Original Article

The Association between Moderate Physical Activity and Stress in Thai Older Adults with Hypertension

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Abstract

Background: Hypertension is a serious health concern for Thailand's aging population. Although moderate physical activity is beneficial to physical and mental health, there are limited studies to specifically examine the relationship between physical activity and stress among older adults with hypertension in Thailand.

Methods: This cross-sectional study was conducted from December 2022 to June 2023 through face-to-face interviews by questionnaires. Multiple logistic regression was employed to investigate the associations between moderate physical activity and stress.

Results: The study included 203 older adults with hypertension. The majority of the participants were female (78.82%) and aged over 69 years (69.46%). Moderate physical activity was reported by 36.45%, while 10.34% experienced stress. Older adults with hypertension who engaged in moderate physical activity were 93% less likely to experience stress compared to those who did not (AOR=0.07, 95% CI: 0.01 - 0.98, p=0.048). Additionally, those who graduated higher education level were less likely to experience stress.

Conclusion: Moderate physical activity and a higher education level were associated with a lower experience of stress among older adults with hypertension. Healthcare professionals should incorporate physical activity and stress management strategies into their care plans for older adults with hypertension. Encouraging and promoting physical activity and educational opportunities are important to reduce stress levels in seniors with hypertension.

Keywords: Moderate Physical activity, Stress, Older adult, Hypertension

Introduction

Global demographic trends indicate a rapid increase in the older population. The proportion of individuals aged 60 and above will rise from 12% in 2015 to 22% by 2050. Notably, this phenomenon of population aging is accelerating in developing countries. By mid-century, it is estimated that two-thirds of the world's population over 60 will reside

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in low- and middle-income nations.[1,2] Thailandis experiencing a demographic shift characterized by a growing elderly population. In 2022, senior citizens comprised 19% of the population, with a projected increase to 31.4 percent by 2042. Notably, one-quarter of all older adults are expected to reside in Thailand's northern region.[3]Older adults are more likely to be affected by the phenomenon of multimorbidity.[4]

Hypertension is a major global health issue with a high and increasing prevalence. An estimated 1.28 billion adults aged 30–79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries.[5]Around 25% of Thai adults have hypertension, or raised blood pressure.[6] The primary mechanism driving hypertension in older adults is vascular aging, which leads to endothelial dysfunction and arterial stiffening.[7] Uncontrolled or untreated hypertension can lead to a wide range of serious and potentially life-threatening complications, including heart disease, kidney disease, stroke, and cognitive decline.[8,9]

Around 14% of adults aged 60 and over live with a mental disorder. These mental health conditions account for 10.6% of the total disability burden among older adults.[10] Depression and anxiety are particularly common mental health issues associated with hypertension in this age group.[11] However, stressful events and chronic hypertension can lead to negative emotions, which further complicate hypertension management and treatment outcomes.[12] This highlights the significant concern of stress in older adults, as it can negatively impact both their physical and mental health.[13,14] In addition, there is a growing elderly population, high blood pressure (hypertension), and mental health issues were also increased. These problems can worsen each other, leading to a poorer quality of life, less successful treatment, and even a higher risk of death.[11]

Physical activity, defined as any bodily movement that expends energy, offers substantial physical and mental health benefits. Approximately one-third (31%) of the global adult population, which equates to around 1.8 billion people, is physically inactive.[15] Physical activity demonstrably improves physical and mental health by contributing to the prevention of non-communicable diseases, reducing symptoms of mental health conditions.[16–20] The Thai government, through a collaborative effort between multiple ministries and agencies, has launched the National Plan to Promote Physical Activity (2018-2030) and its Action Plan (2018-2020) to encourage an active lifestyle among the Thai population.[21,22] The studies found that the prevalence of physical activity varies across countries. Such Thai older adults in Ayuttaya engaged in moderate-intensity activities(48.7%)[23] and Phitsanulok(23.7%).[24] According to the World Health Organization guidelines, older people should do moderate-intensity aerobic activity for at least 150 minutes each week, or alternatively, 75 minutes of vigorous-intensity activity.[25]

While hypertension is a significant health concern for Thailand's aging population, theprevalence of hypertension among Thai older adults has continued to rise. Several studies have demonstrated that moderate physical activity can help reduce blood pressure and enhance the mental health of older adults. However, few studies of specific association between physical activity and stress in older adults with hypertension exist are limited. This study aims to investigate the association between moderate physical activity and stress in Thai older adults with hypertension. The findings could have important implications for the development of more comprehensive hypertension management strategies.

