname.

Barreras del ejercicio que contribuyen a la reducción de la actividad física en los supervivientes de accidentes cerebrovasculares crónicos en una población multiétnica: un estudio transversal en Surinam

Ameerani Jarbandhan[1], Jerry Toelsie[2], H.E.J. Veeger[3], Luc Vanhees[4], Roselien Buys[4], Robbert Bipat[2]

1. Anton de Kom University of Suriname, Dept. of Anatomy, Paramaribo, Suriname 2. Anton de Kom University of Suriname, Dept. of Physiology, Paramaribo, Suriname 3. Dept. of Biomechanical Engineering, Delft University of Technology, Delft, The Netherlands 4. Katholieke Universiteit Leuven - KU Leuven, Dept. of Rehabilitation Sciences, Leuven, Belgium

Corresponding author
Prof. Dr. Robbert Bipat
E-mail: robbert.bipat@uvs.edu, robbert.bipat@gmail.edu

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Abstract

Objectives: Despite all the recommendations physical activity (PA) and participation in structured PA programs remains low among the stroke survivors. Compared to high-income societies, these patients face unequal socio-economic challenges in countries with low- and middle-income and in multi-ethnic populations. We therefore aimed to explore factors associated with reduced PA levels in chronic stroke patients living in a middle-income country with a multi-ethnic population, Suriname. Furthermore, we explored possible barriers that may prevent participation in exercise programs.
Methods: We recruited participants from the general population and the Academic Hospital, and used energy expenditure (EE) and step count, measured with the GARMIN Forerunner 225 for seven consecutive days to evaluate PA. With the Barriers to Physical Activity and Disability (BPAD) questionnaire we identified exercise barriers and obtained demographic and socio-economic characteristics. We used regression analyses to assess associations with reduced PA levels, and descriptive analyses to assess exercise barriers based on socio-economic diversity.
Results: The mean age of the 44 participants was 58.2 ± 10.0 years and 21 were men. The median EE and steps were 24.2 (min-max: 16.1-53.7) Cal/kg/day and 3165.5 (min-max: 1093.0-9727.00) steps/day, respectively. Reduced PA levels were not related to demographic or socio-economic variables. Overall, patient-reported environmental exercise barriers were (1) "cost of the program" (45%) followed by (2) "lack of transportation" (34%). Personal barriers were (1) "feeling that an exercise instructor is incapable to set up an exercise program to meet their needs" (88%) and (2) "not willing to spend money" (40%). Different personal exercise barriers between ethnic groups were reported, but environmental barriers were the same.
Conclusions: Reduced PA levels in chronic stroke survivors were not explained by demographic or socio-economic variables. The participants reported several exercise barriers. In addition to the most common occurring barriers, future research should also evaluate feasibility and (cost-) effectiveness of tailored PA programs.

Keywords: Physical activity, ethnicity, stroke, exercise barriers.

Resumen

Objetivos: A pesar de todas las recomendaciones, la actividad física (AF) y la participación en programas estructurados de AF sigue siendo baja entre los supervivientes de un accidente cerebrovascular. En comparación con las sociedades de altos ingresos, estos pacientes enfrentan desafíos socioeconómicos desiguales en países con ingresos bajos y medios y en poblaciones multiétnicas. Por lo tanto, nuestro objetivo fue explorar los factores asociados con niveles reducidos de AF en pacientes con accidente cerebrovascular crónico que viven en un país de ingresos medios con una población multiétnica, Surinam. Además, exploramos las posibles barreras que pueden impedir la participación en programas de ejercicio.
Métodos: Reclutamos participantes de la población general y del Hospital Académico, y utilizamos el gasto energético (EE) y el conteo de pasos, medidos con el GARMIN Forerunner 225 durante siete días consecutivos para evaluar la AF. Con el cuestionario Barriers to Physical Activity and Disability (BPAD) identificamos barreras para el ejercicio y obtuvimos características demográficas y socioeconómicas. Utilizamos análisis de regresión para evaluar las asociaciones con niveles reducidos de actividad física y análisis descriptivos para evaluar las barreras al ejercicio en función de la diversidad socioeconómica.
Resultados: La edad media de los 44 participantes fue de 58,2 ± 10,0 años y 21 eran hombres. La mediana de EE y los pasos fueron 24,2 (mín.-máx.: 16,1-53,7) Cal/kg/día y 3165,5 (mín.-máx.: 1093,0-9727,00) pasos/día, respectivamente. Los niveles reducidos de AF no se relacionaron con variables demográficas o socioeconómicas. En general, las barreras ambientales para el ejercicio informadas por los pacientes fueron (1) "costo del programa" (45%) seguido de (2) "falta de transporte" (34%). Las barreras personales fueron (1) "sentir que un instructor de ejercicios es incapaz de establecer un programa de ejercicios para satisfacer sus necesidades" (88%) y (2) "no estar dispuesto a gastar dinero" (40%). Se reportaron diferentes barreras de ejercicio personal entre grupos étnicos, pero las barreras ambientales fueron las mismas.
Conclusiones: Los niveles reducidos de AF en sobrevivientes de accidentes cerebrovasculares crónicos no fueron explicados por variables demográficas o socioeconómicas. Los participantes informaron varias barreras al ejercicio. Además de las barreras que ocurren con mayor frecuencia, la investigación futura también debe evaluar la viabilidad y la (costo) efectividad de los programas de AF personalizados.

