

Arterial Hypotension and Cognitive Impairment in High School Students: Prevalence and Treatment

Zalina Yuryevna Sozaeva*, Marina Vsevolodovna Atayeva, Magomed Abu - Khuseynovich Akhmatukaev, Amiliya Aslambekovna Aldamova, Oksana Khozh-Ahmedovna Geraeva, Radima khasanovna Zaypulaeva, Khava Ruslanovna Movlaeva, Islam Ruslanovich Kataev, Suleyman Alkhodzurovich Khasukhayev, Adam Mokhmadovich Barzaev

Received: 03 June 2025 / Received in revised form: 07 September 2025, Accepted: 09 September 2025, Published online: 29 September 2025

Abstract

The relevance of the study of primary arterial hypotension (PAH) in adolescents is due to the high prevalence of this condition and its significant impact on quality of life, cognitive functions, and academic performance. The purpose of this study was to study the prevalence and risk factors of PAH among high school students in Vladikavkaz, as well as to evaluate the effectiveness of a complex of non-drug interventions. 420 students from grades 9-11 participated in the study. The research methods included questionnaires, blood pressure measurements, assessment of cognitive functions using psychometric tests, and analysis of academic performance. The results indicated that the prevalence of PAH among high school students was 30.5%. Significant differences in lifestyle were found: adolescents with PAH slept an average of 6.8 hours a day (versus 7.9 hours in the control group), spent 5.4 hours a day on gadgets (versus 3.9 hours), and in 58.6% of cases regularly skipped breakfast (versus 32.2%). Students with PAH showed a decrease in attention productivity by 22.3%, memory capacity by 18.1%, and attention switching speed by 28.5%. After a three-month course of non-drug correction, which included normalization of daily routine, physical activity, and optimization of gadget usage time, the intervention group (n=64) showed a significant improvement in indicators: an increase in systolic blood pressure from 95.6 to 105.3 mm Hg and diastolic blood pressure from 56.3 to 62.7 mm Hg, a decrease in the frequency of fatigue complaints increased from 93.8% to 40.6%, and improved cognitive performance.

Zalina Yuryevna Sozaeva*, Marina Vsevolodovna Atayeva
Department of Children's Diseases, North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia.

Magomed Abu - Khuseynovich Akhmatukaev, Amiliya Aslambekovna Aldamova, Oksana Khozh-Ahmedovna Geraeva, Radima khasanovna Zaypulaeva, Khava Ruslanovna Movlaeva, Islam Ruslanovich Kataev, Suleyman Alkhodzurovich Khasukhayev, Adam Mokhmadovich Barzaev

Faculty of Medicine, North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia.

*E-mail: publab@bk.ru



© 2025 The Author(s). This is an **Open Access** article distributed under the terms of the Creative Commons Attribution 4.0 International License (CC-BY 4.0).
<https://creativecommons.org/licenses/by/4.0/deed.en>

Keywords: Primary arterial hypotension, Adolescents, Cognitive functions, Academic performance, Non-drug correction, Digital habits

Introduction

The problems of primary arterial hypotension (PAH) in childhood and adolescence remain highly relevant in modern pediatrics and school medicine (Korkut & Aydin, 2023; Krzesinski, 2023). This condition, traditionally defined as a persistent decrease in blood pressure below the 5th percentile of the age norm, is widespread in the adolescent population, reaching, according to various studies, from 10% to 30% (Chung *et al.*, 2021; Kontostoli *et al.*, 2022; Rivasi & Fedorowski, 2022). Unlike arterial hypertension, hypotensive conditions have often been regarded by clinicians for a long time as a relatively harmless variant of the norm that does not require active medical intervention (Fedorowski *et al.*, 2019; Clark, 2022; Hargreaves *et al.*, 2022). However, the data accumulated over the past decades strongly suggest that PAH is a serious pathological condition that has a multifaceted negative impact on the growing body, significantly reducing the quality of life and physical and mental performance of adolescents (Stewart *et al.*, 2018; Hui *et al.*, 2021; Ezepe *et al.*, 2024).

The PAH problem becomes particularly important in high school age (grades 9-11). This period of ontogenesis is characterized by intensive growth processes and neuroendocrine restructuring, known as the puberty leap, which in itself is a significant stress for the vascular tone regulation system (Plash *et al.*, 2013; Tretin *et al.*, 2022). At the same time, the teenager has a huge educational burden associated with preparing for the state final certification and choosing a future profession (Boris & Bernadzikowski, 2018; Kanellopoulou *et al.*, 2021). The combination of these factors creates a premorbid background for the development of functional disorders of the cardiovascular system, among which PAH occupies a leading place (Arnold *et al.*, 2018; Parvin *et al.*, 2022; Koch *et al.*, 2023). The clinical picture is manifested by a complex of astheno-neurotic symptoms: persistent weakness, increased fatigue, dizziness, tension cephalgia, emotional lability, and weather dependence (Wieling *et al.*, 2015; Ansari *et al.*, 2022; Alekseenok *et al.*, 2024; Ansari *et al.*, 2024; Peuters *et al.*, 2024; Samyuktha & Syam, 2024; Suchy & Jurkowski, 2024). It is these symptoms, which are directly related to impaired cerebral

hemodynamics and hypoperfusion of the brain, that become a key factor limiting the cognitive potential of adolescents (Shanks *et al.*, 2013; Zhang *et al.*, 2022).

In today's society, new risk variables that were previously unaccounted for have a significant impact on the condition of the adolescent cardiovascular system (Liu, 2024). We're talking about a fundamental shift in lifestyle driven by digitalization (Tang *et al.*, 2024). The long-term use of cellphones, tablets, and personal computers for study and enjoyment exacerbates the physical inactivity produced by extended static positions at the desk (Brych *et al.*, 2021). This not only lowers the period of physical exercise but also leads to chronic strain on the visual analyzer and psychoemotional overload from information on social networks and computer games and creates addicted behavior (Miglis *et al.*, 2016; Pelevin *et al.*, 2018; Zeng *et al.*, 2025). Sleep hygiene difficulties are also essential since the "blue light" from screens inhibits melatonin synthesis, resulting in desynchronization, late bedtime, and chronic sleep deprivation, which is a direct cause of autonomic dysfunction and hypotensive diseases (Ocon, 2013; Adams *et al.*, 2022; Kontostoli *et al.*, 2023). When combined with an irregular and often imbalanced diet (skipping breakfast, eating too many simple carbs, not drinking enough water), these variables create a complicated unfavorable pattern of behavior that can be regarded as a trigger for the development and progression of PAH (Stewart *et al.*, 2017; Staiano *et al.*, 2024). However, the degree of effect of each of these elements (time spent on gadgets, sleep patterns, stress levels) in a specific group, such as among kids in the North Caucasus area, requires careful investigation.

