

Effects of long-term physical training on depression in adolescents

Guifang Liu¹ , Yonglei Liu² , Haoyuan Li^{3,*}

Abstract

Objective: From the standpoint of sports commitment, investigate the influencing variables of personal aspects on teenagers' physical and mental health.

Methods: It was discovered that there were gender and grade disparities in teenage stress tolerance after a study of 1000 senior high school students. Teenagers' levels of physical activity, frequency of physical activity, and time spent exercising are all pretty consistent and appropriate. Teenagers' stress resistance, mental health, and interpersonal relationships are all influenced by physical activity.

Result: The quantity of physical activity and teenagers' stress tolerance were shown to be positively correlated ($P < 0.05$). It had a favourable relationship with mental wellbeing ($P < 0.05$). There was no statistically significant link between interpersonal relationships ($P > 0.05$). When the pressures of a teenager's life and studies mount, an appropriate amount of physical activity can effectively adjust their mental health and stress tolerance to a degree, allowing them to continuously vent their negative emotions and relieve the pressure, thus improving their mental health, allowing them to face life positively, and improving their ability to withstand pressure.

Conclusion: Sports commitment may completely mobilise social support, promote adolescent happiness through numerous channels, establish a pleasant learning and training life environment, and strengthen positive psychology guidance and development.

Keywords: Adolescents, Mental health model, Qualitative analysis, Quantitative test.

1. Introduction

Physical activity and good health are inextricably linked. Physical inactivity has a direct impact on the health of pupils. One of the primary concerns of physical education reform is how to pique students' interest in participating in physical activities. It is critical to improve the physical health of teens and their involvement in physical activities, and to make this the primary task and basic need of School Physical Education (Meyer, Steinhaus, Bangirana, Onyango-Mangen, & Stark, 2017). Physical exercise is one of the major factors that impact teens' health, according to several experts and researchers. Physical activities involve a wide range of different types of physical activity and sports. Cardiovascular disease and diabetes are not easily caused by physical exercise. As a result, a lack of physical exercise might have a negative impact on teenagers' physical health. Many scientists in the domains of international sports science and health promotion use physical activity research to investigate and explain the link between physical activity, particularly medium and high-intensity physical exercise, and physical health. Schools, families, and society should encourage and support teenagers to participate in physical activities, constantly improve the level of physical activity, integrate interesting and entertaining physical activities into school physical

education and family education, and cultivate teenagers' enthusiasm and interest in physical activities while paying close attention to their physical health. Encourage teens to improve their physical fitness and develop in a healthy manner. (Felipe et al., 2019)

One of the most significant ideas in motivational psychology is the expectation value theory. It asserts that a person's motivation to finish certain activities is governed by his expectation of success and the task's worth. The larger the incentive value acquired from the objective, and the better the individual's drive and degree of completion of the activity, the more likely an individual believes the goal can succeed (Costa et al., 2020). The sense of security, according to GeyhS, is an individual's anticipation of potential danger or risk, as shown in feelings of strength / helplessness, assurance, and control in reaction to disposal. Some researchers believe that security is a personality feature (Geyh, Kunz, Müller, & Peter, 2016). McKenna G discovered that impoverished left-behind children's mental health is much worse than that of non-poor left-behind children. Between life experiences and mental health, psychological resilience serves as a regulator and mediator. The link between life stress and personal health is complicated. Individuals can change the way stress experiences affect their mental health by adjusting some intermediary aspects including

¹ School of Sports, Zhengzhou Normal University, Zhengzhou, Henan, 450044, China

² Physical Education Department, Zhengzhou Institute of Finance and Economics, Zhengzhou, Henan, 450044, China

³ Faculty of Sports and Health Sciences, Guangxi University for Nationalities, Guangxi Nanning, 530006, China

Corresponding Author's Email: liuguifang@edu.com

cognitive appraisal, coping style, and social support (McKenna, Rogers, Walker, & Pope, 2020). To provide a new theoretical perspective and research basis for the cultivation of adolescent mental health, fully excavate the constituent elements of adolescent mental health (Figure 1 and Figure 2), ensure that the constructed model conforms to the environment and its own characteristics of adolescent mental development, and further SEM test the constructed model (Table 1, Table 2, Table 3 and Table 4) on the basis of the current research.