Palabras clave: Actividad física, etnicidad, accidente cerebrovascular, barreras para el ejercicio.

Introduction

Suriname is a middle-income country (LMIC) with a prevalence of stroke ranging from 1.8 to 4.1% among different ethnic groups[1]. Like most LMIC's, chronic patient care is less developed, and resources are not readily available compared to high-income countries (HIC)[2]. One of the factors that may contribute to an additional poor patient care is low Physical Activity (PA). Lack of sufficient PA increases the possibility of recurrent stroke, even in highly active subjects suffering from an initial stroke[3,4]. In addition, PA is a simple and modifiable tool to improve post-stroke mobility[5] and adherence to health enhancing structured PA programs is therefore strongly encouraged by leading current management guidelines for stroke patients[6]. Notwithstanding this, healthy Surinamese show insufficient PA which varies along ethnic lines[7]. In addition to stroke related impairments, low PA can be related to income and education level, marital status and perceived exercise barriers and motivators[8,9]. The latter two may vary among countries and populations and may depend on distinct sociocultural factors.

To date, most of the studies on factors associated with lower PA levels show data from HICs. These studies[3,10,11] include diverse determinants of decreased exercise participation after stroke when compared to middle-income countries[8,12]. However, environmental and facility barriers including costly exercise programs, transportation unavailability, bad local infrastructure and weather conditions are reported in both HIC and LMIC as barriers for exercise[13]. On the other hand, a Nigerian study[14] reports personal exercise barriers such as the notion that people in exercise outfit look funny and are embarrassed to exercise. This shows that cultural aspects may also influence PA behavior. Furthermore, a USA study reports personal exercise barriers like lack of interest in PA programs and concerns that exercise might worsen the health condition[13].

From the abovementioned reports, it can be concluded that generalization of study findings requires caution and that it is relevant to explore factors associated with low PA levels as well as exercise barriers further in stroke survivors from diverse ethnic populations, to be able to advise effective interventions to increase post-stroke PA in the future. As exercise is, by definition, planned structured, repetitive, and intentional movement to improve or maintain physical fitness (PF), low PA levels might result in decreased physical fitness levels. This study is aimed to identify the role of demographic and socio-economic factors in reduced PA levels and to identify barriers in a multi-ethnic stroke population from a LMIC setting.

Methods

Participants

From April 2016 to April 2017, we recruited participants from the database of the Rehabilitation Center Paramaribo and from the local community. Inclusion criteria included: being able to understand simple instructions (Mini Mental Scale Examination >24); living at home; being in the chronic stage after stroke (last stroke >6 months ago); walk independent or with supervision (Functional Ambulation Category score ≥3); not presenting any serious cardiac condition 15 or other neurological deficits or uncontrolled blood pressure (systolic pressure >140 mmHg, diastolic pressure >90 mmHg) 15 and willingness to provide written informed consent.

Baseline Characteristics and Cardiovascular Risk Factors

A questionnaire was administered to obtain demographic and socio-economic characteristics including sex, age, self-reported ethnicity (Asian, African or other), education level (less than high school or high school and higher), monthly income level (≤1000SRD or >1000SRD), and marital status (married or single). Weight and height were measured using an electronic scale (Seca 750) and a stadiometer (Seca 213). Type of stroke (ischemic or hemorrhagic) and the time post stroke were noted from medical records.

We used the daily steps and energy expenditure (EE) measured by the Garmin forerunner 225 to obtain data on PA level. The watch was worn on the non-paretic wrist for 7 consecutive days. It collected daily step counts and energy expenditure per day. PA measurement was considered valid when the watch was worn for at least 22 hours on at least five days, including the weekend, of the measurement week. For invalid measurements, missing data was completed using missing value analysis by SPSS. No registration of PA data resulted in exclusion from further data analysis.

To collect information on exercise barriers, a Dutch translation of the Barriers to Physical Activity and Disability (B-PAD) questionnaire was used[13]. Forward and backward translation was performed by a professional translator and reviewed by two researchers. To assess clarity and readability, the usefulness of the translated questionnaire was piloted in five healthy Surinamese Dutch speaking individuals before being used in the study.

The SCI Exercise Self-Efficacy Scale (ESES Dutch version) was used to obtain information on the participants' level of confidence with regard to carrying out regular physical activities[16]. The ESES consists of 10 items to be scored on a 4-point Likert scale; the total score can range from 10 to 40. The higher the total score the higher the exercise self-efficacy[17].

