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Stages of change for leisure time physical activity in Brazilian adults: longitudinal study

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Abstract *The objective of this study was to analyze the maintenance of and movement between stages of change for leisure time physical activity (LTPA) after four years and the association with sociodemographic characteristics. A cross-sectional population-based study was conducted with 1,180 individuals aged 40 years or over in 2011. In 2015, 885 participants were reinterviewed. The dependent variables were the maintenance of and movement between stages of change for LTPA behavior. The data was analyzed using adjusted Poisson regression. We found that around 40% of the study participants were still at the same stage they were at in the first assessment, while 31.6% had relapsed and 27% had advanced at least one stage. The stages that showed the highest frequencies were remained in precontemplation and maintenance. The risk of remaining at the precontemplation stage was higher among men (RR=1.59; 95%CI:1.21-2.11), respondents aged ≥60 years (RR=1.35; 95%CI:1.03-1.78), those with a lower level of education (RR=1.24; 95%CI:1.04-2.33), and those from economic classes C and D/E (RR=1.71; 95%CI:1.17-2.49 and RR=1.88; 95%CI:1.12-3.18, respectively). The frequency of individuals who remained at the maintenance stage was significantly lower in economic classes D/E than in classes A/B (RR=0.35; 95%CI:0.14-0.87).*

Keywords *Physical activity, Lifestyle, Longitudinal study, Health behavior*

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Introduction

Physical activity (PA) is complex phenomenon that is influenced by a host of biological, socioeconomic, cultural, political, environmental, and behavioral factors[1].

PA can be divided into four domains: leisure time, transportation, household, and work. Leisure time physical activity (LTPA) has been shown to contribute to greater risk reductions for all-cause and cancer mortality[2]. Epidemiological studies of PA suggest that the regular practice of PA is one of the main protective factors for chronic non-communicable diseases[3-8] and contributes to a reduction in costs associated with medicines, medical examinations, and admissions into the health system[9,10].

However, despite decades of research and public health strategies aimed at increasing population levels of PA, the high prevalence of physical inactivity remains a health problem in various countries, including Brazil[11-14].

One of the models that explain health-related behaviors such as regular PA is the transtheoretical model of behavioral change (TTM). One of the model's core constructs is the stages of change for behavior, classified and characterized as follows: precontemplation (individuals exhibiting risk behavior who do not intend to change their behavior in the next six months), contemplation (individuals who intend to change their behavior in the next six months), preparation (individuals intend to change their behavior in the next 30 days), action (individuals who have adopted a change in behavior for less than six months), and maintenance (individuals who have sustained a change in behavior for at least six months). Individuals can progress through stages or relapse without following any logical order and the time spent in each stage may vary[15-17].

According to Hall and Rossi[18], individuals who are more willing to make behavior changes believe that the pros of engaging in regular PA outweigh the cons, in comparison to those who are yet to consider making the change. The adoption or not of health-related behaviors is complex and there are a number of theories and models that seek to better understand the factors that influence this question. Strong evidence has been reported on the correlates and determinants of PA[1]. In this regard, it is worth mentioning that, although TTM is useful, it does not explain all the factors that influence change in behavior, meaning that the combination of other theories, including those that provide a more "ecological" perspective, can make a significant contribution to understanding this issue[19,20].

Although a number of studies have investigated stages of change for LTPA behavior in various populations and groups, most are cross-sectional[21-29], thus limiting the analysis of associated factors and preventing the monitoring of changes between stages over time and the identification of predictors.

The objective of this study was to analyze the maintenance of and movement between stages of change for LTPA behavior after four years and the association with sociodemographic characteristics in individuals aged 40 years and over living in a medium-sized city in the State of Paraná, Brazil.

Methods

Population and sample

We conducted a longitudinal observational epidemiological study with individuals aged 40 years and over living in Cambé in the State of Paraná. The sample was selected using multistage sampling and study participants were interviewed in 2011 and 2015.

Located in the Metropolitan Region of Londrina in the north of Paraná in Brazil's South Region, the population of Cambé in 2011 was 96,733 inhabitants, with 96% of the population living in urban areas[30].

For the baseline study conducted in 2011, sample size was calculated based on the population in 2007 (92,888 people), when 33.1% of residents were aged 40 years and over[28]. The minimum sample size was calculated adopting a margin of error of 3%, expected outcome prevalence of 50%, and 95% confidence interval, resulting in 1,066 individuals. This number was increased by 25% to account for eventual losses, resulting in 1,332 subjects.

