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RESEARCH ARTICLE

DETERMINANTS OF SCHOOL PERFORMANCE IN A SAMPLE OF ADOLESCENTS IN GREECE

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Abstract

Background: A school environment that provides opportunities to learn, practice, and interact with peers can foster adolescents' mental health and quality of life. School performance serves as an indicator of cognitive abilities and self-perceptions, which are essential for academic success and life satisfaction.

Methods: The study aims to assess the association between school performance and socio-economic factors, anthropometric characteristics, and sedentary behavior in a sample of 440 adolescents from 55 junior high schools in Athens and the surrounding area. School performance was assessed through the average overall score and scores in mathematics, language, and history from the last trimester of the curriculum. Logistic regression models were used to examine how socio-economic, personal, and anthropometric characteristics were associated with the risk of performing below the median (score <17/20).

Results: Overall, girls compared to boys (OR=0.44, 95%CI: 0.28 to 0.69) and members of privileged households compared to their less privileged counterparts (OR= 0.57, 95%CI: 0.32 to 1.03) were more likely to perform better at school. Adolescents of non-Greek origin (OR=3.70, 95%CI: 2.09 to 6.54) were more likely to perform worse compared to Greeks or Cypriots. The feeling of unsafety (OR=1.11, 95%CI: 1.02 to 1.20) was associated with performance below the median, whereas parents of higher-performing children were more likely to have higher education (OR= 0.53, 95%CI: 0.32 to 0.87).

Conclusions: These findings can be useful in designing, implementing and monitoring fit-for-purpose public health promoting strategies following a comprehensive and sustainable approach recognizing the adolescents' multiple and variable needs.

Keywords: School performance, adolescence, socio-demographic characteristics, anthropometric characteristics, sedentary behavior

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INTRODUCTION

Students' academic achievement or school performance reflects the soft and hard skills they acquire through schooling, which shape their educational experiences and aspirations, ultimately promoting success in life.¹ Poor school performance has been linked with unfavorable motivational tendencies, learning difficulties, lower educational ambition, educational delays and dropout.² Academic achievement is shaped by students' experiences in school, either positive or negative and it can subsequently be an important determinant of their self-perception. Better achievements are associated with less anxiety, better self-consciousness, self-efficacy and positive attitude towards health-related issues throughout adulthood.³ School environment and students' life have additionally been investigated as major determinants of adolescents' subjective assessments of well-being.⁴ In a two-wave longitudinal study conducted among Filipino high school students, researchers examined the extent to which school engagement was associated with various dimensions of subjective well-being. The findings demonstrated a positive association between school engagement and subjective well-being at both time points. Furthermore, the results showed that the students' engagement in school-related activities can predict adolescents' personal satisfaction later in life.⁵ School performance is usually reflected in adolescents' grades in school syllabuses, not only because of the directness a quantitative measure offers, but also because methods and procedures to assess other determinants, such as behavioral patterns, the sense of security, parental care and the overall school environment have not yet been adequately developed. Earlier studies provided evidence on the importance of personality traits, class attendance and social network structure on students' school performance, but they have traditionally considered these independently through small study samples, while the literature around their possible complex interplay is limited.⁶ An association between adolescents' academic performance and psychosocial dimensions of health, such as relationship with family members, peers, autonomy and school environment has been reported by Vitale et al.⁷ In this context, the importance of adolescents' demographic characteristics such as their age, gender and ethnicity are also highlighted. Birndorf et al.⁸ also report