Methods

Research Design

A cross-sectional study

Population

Older adults diagnosed with hypertension in Lomkao, Phetchabun Province, Thailand.

Sample sizeand sampling techniques

Sample size calculations were conducted for both simple and multiple logistic regression models. For the simple model, where the overall event rate (P) was 0.18, the proportion of the sample with engaged moderate physical activity(B) was 0.5, the event rate for older adults with hypertension who did not engage in moderate physical activity (P1) was 0.09, and the event rate for those who did (P2) was 0.26, a total sample size of 152 was determined. To control for potential confounding factors, a multiple logistic

regression analysis was employed. Using a multiple correlation coefficient of 0.5 to estimate the influence of covariates, the required sample size increased to 203 participants.[26]

A systematic sampling approach was employed to select participants. This study recruited elderly participants residing within the research area for a minimum of one year. Inclusion criteria specified participants aged 60-80 who could communicate in Thai. Participants with severe mental health conditions or significant physical limitations were excluded.

Measurement tools

The study used three parts of questionnaires to gather data from participants: Individual Characteristics: This section included seven questions on gender, age, educational level, sufficient income, employment, living arrangements, and caregiver.

Depression Anxiety Stress Scale-21 (DASS-21): This self-report measure assessed three negative emotional states: depression, anxiety, and stress. It contained 21 items reflecting the participants' experiences over the past week. Responses were rated on a four-point Likert scale (0 = did not apply to me at all; 3 = applied to me very much).[27] The stress section (Items 1, 6, 8, 11, 12, 14, and 18) was scored as "no" (0 to 7) or "yes" (8 to 42).

International Physical Activity Questionnaire-Short Form (IPAQ-SF): This instrument assessed physical activity levels in various daily life domains, including leisure time, domestic and gardening activities, work-related activities, and transport-related activities. It inquired about walking, moderate-intensity, and vigorous-intensity activities. Physical activity was scored in minutes per week or categorized into low, moderate, and high levels. Moderate physical activity was calculated using Items 3 and 4.[28]

Data Collection

We conducted the data collection from December 2022 to June 2023 by face-to-face interviews. The researcher provided a one-week training program to the research assistants (five geriatric care workers) which covered the study protocol, interviewing techniques, and participant selection criteria. Before the interview, each participant provided written informed consent following a detailed explanation of the study's goals, procedures, possible outcomes, and their rights to decline participation. Participant information confidentiality was prioritized, and participants were informed that they could withdraw from the study any time.

Statistical analysis

Descriptive statistics were employed to depict the characteristics of participants. In the case of categorical variables, the distribution was presented as frequency and percentage (%). In the case of continuous variables, the distribution was presented as means and standard deviations (SD).

We used STATA version 17 for data analysis. Categorical data was summarized using frequencies and percentages, while continuous data was described by means and standard deviations. Multiple logistic regression investigated the associations between moderate physical activity and stress adjusting for confounding variables; the adjusted odds ratio (AOR) and 95% confidence interval (CI) were presented. A significant level of 0.05 was used for all statistical tests.

Ethical considerations

The study was approved by the Institutional Review Board (IRB) at Phetchabun Hospital (IEC-20-2565) on November 9, 2022.

Results

Demographic Characteristics of Older Adults with Hypertension

The study included 203 older adults with hypertension. The mean age of the participants was 68.42 years (SD = 4.82). Most were female (78.82%) and over 69 years old (69.46%). The majority had higher primary school education (51.23%), sufficient income without savings (40.39%), and were employed (81.28%). Most lived with others (93.10%) and had a caregiver (72.91%) (Table 1).

Moderate Physical Activity and Stress Levels

Of the older adults with hypertension, 63.55% did not engage in moderate physical activity, while 36.45% did. The mean number of days per week of

moderate physical activity was 1.46 days (SD = 2.28). The mean duration per week was 84.83 minutes (SD = 173.71). Additionally, 89.66% did not experience stress in the past week, while 10.34% did (Table 2).