The issue of not only diagnosis but also effective correction of PAH is extremely important. Pharmacotherapy of hypotensive conditions in children has limited use due to the risk of side effects, the undesirability of long-term medication intake, and often insufficient evidence (AlHussain *et al.*, 2023; Manea *et al.*, 2024; Alsaif *et al.*, 2025). In this regard, non-medicinal methods of exposure aimed at lifestyle normalization and vascular tone training are of paramount importance (Shaw *et al.*, 2019; Liu *et al.*, 2020; Yang *et al.*, 2020; Ilhan *et al.*, 2022; Mobeen & Dawood, 2022; Attenborough *et al.*, 2023; Cirik *et al.*, 2023). These include optimization of the daily routine and nutrition, metered aerobic exercise (physical therapy, swimming, running), hydrotherapy (contrast shower, therapeutic baths), methods of psychological relief, and sleep correction (Alnemer *et al.*, 2022; Kumar *et al.*, 2022; Spirito *et al.*, 2022; Prada *et al.*, 2024). Despite the fact that these methods are universally recommended, their effectiveness is often declarative and requires rigorous evaluation in controlled studies, especially in terms of their impact not only on blood pressure levels but also on the subjective well-being, cognitive functions, and academic performance of schoolchildren (Vernino *et al.*, 2021; Michałowska *et al.*, 2022).

Thus, there is an obvious scientific and practical need for a comprehensive study that would:

- Assessed the actual prevalence of PAH among high school students in Vladikavkaz, a major industrial and cultural center of the North Caucasus.

- Analyzed the relationship between blood pressure levels and new risk factors: digital habits, sleep patterns, and educational and psychological stress levels.
- Determined the effect of PAH on key parameters for successful learning: cognitive functions (attention, memory, speed of processing information) and academic performance.
- Evaluated the effectiveness of the developed non-drug correction program (including regimen correction, physical activity, and hydrotherapy) on the dynamics of clinical symptoms, blood pressure levels, and quality of life in adolescents.

The purpose of this study: to study the prevalence and risk factors of primary arterial hypotension in Vladikavkaz high school students and to evaluate the effectiveness of a complex of non-drug interventions on their health (Rani *et al.*, 2023; Ludovichetti *et al.*, 2024).

Research Objectives

1. Using a survey of 420 students in grades 9-11, identify the prevalence of PAH-specific complaints and assess lifestyle (sleep patterns, nutrition, time spent using gadgets, stress levels, and bad habits).
2. Perform instrumental blood pressure measurements to form two groups: the main group (with a confirmed PAH diagnosis) and the control group (healthy adolescents).
3. To conduct a comparative analysis of lifestyle, cognitive functions (using psychometric tests), and academic performance between groups.
4. To develop and implement an individually selected set of non-medicinal measures for a part of the PAH group.
5. Evaluate the effectiveness of a set of measures after 3 months based on the dynamics of clinical symptoms, blood pressure levels, cognitive tests, and subjective assessment of quality of life.

Materials and Methods

The present study was conducted on the basis of secondary schools in Vladikavkaz in the period from September 2023 to March 2024. The study involved 420 students in grades 9-11, aged 15 to 18 years. The sample population was formed by random selection. The inclusion criteria were the voluntary informed consent of the adolescent and his legal representatives, as well as the absence of a history of organic pathology of the cardiovascular, nervous, and endocrine systems and severe chronic diseases that could cause the secondary nature of arterial hypotension. Exclusion criteria included refusal to participate and the presence of acute illnesses at the time of the examination.

To solve the tasks set, a set of methods was applied, including questionnaires, objective clinical examination, psychometric testing, and a formative experiment (Patatou *et al.*, 2022; Seoane-Viaño *et al.*, 2024). At the first stage, all participants were interviewed anonymously using a specially designed questionnaire validated for the purposes of this study. The questionnaire included blocks of questions aimed at identifying complaints of an asthenic-vegetative nature (dizziness, weakness, fatigue, headache), an assessment of the daily routine (duration and quality of night sleep,

time of rising and going to bed), the nature of nutrition (regularity of meals, skipping breakfast), and the level of educational and psycho-emotional stress. A separate section was devoted to digital habits: recording the average time of daily use of a smartphone, computer, and other electronic devices for educational and entertainment purposes, as well as assessing the presence of bad habits.

At the second stage, all respondents had their blood pressure (BP) measured using a standard technique on both hands at rest, after a five-minute rest, using mechanical tonometers that had passed metrological verification. The measurements were carried out three times with an interval of five minutes; the average value of the obtained indicators was used for analysis. The diagnosis of primary arterial hypotension was established in accordance with generally accepted age standards, with systolic and/or diastolic blood pressure levels below the 5th percentile of the BP distribution curve for the corresponding age, gender, and height percentile. Based on the measurement results, all participants were divided into two groups: the main group consisted of adolescents with a PAH diagnosis, and the comparison group consisted of students with normal blood pressure levels.

To assess the effect of PAH on cognitive functions, students from both groups underwent psychometric testing. A set of validated methods was used, including a correction test (Bourdon test) to assess stability and concentration of attention, a 10-word memorization test to assess short-term verbal memory, and a Schulte test to assess the speed of attention switching. Academic performance was assessed based on official data on the average academic achievement score (GPA) for the previous academic quarter.

At the third stage, a set of non-drug interventions lasting 3 months was applied to some of the students in the main group with the consent of their parents. The complex was individualized and included the following key components: correction of the daily routine with an emphasis on normalizing the duration of night sleep (at least 8-9 hours), recommendations for a balanced diet and a drinking regime with a mandatory full breakfast. Recommendations for metered aerobic exercise (daily morning exercises, walking for at least 40 minutes a day, swimming 2 times a week) and a course of hydrotherapy in the form of a contrast shower in the morning took center stage. Discussions were also held on the rational limitation of the time of using digital devices in the evening. The students who made up the control group, as well as the part of the main group that was not included in the intervention program, continued to be monitored as usual.

Evaluation of the effectiveness of non-drug correction was carried out after 3 months by repeated measurement of blood pressure, questionnaires to assess the dynamics of subjective complaints, and repeated psychometric testing.