that adolescents' individual characteristics and socioeconomic factors are significantly associated with higher academic achievement, goal-setting behavior, and enhanced self-esteem. The adolescents' socioeconomic status (SES) can have an impact on their academic performance, as students of lower social class seem to perform academically worse than their counterparts with higher SES⁹, and adolescents enjoying safety in their family environment generally report greater academic achievements.¹⁰ Furthermore, lifestyle choices as dietary habits and physical activity have their own contribution. In a 3-year longitudinal study in Denmark, Lima et al.¹¹ reported that a sedentary lifestyle was positively associated with academic performance in national tests in language and mathematics and, identifying limitations in assessing physical activity, recommended a distinction between school-related sedentary and other sedentary activities when their relationship with academic performance is assessed. In their review of how exercise relates to school performance, cognition, brain structure and function, Herting & Chu,¹² reported that physical activity and aerobic exercise are positively associated with academic performance and brain activity. Santana et al.,^{13,14} reviewed studies evaluating the association between physical fitness¹³ or obesity¹⁴ and academic performance. The majority of studies, primarily relying on cross-sectional designs, reported a positive association between cardiorespiratory fitness and school performance; the magnitude of the associations was however weak to moderate.¹³ Nonetheless, after controlling for covariates such as socio-economic status, parental education and physical activity, the association between obesity and academic performance was uncertain for most of the studies. A strong association between school performance and screen time (e.g., internet, mobile phone, TV, computer use) has also been reported with adolescents who adhere less to screen time achieve better academic performance.¹⁵ In the present analysis, we aim to investigate whether the observation that adolescents' academic performance is related to their lifestyle choices and personal characteristics (e.g. being overweight or obese and of sedentary behavior), their psychological well-being and perception of health, as well as of their households' positioning in the social ladder is also prevalent in the population in Greece. To address this, we have evaluated the

association between school performance, as assessed through achievements overall and in specific school syllabuses, and self-perceived health and subjective well-being (SWB), socio-economic factors, anthropometric characteristics and sedentary behavior in a sample of adolescents with mean age approximately 14 years old in Athens and the greater Attica region.

MATERIALS AND METHODS

The sample of schools was selected using a proportionally stratified random sampling method. Schools represented clusters within each stratum and were randomly selected per stratum through the application of probability sampling proportional to the school's size. All adolescents aged 13 to 15 years attending 55 junior high schools in Athens and the Athens metropolitan area (Attica region) were invited to participate. Overall, 532 eligible adolescents agreed to participate. For the purpose of the present analysis, 90 adolescents were excluded due to missing information in any of the characteristics considered. Hence, the present analysis relied on 440 adolescents, 200 boys and 240 girls. The adolescents' parents or legal guardians provided an informed consent for adolescents to participate. The data collection was approved by the Hellenic Ministry of Education. The analysis of the data has been approved by the Bioethics Committee of the National and Kapodistrian University of Athens.

Data collection and management

Self-administered questionnaires were used for data collection, fully respecting the adolescents' anonymity and data collection was carried out between September 2015 and June 2016. The adolescents' socio-demographic and anthropometric characteristics (gender, age, ethnicity, parental educational level, family status, self-reported body height and weight) were recorded and family prosperity was assessed through the *Family Affluence Scale* (FAS)¹⁶ in Greek. Information on time spent in sedentary activities was collected through the Greek version of *Adolescent Sedentary Activity Questionnaire* (ASAQ)¹⁷, internet use through the *Online Communication and other Internet Function* scale¹⁸; and adolescents' perception of personal safety using the Greek

version of the *Personal Safety* scale¹⁹. On average study participants needed 30-40 minutes to reply to all questionnaires.

The FAS questionnaire aims to assess items that the family owns (car ownership, children having their own unshared room, the number of PCs available in the household) and the time adolescents spend on holidays. The 10-point FAS scale for measuring family prosperity was classified into three categories: low (0-4), intermediate (5-6) or high (7-9). The ASAQ questionnaire on sedentary lifestyle includes 11 questions relevant to time spent sitting or in transportation together with screen-time (all reported as hours per week), separating school days from the weekend. The questionnaire assessing the extent of internet use includes 8 questions on a 5-point Likert scale with the value of 1 corresponding to "less than once a week" and the value of 5 to "almost daily". The score was constructed by summing the points of the 8 questions ranging from 8 (low internet use) to 40 (high internet use). The questionnaire on self-perceived safety included 5 questions (with replies expressed on a 5-point Likert scale) aiming to assess the frequency of certain feelings with the value of 1 corresponding to "Never" and the value of 5 to "Always". In four out of the five questions, the answer "Always" had a negative dimension reflecting thus lower feelings of safety. Therefore, one question which had the opposite direction in meaning was inverted first and then a score was constructed by adding up the points of all 5 questions. The final score ranged from 5 (feeling safe) to 25 (feeling unsafe). For interpretation purposes this score was named "personal feeling of unsafety score".