Associations between Moderate Physical Activity and Stress

Older adults with hypertension who engaged in moderate physical activity were 93% less likely to experience stress compared to those who did not (AOR=0.07, 95% CI: 0.01 - 0.98, p=0.048). Those who graduated from primary school (AOR=0.01, 95% CI: 0.01 – 0.04, p<0.001) and higher than primary school (AOR=0.01, 95% CI: 0.01 – 0.12, p=0.002) were less likely to experience stress compared to those with no education. (Table 3)

Table 1: Demographic characteristics of the participants

Demographic characteristics(n=203)	Number	Percentage
Gender		
Male	43	21.18
Female	160	78.82
Age (years)		
≤69	62	30.54
>69	141	69.46
Mean(SD)	68.42 (4.82)	
Min - Max	60 - 79	
Educational level		
No education	18	8.87
Primary school	81	39.90
Higher than Primary school	104	51.23
Sufficient income		
Not sufficiency	62	30.54
Sufficiency without saving	82	40.39
Sufficiency and saving	59	29.06
Employment		
Unemployed	38	18.72
Employed	165	81.28
Living arrangement		
With other (partner, family, relatives, friend, etc.)	189	93.10
Living alone	14	6.90
Caregiver		
No	55	27.09
Yes	148	72.91

Table 2: Moderate physical activity and stress of the participants

Moderate physical activity and stress (n=203)	Number	Percentage
Moderate physical activity		
No	129	63.55
Yes	74	36.45
Days per week		
Mean (SD)	1.46 (2.28)	
Min-Max	0 -7	

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Minutes per week		
Mean (SD)	84.83 (173.71)	
Min-Max	0 - 700	
Stress		
No	182	89.66
Yes	21	10.34

Table 3: The association associations between moderate physical activity and stress

Factors	n= 203	Stress		COR	AOR	95% CI	p-value
		n	%				
Gender							
Male	43	6	13.95	Ref.	Ref.		
Female	160	15	9.38	0.64	0.29	0.05 – 1.61	0.158
Age (years)							
≤69	62	6	9.68	Ref.	Ref.		
>69	141	15	10.64	1.11	0.83	0.13 – 5.36	0.848
Educational level							
No education	18	16	88.89	Ref.	Ref.		
Primary school	81	3	3.70	0.01	0.01	0.01 – 0.04	<0.001
Higher than Primary school	104	2	1.92	0.01	0.01	0.01 - 0.12	0.002
Sufficient income							
Not sufficiency	62	18	29.03	Ref.	Ref.		
Sufficiency without saving	82	2	2.44	0.06	0.75	0.06 – 10.02	0.830
Sufficiency and saving	59	1	1.69	0.04	0.65	0.01 - 28.94	0.824
Employment							
Unemployed	38	12	31.58	Ref.	Ref.		
Employed	165	9	5.45	0.13	0.33	0.05 – 2.16	0.247
Living arrangement							
With other (partner, family, relatives, friend, etc.)	189	20	10.58	Ref.	Ref.		
Living alone	14	1	7.14	0.65	0.22	0.01 – 27.79	0.538
Moderate physical activity							
No	129	18	13.95	Ref.	Ref.		
Yes	74	3	4.05	0.26	0.07	0.01 - 0.98	0.048

Note: COR: Crude odds ratios,AOR:adjusted odds ratio, and CI: Confidence interval

Discussion

The study provided valuable insights into the relationship between physical activity, stress, and demographic factors in older adults with hypertension which is particularly relevant, as this group often faces both physical and psychological challenges. We found that engaging in moderate physical activity and having higher education levels were associated with lower stress.

Our findings on the prevalence of moderate physical activity (36.45%) align with previous research in various locations, such as Beijing, China (78.57%)[29], Demak Regency, Indonesia (60.3%)[30], and Ayuttaya, Thailand (48.7%)[23]. However, variability

was observed in other studies, for example, national surveys in the US showed participation rates ranging from 27.3% to 44.3%[31], while Phitsanulok, Thailand reported 23.7%[24], Cawang, East Jakarta Indonesia reported 17.6%[32], and Northern Ireland reported 10%.[33] Participants in our study engaged in an average of 84 minutes of moderate physical activity per week which is below the recommended 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity activity per week for substantial health benefits.[25,34] Only 10.34% of participants reported experiencing stress in the past week, consistent with the rate among hypertensive patients in a primary care clinic in Malaysia (13.9%).[35] The "district health system" in Lomkao, which promotes health, disease prevention, environmental health, and community participation, might have influenced our study results.