Statistical data processing was carried out using the IBM SPSS Statistics 23.0 application software package. The verification of quantitative data for the normality of the distribution was carried out using the Shapiro-Wilk criterion. To compare independent groups, the Student's t-test was used for data with a normal distribution and the Mann-Whitney U-test for data with a different distribution from normal. A paired t-test or Wilcoxon test was used to compare the indicators before and after the intervention in one group. The qualitative features were compared using the chi-square criterion (χ^2). The differences were considered statistically significant at the $p < 0.05$ level.

Results and Discussion

The conducted research allowed us to obtain a comprehensive description of the state of health, lifestyle, and effectiveness of non-drug correction in high school students with primary arterial hypotension.

Based on the results of screening blood pressure measurements, out of 420 examined students in grades 9-11, a main group was formed—128 adolescents with a diagnosis of primary arterial hypotension (30.5% of the total sample). The comparison group consisted of 292 students with a normal blood pressure level. The distribution by gender and age in the groups was comparable, which excluded the influence of these factors on further analysis. The average age of participants in the main group was 16.2 ± 0.8 years; in the comparison group, it was 16.4 ± 0.7 years. The ratio of girls and boys in the main group was 2:1 (85 and 43 people, respectively), which is consistent with the literature data on the higher prevalence of PAH among female adolescents (Hardy & Urbina, 2021; Flynn *et al.*, 2022).

The analysis of the questionnaire data revealed statistically significant differences in lifestyle and subjective complaints between the groups (**Table 1**). Adolescents with PAH were significantly more likely to complain of increased fatigue at school (94.5% vs. 32.9% in the comparison group), difficulty concentrating in class (87.5% vs. 28.1%), episodes of dizziness when changing body position (78.9% vs. 15.1%), and weather dependence (82.0% vs. 24.7%). All differences were statistically significant ($p < 0.001$).

Table 1. Comparative characteristics of lifestyle and complaints in high school students with PAH and normal BP

Parameter	Group with primary arterial hypotension (n=128)	Group with normotension (n=292)	p-value
Average night's sleep duration, hours	6.8 ± 1.2	7.9 ± 0.9	< 0.001
Skip breakfast regularly, %	58.6% (75)	32.2% (94)	< 0.001
Average gadget usage time (non-academic), hour/day	5.4 ± 1.8	3.9 ± 1.5	< 0.001
Complain of increased fatigue, %	94.5% (121)	32.9% (96)	< 0.001
Complain of dizziness, %	78.9% (101)	15.1% (44)	< 0.001
They engage in regular physical activity, %	25.8% (33)	61.6% (180)	< 0.001

A comparison of cognitive functions showed that students with PAH showed statistically significantly lower scores on all the tests performed (**Table 2**). Thus, the productivity of attention according to the correction test in the main group was 22.3% lower ($p < 0.01$),

the volume of short-term memory was 18.1% lower ($p < 0.05$), and the execution time of the Schulte test, reflecting the speed of attention switching, was 28.5% longer ($p < 0.001$) compared with the normotension group.

Table 2. Indicators of cognitive functions in high school students of the studied groups ($M \pm \sigma$)

Cognitive function	Group with primary arterial hypotension (n=128)	Group with normotension (n=292)	p-value
Concentration of attention (number of characters viewed)	1286.4 $\pm$ 214.7	1655.2 $\pm$ 285.3	< 0.01
Short-term memory (number of words played)	6.8 $\pm$ 1.5	8.3 $\pm$ 1.7	< 0.05
The speed of switching attention (time of the Schulte test, seconds)	68.5 $\pm$ 12.3	49.3 $\pm$ 10.8	< 0.001

Academic performance, measured by grade point average (GPA), was also significantly lower in the group of students with PAH. The average score in the main group was 3.82 ± 0.41 , while in the comparison group it was 4.35 ± 0.38 ($p < 0.01$).

To assess the effectiveness of non-drug correction, a random sample of 64 students with PAH who underwent a three-month intervention program was formed. The remaining 64 adolescents formed a control group within the main cohort that did not receive targeted recommendations.

Following the instructions for three months resulted in a good trend in the intervention group, as shown in **Figure 1**. Systolic and diastolic blood pressure values increased statistically significantly, although they still fall within the age normotension range. The frequency of complaints of weariness and dizziness dropped by more than two and almost four times, respectively, indicating a clear positive trend in the reduction of the primary subjective complaints. Additionally, the intervention group's members were able to decrease their time spent on electronic devices and considerably extend their average nightly sleep length.

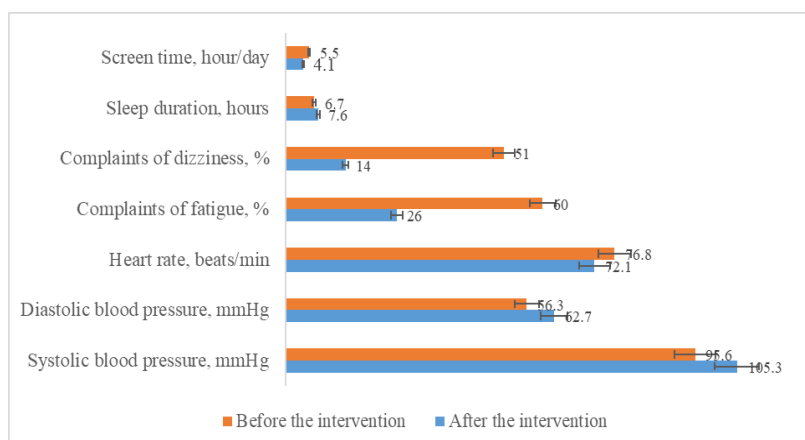


Figure 1. Dynamics of clinical and physiological parameters in the intervention group before and after the course of non-drug correction (n=64)

An analysis of the dynamics of cognitive functions (**Table 3**) showed that in the group that underwent a course of non-drug correction, there was a statistically significant improvement in all the assessed parameters. At the same time, there were no

significant dynamics of attention and memory indicators in the control group that did not change their lifestyle. The differences in dynamics between the two groups were significant.