Statistical analysis

Data were assessed for normality using the Shapiro-Wilk statistic. Data and survey responses were summarized descriptively (for continuous variables, mean and standard deviation were provided; median and range when not normally distributed, categorical variables were described by frequency and percentages). To study significant differences of the PA outcome measures compared to the global PA recommendations, a one-sample T-test was performed for parametric data. Independent students' T-test were used to compare outcomes between sex and ethnic groups. Pearson's correlation was used to study correlation within continuous data. Univariate regression analysis was used to study the factors associated with low PA, quantified as average calories/kg/day (energy expenditure, EE) and average steps/day (the dependent variables). Independent variables were sex, age, education level, income level, marital status, ethnicity, self-efficacy. Multivariate regression analysis was used to study which variables were independent predictors of PA. Hereby, the stepwise method was used in order to prevent multicollinearity. The difference between perceived exercise barriers according to education level, income level, marital status and ethnic background were completed using descriptive analyses. Statistical analyses were undertaken using IBM SPSS Statistics version 21.1. Statistical significance was set at $p < 0.05$.

Ethics

All participants provided written consent to participate in the study. At all times a Medical Doctor was available in case of emergency and the emergency department of the Hospital was within close proximity. All procedures were completely in line with the declaration of Helsinki. The Institutional Review Board of The Ministry of Health of Suriname formally approved the study including all procedures and interventions (reference number: VG-023-15).

Results

Baseline characteristics and PA

Fifty participants (48% males, mean age 58.2 ± 9.5 years) in the chronic phase after stroke (93.2% ischemic stroke and 46% left hemisphere affected) were included. Collection of the data regarding daily EE and steps/day of three participants was incomplete and were supplied for by using missing value analysis. The data of 6 participants was not registered and therefore excluded from further analysis, ultimately resulting in a total study group of 44 (**Table I**). Most of the 44 participants were Asian (N=25, 56.8%) followed by African (N=13, 29.5%) and other ethnic backgrounds (N=6, 13.6%). The latter two were regrouped together as Non-Asians (N=19, 43.2%) to prevent defragmentation in ethnic groups. Twenty-one participants (47.7%) had a monthly income lower than 1000 SRD (at that time roughly 100 Euro), and most of the participants (68.2%) had an educational degree lower than high school and thirteen were single (29.5%). Median time post-stroke was 2.5 (range 0.5-16.6) years. Hypertension (N=37, 84.1%) and diabetes (N=23, 52.3%) were the most common comorbidities.

Factors associated with low physical activity

A priori correction was done for weight in the data of EE/day and this data did not show a normal distribution (p=0.000). Data from steps/day showed a normal distribution after transformation with the Ln function (p=0.006). Moreover, education level was associated to income level (r=0.457, p=0.002).

A univariate regression analysis was run to predict physical activity (steps/day) from age, sex, education level, income level, marital status, exercise self-efficacy and ethnicity (**Table II**). Furthermore, PA was not explained by these variables (**Table III**), therefore no multivariate regression analysis was conducted with these variables. No association was found between energy expenditure and steps/day (r =0.027, p =0.863).

Table I: Characteristics of all participants included in data analysis (N=44).

Age (years, mean ± SD)	58.2 ± 9.5
Sex (N, female)	23.0
Weight (kg, mean ± SD)	72.1 ± 13.4
PA level	
EE (calories / kg / day, median (min-max))	24.2 (16.1-53.7)
Steps / day (median, min-max)	3165.5 (1093.0-9727.0)

EE: Energy Expenditure; PA: Physical Activity; SD: Standard Deviation.

Table II: Univariate regression analysis between PA measures and independent variables.

Independent variables	Total, N=44	PA level and PA intensity			
		Average steps /day		Average EE	
		p-value	r-square	p-value	r-square
Sex (N, females)	23	0.93	0.00	0.24	0.03
Age (years, mean ± SD)	58.2 ± 10.0	0.97	0.00	0.34	0.02
Marital status (N, single)	13	0.47	0.12	0.19	0.03
Education level (N, lower than high school)	30	0.32	0.02	0.84	0.00
Income level (N, lower than 1000SRD)	21	0.77	0.00	0.99	0.00
Ethnicity (N, Asian/ Non-Asian)	25/19	0.25	0.03	0.18	0.41
Exercise Self-Efficacy score (median (min-max))	35 (10-40)	0.56	0.32	0.98	0.15

*EE: Energy Expenditure; Max: Maximum; Min: Minimum; PA: Physical Activity; R-square: percentage of variance explained by independent variable; SRD: Surinamese Dollar

BPAD questionnaire

Barriers to exercise can be found in **table II**. One participant (2.3%) was enrolled in a structured exercise program. About 9% of the participants stopped exercise due to health problems. Another 11.4% had an injury after participating in an exercise program. Most participants were interested in (re)starting an exercise program (81.8%) and felt that exercise would help their condition (93%). The most common patient-reported environmental exercise barriers were (1) "cost of the program" (45%) followed by (2) "lack of transportation" (34%). The most reported personal barriers were (1) "feeling that an exercise instructor is incapable to set up an exercise program to meet their needs" (88%), (2) "not willing to spend money" (40%), (3) "don't know a fitness center"(38%), (4) "never exercised regularly (25%), (5) "lack of personal care attendant who help for exercise" (20%) (**Table II**). On average, each participant reported seven exercise barriers.