Our findings indicated that older adults with hypertension who engaged in moderate physical activity were less likely to experience stress. The findings were supported by studies conducted in Texas, which highlighted the effectiveness of engaging in more light physical activity for managing stress among older adults.[36]Furthermore, these studies confirmed the effect of moderate physical activity in reducing stress for older adults in Brazil.[37]Consistent with a systematic review that demonstrated that exercise interventions effectively reduced psychological stress in adults aged 50 and older.[38] Combining stress management techniques with exercise programs may further reduce stress levels.[39]Moreover, the results of our study indicated that higher education levels were also associated with lower stress. This aligns with previous studies showing that higher education is related to better mental health and psychological well-being in older adults.[37,40,41] Education may empower older adults to maintain resilience and effectively cope with challenges of aging.[42]

The strengths and limitations

The study's findings provided unique and robust evidence supporting the positive impact of moderate physical activity on stress reduction in older adults with hypertension, particularly in this population experiencing "complete aging society" areas. However, the geographically specific sample limited generalizability to other populations or cultural contexts. Moreover, due to the cross-sectional study, causal relationship couldn't be determined, and the assessment period for data collection was short.

Implications for Community Nurses

Healthcare providers should prioritize integrating evidence-based physical activity and stress management interventions into comprehensive care plans for older adults with hypertension. Nurses can play an essential role by promoting specific, moderate-intensity physical activities such as walking, tai chi, or resistance training, to reduce stress levels among senior populations affected by hypertension. Collaborating with social workers or mental health professionals can address underlying stressors, facilitating a comprehensive approach to hypertension management.

Recommendations

Healthcare providers should develop, implement, and encourage participation in physical activity programs specifically designed for older adults with hypertension, such as low-impact aerobics, chair exercises, or walking groups. The government and stakeholders should provide funding and support for the creation and maintenance of senior centers with exercise facilities and promote walkable communities with parks, sidewalks, and safe pedestrian crossings. Future research should examine the long-term impact of physical activity on stress management and overall well-being. Expanding research to other levels of physical activity will help understand how different types of exercise impact stress levels, providing a holistic picture of long-term stress and its connection to physical activity habits.

Conclusion

The present study underscored that moderate physical activity and higher educational levels were associated with lower stress in older adults with hypertension. Healthcare providers should encourage hypertensive patients, especially older adults, to adopt moderate physical activity routines. Community programs promoting physical activity for seniors should be expanded. Additionally, future research should explore the mechanisms of the long-term impact of physical activity on stress.

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Declarations:

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Conflict of interest: The authors declare that there is no conflict of interest.

Ethical approval: The study was approved by the Institutional Review Board (IRB) Phetchabun Hospital which assigned an IEC-20-2565 on November 9, 2022