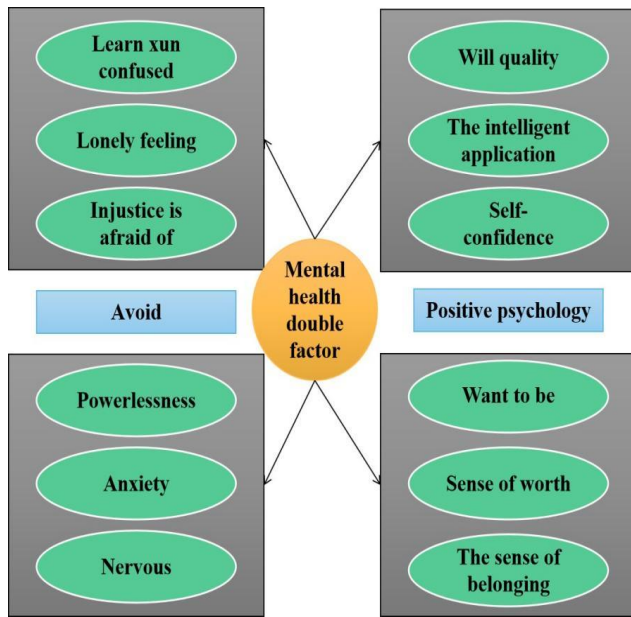


Figure 1. Two factor model of adolescent mental health

2. Research object and method

2.1 Research object

1000 questionnaires were randomly distributed in two local high schools, and 980 questionnaires were

Table 1. Physical exercise intensity of teenagers

Exercise intensity	Frequency	Percentage	Effective percentage	Cumulative percentage
Light physical exercise	212	22.8	22.8	45.6
Low intensity physical exercise	172	18.5	18.5	37
Moderate intensity physical exercise	134	14.5	14.5	29
High intensity physical exercise	397	42.6	42.6	85.2
High intensity physical exercise	15	1.6	1.6	100
Total	930	100	100	

Through the statistical analysis of 930 teenagers, 212 of them took slight physical exercise, accounting for 22.7% of the total. The number of low-intensity physical exercise was 172, accounting for 18.5% of the total. The number of moderate intensity physical exercise was 134, accounting for 14.4% of the total. The number of high-intensity physical exercise was 397, accounting for 42.6% of the total. The number of extremely high-intensity physical exercise is 1.6%,

recovered, with a recovery rate of 98.0%. There were 930 valid questionnaires, and the effective rate was 93%. The age range was 15-18 years, and the average age was 15.82 ± 1.20. Among them, there are 552 boys, accounting for 59.3%, and 378 girls, accounting for 40.6%.

2.2 Research methods

This study mainly adopts the physical exercise grade scale, adolescent self-assessment life events scale, comprehensive diagnosis scale of interpersonal relationship and mental health scale of college students. The 980 investigation reports were analyzed. The data were analyzed by systematic statistics and analysis of variance to explore the current situation of teenagers' physical exercise and the overall characteristics and changes of life stress resistance, mental health and interpersonal relationship (Man, Chan, Alabdulkarim, & Zhang, 2021).

2.3 Mathematical statistics

The survey data are statistically analyzed through SPSS22.0 and AMOS23.0. The reliability of adolescent mental health questionnaire was tested by α coefficient, confirmatory factor analysis was carried out by SEM, the appropriateness of construction validity of the model constructed by qualitative research was tested, and the differential validity was tested by AVE method.

3. Research results and analysis

3.1 Current situation and analysis of teenagers' physical exercise

Statistical analysis on the current situation of teenagers' physical exercise intensity. Through the statistics of 930 valid survey reports, the basic situation of teenagers' physical exercise intensity is understood. See Table 1 for details.

accounting for 1.6% of the total. The basic sports intensity of teenagers is statistically developed, and the number of Teenagers Participating in high-intensity physical exercise is the largest. Followed by light physical exercise (Van Dyck, Teychenne, McNaughton, De Bourdeaudhuij, & Salmon, 2015).