Furthermore, the parents' educational attainment was recorded and categorized into two groups: low/middle (both parents had completed secondary education) and high level (at least one parent was a college or university graduate). Regarding their family status, adolescents reported whether they lived with either both parents/legal guardians or with one (single-parent family). The ethnicity was categorized as Greek/ Cypriot or other. Body Mass Index (BMI) was calculated as body weight in kilograms divided by the square of body height in meters.

The adolescents' self-perception of well-being was assessed through the KIDSCREEN-52 scale²⁰, harmonized in Greek. The

internal consistency, test-retest reliability, as well as the convergent and concurrent validity of the KIDSCREEN-52 version have been previously assessed and were generally deemed adequate^{21,22,23}. The internal consistency and convergent validity of the Greek version of the KIDSCREEN-52 have also been assessed suitable (Cronbach's alpha above 0.73 for internal consistency and results of the Greek version correlated significantly with the Strengths and Difficulties Questionnaire)²⁰. In the present data collection, six questions on school bullying were omitted as they were not relevant to the objective of the present study. The scale thus included 46 questions and, hereafter, is called KIDSCREEN-46. Questions are expressed on a 5-point Likert scale and cover physical and psychological well-being, moods and emotions, self-perception, autonomy, parental relations and home life, financial resources, peers and social support and school environment. In general, higher scores reflect increased satisfaction. The estimated overall score ranged from 46 (low subjective well-being) to 230 (optimal subjective well-being). In this analysis, the total score per participant was divided by 230 (highest value) to reflect the percentage (%) of optimal subjective well-being achieved.

School performance

School performance was assessed by measuring the average overall score accomplished at the end of the school year, together with the scores in each of three syllabuses (mathematics, language and history) during the last trimester of junior high school. These three subjects constitute core components of the high school curriculum in Greece, as they are included in all grades of both junior high school (attended by adolescents aged 13–15) and senior high school (attended by adolescents aged 16–18), and form part of the national examination subjects required for university admission. According to the Greek educational system, maximum performance is indicated by a score of 20. To allow for the non-normal distribution of scores achieved, a dichotomous variable was used to indicate an overall performance above the median (score $\geq 17/20$) or below the median (score $< 17/20$), which reflects the adolescent's overall achieve-

ment in the school environment which is shaped by various syllabuses requiring many and different attributes and qualifications.

Statistical analysis

Participants' characteristics are presented as frequencies (N, %) for categorical variables and as mean and standard deviation (SD) for continuous ones. The chi-square test (χ^2) was used to compare categorical variables and the t-test or the Mann-Whitney non parametric test to evaluate the statistical significance of difference between means of two groups for normally and non-normally distributed variables respectively. In light of the small modifications applied in the validated KIDSCREEN-52 version, we evaluated the internal consistency of the KIDSCREEN-46 scale used in this study. The Cronbach's alpha coefficient was computed for the overall scale and for each individual dimension to determine internal consistency and a value above 0.70 was considered acceptable. Univariate and multivariate logistic regression models were applied to evaluate how the achievement of school performance below the median (score $< 17/20$) was related to adolescents' personal characteristics, family conditions and lifestyle choices. Model covariates further included: gender (categorically), ethnicity (2 groups, categorically), family affluence (3 groups based on the FAS, categorically), parental educational attainment (2 groups, categorically), family status (2 groups, categorically), BMI (in kg/m^2 , continuously), time spent on sedentary activities (4 groups, categorically including a category for missing values), extent of internet use (continuously), personal feeling of unsafety score (based on the *Personal Safety* scale, continuously), junior high school grade (3 groups, categorically) and score of subjective well-being (continuously, expressed in percentages of optimal subjective well-being achieved). Age was not introduced to the multivariate regression model due to collinearity with the school grade. The statistical significance level was set at 0.05 ($p=0.05$) and analysis was performed with the SPSSv25 (IBM SPSS Statistics for Windows, Version 25.0, Armonk, NY: IBM Corp) statistical software.

RESULTS

Table 1 presents the characteristics of the study population, overall and by school grade. The sample consists of 440 adolescents (55% girls). Overall, there were no significant differences in the characteristics of boys compared to girls or by school grade, except for BMI, which was higher among boys (Mean=20.7 kg/m², SD=3.5) than girls (Mean=19.9kg/m², SD=2.9). Mean age was 12.7, 13.7 and 14.7 years respectively across the three grades as expected, irrespective of sex. The adolescents' social ranking was intermediate, according to FAS. Most girls reported low family affluence (N=95, 39.6%), whereas boys attained an intermediate score (N=80, 40.0%). The parents of most girls (N=165, 68.8%) and boys (N=129, 64.5%) received higher education, but the parents of boys at the third grade were more often of intermediate education ($p=0.001$). With respect to family status, a slightly higher proportion of girls than boys were living in single-parent households (19.6 vs 19%).