Table 3. Comparative dynamics of cognitive indicators in groups with PAH after 3 months

Indicator	Intervention group (n=64)		Control group (n=64)		p-value*
	Before	After	Before	After	
Productivity of attention	1275.3 $\pm$ 205.4	1520.8 $\pm$ 198.7	1297.1 $\pm$ 223.9	1310.5 $\pm$ 216.3	< 0.01
Memory capacity (words)	6.7 $\pm$ 1.6	7.9 $\pm$ 1.5	6.9 $\pm$ 1.4	6.8 $\pm$ 1.7	< 0.05
Schulte test time (sec)	69.2 $\pm$ 11.8	53.1 $\pm$ 10.5	67.8 $\pm$ 12.9	66.3 $\pm$ 11.2	< 0.001

Note: *The p-value is calculated to compare the dynamics (Δ) between the intervention and control groups.

Following the findings of the research period during which the correction was made, the students in the intervention group showed a notable increase in their academic performance, as shown in **Table 4**. The mean GPA score in the normotension group and the

PAH control group did not change significantly during the same time period.

Table 4. The impact of non-drug correction on academic performance (average GPA)

Group	Average score before the intervention	Average score after the intervention	p-value
Intervention Group (n=64)	3.81 ± 0.43	4.18 ± 0.39	< 0.01
Control Group (PAH) (n=64)	3.83 ± 0.40	3.85 ± 0.42	> 0.05
Normotension Group (n=292)	4.35 ± 0.38	4.37 ± 0.41	> 0.05

Thus, the results obtained indicate a pronounced negative effect of primary arterial hypotension on the quality of life, cognitive functions, and academic performance of high school students. Comprehensive non-drug correction of the daily routine, physical activity, and digital habits has shown high clinical and functional effectiveness, which is confirmed by the positive dynamics of both objective physiological parameters and subjective indicators (Abdelmuhsin *et al.*, 2022; Fiodorova *et al.*, 2022; Zakinyan *et al.*, 2023; Negreiros *et al.*, 2024).

The conducted study allowed us to obtain comprehensive data on the prevalence, risk factors, and consequences of primary arterial hypotension in high school students, as well as to evaluate the effectiveness of non-drug methods for correcting this condition. The results obtained require a multidimensional analysis in the context of modern scientific concepts of vegetative regulation in adolescents.

The revealed prevalence of PAH at the level of 30.5% corresponds to the upper limit of the data presented in modern literary sources, where this indicator varies from 10% to 30% in the adolescent population (de Simone *et al.*, 2022; Dursun *et al.*, 2022; Medeiros *et al.*, 2023). Such a high prevalence in the study sample can be explained by the combined effect of several factors. Students in grades 9-11 are under chronic stress due to high academic workload and preparation for final assessment, which creates an increased burden on the neurovegetative system and can provoke its dysfunction. In addition, the influence of regional peculiarities cannot be excluded, including climatic and geographical factors and the specifics of the educational process in a particular region.

The analysis of lifestyle factors associated with PAH deserves special attention. The data obtained convincingly demonstrate that modern adolescents with arterial hypotension significantly sleep less, spend significantly more time watching gadget screens for non-educational purposes, skip main meals more often, and are characterized by low physical activity compared to their normotensive peers. These findings are fully consistent with studies emphasizing the role of sleep deprivation and physical inactivity in the pathogenesis of autonomic disorders (Flynn, 2022; Urbina *et al.*, 2023; Astudillo *et al.*, 2024). Chronic sleep deprivation disrupts the circadian rhythms of the production of key neurotransmitters and hormones that regulate vascular tone. Prolonged use of digital devices, especially in the evening, exacerbates this problem by suppressing melatonin secretion and leading to overexcitation of the nervous system, which eventually depletes its adaptive reserves (Jones *et al.*, 2021; Muppalla *et al.*, 2023; Hartstein *et al.*, 2024).

The study's most important and alarming findings include an objective assessment of the influence of PAH on cognitive function and academic achievement. The observed decrease in attention production, volume of short-term memory, and speed of attention

switching in high school adolescents with hypotension has a straightforward and rational pathophysiological explanation. A sustained decline in blood pressure naturally leads to a decrease in cerebral perfusion and moderate chronic hypoxia of brain tissue, which predominantly negatively affects the functioning of the hippocampus and prefrontal cortex, regions crucial for memory, concentration, and executive functions (Gastaud *et al.*, 2023; Presta *et al.*, 2024; Maia *et al.*, 2025). This is further supported by the finding that blood pressure measures and cognitive test scores have an inverse relationship. As a result of these neurophysiological abnormalities, the average academic success score (GPA) declines objectively, highlighting the problem's substantial socio-educational as well as medical implications (Baklanov *et al.*, 2020; Morosanov *et al.*, 2023; Merino-Soto *et al.*, 2024). Due to functional difficulties, adolescents with PAH who do not have an organic disease may unintentionally be placed in an academic risk category. Teachers and school psychologists need to pay more attention to these adolescents.

The key conclusion of this study is the proven high effectiveness of the developed complex of non-medicinal interventions. Positive dynamics were observed not only at the level of key physiological parameters (stabilization of blood pressure), but also, most importantly, in reducing subjective symptoms and improving cognitive functions. The improvement in attention and memory indicators in the intervention group is likely a direct consequence of improved cerebral hemodynamics against the background of normalization of the daily routine, increased sleep duration, and dosed physical activity. Aerobic exercise, such as swimming and hiking, acts as a natural vasotraining factor, contributing to the improvement of vascular tone and endothelial function. Reducing the time spent using gadgets, especially in the evening, has led to the normalization of sleep architecture, which in itself is a powerful factor in restoring cognitive resources and stabilizing vegetative status.

It is important to note that in the control group that did not receive interventions, there were no significant dynamics in any of the studied parameters, which indicates the stability of the condition and the absence of a placebo effect, and also confirms the need for a targeted and structured approach to PAH correction.

Conclusion

Thus, the results of the study allow us to draw the following conclusions. First, primary arterial hypotension is a widespread condition among high school students, closely associated with maladaptive behaviors (chronic lack of sleep, physical inactivity, and excessive use of digital devices). Secondly, PAH has a significant negative impact on cognitive functions, which objectively affects a decrease in academic performance. Thirdly, a set of non-drug interventions, including optimization of sleep patterns, nutrition, physical activity, and digital habits,

demonstrates high clinical and functional effectiveness, leading to normalization of blood pressure levels, improvement of well-being, and restoration of cognitive potential of adolescents. The data obtained substantiate the need to introduce blood pressure screening programs and preventive educational programs on occupational health and recreation in general education schools in order to timely identify and correct risk factors for the development of autonomic dysfunction.