Statistical analysis on the current situation of teenagers' physical exercise time. Through the statistics of 930 valid survey reports, the basic situation

of teenagers' physical exercise time is understood. See Table 2:

Table 2. Physical exercise time of teenagers

Time	Number of people	Percentage	Effective percentage	Cumulative percentage
Under 10min	126	13.5	13.5	27
11min~20min	187	20.1	20.1	40.2
21min~30min	468	50.3	50.3	100.6
30min~59min	115	12.3	12.3	24.6
Over 60min	34	3.8	3.8	7.6
Total	930	100	100	

Through the statistical analysis of 930 teenagers, 126 of them took physical exercise for less than 10 minutes, accounting for 13.5% of the total. The number of people with physical exercise time between 11min and 20min is 187, accounting for 20.1% of the total. 468 people took physical exercise between 21min and 30min, accounting for 50.3% of the total. The number of people with physical exercise time between 30 min and 59 min was 115, accounting for 12.3% of the total. The number of people who took physical exercise for more than one hour was 34, accounting for 3.8% of the total.

According to the statistics of teenagers' basic physical exercise time, it is found that teenagers' time to participate in physical exercise is concentrated between 20min and 60min.

Relatively speaking, the sports time arrangement of teenagers' physical exercise is more reasonable. Statistical analysis on the current situation of teenagers' physical exercise frequency. Through the statistics of the obtained data, we can understand the basic situation of teenagers' physical exercise frequency. See Table 3 for details:

Table 3. Physical exercise frequency of teenagers

Frequency	Number of people	Percentage	Effective percentage	Cumulative percentage
Less than once a month	46	5	5	10
Two to three times a month	115	12.4	12.4	24.8
Once or twice a week	473	50.9	50.9	101.8
Three to five times a week	217	23.4	23.4	46.8
About once a day	79	8.3	8.3	16.7
Total	930	100	100	

Physical exercise frequency refers to the physical exercise carried out by students independently except school physical education. The survey shows that the number of people whose physical exercise frequency is less than once a month is 46, accounting for 5% of the total number.

The number of people who exercise twice or three times a month is 115, accounting for 12.4% of the total. The number of people with physical exercise frequency between once and twice a week was 473, accounting for 50.9% of the total. 217 people took physical exercise three to five times a week, accounting for 23.4% of the total. The number of people who exercise once a day is

79, accounting for 8.3% of the total.

According to the statistics of the basic exercise frequency of teenagers, it is found that the frequency of Teenagers Participating in physical exercise is concentrated once or twice a week, followed by three to five times a week.

Relatively speaking, the exercise frequency arrangement of teenagers' physical exercise is more reasonable. Statistical analysis on the current situation of teenagers' physical exercise. Through the statistics of the obtained data, we can understand the basic situation of teenagers' physical exercise. See Table 4 for the specific situation.

Table 4. Physical exercise of teenagers

Exercise intensity	Number of people	Percentage	Effective percentage
Low physical exercise	533	57.4	57.4
Moderate physical exercise	242	26.1	26.1
High physical exercise	155	16.5	16.5
Total	930	100	100

Through the statistical analysis of 930 teenagers, the number of low physical exercise is 533, accounting for 57.4% of the total. The number of people with medium physical exercise is 242, accounting for 26.1% of the total.

The number of people with high physical exercise is 155, accounting for 16.5% of the total. Based on the statistical analysis of the basic exercise volume of teenagers, the amount of Teenagers Participating in physical exercise is relatively concentrated between

low physical exercise volume and medium physical exercise volume, which shows that the overall physical exercise level of teenagers remains stable to a certain extent.