All of the 86 census tracts in the urban area were included in the study. For each tract we defined a quota of interviews based on the population distribution by sex and age group. The proportional division of the census tracts resulted in a total of 1,339 individuals, due to the rounding to the nearest integer. To select the interviewees, the streets and blocks were identified on tract maps. The blocks were numbered and the collection starting points (block, corner, and residence) were randomly selected. The route was initiated in an anti-clockwise direction and a 1:2

Ciência & Saúde Coletiva, 26(8):2969-2980, 2021

sampling interval was used. In households with more than one eligible member, the interviewee was randomly selected from the eligible members present. The following exclusion criteria were adopted: individuals with a serious uncorrected visual and/or hearing impairment or with mental disorders that affected their understanding and administration of the interviewee, unless they had a carer who was able to provide the requested information; and people who did not speak Portuguese. There were a total of 159 losses, resulting in a final sample of 1,180 subjects[31].

All the subjects interviewed in 2011 who were located and gave their consent participated in the follow-up study in 2015. The interviews were scheduled by telephone using the number informed in the baseline study (2011). When contact was not made, the person's residence was visited up to three times on different days and at different times. There were 295 losses (25%), consisting of 51 deaths, 87 refusals, 49 people not found after three attempts, and 108 changes of address, resulting in a final follow-up study sample of 885 individuals.

Data collection and variables

In both studies the data were collected by conducting home interviews using a questionnaire containing blocks of questions devised to collect information on the following: sociodemographic characteristics, lifestyle habits, health status, medicine use, functional capacity, health service utilization, and social capital. In addition, anthropometric measurements were taken, blood pressure was measured, and laboratory tests were performed[31].

The interviews were conducted by a previously trained team of interviewers made up of undergraduate and postgraduate students from the Londrina State University Health Sciences Center and collaborating interviewers. Each interview lasted an average of 30 minutes in 2011 and 40 minutes in 2015.

The dependent variables were maintenance of and movement between stages of change for LTPA behavior[16,32,33]. Chart 1, adapted from Prochaska and Marcus[34], presents the five stages of change for behavior (precontemplation, contemplation, preparation, action, and maintenance) and their respective characteristics. Information on the stages was obtained using the questions from the lifestyle habits block of the questionnaire in which the participants were asked whether they practiced some type of LTPA during a normal week. Respondents who answered "yes" and had been practicing LTPA for more than six months were regarded as being at the maintenance stage, while those who had been practicing LTPA for less than six months were regarded as being at the action stage. Respondents who said they did not practice regular physical activity in a normal week were asked if they intended to do LTPA in the next 30 days. Those who responded "yes" were regarded as being at the preparation stage. Those who answered "no" were asked if they intended to do LTPA in the next six months, with those responding "yes" being regarded as being at the contemplation stage and those who answered "no" being regarded as being at the precontemplation stage.

With regard to maintenance of stages of change for LTPA behavior, respondents who were still in the same stage after four years were classified as follows: "remained in precontemplation", "remained in contemplation", "remained in preparation", "remained in action", and "remained in maintenance". Movement between stages was classified as "positive" (including all individuals who progressed at least one stage after four years) and "negative" (including all individuals who relapsed at least one stage after four years).

The independent variables were the sample's sociodemographic characteristics in 2011, stratified as follows:

Sex (male, female);

Age (40 to 59 years, 60 years and over);

Level of education (0 to 8 years, 9 to 11 years, 12 or more years);

Marital status (with a partner, including married and in stable union; without a partner, including single, divorced, separated, and widowed);

Economic classes (A/B, C, D/E), based on the criteria proposed by the Brazilian Market Research Association (ABEP)[35].

Data tabulation and analysis

The baseline study data were collected using paper questionnaires, double entered into the program Epi Info® version 3.5.1 and crosschecked for consistency. Approximately two-thirds of the follow-up study questionnaires were also paper questionnaires. The data from these questionnaires were double entered into Microsoft Office Excel® 2010 and crosschecked to identify and correct inconsistencies. The rest of the data were collected using tablets and ODK Collect (Open

Chart 1. Stages of change for physical activity behavior.

Stages	Characteristics
Precontemplation	Individuals who do not intend to change their behavior in the next six months
Contemplation	Individuals who intend to change their behavior in the next six months
Preparation	Individuals who intend to change their behavior in the foreseeable future (generally the next 30 days)
Action	Individuals who have adopted a change in behavior for less than six months
Maintenance	Individuals who have sustained a change in behavior for more than six months

Source: Adapted from Prochaska and Marcus[32].