Table III: Exercise Barriers (N=44).

BARRIERS to exercise	N, yes
Lack of transport facilities	15
Lack of time	7
Lack of energy	3
Lack of motivation	5
Lack of family and friends support*	2
Ever afraid to leave your home*	6
Costly exercise program	20
Lack of interest in exercise	1
Lack of personal care attendant who will help with exercise	9
Lack of accessible fitness center	4
Exercise is monotonic and dull	0
Exercise will not improve my condition	1
Exercise will worsen my health	1
Exercise is too difficult	3
Not knowing how to exercise	8
Not knowing where to exercise	5
Health concerns prevent from exercise	4
Pain prevents exercise	4
Too old for exercise	0
Feeling uncomfortable and self-conscious in a fitness center	3
Injury due to exercise	5
Any concerns about exercising in a fitness center	5
Had a bad experience in a fitness center	4
Satisfied with physical appearance and does not need to exercise	7
Family responsibilities prevent to exercise	2
Work prevents to exercise	5
Feeling that exercise instructor is incapable to set up an exercise program to meet your needs	39
Know a fitness center where you could exercise	27
Willing to pay for exercise program	26
Would like to start exercise program	36
Feel that an exercise program could help	41
Doctor advised exercise	27

EE: Energy Expenditure; BPAD: Barriers to Physical Activity and Disability.

Within group analysis of the BPAD results

There were no significant differences found in the number of exercise barriers between participants with low and high education level (p=0.765). This was also the case for groups with low- and high-income level (p=0.644), marital status (p=0.290) and people from different ethnic backgrounds (p=0.388).

Figures 1 to **3** show the most common reported exercise barriers for every ethnic group, marital status group, education- and income level group. Three of the top five barriers are common between low education, low income and single marital status group and included "not exercised regularly" and "don't know how to exercise". Furthermore, environmental PA barriers were a commonality across all groups. Both, the high and low education group, reported that they did not know a fitness center where they could go to and that they thought that the cost of the program was an issue. This was also the case for people from the low- and high-income groups. Moreover, both income level groups identified "not willing to spend money for a PA program", as a barrier for PA. All the top five barriers between the single and married marital status group were identical and included "feeling that the exercise instructor is incapable of to help", "doesn't know a fitness center" and "lack of transportation". The least common reported exercise barriers were: 1) exercise will worsen my health; 2) exercise will not improve my condition; 3) lack of interest; 4) exercise is too difficult and 5) lack of support from family and friends.

Discussion

In this study, factors associated with low PA levels were explored and barriers to exercise were described in chronic stroke survivors from a LMIC country with a multi-ethnic background. Results show that reduced PA levels were not explained by demographic or socio-economic variables. Between ethnic groups, personal exercise barriers were distinct, but environmental/facility exercise barriers were common. The most common reported environmental exercise barriers were (1) "cost of the program" followed by "lack of transportation". The most common reported personal barrier was "feeling that an exercise instructor is incapable to set up an exercise program to meet their needs".

Overall, PA levels were low compared to other stroke studies[3,18]. Lower median steps/day and lower median values for EE were seen in our cohort, which might be explained by the difference in age (21 to 96 years) and PA monitoring tools (accelerometers and pedometers) in reviews of heterogeneously designed studies[3,18]. Moreover, demographic and socio-economic variables did not explain these low levels of PA in our study population. Previous studies[19,20] showed conflicting results and suggest research in other potential factors limiting post-stroke PA. Perhaps, stroke-related impairments play a role here. Previous studies have highlighted influential factors on post-stroke PA level such as poor walking ability, sensorimotor dysfunction and low mood[3,21]. On the other hand, balance and degree of physical fitness (PF) were positively associated with higher PA levels[21]. A minimum level of PF is a prerequisite for maintenance of a physically active lifestyle, while at the

Figure 1: The most common reported PA-barriers across ethnic groups.