References

1. World Health Organization. Ageing and health. Published October 1, 2022. Accessed July 11, 2023. https://www.who.int/news-room/fact-sheets/detail/ageing-and-health
2. Affairs UND of E and S. World Population Ageing 2019. United Nations; 2020. doi:10.18356/6a8968ef-en
3. Department of Older Persons. Situation of The Thai Older Persons 2022. Foundation of Thai Gerontology Research and Development Institute and Institute for Population and Social Research, Mahidol University; 2023. https://thaitgri.org/?wpdmpro=situation-of-the-thai-older-persons-2022
4. Rodrigues LP, Rezende AT de O, Moura L de AN e, et al. What is the impact of multimorbidity on the risk of hospitalisation in older adults? A systematic review study protocol. BMJ Open. 2021;11(6):e049974. doi:10.1136/bmjopen-2021-049974
5. World Health Organization. Hypertension. Published March 16, 2023. Accessed July 17, 2024. https://www.who.int/news-room/fact-sheets/detail/hypertension
6. Reducing cardiovascular disease (hypertension and sodium). Accessed July 17, 2024. https://www.who.int/thailand/activities/reducing-cardiovascular-disease
7. Benetos A, Petrovic M, Strandberg T. Hypertension Management in Older and Frail Older Patients. Circulation Research. 2019;124(7):1045-1060. doi:10.1161/CIRCRESAHA.118.313236
8. Ahuja R, Ayala C, Tong X, Wall HK, Fang J. Public Awareness of Health-Related Risks From Uncontrolled Hypertension. Prev Chronic Dis. 2018;15:E40. doi:10.5888/pcd15.170362
9. Masenga SK, Kirabo A. Hypertensive heart disease: risk factors, complications and mechanisms. Front Cardiovasc Med. 2023;10:1205475. doi:10.3389/fcvm.2023.1205475
10. World Health Organization. Mental health of older adults. Published October 20, 2023. Accessed March 25, 2024. https://www.who.int/news-room/fact-sheets/detail/mental-health-of-older-adults
11. Turana Y, Tengkawan J, Chia YC, et al. Mental health problems and hypertension in the elderly: Review from the HOPE Asia Network. J Clin Hypertens (Greenwich). 2021;23(3):504-512. doi:10.1111/jch.14121
12. Gan Q, Yu R, Lian Z, Yuan Y, Li Y, Zheng L. Unraveling the link between hypertension and depression in older adults: a meta-analysis. Front Public Health. 2023;11. doi:10.3389/fpubh.2023.1302341
13. Gore R. The Impact of Stress on Older Adults and Tips for Managing It. Published January 16, 2024. Accessed July 17, 2024. https://www.hebrewseniorlife.org/blog/impact-stress-older-adults-and-tips-managing-it
14. Seangpraw K, Auttama N, Kumar R, Somrongthong R, Tonchoy P, Panta P. Stress and associated risk factors among the elderly: a cross-sectional study from rural area of Thailand. F1000Res. 2020;8:655. doi:10.12688/f1000research.17903.2
15. World Health Organization. Physical activity. Published June 26, 2024. Accessed July 17, 2024. https://www.who.int/news-room/fact-sheets/detail/physical-activity
16. Saqib ZA, Dai J, Menhas R, et al. Physical Activity is a Medicine for Non-Communicable Diseases: A Survey Study Regarding the Perception of Physical Activity Impact on Health Wellbeing. Risk Manag Healthc Policy. 2020;13:2949-2962. doi:10.2147/RMHP.S280339
17. DHULI K, NAUREEN Z, MEDORI MC, et al. Physical activity for health. J Prev Med Hyg. 2022;63(2 Suppl 3):E150-E159. doi:10.15167/2421-4248/jpmh2022.63.2S3.2756
18. Masanovic B, Akpinar S, Halasi S, Stupar D, Popovic S. Editorial: Physical activity as a natural cure for non-communicable diseases. Front Public Health. 2023;11:1209569. doi:10.3389/fpubh.2023.1209569
19. Mahindru A, Patil P, Agrawal V. Role of Physical Activity on Mental Health and Well-Being: A Review. Cureus. 15(1):e33475. doi:10.7759/cureus.33475
20. Schuch FB, Vancampfort D. Physical activity, exercise, and mental disorders: it is time to move on. Trends Psychiatry Psychother. 2021;43(3):177-184. doi:10.47626/2237-6089-2021-0237
21. World Health Organization. Thailand's physical activity drive is improving physical health. Accessed July 17, 2024. https://www.who.int/southeastasia/activities/thailand-s-physical-activity-drive-is-improving-physical-health