Acknowledgments: None

Conflict of interest: None

Financial support: None

Ethics statement: All studies were conducted in compliance with the ethical standards and principles of the Helsinki Declaration. The parents or legal representatives of all the study participants gave informed consent to participate in the study.

References

- Abdelmuhsin, A. A., Alghamdi, A. A., & Ibrahim, N. A. (2022). Evaluating the phenotypic and genotypic diversity of *Plantago ciliata* in the Ha'il region, Saudi Arabia. *International Journal of Veterinary Research and Allied Sciences*, 2(1), 15–23. doi:10.51847/Qd2C6vFTgc
- Adams, J., Lawrence, E. M., Goode, J. A., Schaefer, D. R., & Mollborn, S. (2022). Peer network processes in adolescents' health lifestyles. *Journal of Health and Social Behavior*, 63(1), 125–141. doi:10.1177/00221465211054394
- Alekseenok, A. A., Kaira, Y. V., Kondratova, E. K., Tczuntze, L., Siaoitui, T., & Alekseenok, A. A. (2024). The social health of modern student youth: sociological analysis. *Problemy Sotsialnoi Gigieny, Zdravookhraneni i Istorii Meditsiny*, 32(4), 748–754. Russian. doi:10.32687/0869-866X-2024-32-4-748-754
- AlHussain, B. S., AlShehri, A. M., AlRasheed, M. A., AlGadhi, S. K., & AlAhmad, F. A. (2023). A systematic review on endodontic retreatment and the effective removal of endodontic sealers using lasers. *International Journal of Dental Research and Allied Sciences*, 3(1), 8–16. doi:10.51847/m7WmmgNWH1
- Alnemer, S., Alajlan, A. M., Alqarni, A. N., Alshanbari, S. H., Alhejazi, M. A., Matrood, M. A., Alkathiri, M. S., Almutairi, M. S., Aldayhani, A. B., Daabash, M. D., et al. (2022). Knowledge and practices of Riyadh-based dentists in managing traumatic dental injuries. *Annals of Journal of Dental Medicine and Assistance*, 2(1), 22–25. doi:10.51847/ZGZXliiSUR
- Alsaif, B., Asweto, C. O., Hassan, S. U., Alzain, M. A., Saeed, M. E., Kassar, A., Ali, K. E. M., Ghorbel, M., Zrieq, R., & Wang, W. (2025). Undergraduates' lifestyle and suboptimal health status (SHS): a cross-sectional study in the Ha'il region of Saudi Arabia. *PLoS ONE*, 20(1), e0317127. doi:10.1371/journal.pone.0317127
- Ansari, S. H., Qamar, Z., Alshammari, M., Bazoun, R., Alenazi, R., & Alattar, R. (2024). Clinical efficacy and longevity of monolithic vs layered zirconia crowns: a systematic review. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 3(1), 7–18. doi:10.51847/0xBNKCjrDi
- Ansari, S., Alshamrani, B., Alzahrani, A., Alfayez, A., Alhebsshan, N., & Alshamrani, A. (2022). Prevalence of dental fluorosis among teenagers: a cross-sectional study in the schools of Riyadh. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 1(1), 13–17. doi:10.51847/37FuXGVEpm
- Arnold, A. C., Ng, J., & Raj, S. R. (2018). Postural tachycardia syndrome - Diagnosis, physiology, and prognosis. *Autonomic Neuroscience*, 215, 3–11. doi:10.1016/j.autneu.2018.02.005
- Astudillo, Y., Kibrom, S., Pereira, T., Solomon, S., Krishnan, S., & Samsonov, D. (2024). Association between anxiety and elevated blood pressure in adolescent patients: a single-center cross-sectional study. *Journal of Hypertension*, 42(4), 644–649. doi:10.1097/HJH.0000000000003652
- Attenborough, J., Abbott, S., Brook, J., & Knight, R. (2023). Studying barriers to work-based learning in clinical environments from the perspective of nursing managers and nurses. *Journal of Integrative Nursing and Palliative Care*, 4, 46–52. doi:10.51847/qQR0GNUES7
- Baklanov, I. S., Baklanova, O. A., Nesmeyanov, E. E., & Ivashova, V. A., Kabardokova, L. A. (2020). Comparative analysis of urban and rural environmental quality: the opinions of residents of the region. *IOP Conference Series: Materials Science and Engineering*, 944(1), 012013. doi:10.1088/1757-899x/944/1/012013
- Boris, J. R., & Bernadzikowski, T. (2018). Demographics of a large paediatric postural orthostatic tachycardia syndrome program. *Cardiology in the Young*, 28(5), 668–674. doi:10.1017/S1047951117002888
- Brych, V. V., Dudash, H. V., Bilak-Lukyanchuk, V. Y., Dub, M. M., & Hutsol, I. Y. (2021). Evaluation results of the use of modern internet sources by the students of vocational education institutions for the formation of health awareness. *Wiadomosci Lekarskie*, 74(5), 1061–1064.
- Chung, A., Vieira, D., Donley, T., Tan, N., Jean-Louis, G., Kiely Gouley, K., & Seixas, A. (2021). Adolescent peer influence on eating behaviors via social media: scoping review. *Journal of Medical Internet Research*, 23(6), e19697. doi:10.2196/19697
- Cirik, V. A., Aksoy, B., & Bulut, E. (2023). Studying the relationship between the attitude towards gender roles of parents and the quality of parent-child relationship in nurses. *Journal of Integrative Nursing and Palliative Care*, 4, 30–37. doi:10.51847/90pkztCQgl
- Clark, C. E. (2022). Hypertension and hypotension: getting the balance right. *British Journal of General Practice*, 73(726), 6–7. doi:10.3399/bjgp23X731493
- de Simone, G., Mancusi, C., Hanssen, H., Genovesi, S., Lurbe, E., Parati, G., Sendzikaite, S., Valerio, G., Di Bonito, P., Di Salvo, G., et al. (2022). Hypertension in children and adolescents. *European Heart Journal*, 43(35), 3290–3301. doi:10.1093/eurheartj/ehac328
- Dursun, H., Türkmenoğlu, Y., Aygun, T. S., Kacar, A., Umman, N., & Irdem, A. (2022). Blood pressure and heart rate monitoring in children and adolescents with Still's vibratory