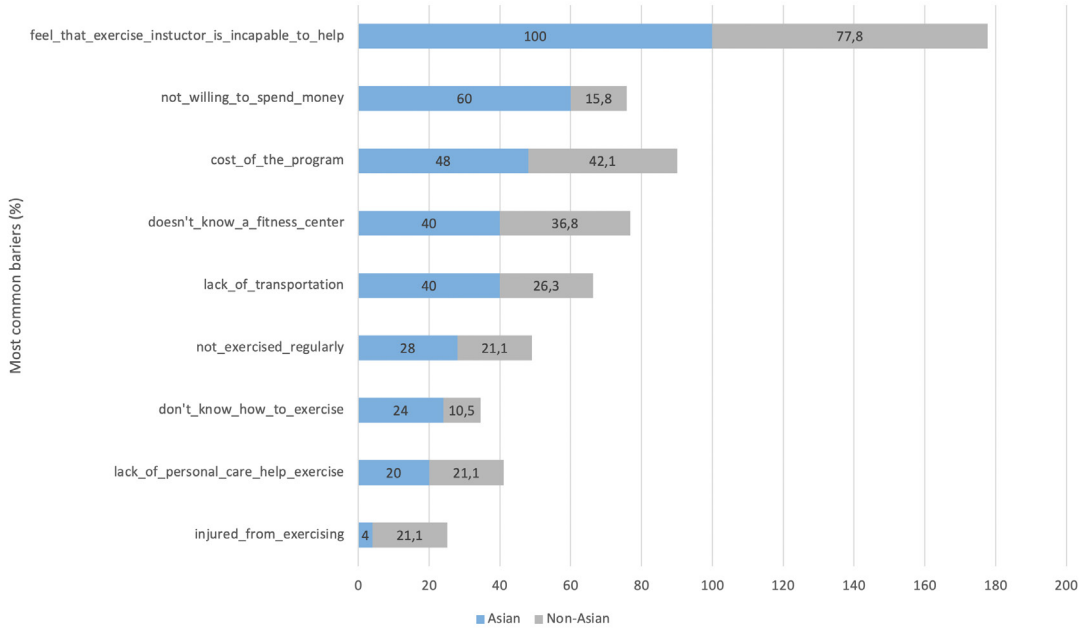


Figure 2: The most common PA barriers in the group with low education, low income and single marital status.

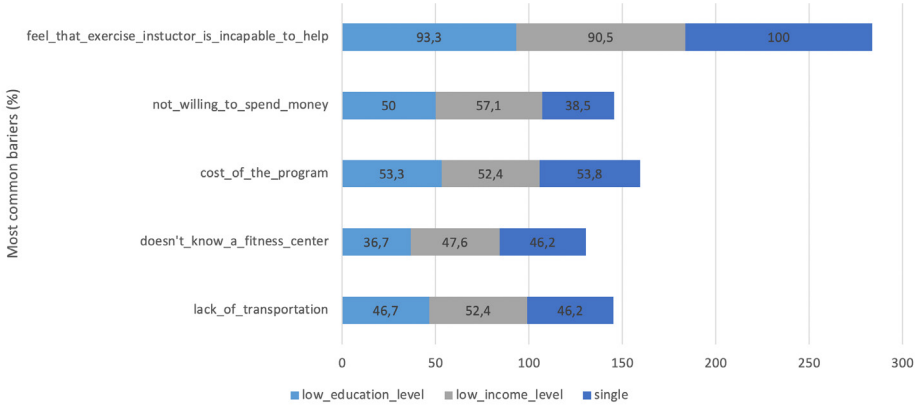
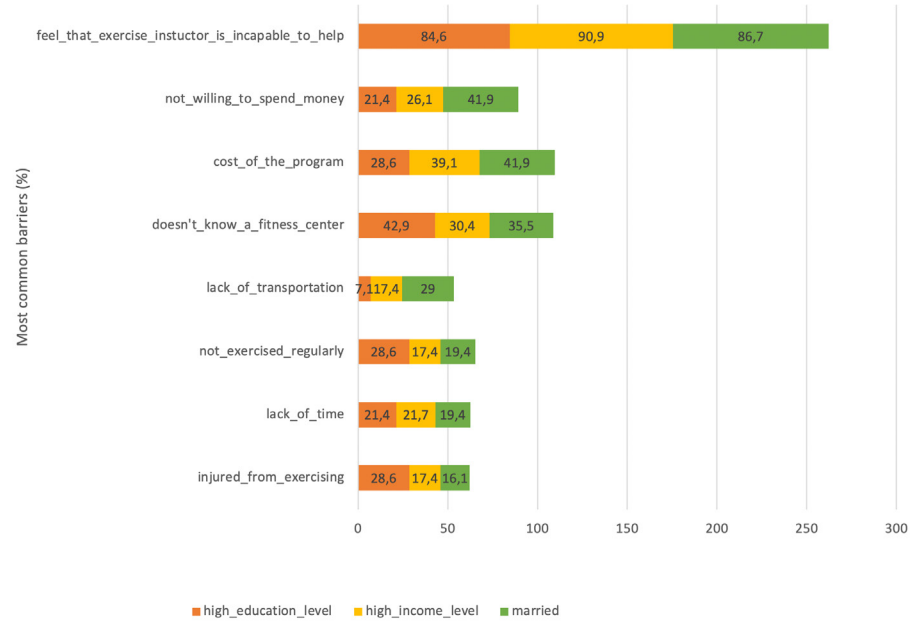


Figure 3: The most common PA barriers in the group with high education, high income and married marital status .



same time PA is important for improving and maintaining adequate levels of PF[5,22], so both PA and PF need attention. PF is stimulated by participation in structured PA programs[3,5,22]. Stroke survivors might not participate enough due to high-perceived exercise barriers.