The participants' subjective well-being was assessed through KIDSCREEN-46. The internal consistency of the KIDSCREEN-46 scale was substantial, with an overall Cronbach's alpha of 0.94, indicating excellent reliability. When analyzing each dimension separately, Cronbach's alpha values ranged between 0.70 and 0.89, indicating acceptable to high internal consistency across subscales. The highest reliability was observed in the dimension "moods and emotions" with $\alpha = 0.89$, while the lowest, still satisfactory, was found in the "school environment" dimension with $\alpha = 0.70$. Boys reported higher subjective well-being than girls (77.4 versus 74.3%, $p=0.005$), a finding which was more prevalent among boys of the 2nd grade (boys: Mean=78.6, SD = 9.0 vs girls: Mean= 74.2, SD=12.7, $p=0.011$). Lastly, more 1st grade's adolescents of non-Greek or Cypriot ethnicity were girls (33.8 % vs. 14.9 % among boys).

Table 2 presents the median and Q1 and Q3 school performance overall, as well as per gender and school grades. Study participants achieved a median of 17 out of 20. Girls generally performed better than boys (17.5 vs 16, $p<0.001$). We further focused on three courses, i.e., mathematics, Greek language and history. Study participants achieved a median score of 16 in these courses, while girls performed better than boys in all three courses of interest. Overall, the youngest participants (pupils of Karava et al.

the 1st junior high school grade) achieved the highest overall score (Median=17.6, Q1-Q3=15.6 – 19), whereas the oldest (3rd grade) achieved the lowest (Median=16, Q1-Q3=14 – 17.9).

Table 3 presents the results of univariate logistic regression analyses evaluating the association between the adolescents' characteristics and the risk of achieving a school performance below the median (less than 17 out of 20). Notwithstanding mutual confounding among the variables considered, sex (girls vs. boys) higher subjective well-being and socio-economic status were associated with lower likelihood of performing below the median in the school environment. Older adolescents, of non-Greek or Cypriot ethnicity and of higher BMI were more likely to perform below the median in mathematics, language and history.

Table 4 presents the results of multivariate logistic regression analyses evaluating adolescents' characteristics and the risk of achieving performance below the median in the school environment (general score less than 17 out of 20). Hence, controlling for possible confounders, girls had significantly lower risk of achieving overall performance below the median (OR= 0.44 and 95% CI: 0.28 to 0.69) as well as in mathematics (OR= 0.64 and 95% CI: 0.41 and 0.99), language (OR=0.34 and 95%CI: 0.21 to 0.54), and history (OR= 0.47 and 95%CI: 0.30 to 0.75) compared to boys. Adolescents of high socio-economic status, as indicated by their scoring in the FAS, were also more likely to succeed academically than the counterparts of low socio-economic status (high status OR= 0.57 and 95% CI: 0.32 to 1.03). Similarly, the family status, in particular when living with both parents (OR=0.54 and 95% CI: 0.31 to 0.96), and high parental educational attainment (high vs low OR= 0.53 and 95%CI: 0.32 to 0.87) were significantly associated with the achievement of overall performance above the median in school. In particular, students who have parents of high educational attainment were 47% less likely to score below the median overall (OR=0.53 and 95%CI: 0.32 to 0.87), and this was also observed for their scoring in mathematics (OR=0.47 and 95%CI: 0.29 to 0.77) and history (OR=0.63 and 95%CI: 0.37 to 1.05). In contrast, adolescents of non-Greek or Cypriot ethnicity (OR=3.70 and 95%CI: 2.09 to

6.54) and with higher personal feeling of unsafety score (OR= 1.11 and 95% CI: 1.02 to 1.20) were significantly more likely to perform overall below the median. The non-Greek or Cypriot ethnicity was also associated with higher risk of achieving scores below the median in mathematics (OR= 2.20 and 95% CI: 1.27 to 3.83), history (OR= 3.32 and 95% CI: 1.83 to 6.03) and language (OR= 4.42 and 95% CI: 2.45 to 7.99), respectively. In addition to this, students attending higher school grades (3rd Grade: OR=3.58 and 95%CI: 1.38 to 9.29) and feeling more unsafe at personal level (OR= 1.10 and 95%CI: 1.01 to 1.20) were less likely to perform above the median in history compared with their counterparts.