Data Kit) and stored in Ona (hosted at https://ona.io/vigicardio) in a format that is compatible with Microsoft Excel®.

The data were analyzed using descriptive statistics (absolute and relative frequencies). The participants of the follow-up study and losses were compared using Pearson's chi-squared test, adopting a significance level of $p \leq 0.05$. We used Poisson regression with adjustment using robust variance estimation to calculate relative risk (RR), adopting a 95% confidence interval (95% CI). The model was adjusted for sex, age, marital status, level of education, and economic class, regardless of the p-value obtained by these variables in the bivariate analysis. The analyses were performed using SPSS® for Windows version 19.0.

Ethical considerations

The study was approved by the Londrina State University Research Ethics Committee. All participants signed an informed consent form.

Results

The majority of the 1,180 individuals from the baseline study (2011) were women (54.3%), aged 50 years and over (59.7%), living with a partner (73.1%), had up to eight years of schooling (72.9%), and in economic class C and D/E (61.9%). This profile remained the same in the follow-up study (2015). The proportion of losses was greater among men and in respondents aged 60 years and over, with a partner, and in economic class A/B (Table 1).

Table 2 shows the maintenance of and movement between stages of change for LTPA behavior (2011-2015). Approximately 40% of the 885 individuals remained in the same stages, 31.6% relapsed, and 27% progressed to other stages after four years. The stages that showed the highest frequencies were remained in precontemplation (n= 172; 57.0%) and remained in maintenance (n=119; 51.3%). With regard to incidence of precontemplation in 2015, 34.2% of the subjects who were in the contemplation stage, 31.1% of those in the preparation stage, 21.1% of those in the action stage, and 19.0% of those in the maintenance stage had moved to the precontemplation stage.

Table 3 shows the relative risk values for individuals who were still in the maintenance, action, preparation, contemplation and precontemplation stages after four years and the association with sociodemographic characteristics and Table 4 presents the relative risk values for respondents who moved between stages (positive and negative). Most of the significant differences were related to the maintenance of the precontemplation stage. The risk of remaining at this stage at the follow-up was higher among men (RR = 1.59; 95% CI: 1.21-2.11), individuals aged over 60 years (RR=1.35; 95% CI: 1.03-1.78), those in the lowest education group (RR=1.24; 95% CI: 1.04-2.33), and those in economic classes C and D/E ((RR=1.71; 95% CI: 1.17-2.49 and RR=1.88; 95% CI: 1.12-3.18, respectively). The proportion of individuals who remained at the maintenance stage was lower in economic classes D/E than in classes A/B (RR=0.35; 95% CI: 0.14-0.87).

Discussion

The findings show that approximately 40% of the subjects were still in the same stages after four years. The proportion of individuals who were still at the precontemplation stage was greater among men, individuals aged over 60 years, those with up to only nine years of schooling, and those in economic classes C and D/E. These findings reinforce the importance of public policies designed to tackle the problem of physical inactivity, particularly for groups who have less access to physical activity, such as those with lower levels of education and economic status.

Ciência & Saúde Coletiva, 26(8):2969-2980, 2021

Table 1. Sociodemographic characteristics of the baseline study sample (2011) of individuals aged 40 years and over living in Cambé, Paraná and analysis of losses according to the sociodemographic characteristics of the follow-up study (2015).

Total	Participants 2011		Participants 2015		Losses		p-value*
	n=1180	%	n=885	%	n=295	%	
Sex							
Male	641	54.3	495	77.2	146	22.8	
Female	539	45.7	390	72.4	149	27.6	0.032
Age group (years)							
40-49	476	40.3	349	73.3	127	26.7	
50-59	366	31.0	297	81.1	69	18.9	0.003
≥ 60	338	28.7	239	70.7	99	29.3	
Marital status							
With a partner	863	73.1	608	70.5	255	29.5	
Without a partner	317	26.9	277	87.4	40	12.6	<0.001
Level of education (years)							
0-8	860	72.9	648	75.3	212	24.7	
9-11	190	16.1	145	76.3	45	23.7	0.479
≥ 12	130	11.0	92	70.8	38	29.2	
Economic class (ABEP)							
A/B	449	38.1	313	69.7	136	30.3	
C	614	52.0	472	76.9	142	23.1	0.001
D/E	117	9.9	100	85.5	17	14.5	

Note: ABEP = Brazilian Association of Market Research Companies.
*P-value calculated using Pearson's chi-squared test adopting $p \leq 0.05$, considering the comparison between the participants of the follow-up study and losses.