- murmur. *Blood Pressure Monitoring*, 27(1), 9–13. doi:10.1097/MBP.0000000000000557
- Ezepue, E. I., Ezepue, C. O., Okafor, N. R., Chukwujindu, G. A., Nduka, C. U., Abiaeme, J. U., & Okechukwu, F. (2024). Modeling the effects of health-related habits and lifestyle on the general health of university students. *Medicine (Baltimore)*, 103(41), e39691. doi:10.1097/MD.00000000000039691
- Fedorowski, A., Ricci, F., & Sutton, R. (2019). Orthostatic hypotension and cardiovascular risk. *Kardiologia Polska*, 77(11), 1020–1027. doi:10.33963/KP.15055
- Fiodorova, O. A., Sivkova, E. I., & Nikonov, A. A. (2022). Safeguarding beef cattle from gnats and gadflies in the southern Tyumen region. *International Journal of Veterinary Research and Allied Sciences*, 2(2), 8–13. doi:10.51847/iVXOeXmSNZ
- Flynn, J. T. (2022). What level of blood pressure is concerning in childhood? *Circulation Research*, 130(5), 800–808. doi:10.1161/CIRCRESAHA.121.319819
- Flynn, J. T., Urbina, E. M., Brady, T. M., Baker-Smith, C., Daniels, S. R., Hayman, L. L., Mitsnefes, M., Tran, A., & Zachariah, J. P.; Atherosclerosis, Hypertension, and Obesity in the Young Committee of the American Heart Association Council on Lifelong Congenital Heart Disease and Heart Health in the Young; Council on Cardiovascular Radiology and Intervention; Council on Epidemiology and Prevention; Council on Hypertension; and Council on Lifestyle and Cardiometabolic Health. (2022). Ambulatory blood pressure monitoring in children and adolescents: 2022 update: a scientific statement from the American Heart Association. *Hypertension*, 79(7), e114–e124. doi:10.1161/HYP.0000000000000215
- Gastaud, L. M., Trettim, J. P., Scholl, C. C., Rubin, B. B., Coelho, F. T., Krause, G. B., Ferreira, N. M., de Matos, M. B., Pinheiro, R. T., & de Avila Quevedo, L. (2023). Screen time: implications for early childhood cognitive development. *Early Human Development*, 183, 105792. doi:10.1016/j.earlhumdev.2023.105792
- Hardy, S. T., & Urbina, E. M. (2021). Blood pressure in childhood and adolescence. *American Journal of Hypertension*, 34(3), 242–249. doi:10.1093/ajh/hpab004
- Hargreaves, D., Mates, E., Menon, P., Alderman, H., Devakumar, D., Fawzi, W., Greenfield, G., Hammoudeh, W., He, S., Lahiri, A., et al. (2022). Strategies and interventions for healthy adolescent growth, nutrition, and development. *The Lancet*, 399(10320), 198–210. doi:10.1016/S0140-6736(21)01593-2
- Hartstein, L. E., Mathew, G. M., Reichenberger, D. A., Rodriguez, I., Allen, N., Chang, A. M., Chaput, J. P., Christakis, D. A., Garrison, M., Gooley, J. J., et al. (2024). The impact of screen use on sleep health across the lifespan: a national sleep foundation consensus statement. *Sleep Health*, 10(4), 373–384. doi:10.1016/j.sleh.2024.05.001
- Hui, T. T., Garvey, L., & Olasoji, M. (2021). Improving the physical health of young people with early psychosis with lifestyle interventions: scoping review. *International Journal of Mental Health Nursing*, 30(6), 1498–1524. doi:10.1111/inm.12922
- İlhan, N., Telli, S., Temel, B., & Aşti, T. (2022). Investigating the sexual satisfaction mediating role in the relationship between health literacy and self-care of men with diabetes and women's marital satisfaction. *Journal of Integrative Nursing and Palliative Care*, 3, 19–25. doi:10.51847/sFjL3OLpqq
- Iu, J. (2024). Promoting a healthy lifestyle: exploring the role of social media and fitness applications in the context of social media addiction risk. *Health Education Research*, 39(3), 272–283. doi:10.1093/her/cyad047
- Jones, A., Armstrong, B., Weaver, R. G., Parker, H., von Klingraeff, L., & Beets, M. W. (2021). Identifying effective intervention strategies to reduce children's screen time: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity*, 18(1), 126. doi:10.1186/s12966-021-01189-6
- Kanellopoulou, A., Diamantis, D. V., Notara, V., & Panagiotakos, D. B. (2021). Extracurricular sports participation and sedentary behavior in association with dietary habits and obesity risk in children and adolescents and the role of family structure: a literature review. *Current Nutrition Reports*, 10(1), 1–11. doi:10.1007/s13668-021-00352-6
- Koch, S. A., Jarjour, I. T., & Evankovich, K. D. (2023). Neurocognitive profiles in adolescents with postural tachycardia syndrome and perceived brain fog: a preliminary report. *Pediatric Neurology*, 148, 128–132. doi:10.1016/j.pediatrneurol.2023.08.011
- Kontostoli, E., Jones, A. P., & Atkin, A. J. (2022). The diurnal pattern and social context of screen behaviours in adolescents: a cross-sectional analysis of the Millennium Cohort Study. *BMC Public Health*, 22(1), 1143. doi:10.1186/s12889-022-13552-8
- Kontostoli, E., Jones, A. P., Pearson, N., Foley, L., Biddle, S. J. H., & Atkin, A. J. (2023). The association of contemporary screen behaviours with physical activity, sedentary behaviour and sleep in adolescents: a cross-sectional analysis of the Millennium Cohort Study. *International Journal of Behavioral Medicine*, 30(1), 122–132. doi:10.1007/s12529-022-10077-7
- Korkut, O., & Aydin, H. (2023). Neurological symptoms that may represent a warning in terms of diagnosis and treatment in a group of children and adolescents with vitamin D deficiency. *Children*, 10(7), 1251. doi:10.3390/children10071251
- Krzesinski, J. M. (2023). Functional disorder and arterial hypotension. *Revue Médicale de Liège*, 78(5-6), 345–350. French.
- Kumar, D., Gurunathan, D., Jabin, Z., & Talal, S. (2022). Comparative efficacy of aromatherapy and conscious sedation in pediatric dental anxiety management. *Annals of Journal of Dental Medicine and Assistance*, 2(1), 14–21. doi:10.51847/TVRFhVailQ
- Liu, L., Liu, C., Ke, X., & Li, N. (2020). Mediating effect of social support on the association between life events and depression: a cross-sectional study of adolescents in Chongqing, China. *Medicine (Baltimore)*, 99(51), e22627. doi:10.1097/MD.00000000000022627
- Ludovichetti, F. S., Stellini, E., Zuccon, A., Lucchi, P., Dessupoiu, N., Mazzoleni, S., & Parciannello, R. G. (2024). Comparative