Our results indicate that all the top five barriers for exercise were common for people from the low education (N=30) and low-income group (N=21) (**Figure 2**). Education levels have previously been shown to be associated with both work-related and leisure-time physical activity and somewhat to total PA[23]. Healthy persons with lower educational levels show more work-related physical activity, but less leisure-time physical activity. Lower education levels can be accompanied by lower income, which is depicted by the commonality of exercise barriers found across these groups in this study (**Figure 2**) and in line with findings of other stroke survivors[8,24]. Lower incomes could result from difficulties of stroke survivors to find work which in turn could induce low self-esteem, and low confidence which may further lower participation in exercise, as such introducing a negative vicious circle[25,26]. Similar to findings from HIC[13], LMIC[8], general population[27] as well as specific neurological populations[13,28], we found that participants in our study reported costly programs and lack of transport facilities as a barrier for participation in exercise programs. As many reported the incapability of the fitness instructor for setting up an individualized exercise program that meets their specific needs, this warrants further attention in stroke management policies. Therefore, targeting education, income, and environmental factors, might eventually help in successful improvement of participation in structured PA programs. Furthermore, ethnic differences were seen in the reported frequencies of the barriers. Therefore, research should be promoted on the change in physical fitness levels after barrier removal, as exercise barriers might change over time and people might still not feel comfortable or see the need to exercise. For instance, if there is a cultural difference in acceptance of a larger body size across ethnic groups or a need to uphold sociocultural identity, a person might still not be motivated to maintain the recommended PA level[29]. Perhaps, an intervention to alter this complex behavior, such as awareness campaigns or exercise programs must have behavior, or a measurable consequence of behavior, as its outcome measure[30]. Conclusively, exercise barriers are not similar enough across ethnic groups in this cohort to be targeted by one generalized intervention. Additionally, a HIC study[13] reported lack of energy as a common barrier to exercise and lack of time as a least reported exercise-barrier, whilst our study participants from a high-income and high education level reported lack of time, being injured during an exercise session and the fact that they haven't exercised regularly as exercise barriers. The exercise-barrier "lack of time" was least reported and might reflect the employed status of a part of this group, as this is largely reported as an exercise-barrier by healthy employed adults[31]. This in contrast to the HIC study amongst stroke survivors where "lack of time" reflected their unemployed stroke population[13]. However, people from India also reported lack of time as an exercise-barrier whilst they were unemployed[32]. Hence, careful individualized assessment is necessary in order to understand why people have low participation in structured PA programs.

Moreover, despite a low PA level, scores on exercise self-efficacy were good. And most of our participants were interested in starting an exercise program and felt that it would improve their condition. Literature shows that self-efficacy explains exercise adherence in chronic stroke survivors[33]. The high level of self-efficacy in our cohort might indicate that they believe to have the capability to reach and maintain a healthy level of exercise. That it still does not result in a higher PA level in our study might be due to the presence of several environmental/facility exercise barriers and the lack of specific exercise programs and specialized coaching during exercise after stroke.

Strengths and limitations

It should be kept in mind that the imbalance of the ethnic groups, the high-ambulating group of participants as well as the sample size within this study might prevent generalization of results. Nevertheless, an important strength of this study is the first in its kind for Suriname and that it provided information on patient-reported exercise barriers after stroke for a setting with scarce resources in a multi-ethnic population with a high level of confidence to perform exercise. Furthermore, we were not able to explore PA facilitators[34]. The importance of facilitators is emphasized in the study by Simpson et al. (2011)[34]. Information of facilitators might have facilitated the development of successful structured PA programs. The study by Simpson et al. (2011)[34] suggested support to exercise (external encouragement/qualified personnel) as a facilitator and at the same time lack of support to exercise was identified through our survey as a barrier. Findings of this study might serve as a strategy for physiotherapists to tailor exercise interventions in order to improve exercise participation of the participants.

Data on PA in our study was obtained from a Garmin device of which the algorithm for calculation of energy expenditure and steps/day was not known. This algorithm is likely to be based on healthy individuals whilst stroke survivors might show an increased energy expenditure for the same activity compared to healthy age-matched controls[4]. We tried to minimize bias as much as possible by putting the Garmin device on the non-paretic side of the body for 7 consecutive days.