Source: Author's elaboration.

Table 2. Maintenance of and movement between stages of change for leisure time physical activity behavior after four-year follow-up with individuals aged 40 years and over living in Cambé, Paraná (n=885).

2011 \ 2015	PC	C	P	A	M	Total
PC	172 (57.0%)	35 (11.6%)	54 (17.9%)	4 (1.32%)	37 (12.3%)	302 (34.1%)
C	41 (34.2%)	22 (18.3%)	32 (26.7%)	3 (2.5%)	22 (18.3%)	120 (13.6%)
P	60 (31.1%)	37 (19.2%)	52 (27.0%)	16 (8.3%)	28 (14.5%)	193 (21.8%)
A	8 (21.1%)	8 (21.1%)	13 (34.2%)	1 (2.63%)	8 (21.1%)	38 (4.3%)
M	44 (19.0%)	22 (9.5%)	37 (16.0%)	10 (4.31%)	119 (51.3%)	232 (26.2%)
Total	325 (36.8%)	124 (14.0%)	188 (21.2%)	34 (3.8%)	214 (24.2%)	885 (100.0%)

Note: PC = Precontemplation; C = Contemplation; P = Preparation; A = Action; M = Maintenance.
Source: Author's elaboration.

The proportion of individuals who remained at the maintenance stage was lower in economic classes D/E than in classes A/B. In a systematic review of studies investigating stages of changes for

Table 3. Maintenance of and movement between stages of change for leisure time physical activity behavior after four-year follow-up and associated sociodemographic characteristics in individuals aged 40 years and over living in Cambé, Paraná (n=885).

Variables	Remained in M		Remained in A		Remained in P		Remained in C		Remained in PC	
	n (%)	RR[(1)(2)] (IC95%)	n (%)	RR[(1)(2)] (IC95%)	n (%)	RR[(1)(2)] (IC95%)	n (%)	RR[(1)(2)] (IC95%)	n (%)	RR[(1)(2)] (IC95%)
Sex										
Male	67 (13.5%)	1.0	-	1.0	37 (7.5%)	1.0	14 (2.8%)	1.0	80 (16.2%)	1.0
Female	52 (13.3%)	0.93 (0.66-1.31)	1 (0.3%)	-	15 (3.8%)	0.46 (0.25-1.04)	8 (2.1%)	0.75 (0.30-1.87)	92 (23.6%)	1.59 (1.21-2.11)**
Age group (years)										
44-59	66 (12.4%)	1.0	1 (0.2%)	1.0	38 (7.1%)	1.0	13 (2.4%)	1.0	86 (16.1%)	1.0
≥ 60	53 (15.1%)	1.09 (0.86-2.10)	-	-	14 (4.0%)	0.62 (0.34-1.12)	9 (2.6%)	1.06 (0.44-2.59)	86 (24.4%)	1.35 (1.03-1.78)**
Marital status										
With a partner	90 (13.7%)	1.0	1 (0.2%)	1.0	40 (6.1%)	1.0	16 (2.4%)	1.0	127 (19.4%)	1.0
Without a partner	29 (12.6%)	1.02 (0.68-1.52)	-	-	12 (5.2%)	0.92 (0.47-1.79)	6 (2.6%)	0.91 (0.31-2.68)	45 (19.7%)	0.99 (0.71-1.37)
Level of education (years)										
0-8	72 (11.1%)	0.62 (0.38-1.03)	-	-	34 (5.2%)	1.03 (0.68-8.01)	14 (2.2%)	0.44 (0.14-1.36)	146 (22.5%)	1.24 (1.04-2.33)**
9-11	27 (18.6%)	0.94 (0.56-1.58)	-	-	15 (10.3%)	1.06 (0.99-11.38)	4 (2.8%)	0.63 (0.15-2.65)	15 (10.3%)	0.77 (0.37-1.60)
≥ 12	20 (21.7%)	1.0	1 (1.1%)	1.0	3 (3.3%)	1.0	4 (4.3%)	1.0	11 (12.0%)	1.0
Economic class (ABEP)										
A/B	61 (18.3%)	1.0	1 (0.3%)	1.0	25 (7.5%)	1.0	9 (2.7%)	1.0	41 (12.2%)	1.0
C	53 (11.4%)	0.71 (0.48-1.04)	-	-	24 (5.1%)	0.67 (0.36-1.24)	10 (2.1%)	1.03 (0.45-2.36)	109 (23.3%)	1.71 (1.17-2.49)*
D/E	5 (6.1%)	0.35 (0.14-0.87)**	-	-	3 (3.6%)	0.50 (0.14-1.83)	3 (3.6%)	1.08 (0.37-8.54)	22 (26.5%)	1.88 (1.12-3.18)*
Total	119 (13.4%)		1 (0.1%)		52 (5.9%)		22 (2.5%)		172 (19.4%)	