- impact of chlorhexidine and fluoride varnish on white spot lesion prevention in orthodontic patients. *Turkish Journal of Public Health Dentistry*, 4(1), 6–12. doi:10.51847/Pw5eiJPGY2
- Maia, C., Braz, D., Fernandes, H. M., Sarmiento, H., & Machado-Rodrigues, A. M. (2025). The impact of parental behaviors on children's lifestyle, dietary habits, screen time, sleep patterns, mental health, and BMI: a scoping review. *Children (Basel)*, 12(2), 203. doi:10.3390/children12020203
- Maneea, A. S. B., Alqahtani, A. D., Alhazzaa, A. K., Albalawi, A. O., Alotaibi, A. K., & Alanazi, T. F. (2024). Systematic review of the microbiological impact of sodium hypochlorite concentrations in endodontic treatment. *International Journal of Dental Research and Allied Sciences*, 4(2), 9–15. doi:10.51847/PH80PpWOX7
- Medeiros, B. M., Da Silva, T. L. N., Bloch, K. V., Kuschir, M. C. C., Sbaraini, M., Schaan, B. D., & Cureau, F. V. (2023). Adolescent blood pressure classification curves and cardiometabolic risk factors: a comparison of the Brazilian and American references. *Journal of Hypertension*, 41(3), 420–428. doi:10.1097/HJH.0000000000003349
- Merino-Soto, C., Angulo-Ramos, M., Llaja-Rojas, V., & Chans, G. M. (2024). Academic performance, emotional intelligence, and academic burnout: a cross-sectional study of a mediational effect in nursing students. *Nurse Education Today*, 139, 106221. doi:10.1016/j.nedt.2024.106221
- Michałowska, S., Rachubińska, K., & Konieczny, K. (2022). Anxiety, stress coping styles and hope for success among graduate students and high school graduates during the COVID-19 pandemic: the moderating role of remote learning. *International Journal of Environmental Research and Public Health*, 19(15), 9692. doi:10.3390/ijerph19159692
- Miglis, M. G., Muppidi, S., Feakins, C., Fong, L., Prieto, T., & Jaradeh, S. (2016). Sleep disorders in patients with postural tachycardia syndrome. *Clinical Autonomic Research*, 26(1), 67–73. doi:10.1007/s10286-015-0331-9
- Mobeen, T., & Dawood, S. (2022). Studying the effect of perceived social support and mental health on marital burnout in infertile women. *Journal of Integrative Nursing and Palliative Care*, 3, 7–12. doi:10.51847/7DkM3Fkiu3
- Morosanova, V. I., Fomina, T. G., & Bondarenko, I. N. (2023). Conscious self-regulation as a meta-resource of academic achievement and psychological well-being of young adolescents. *Psychology in Russia*, 16(3), 168–188. doi:10.11621/pir.2023.0312
- Muppalla, S. K., Vuppapapati, S., Reddy Pulliahgaru, A., & Sreenivasulu, H. (2023). Effects of excessive screen time on child development: an updated review and strategies for management. *Cureus*, 15(6), e40608. doi:10.7759/cureus.40608
- Negreiros, A. B., Silva, G. R. D., Pereira, F. D. M., Souza, B. D. A., Lopes, M. T. D. R., & Diniz, F. M. (2024). Evidence of genetic diversity gradients in *Melipona rufiventris* (Hymenoptera: Apidae) within the Brazilian semiarid region. *Entomology Letters*, 4(1), 1–7. doi:10.51847/19Wmr8r6qW
- Ocon, A. J. (2013). Caught in the thickness of brain fog: exploring the cognitive symptoms of chronic fatigue syndrome. *Frontiers in Physiology*, 4, 63. doi:10.3389/fphys.2013.00063
- Parvin, P., Masihay-Akbar, H., Cheraghi, L., Razmjouei, S., Shab-Khaneh, A. Z., Azizi, F., & Amiri, P. (2022). Effectiveness of a practical multi-setting lifestyle intervention on the main BMI trajectories from childhood to young adulthood: a community-based trial. *BMC Public Health*, 22(1), 1995. doi:10.1186/s12889-022-14306-2
- Patatou, A., Iacovou, N., Zaxaria, P., Vasoglou, M., & Vasoglou, G. (2022). Corticotomy-assisted orthodontics: biological basis and clinical applications. *Annals of Orthodontics and Periodontics Special*, 2, 8–13. doi:10.51847/0qGERVSoQm
- Pelevin, S. I., Taubaev, B. D., & Baklanov, I. S. (2018). Problem of technogenic society dynamics under the conditions of contemporaneity. *International Journal of Civil Engineering and Technology*, 9(11), 2437–2443.
- Peuters, C., Maenhout, L., Cardon, G., De Paepe, A., DeSmet, A., Lauwerier, E., Leta, K., & Crombez, G. (2024). A mobile healthy lifestyle intervention to promote mental health in adolescence: a mixed-methods evaluation. *BMC Public Health*, 24(1), 44. doi:10.1186/s12889-023-17260-9
- Plash, W. B., Diedrich, A., Biaggioni, I., Garland, E. M., Paranjape, S. Y., Black, B. K., Dupont, W. D., & Raj, S. R. (2013). Diagnosing postural tachycardia syndrome: comparison of tilt testing compared with standing haemodynamics. *Clinical Science*, 124(2), 109–114. doi:10.1042/CS20120276
- Prada, A. M., Cicalău, G. I. P., & Ciavoi, G. (2024). Resin infiltration for white-spot lesion management after orthodontic treatment. *Asian Journal of Periodontics and Orthodontics*, 4, 19–23. doi:10.51847/ZTuGEanCSV
- Presta, V., Guarneri, A., Laurenti, F., Mazzei, S., Arcari, M. L., Mirandola, P., Vitale, M., Chia, M. Y. H., Condello, G., & Gobbi, G. (2024). The impact of digital devices on children's health: a systematic literature review. *Journal of Functional Morphology and Kinesiology*, 9(4), 236. doi:10.3390/jfink9040236
- Rani, H., Mohd-Dom, T. N., Meei, T. I., Rosli, M. S., Quan, L. Z., Aziz, A. F., Hassan, S. A., & Aun, N. S. (2023). Dental home care challenges for homebound patients at Prince Sultan Military Medical City. *Turkish Journal of Public Health Dentistry*, 3(2), 27–32. doi:10.51847/VwQFNrdHml
- Rivasi, G., & Fedorowski, A. (2022). Hypertension, hypotension and syncope. *Minerva Medica*, 113(2), 251–262. doi:10.23736/S0026-4806.21.07562-5
- Samyuktha, P. S., & Syam, S. (2024). Periodontal abscess as a clinical oral sign in patients with diabetes mellitus: an original study. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 3(2), 7–12. doi:10.51847/ZDpdihizWm
- Seoane-Viaño, I., Seoane-Gigirey, M., Bendicho-Lavilla, C., Gigirey, L. M., Otero-Espinar, F. J., & Seoane-Trigo, S. (2024). Localized drug delivery using linezolid hydrogel for periodontal therapy. *Annals of Orthodontics and Periodontics Special*, 4, 39–46. doi:10.51847/nSySWrEvex
- Shanks, L., Jason, L. A., Evans, M., & Brown, A. (2013). Cognitive impairments associated with CFS and POTS.