3.2 Current situation and analysis of teenagers' life stress resistance, interpersonal relationship and mental health

Differences in life stress resistance, interpersonal relationship and mental health of adolescents of different genders. Independent sample t-test was used to analyze the differences in life stress tolerance, interpersonal relationship and mental health of adolescents of different genders. In order to facilitate the detection, stress tolerance will be used instead of life stress tolerance. Statistics showed that there was no significant difference in interpersonal relationship and mental health between adolescents of different genders ($P > 0.05$).

There were significant differences in stress tolerance between adolescents of different genders ($P < 0.05$). It can be seen that in the adolescent stage, the differences between adolescents of different genders in mental health and interpersonal communication are relatively small, which means that there is no obvious difference in adolescents' mental health between different genders, which further shows that adolescents have a healthy physical and mental development in a good living environment. Once they have psychological problems, teenagers can adjust themselves in time and adopt more correct methods to deal with problems. At the same time, there is no obvious gender difference in teenagers' interpersonal communication.

The samples of this study are more similar in family characteristics and growth environment. In terms of stress tolerance, there are significant differences between adolescents of different genders. Analyze the reasons. In adolescence, there are gender differences in their family rearing methods, different family hopes for boys and girls, different classmate relationships between male and female students, and different personalities and coping styles of middle school students.

Affected by the gender differences of many factors, adolescents of different genders have different tolerance to life pressure, which further shows that life stress resistance is related to teenagers' personality characteristics, growth environment and coping styles. In the future research, the characteristics of adolescents can be studied according to different social variables ([Kieras, do Amaral Machado, Pelissari, Cysneiros, & da Silva, 2020](#)). Differences in life stress resistance, interpersonal relationship and mental health of adolescents in different grades. One-way ANOVA was used to analyze the sample data to understand the differences between different genders in life stress tolerance, interpersonal relationship, mental health and physical exercise.

In order to facilitate data processing, stress tolerance

will be used instead of life stress tolerance. Through the univariate analysis of the test results of ASLES, interpersonal relationship and MHI-5 of adolescents in different grades, the conclusion is that there is no significant difference between adolescents in grades in terms of mental health and interpersonal relationship ($P > 0.05$). In terms of stress tolerance, there are significant differences among adolescents of different grades, that is, $P < 0.05$. Especially, the stress tolerance of senior two and senior three students is higher than that of senior one, which is mainly reflected in that the stress tolerance of senior students is better than that of junior students.

3.3 Investigation and Analysis on the relationship between physical exercise and teenagers' life stress resistance, interpersonal relationship and mental health

Discussion on the differences of life stress resistance, interpersonal relationship and mental health among adolescents with different exercise intensity. Through the single factor analysis of the test results, we can further understand whether there are corresponding differences in life pressure resistance, interpersonal relationship and mental health under different physical exercise intensity. In order to facilitate data processing, stress tolerance will be used instead of life stress tolerance. We know that there is no significant difference in stress tolerance among adolescents under different physical exercise intensity ($P > 0.05$). However, there were significant differences in interpersonal relationship and mental health under different intensity ($P < 0.05$).

Under the different intensity of physical exercise, the mental health of teenagers is different, and there are differences in varying degrees. At the same time, after multiple post test results show that: according to the test results of mental health, it is found that under the background of different physical exercise intensity, the mental health level of adolescents with medium physical exercise intensity and higher physical exercise intensity is significantly higher than that of adolescents with low physical exercise intensity.

Under different physical exercise intensity, teenagers also have certain differences in interpersonal communication. According to the test results of interpersonal communication, it is found that under the background of different physical exercise intensity, the mental health level of teenagers with slight physical exercise intensity is significantly higher than that of teenagers with medium and high physical exercise intensity ([Gonçalves, Endrass, Rossegger, & Dirkwager, 2016](#)). Discussion on the differences of life stress resistance, interpersonal relationship and mental health among adolescents with different amount of exercise. Through the single factor analysis of the test results, we can further understand whether teenagers have corresponding differences in life stress resistance, interpersonal relationship and mental health under

different amounts of physical exercise. In order to facilitate data processing, we will use stress tolerance

instead of life stress resistance. The results are shown in Figure 2:

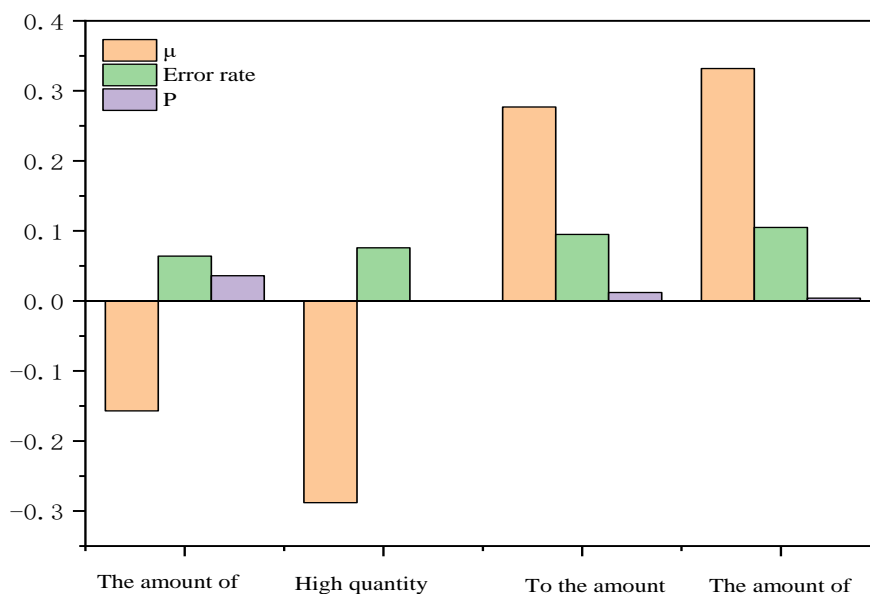


Figure 2. Post hoc multiple test of LSD in adolescents under different physical exercise quantities

From the test results, we can know that there are different degrees of differences in teenagers' mental health status and stress tolerance under the condition of different amount of exercise. Through the test, it is found that the mental health status of teenagers with high amount of physical exercise and medium amount of physical exercise is significantly better than that of teenagers with low amount of physical exercise ($P < 0.05$). The stress tolerance of adolescents with high physical exercise was significantly higher than that of adolescents with medium physical exercise and low physical exercise ($P < 0.05$).

Under the intensity of different physical exercise, there is no significant difference in interpersonal relationship. The results of this study showed that there was a positive correlation between the amount of physical exercise and adolescents' stress tolerance ($P < 0.05$). It was positively correlated with mental health ($P < 0.05$). There was no significant correlation with interpersonal relationship ($P > 0.05$). This result shows that when the pressure of teenagers' life and study is increasing, appropriate physical exercise can effectively adjust their mental health and stress tolerance to a certain extent, so as to continuously vent their bad emotions and relieve the pressure, so as to improve their mental health, let them face life positively and improve their ability to withstand pressure.

4. Discussion

The environmental determinism of behaviorist psychology holds that the individual's psychological state is not an independent vacuum existence, but the product of the environment, which is affected by both the natural environment and the social environment.

Based on this view, ecosystem theory emphasizes that micro systems such as school environment, teacher-student relationship and partnership play an intermediary role in teenagers' mental health. Good campus atmosphere and harmonious teacher-student relationship can improve mental health and reduce risk behavior. At the same time, some surveys show that "bullying" is very common among teenagers, and the bullied will have a series of physical and psychological symptoms. Teenagers can't avoid the social environment. At the same time, they also need to face their unique development environment, such as boring training, fierce and cruel competition, pre competition anxiety, sports injury and physical and mental fatigue. This environment is different from the general population, with more complex environmental adaptation and more prominent impact on mental health (Donnelly, Clarke, Phinney, & MacEntee, 2016). Although the influence of environment on people's psychology cannot be ignored, in the adolescent stage, the regulation and release of positive psychological state on negative emotions cannot be underestimated. Subjective well-being and positive psychology are some indicators. Social support theory holds that individuals get a happy experience by being concerned, loved and respected in social relations. Parent-child relationship and peer support are particularly important for teenagers' psychological impact. Emotional support can make the mind in the contradiction period of dependence and exclusion, opening and locking, relieve tension, reduce psychological stress response, and improve and enhance mental health. In addition to social support and external environment, internal factors (characteristics, temperament, self-awareness, etc.) also play a role in teenagers' mental health. The

internal factors affecting individual psychology are determined by heredity, which is the basic and stable psychological quality of every teenager, which is closely related to people's social adaptation behavior and creative behavior. Empirical research shows that psychological characteristics will directly affect individual mental health.