Furthermore, self-reported data such as the exercise barriers in this study are subject to response bias ('socially desirable

responding')[35] which we need to take into account when designing and conducting PA programs. Moreover, there is no known evaluation of reliability and validity of the BPAD in stroke survivors, but the study by Rimmer et al. (2001)[24] suggests adequate reliability and validity for the use of the BPAD in people with chronic disabilities (N=149). Eventually, we advise that it would be best to design feasibility studies before conducting large PA programs in order to develop the best possible intervention.

Conclusions

Demographic and socio-economic variables did not explain the low PA level in our study population. These stroke survivors reported several barriers. Physiotherapists can therefore tailor stroke exercise programs according to personal barriers, include policy-making bodies to tackle environmental barriers and educate movement instructors for customized post-stroke exercise. Future research should evaluate feasibility and (cost) effectiveness of tailored exercise programs.

Geolocation information

This study was performed in the urban area of Suriname.

References

1. Jarbandhan A V, Hoozemans MJM, Buys R, Diemer FS, Baldew SSM, Aartman J, et al. Prevalence of self-reported stroke in association with ethnic background within a multi-ethnic population in Paramaribo, Suriname: Results from the helisur study. Neurol Asia. 2016;21(4).

2. Turk-Adawi KI, Grace SL. Narrative review comparing the benefits of and participation in cardiac rehabilitation in high-, middle- and low-income countries. Heart Lung Circ. 2014/11/29. 2015;24(5):510–20.

3. Field MJ, Gebruers N, Shanmuga Sundaram T, Nicholson S, Mead G. Physical Activity after Stroke: A Systematic Review and Meta-Analysis. ISRN Stroke. 2013;2013:1–13. http://dx.doi.org/10.1155/2013/464176

4. Galea SL, Lee MJ, English C, Ada L. Sedentary versus active behavior in people after stroke. Physical Therapy Reviews. 2014;20(1):1–7. http://dx.doi.org/10.1179/1743288x14y.0000000161

5. Billinger SA, Arena R, Bernhardt J, Eng JJ, Franklin BA, Johnson CM, et al. Physical Activity and Exercise Recommendations for Stroke Survivors. Stroke. 2014;45(8):2532–53. http://dx.doi.org/10.1161/str.0000000000000022

6. Winstein CJ, Stein J, Arena R, Bates B, Cherney LR, Cramer SC, et al. Guidelines for adult stroke rehabilitation and recovery: a guideline for healthcare professionals from the american heart association/american stroke association. Stroke. 2016;(47):e98-169.

7. Baldew SSM, Krishnadath ISK, Smits CCF, Toelsie JR, Vanhees L, Cornelissen V. Self-reported physical activity behavior of a multi-ethnic adult population within the urban and rural setting in Suriname. BMC Public Health. 2015;15:485.

8. Idowu OA, Adeniyi AF, Ogwumike OO, Fawole HO, Akinrolie O. Perceived barriers to physical activity among Nigerian stroke survivors. Pan Afr Med J. 2015;21:274. https://pubmed.ncbi.nlm.nih.gov/26587124

9. Nicholson S, Sniehotta FF, van Wijck F, Greig CA, Johnston M, McMurdo MET, et al. A Systematic Review of Perceived Barriers and Motivators to Physical Activity after Stroke. International Journal of Stroke. 2012;8(5):357-64.

10. Mead G, Bernhardt J, Kwakkel G. Stroke: physical fitness, exercise, and fatigue. Stroke Res Treat. 2012/03/14. 2012;2012:632531.

11. Törnbom K, Sunnerhagen KS, Danielsson A. Perceptions of physical activity and walking in an early stage after stroke or acquired brain injury. PLoS One. 2017;12(3):e0173463–e0173463.

12. Prakash V, Shah MA, Hariohm K. Family's presence associated with increased physical activity in patients with acute stroke: an observational study. Braz J Phys Ther. 2016/06/16. 2016;20(4):306-11.

13. Rimmer JH. Barriers associated with exercise and community access for individuals with stroke. The Journal of Rehabilitation Research and Development. 2008;45(2):315–22. http://dx.doi.org/10.1682/jrrd.2007.02.0042

14. Idowu OA, Adeniyi AF, Atijosan OJ, Ogwumike OO. Physical inactivity is associated with low self efficacy and social support among patients with hypertension in Nigeria. Chronic Illness. 2012;9(2):156-64.

15. Pang MYC, Eng JJ, Dawson AS, McKay HA, Harris JE. A community-based fitness and mobility exercise program for older adults with chronic stroke: a randomized, controlled trial. J Am Geriatr Soc. 2005;53(10):1667–74.