- Frontiers in Physiology*, 4, 113. doi:10.3389/fphys.2013.00113
- Shaw, B. H., Stiles, L. E., Bourne, K., Green, E. A., Shibao, C. A., Okamoto, L. E., Garland, E. M., Gamboa, A., Diedrich, A., Raj, V., et al. (2019). The face of postural tachycardia syndrome—Insights from a large cross-sectional online community-based survey. *Journal of Internal Medicine*, 286(4), 438–448. doi:10.1111/joim.12895
- Spirito, F. D., Iacono, V. J., Alfredo, I., Alessandra, A., Sbordone, L., & Lanza, A. (2022). Impact of COVID-19 awareness on periodontal disease prevention and management. *Asian Journal of Periodontics and Orthodontics*, 2, 16–26. doi:10.51847/t8D9TJGOCU
- Staiano, A. E., Button, A. M., Baker, A., Beyl, R., Conn, A. M., Lima, A., Lindros, J., Newton, R. L. Jr., Stein, R. I., Welch, R. R., et al. (2024). A pragmatic trial of a family-centered approach to childhood obesity treatment: rationale and study design. *Contemporary Clinical Trials*, 138, 107459. doi:10.1016/j.cct.2024.107459
- Stewart, J. M., Boris, J. R., Chelimsky, G., Fischer, P. R., Fortunato, J. E., Grubb, B. P., Heyer, G. L., Jarjour, I. T., Medow, M. S., Numan, M. T., et al. (2018). Pediatric disorders of orthostatic intolerance. *Pediatrics*, 141(1), e20171673.
- Stewart, J. M., Medow, M. S., Sutton, R., Visintainer, P., Jardine, D. L., & Wieling, W. (2017). Mechanisms of vasovagal syncope in the young: reduced systemic vascular resistance versus reduced cardiac output. *Journal of the American Heart Association*, 6(1), e004417. doi:10.1161/JAHA.116.004417
- Suchy, W., & Jurkowski, O. (2024). Clinical assessment of 5% lidocaine patches for postoperative analgesia: efficacy, effectiveness, and safety. *Bulletin of Pioneer Research in Medical and Clinical Sciences*, 3(1), 31–36. doi:10.51847/UxKg3AkOTB
- Tang, H., Spreckley, M., van Sluijs, E., Ahern, A. L., & Smith, A. D. (2024). The impact of social media interventions on eating behaviours and diet in adolescents and young adults: a mixed methods systematic review protocol. *BMJ Open*, 14(4), e083465. doi:10.1136/bmjopen-2023-083465
- Trettin, B., Hansen, J., & Bygum, A. (2022). The impact of adolescents' everyday life experiences on their primary hyperhidrosis treatment - A qualitative study. *Journal of Dermatological Treatment*, 33(2), 928–934. doi:10.1080/09546634.2020.1789541
- Urbina, E. M., Daniels, S. R., & Sinaiko, A. R. (2023). Blood pressure in children in the 21st century: What do we know and where do we go from here? *Hypertension*, 80(8), 1572–1579. doi:10.1161/HYPERTENSIONAHA.122.19455
- Vernino, S., Bourne, K. M., Stiles, L. E., Grubb, B. P., Fedorowski, A., Stewart, J. M., Arnold, A. C., Pace, L. A., Axelsson, J., Boris, J. R., et al. (2021). Postural orthostatic tachycardia syndrome (POTS): state of the science and clinical care from a 2019 National Institutes of Health Expert Consensus Meeting—Part 1. *Autonomic Neuroscience*, 235, 102828. doi:10.1016/j.autneu.2021.102828
- Wieling, W., van Dijk, N., Thijs, R. D., de Lange, F. J., Krediet, C. T., & Halliwill, J. R. (2015). Physical countermeasures to increase orthostatic tolerance. *Journal of Internal Medicine*, 277(1), 69–82. doi:10.1111/joim.12249
- Yang, C., Chan, M. K., & Ma, T. L. (2020). School-wide social emotional learning (SEL) and bullying victimization: moderating role of school climate in elementary, middle, and high schools. *Journal of School Psychology*, 82, 49–69. doi:10.1016/j.jsp.2020.08.002
- Zakinyan, R. G., Badakhova, G. K., Lopteva, M. S., Koshkina, N. A., Tolokonnikov, V. P., & Povetkin, S. N. (2023). The link between ixodid tick populations and climate change in the Stavropol region. *Entomology Letters*, 3(2), 38–43. doi:10.51847/4IXTZ8h0Bs
- Zeng, Y., Song, J., Zhang, Y., Guo, X., Xu, X., Fan, L., Zhao, L., Song, H., & Jiang, L. (2025). Life changes and symptoms of depression and anxiety among Chinese children and adolescents before, during, and after the COVID-19 pandemic lockdown: a combination of cross-sectional, longitudinal, and clustering studies. *European Child & Adolescent Psychiatry*, 34(3), 1025–1038. doi:10.1007/s00787-024-02533-4
- Zhang, X., Cheung, S. S. L., Chan, H. N., Zhang, Y., Wang, Y. M., Yip, B. H., Kam, K. W., Yu, M., Cheng, C. Y., Young, A. L., et al. (2022). Myopia incidence and lifestyle changes among school children during the COVID-19 pandemic: a population-based prospective study. *British Journal of Ophthalmology*, 106(12), 1772–1778. doi:10.1136/bjophthalmol-2021-319307