Teenagers' initiative, temperament type and subjective consciousness often play a direct and important role in their performance in competition and training, interpersonal and coping. In order to further promote the development of teenagers' physical quality, mental health and interpersonal relationship, relevant departments should pay attention to the improvement of teenagers' physical exercise quality, and constantly strengthen their awareness of participating in physical exercise.

It is suggested that high schools should constantly strengthen the quality management system of PE classroom teaching, equip PE equipment according to the needs of teenagers, formulate the corresponding training system and assessment standards of PE teachers, and further ensure the perfection of teenagers' physical exercise. At the same time, teachers are actively encouraged to pay attention to the implementation of diversified physical education methods, cultivate students' interest in a variety of physical exercise, and promote students' concept of lifelong physical exercise.

Local sports departments should attach importance to the development of youth sports, actively cooperate with school sports work, actively establish various sports associations and clubs, strengthen the guidance and organization of sports exercise for left-behind youth students, and urge rural left-behind youth students to actively participate in sports activities. In addition, we should continue to strengthen the ideological education of teenagers, make use of social practice activities, let students fully participate in the process of social life, let teenagers extract effective time from the subject learning to relieve their fatigue, improve the ability to resist pressure, understand their own deficiencies, and actively carry out self-improvement.

Schools at all levels should attach importance to the corresponding international curriculum standards, ensure the quality of PE classes and ensure the time for physical exercise for young people. Among them for junior high school students, at least three hours a week to arrange physical education; For high school students, schedule at least two hours of physical education per week. In the spare time without PHYSICAL education, the school can organize students' physical exercise activities after class, the length of physical exercise time and frequency should be carried out according to the actual situation of the students, and these physical exercise teaching activities into the teaching plan. At the same time, actively implement big recess sports activities. Every morning between classes, about 20

minutes of unified sports activities, seriously organize students to carry out radio gymnastics, extracurricular sports activities; For boarding schools, we should pay attention to morning exercises. In addition, the school should pay attention to the management of physical education curriculum and actively carry out curriculum reform, bring the corresponding extracurricular activities into the daily teaching plan, so that the teenagers have at least three times a week physical exercise. Administrative departments of education at all levels should put forward the specific requirements of exercising one hour a day and do their best to implement them, organize students to carry out physical exercise according to local conditions, and give targeted guidance and support to the physical exercise activities of disabled teenagers. It is necessary to strengthen the construction of physical education teachers, to match the strong physical education teachers and retrain the physical education teachers according to the needs of opening physical education and developing after-school physical exercise.

In the process of promoting the improvement of teenagers' physical exercise level, the government, schools and society should manage the work of teenagers' physical exercise together. Government administration departments at all levels should pay attention to the development of youth physical exercise work, realize the importance of physical exercise, put its work on the important agenda. At the same time, the competent departments at all levels should attach importance to the development of sports activities and the guarantee of equipment for community teenagers, enrich the types of family sports activities, and form a pattern of sports activities carried out jointly by schools, society and families. According to relevant data, family is the key to teenagers' participation in physical exercise. Therefore, governments at all levels and communities should actively advocate and continuously publicize the concept of health first physical exercise, develop the correct concept of education and the concept of achievement from the youth period, and pay attention to the formation of teenagers' lifelong exercise consciousness. In addition, attention should be paid to the formation of teenagers' daily habits and civilized and healthy life patterns, and parents and children should be actively encouraged to participate in sports activities.