DISCUSSION

In a sample of 440 adolescents from 55 junior high schools in Athens (the capital city) and its metropolitan area, personal characteristics such as gender, BMI, sedentary behavior, socio-economic status and personal feeling of unsafety score were associated with the adolescents' school performance overall as well as in three core syllabuses, i.e., mathematics, Greek language and history. In general, boys of non- Greek origin, members of non-privileged families, with a feeling of unsafety in their life and of parents of low educational attainment were more likely to perform less well at school.

In our study in particular, the main determinants of adolescents' school performance overall as well as in three core syllabuses were gender, ethnicity, parental education and socio-economic status. After controlling for potential confounders, girls had 56% (OR = 0.44 and 95% CI: 0.28 to 0.69) lower risk of performing below the median in the school environment (less than 17 out of 20) compared to boys; adolescents of non- Greek origin were approximately four times more likely to face difficulties in school curriculum compared to Greek counterparts; adolescents with parents of high educational attainment were more likely to perform well overall as well as in mathematics and history; adolescents of higher socio-economic status had lower risk of performing below the median compared to their socio-economic counterparts; and adolescents who reported feeling unsafe were also less likely to accomplish a good overall school performance.

Our findings on gender differences in school performance controlling for participants' age are in line with previous findings. According to Vitale et al.⁷, boys are less likely to achieve good academic performance than girls of the same age. Similarly, based on our study, girls achieved better median value of overall score compared to boys (17.5 vs 16, $p < 0.001$). Girls achieved their greatest performance in language (Median=17, Q1-Q3=15 – 18) and history (Median=17, Q1-Q3=14 – 19) compared to their achievements in mathematics (Median=16, Q1-Q3=14 – 18), whereas boys achieved similar median scores in all three courses. Furthermore, adolescents of higher school grade reported overall academic performance below the median and in particular in mathematics, language and history, with girls still achieving higher scores than boys. In particular, a median overall score of 17.6 was achieved by students of 1st junior high school grade while in contrast adolescents of 3rd grade reported a median overall score of 16, which imply that the effort of academic success declines among adolescents of higher grades due to their engagement with extracurricular activities.

The development of the adolescents' physical, mental, emotional, and social functioning depends on socio-economic factors in which educational achievement plays a crucial role²⁴. School performance, as an important determinant of adolescents' perception, can be influenced by various personal characteristics such as gender, subjective well-being, family affluence and parental educational attainment. According to Sunden²⁵ subjective well-being has been associated with academic achievements, whereas the increased feeling of anxiety seems to have a negative impact on the learning process as well as students' physical and psychological well-being. In our study, enhanced subjective well-being was associated with lower risk of performing below the median in the school environment, indicating that the self-determination of adolescents is enhanced by the process of learning and developing skills and abilities. Degoy & Berra²⁶ reported that students who achieved excellent grades in language and mathematics scored better in the psychosocial domains of scales assessing their subjective well-being.

In our study, boys reported higher BMI than girls ($p=0.011$), but BMI was not associated with school performance controlling for the adolescents' gender which could demonstrate that girls pay more attention to maintain a healthy body weight. Notably, a direct association between obesity and poor academic performance in school-age children and adolescents has not been reported in the literature¹⁴ but healthy dietary choices and regular physical activity have been associated with better school performance.²⁷ Nevertheless, the subjective well-being was higher among boys than among girls both overall and by school class.