22. Topothai T. Thailand Physical Activity Strategy 2018-2030: Challenges and Recommendations for Improved Implementation. Journal of Health Science of Thailand. 2021;30(6):1153-1164.
23. Ethisan P, Somrongthong R, Ahmed J, Kumar R, Chapman RS. Factors Related to Physical Activity Among the Elderly Population in Rural Thailand. J Prim Care Community Health. 2017;8(2):71-76. doi:10.1177/2150131916675899
24. Kitreerawutiwong N, Keeratisiroj O, Mekrungrongwong S. Factors That Influence Physical Activity Among Older Adults Living in Rural Community in Wangthong District, Phitsanulok, Thailand. Sage Open. 2021;11(4):21582440211061368. doi:10.1177/21582440211061368
25. World Health Organization. Promoting physical activity. World Health Organization - Regional Office for the Eastern Mediterranean. Accessed July 17, 2024. http://www.emro.who.int/health-education/physical-activitiy/promoting-physical-activity/What-is-the-recommended-amount-of-exercise.html
26. Hsieh FY, Bloch DA, Larsen MD. A simple method of sample size calculation for linear and logistic regression. Stat Med. 1998;17(14):1623-1634. doi:10.1002/(sici)1097-0258(19980730)17:14<1623::aid-sim871>3.0.co;2-s
27. Depression Anxiety Stress Scale-21 (DASS21). Addiction Research Center. Accessed March 11, 2024. https://arc.psych.wisc.edu/self-report/depression-anxiety-stress-scale-21-dass21/
28. International Consensus Group. International Physical Activity Questionnaire - Short Form. Published online 1998. https://youthrex.com/wp-content/uploads/2019/10/IPAQ-TM.pdf
29. Miao H, Li J, Weng X, et al. Impact of physical activity on the prevalence of hypertension among the older adults in Beijing communities. Advances in Health and Behavior. 2019;2(1):41-48. doi:10.25082/AHB.2019.01.003
30. Soesanto E, Khoiriyah K, Handayani IF. Description of Physical Activities in the Elderly with Hypertension in PosbinduSumber Sehat, Demak Regency. Open Access Macedonian Journal of Medical Sciences. 2021;9(T4):194-198. doi:10.3889/oamjms.2021.5759
31. Keadle SK, McKinnon R, Graubard BI, Troiano RP. Prevalence and trends in physical activity among older adults in the United States: A comparison across three national surveys. Prev Med. 2016;89:37-43. doi:10.1016/j.ypmed.2016.05.009
32. Suling F, Rantung N, Gowa M, Lumaksono M, Widihastuti W, Suling T. 63. Effect of Physical Activity on Hypertension in the Geriatric Population at Cawang, East Jakarta. Journal of Hypertension. 2023;41(Suppl 2):e15. doi:10.1097/01.hjh.0000935632.19879.e5
33. O'Doherty M, Cunningham C, Neill RD, Tully MA. The association of resilience and physical activity in older adults: cross-sectional analyses from the NICOLA study. J Public Health (Berl). Published online May 15, 2024. doi:10.1007/s10389-024-02274-3
34. CDC. Physical Activity for Adults: An Overview. Physical Activity Basics. Published February 21, 2024. Accessed July 17, 2024. https://www.cdc.gov/physical-activity-basics/guidelines/adults.html
35. Loke WH, Ching SM. Prevalence and factors associated with psychological distress among adult patients with hypertension in a primary care clinic: A cross-sectional study. Malays Fam Physician. 2022;17(2):89-98. doi:10.51866/oa.131
36. Leger KA, Charles ST, Brown CJ, Fingerman KL. Physical Activity and Daily Stress Processes in Older Adulthood. J Gerontol B Psychol Sci Soc Sci. 2023;78(1):20-29. doi:10.1093/geronb/gbac113
37. Figueira HA, Figueira OA, Figueira AA, Lyra da Silva CR, Figueira JA, Martin Dantas EH. Association of Stress with Healthy Aging, the Role of Physical Activity. OBM Geriatrics. 2022;6(4):1-10. doi:10.21926/obm.geriatr.2204219
38. Churchill R, Teo K, Kervin L, Riadi I, Cosco TD. Exercise interventions for stress reduction in older adult populations: a systematic review of randomized controlled trials. Health Psychol Behav Med. 10(1):913-934. doi:10.1080/21642850.2022.2125874
39. Stults-Kolehmainen MA, Sinha R. The Effects of Stress on Physical Activity and Exercise. Sports Med. 2014;44(1):81-121. doi:10.1007/s40279-013-0090-5
40. Kao IC, Chang LC. Long-term effects of leisure education on leisure needs and stress in older adults. Educational Gerontology. 2017;43(7):356-364. doi:10.1080/03601277.2017.1299447
41. Belo P, Navarro-Pardo E, Pocinho R, Carrana P, Margarido C. Relationship Between Mental Health and the Education Level in Elderly People: Mediation of Leisure Attitude. Front Psychol. 2020;11:573. doi:10.3389/fpsyg.2020.00573
42. Brinkhof LP, Chambon M, Ridderinkhof KR, et al. Resilience Among Older Individuals in the Face of Adversity: How Demographic and Trait Factors Affect Mental-Health Constructs and Their Temporal Dynamics. Clinical Psychological Science. Published online August 11, 2023:21677026231190294. doi:10.1177/21677026231190294