5. Conclusion

Physical exercise is of great significance to improve teenagers' life stress resistance, mental health and interpersonal relationship. Through physical exercise, teenagers can not only improve the overall body function and mental activity ability, but also lay a foundation for the improvement of individual stress resistance. Secondly, through physical exercise, provide more interpersonal opportunities for teenagers, promote the improvement of teenagers' social

adaptability, let teenagers correctly face all kinds of setbacks and difficulties in life, and form an independent personality.

Finally, physical exercise can further promote the mental health development of teenagers and let teenagers have a healthy attitude to face life. The internal factors affecting individual psychology are determined by heredity, which is the basic and stable psychological quality of every teenager, which is closely

related to people's social adaptation behavior and creative behavior. Empirical research shows that psychological characteristics will directly affect individual mental health.

Teenagers' initiative, temperament type and subjective consciousness often play a direct and important role in their performance in competition and training, interpersonal and coping. Therefore, we should pay attention to the exploration and research in this aspect.

Reference

- Costa, A. A. M., Silva, L. A. P., Aguiar, Y. P. C., Ramos, F. B. A., de Sousa Neto, A. F., & Valadares, D. C. G. (2020). The influence of personal factors on errors when interacting with a critical system. *IEEE Latin America Transactions*, *18*(05), 931-937. doi:10.1109/TLA.2020.9082922
- Donnelly, L. R., Clarke, L. H., Phinney, A., & MacEntee, M. I. (2016). The impact of oral health on body image and social interactions among elders in long-term care. *Gerodontology*, *33*(4), 480-489. doi:10.1111/ger.12187
- Felipe, J., Rodrigues, M. V. P., Ferreira, A. D., Fonseca, E. S., Ribeiro, G. G. d. S., & Arana, A. R. A. (2019). Physical activity and environment: the influence of urban green spaces on health. *Revista Brasileira de Medicina do Esporte*, *25*, 305-309. doi:10.1590/1517-869220192504187662
- Geyh, S., Kunz, S., Müller, R., & Peter, C. (2016). Describing functioning and health after spinal cord injury in the light of psychological-personal factors. *Journal of rehabilitation medicine*, *48*(2), 219-234. doi:10.2340/16501977-2027
- Gonçalves, L. C., Endrass, J., Rossegger, A., & Dirkzwager, A. J. (2016). A longitudinal study of mental health symptoms in young prisoners: exploring the influence of personal factors and the correctional climate. *BMC psychiatry*, *16*, 1-11. doi:10.1186/s12888-016-0803-z
- Kieras, W. S., do Amaral Machado, S., Pelissari, A. L., Cysneiros, V. C., & da Silva, S. A. (2020). INFLUENCE OF THE LAURACEAE FAMILY ON THE DYNAMICS OF A MIXED OMBROPHILOUS FOREST REMNANT. *Floresta*, *51*(1), 164-173. doi:10.5380/rf.v51i1.67629
- Man, S. S., Chan, A. H. S., Alabdulkarim, S., & Zhang, T. (2021). The effect of personal and organizational factors on the risk-taking behavior of Hong Kong construction workers. *Safety Science*, *136*, 105155. doi:10.1016/j.ssci.2020.105155
- McKenna, G., Rogers, A., Walker, S., & Pope, C. (2020). The influence of personal communities in understanding avoidable emergency department attendance: qualitative study. *BMC Health Services Research*, *20*(1), 1-12. doi:10.1186/s12913-020-05705-5
- Meyer, S. R., Steinhaus, M., Bangirana, C., Onyango-Mangen, P., & Stark, L. (2017). The influence of caregiver depression on adolescent mental health outcomes: findings from refugee settlements in Uganda. *BMC psychiatry*, *17*(1), 1-10. doi:10.1186/s12888-017-1566-x
- Van Dyck, D., Teychenne, M., McNaughton, S. A., De Bourdeaudhuij, I., & Salmon, J. (2015). Relationship of the perceived social and physical environment with mental health-related quality of life in middle-aged and older adults: mediating effects of physical activity. *PloS one*, *10*(3), e0120475. doi:10.1371/journal.pone.0120475