16. Nooijen C, Post M, Spijkerman D, Bergen M, Stam H, Berg-Emons R. Exercise self-efficacy in persons with spinal cord injury: Psychometric properties of the Dutch translation of the Exercise Self-Efficacy Scale. Journal of Rehabilitation Medicine. 2013;45(4):347-50. http://dx.doi.org/10.2340/16501977-1112

17. Kroll T, Kehn M, Ho PS, Groah S. The SCI Exercise Self-Efficacy Scale (ESES): development and psychometric properties. Int J Behav Nutr Phys Act. 2007 Aug 30;4:34. https://pubmed.ncbi.nlm.nih.gov/17760999

18. Fini NA, Holland AE, Keating J, Simek J, Bernhardt J. How Physically Active Are People Following Stroke? Systematic Review and Quantitative Synthesis. Physical Therapy. 2017;97(7):707-17. http://dx.doi.org/10.1093/ptj/pzx038

19. Grube MM, Koennecke HC, Walter G, Thümmler J, Meisel A, Wellwood I, et al. Association Between Socioeconomic Status and Functional Impairment 3 Months After Ischemic Stroke. Stroke. 2012;43(12):3325-30. http://dx.doi.org/10.1161/strokeaha.112.669580

20. van den Bos GAM, Smits JPJM, Westert GP, van Straten A. Socioeconomic variations in the course of stroke: unequal health outcomes, equal care? J Epidemiol Community Health (1978). 2002 Dec;56(12):943–8. https://pubmed.ncbi.nlm.nih.gov/12461116

21. English C, Manns PJ, Tucak C, Bernhardt J. Physical Activity and Sedentary Behaviors in People With Stroke Living in the Community: A Systematic Review. Physical Therapy 2014;94(2):185-96. http://dx.doi.org/10.2522/ptj.20130175

22. Saunders DH, Greig CA, Mead GE. Physical Activity and Exercise After Stroke. Stroke 2014;45(12):3742–7. http://dx.doi.org/10.1161/strokeaha.114.004311

23. He XZ, Baker DW. Differences in leisure-time, household, and work-related physical activity by race, ethnicity, and education. J Gen Intern Med. 2005 Mar;20(3):259-66. https://pubmed.ncbi.nlm.nih.gov/15836530

24. Rimmer JH, Riley BB, Rubin SS. A New Measure for Assessing the Physical Activity Behaviors of Persons with Disabilities and Chronic Health Conditions: The Physical Activity and Disability Survey. American Journal of Health Promotion. 2001;16(1):34–45. http://dx.doi.org/10.4278/0890-1171-16.1.34

25. Peters GO, Buni SG, Oyeyemi AY, Hamzat TK. Determinants of return to work among Nigerian stroke survivors. Disability and Rehabilitation 2012;35(6):455–9. http://dx.doi.org/10.3109/09638288.2012.697251

26. Wolfenden B, Grace M. Returning to work after stroke: a review. International Journal of Rehabilitation Research. 2009;32(2):93–7. http://dx.doi.org/10.1097/mrr.0b013e328325a358

27. Cowan RE, Nash MS, Anderson KD. Exercise participation barrier prevalence and association with exercise participation status in individuals with spinal cord injury. Spinal Cord. 2012;51(1):27–32. http://dx.doi.org/10.1038/sc.2012.53

28. Khalil H, Nazzal M, Al-Sheyab N. Parkinson's disease in Jordan: Barriers and motivators to exercise. Physiotherapy Theory and Practice. 2016;32(7):509–19. http://dx.doi.org/10.1080/09593985.2016.1219433

29. Ard JD, Zunker C, Qu H, Cox T, Wingo B, Jefferson W, et al. Cultural perceptions of weight in African American and Caucasian women. Am J Health Behav. 2013 Jan;37(1):3–13. https://pubmed.ncbi.nlm.nih.gov/22943096

30. Michie S, van Stralen MM, West R. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement Sci. 2011 Apr 23;6:42. https://pubmed.ncbi.nlm.nih.gov/21513547

31. Heesch KC, Brown DR, Blanton CJ. Perceived Barriers to Exercise and Stage of Exercise Adoption in Older Women of Different Racial/Ethnic Groups. Women & Health. 2000;30(4):61–76. http://dx.doi.org/10.1300/j013v30n04_05

32. Akhtar MU, Arora S, Mehndiratta MM. Barriers Associated with Community Access by Stroke Patients in Indian Population. Indian Journal of Physiotherapy and Occupational Therapy - An International Journal. 2013;7(3):260. http://dx.doi.org/10.5958/j.0973-5674.7.3.104

33. Caetano LCG, Pacheco BD, Samora GAR, Teixeira-Salmela LF, Scianni AA. Self-Efficacy to Engage in Physical Exercise and Walking Ability Best Predicted Exercise Adherence after Stroke. Stroke Res Treat. 2020 Mar 4;2020:2957623. https://pubmed.ncbi.nlm.nih.gov/32190284

34. Simpson LA, Eng JJ, Tawashy AE. Exercise perceptions among people with stroke: Barriers and facilitators to participation. Int J Ther Rehabil. 2011 Sep 6;18(9):520–30. https://pubmed.ncbi.nlm.nih.gov/23255881

35. McDonald JD. Measuring personality constructs: The advantages and disadvantages of self-reports, informant reports and behavioral assessments. Enquire. 2008;1-19.