The family's positioning on the social ladder has been associated with children's intellectual development from infancy through adolescence.²⁸ In our study, adolescents of higher socio-economic status, based on their scoring on the FAS, had approximately 43% lower risk of school performance below the median (OR=0.57 and 95%CI: 0.32 to 1.03) compared with their socio-economic counterparts. Similarly, adolescents of parents with higher educational attainment were more likely to achieve better in school, while in contrast students of single-parent family were more likely to achieve lower grades. Moreover, in our study, non-Greek adolescents were approximately four times more likely to face difficulties in following the school curriculum. Aldridge and colleagues²⁹ highlight the importance of the adolescents' ethnic identity and its long-term consequences in their mental and physical health, which are affected by challenges in the school environment (such as bullying, acceptance by their teachers and classmates), which can subsequently affect their school performance. Adolescents who reported feeling unsafe were also less likely to accomplish a good overall school performance. It is thus imperative to recognize the importance of trauma and stress in policies promoting the well-being of young individuals.³⁰

In our study, the main determinants of adolescents' school performance overall as well as in three core syllabuses were gender, ethnicity, parental education and socio-economic status. After controlling for possible confounders girls had 56% (OR = 0.44 and 95% CI: 0.28 to 0.69) lower risk of performing below the

median in the school environment (less than 17 out of 20) compared to boys; adolescents of non- Greek origin were approximately four times more likely to face difficulties in school curriculum compared to Greek counterparts; adolescents with parents of high educational attainment were more likely to perform well overall as well as in mathematics and history; adolescents of higher socio-economic status had lower risk of performing below the median compared to their socio-economic counterparts; and adolescents who reported feeling unsafe were also less likely to accomplish a good overall school performance.

In conclusion, after controlling for possible confounders, gender, ethnicity, parental education attainment and family status were significantly associated with overall academic performance below the median, particularly in mathematics and history. Girls of privileged households, of parents with high educational attainment were more likely to perform well at school; while adolescents of non-Greek or Cypriot ethnicity and with a personal feeling of unsafety were more probable to perform below the median in the school environment.

Strengths and limitations

The present study aims to comprehensively evaluate the association between school performance and socioeconomic factors, anthropometric characteristics, and sedentary lifestyle among adolescents. The study is however limited by its cross-sectional nature, which further impedes the possibility of causal inferences. The academic performance was evaluated by measuring the overall average score as well as the score in three syllabuses in the last trimester of the school curriculum. Lastly, our knowledge on characteristics of the school environment and adolescents' overall behavior as well as their achievement in other syllabuses (such as art and /or music) was limited and should have also been assessed for an ample evaluation of school performance.³¹

Adolescents' school performance is interrelated with their overall quality of life and in turn with their subjective assessment of personal well-being. Hence, the present study can serve as a reference point to comparatively assess school performance in the

aftermath of the pandemic Covid-19. Overall, our findings can be useful in designing, implementing and monitoring fit-for-purpose public health promoting strategies following a comprehensive and sustainable approach recognizing the adolescents' multiple and variable needs.