Notes: M = Maintenance; A = Action; P = Preparation; C = Contemplation; PC = Precontemplation; RR = Relative Risk; 95% CI= 95% Confidence Interval; ABEP = Brazilian Association of Market Research Companies. (1) RR calculated using Poisson regression with adjustment using robust variance. (2) RR adjusted for sociodemographic variables (sex, age group, marital status, level of education, economic class). * $p < 0.001$. ** $p \leq 0.05$.

Source: Author's elaboration.

physical activity behavior among adults, Dumith, Domingues, and Gigante[16] found that better-educated young single white men, non-smokers, non-overweight/obese individuals, and those who showed a higher level of PA and fitness were more likely to be in the advanced stages (action and maintenance). It is important to highlight that, due to the characteristics of our sample, particularly in relation to age (our sample was restricted to people aged 40 years and over in the baseline study and 44 years and over in the follow-up study), caution should be taken when comparing our findings with those of studies with adults considering wider age groups.

Table 4. Positive and negative movement between stages of change for leisure time physical activity behavior after four-year follow-up and associated sociodemographic characteristics in individuals aged 40 years and over living in Cambé, Paraná (n=885).

	Positive[1]		Negative[2]	
Variables	**n (%)**	**RR (95% CI)[3][4]**	**n (%)**	**RR (95% CI)[3][4]**
Sex				
Male	132(26.7%)	1.0	165(33.3%)	1.0
Female	107(27.4%)	1.00(0.80-1.25)	115(29.5%)	0.90(0.73-1.10)
Age group (years)				
44-59	158(29.6%)	1.0	171(32.1%)	1.0
≥ 60	81(23.0%)	0.74(0.58-1.14)	109(31.0%)	0.98(0.79-1.20)
Marital status				
With a partner	178(27.1%)	1.0	204(31.1%)	1.0
Without a partner	61(26.6%)	1.02(0.78-1.32)	76(33.2%)	1.03(0.82-1.29)
Level of education (years)				
0-8	187(28.9%)	1.06(0.98-2.32)	195(30.1%)	0.81(0.58-1.13)
9-11	32(22.1%)	1.03(0.62-1.68)	52(35.9%)	1.00(0.70-1.42)
≥ 12	20(21.7%)	1.0	33(35.9%)	1.0
Economic class (ABEP)				
A/B	91(27.2%)	1.0	107(31.9%)	1.0
C	126(27.0%)	0.91(0.59-1.40)	145(31.0%)	1.05(0.83-1.33)
D/E	22(26.5%)	0.89(0.69-1.14)	28(33.7%)	1.07(0.78-1.69)
Total	239(27.0%)		280(31.6%)	

Notes: RR = Relative Risk; 95% CI= 95% Confidence Interval; ABEP = Brazilian Association of Market Research Companies. (1) Positive movement = progressed at least one stage. (2) Negative movement = relapsed at least one stage. (3) RR calculated using Poisson regression with adjustment using robust variance. (4) RR adjusted for sociodemographic variables (sex, age group, marital status, level of education, economic class). * $p < 0.001$. ** $p \leq 0.05$.

Source: Author's elaboration.

In general, a possible explanation for the results involving inactive behavior (without any intention to do PA in the next six months) may be related to a combination of demographic, socioeconomic, sociocultural, environmental, and behavioral factors, among others. In this regard, a study of ecological models of physical activity conducted by Bauman et al.[1] showed that the interaction of different determinants (individual, interpersonal, environmental, and policy) influences PA behavior.

With regard to sex, our findings show that a higher proportion of men were still at the precontemplation stage after four years. The opposite was found by Jiang et al. in a study examining longitudinal patterns of stages of change for PA among 1,344 American Indians and Alaska Natives[36], which showed that male participants were more likely to be at the maintenance stage than female participants. Two other longitudinal studies with adults, one in Asia[37] (24-month follow-up) and the other in the EUA[38] (six-month follow-up), did not find an association between sex and the five stages of change for behavior.

One hypothesis that may explain why men are more likely to remain at the precontemplation stage is the social construction of masculinity, whereby men have a different attitude than women towards various types of risks, being more likely to bear or deny the consequences of health risk behaviors[39-41]. Moreover, it is important to highlight that men are less likely to visit the doctor[42] and exhibit a high prevalence for other health risk behaviors, such as low fruit and vegetable intake[43], smoking[44], and alcohol abuse[45].

With regard to age, the proportion of individuals who remained at the precontemplation stage was higher in the 60 years and over age group. Studies conducted by Huang et al.[37] and Zhou et al.[46] reported an inverse association between age and stages of change for PA behavior, whereby older individuals were more likely to be at initial stages and younger individuals at the maintenance stage. In a systematic review of the

relation between PA and personal and environmental factors among adults, Choi et al.[47] found a negative association between PA and age.

In contrast, Lipschitz et al.[38] showed that both older (≥ 65 years) and younger (≤ 34 years) individuals were more likely to remain in the inactive stages (precontemplation, contemplation, and preparation).

Both intrinsic factors (reduced functional capacity, physical disability due to disease, or character traits) and extrinsic factors (marital status, socioeconomic status, environment, lack of social support, among others) may mean that older people are more likely to remain at the precontemplation stage[48-50]. It is worth mentioning that social support for LTPA appears to be more important for individuals aged over 40 years than for younger adults[51].

The findings also show that the proportion of individuals who remained at the precontemplation stage was higher in the low education group and lower economic classes (C and D/E). Furthermore, the proportion of individuals in classes D/E who remained at the maintenance stage was lower than in classes A/B.

It is possible that people with lower levels of education and in lower economic classes are less likely to have positive experiences of PA throughout their life or at school. In this regard, studies show that individuals with a higher level of education and more positive experiences of PA from childhood are more likely to practice LTPA during their lifetime[52-54].

Cleland et al.[55] and Boone-Heinonen et al.[56] showed that people living in socioeconomically disadvantaged neighborhoods (with unfavorable conditions for PA, such as lack of access to walking environments and lack of personal safety) were less likely to engage in LTPA. In a study examining sociodemographic and environmental factors associated with leisure time and transport PA among 460 adults in a city in the northeast of Brazil, Pitanga et al.[57] found that access to public spaces was associated with a ninefold increase in the likelihood of practicing PA.

Other factors that may lead individuals from socioeconomically disadvantaged groups to remain at the precontemplation stage include the fact that people in these groups are more likely to have more than one job or work overtime and tend to live far from the workplace and use public transport, meaning they spend more time commuting and working and therefore have less time and energy for LTPA[58].

The longitudinal design used by this study allowed us to obtain a more in-depth understanding of the participants' LTPA behavior. Future research should focus on other population groups and address other factors, given that most studies in the literature on stages of change for PA behavior are cross-sectional[21-29].

One of the limitations of this study is the fact that we used self-reported data. In this regard, participant understanding may be influenced by the type of language and terminology used and level of education. However, this technique is widely used in epidemiological studies and it is important to highlight that the interviews were conducted by a previously trained team of health undergraduate and postgraduate students. Another limitation is that we used only two points in time (2011 and 2015), meaning that it was not possible to assess whether participants had moved between stages of change for behavior between these two points. However, this is a common limitation of longitudinal studies that could only have been controlled with more frequent monitoring of the individuals. Finally, it is important to mention the differential losses between the baseline study and follow-up. Although there were no changes in the sample profile between the two points in time, these differences suggest the need for caution when extrapolating the results to other populations.

In conclusion, this study shows that the proportion of individuals that remained at the precontemplation stage (i.e. without the intention to practice LTPA) after the four-year follow-up was high. The findings also show that the risk of remaining in this stage was greater in women, those aged 60 years and over, those with up to eight years of schooling, and those in economic classes C and D/E.

The analysis of stages of change for behavior and associated factors provides valuable information for the formulation and implementation of strategies targeting vulnerable population groups designed to promote reflection and awareness of determining factors and the risks and benefits of practicing LTPA. Given the complex set of factors involved in changing behavior, intersectoral actions designed to help individuals minimize and overcome personal, social, and environmental barriers can promote the adoption of more active lifestyles.

Collaborations

VCZ Tessaro worked in the conception and design, analysis and interpretation of data, article writing, critical review of intellectual content. AMR Silva and MR Loch worked on the conception and design, analysis and interpretation of data, review of the article's writing, critical review of the intellectual content and approval of the final version.

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