REFERENCES

- Liem GAD. Academic performance and assessment. *Educational Psychology*. 2019; 39(6):705-708. doi:10.1080/01443410.2019.1625522.
- Widlund A, Tuominen H, Korhonen J. Academic Well-Being, Mathematics Performance, and Educational Aspirations in Lower Secondary Education: Changes Within a School Year. *Front Psychol*. 2018;9:297. doi: 10.3389/fpsyg.2018.00297.
- Ng ZJ, E Huebner S, J Hills K. Life Satisfaction and Academic Performance in Early Adolescents: Evidence for Reciprocal Association. *J Sch Psychol*. 2015;53(6):479-91. doi: 10.1016/j.jsp.2015.09.004.
- Steinmayr R, Heyder A, Naumburg C, Michels J, Wirthwein L. School-Related and Individual Predictors of Subjective Well-Being and Academic Achievement. *Front Psychol*. 2018;9:2631. doi: 10.3389/fpsyg.2018.02631.
- Datu JAD, King RB. Subjective well-being is reciprocally associated with academic engagement: A two-wave longitudinal study. *J Sch Psychol*. 2018;69:100-110. doi: 10.1016/j.jsp.2018.05.007.
- Kassarnig V, Mones E, Bjerre-Nielsen A, Sapiezynski P, Dreyer Lassen D, Lehmann S. Academic performance and behavioral patterns. *EPJ Data Science*. 2018;7(10).doi:10.1140/epjds/s13688-018-0138-8
- Vitale R, Degoy E, Berra S. Perceived health and academic performance among adolescents from public schools in the city of Córdoba. *Arch Argent Pediatr*. 2015;113(6):526-33. English, Spanish. doi: 10.5546/aap.2015.eng.526.
- Birndorf S, Ryan S, Auinger P, Aten M. High self-esteem among adolescents: longitudinal trends, sex differences, and protective factors. *J Adolesc Health*. 2005;37(3):194-201. doi: 10.1016/j.jadohealth.2004.08.012.
- Coe DP, Peterson T, Blair C, Schutten MC, Peddie H. Physical fitness, academic achievement, and socioeconomic status in school-aged youth. *J Sch Health*. 2013;83(7):500-7. doi: 10.1111/josh.12058.
- Ragnarsdottir LD, Kristjansson AL, Thorisdottir IE, Allegrante JP, Valdimarsdottir H, Gestsdottir S, Sigfusdottir ID. Cumulative risk over the early life course and its relation to academic achievement in childhood and early adolescence. *Prev Med*. 2017;96:36-41. doi: 10.1016/j.ypmed.2016.12.019.
- Lima RA, Pfeiffer KA, Møller NC, Andersen LB, Bugge A. Physical Activity and Sedentary Time Are Positively Associated With Academic Performance: A 3-Year Longitudinal Study. *J Phys Act Health*. 2019;16(3):177-183. doi: 10.1123/jpah.2017-0587.
- Herting MM, Chu X. Exercise, cognition, and the adolescent brain. *Birth Defects Res*. 2017;109(20):1672-1679. doi: 10.1002/bdr2.1178.
- Santana CCA, Azevedo LB, Cattuzzo MT, Hill JO, Andrade LP, Prado WL. Physical fitness and academic performance in youth: A systematic review. *Scand J Med Sci Sports*. 2017a;27(6):579-603. doi: 10.1111/sms.12773.
- Santana CCA, Hill JO, Azevedo LB, Gunnarsdottir T, Prado WL. The association between obesity and academic performance in youth: a systematic review. *Obes Rev*. 2017b;18(10):1191-1199. doi: 10.1111/obr.12582.
- Lien A, Sampasa-Kanyinga H, Colman I, Hamilton HA, Chaput JP. Adherence to 24-hour movement guidelines and academic performance in adolescents. *Public Health*. 2020;183:8-14. doi: 10.1016/j.puhe.2020.03.011.
- Currie CE, Elton RA, Todd J, Platt S. Indicators of socioeconomic status for adolescents: the WHO Health Behaviour in School-aged Children Survey. *Health Educ Res*. 1997;12(3):385-97. doi: 10.1093/her/12.3.385.
- Hardy LL, Booth ML, Okely AD. The reliability of the Adolescent Sedentary Activity Questionnaire (ASAQ). *Prev Med*. 2007;45(1):71-4. doi: 10.1016/j.ypmed.2007.03.014.
- van den Eijnden RJ, Meerkerk GJ, Vermulst AA, Spijkerman R, Engels RC. Online communication,

- compulsive Internet use, and psychosocial well-being among adolescents: a longitudinal study. *Dev Psychol.* 2008;44(3):655-65. doi: 10.1037/0012-1649.44.3.655.
19. Yarcheski A, Mahon NE, Yarcheski TJ. Validation of the PRQ85 social support measure for adolescents. *Nurs Res.* 1992;41(6):332-7. PMID: 1437581
20. Tzavara C, Tzonou A, Zervas I, Ravens-Sieberer U, Dimitrakaki C, Tountas Y. Reliability and validity of the KIDSCREEN-52 health-related quality of life questionnaire in a Greek adolescent population. *Ann Gen Psychiatry.* 2012;11:3. doi: 10.1186/1744-859X-11-3.
21. Ravens-Sieberer U., Gosch A., Rajmil L., Erhart, M., Bruil J., Duer, W., Auquier P, Power M, Abel T, Czemy L, Mazur J, Czimbalmos A, Tountas Y, Hagquist C, Kilroe J, European Kidscreen Group. KIDSCREEN-52 quality-of-life measure for children and adolescents. Expert review of pharmacoeconomics & outcomes research.2005; 5(3), 353-364. doi: 10.1586/14737167.5.3.353.
22. Ravens-Sieberer U., Auquier P., Erhart M., Gosch A., Rajmil L., Bruil J., Power M., Duer W., Cloetta B., Czemy L, Mazur J., Czimbalmos A., Tountas Y., Hagquist C., Kilroe J.The KIDSCREEN-27 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Quality of Life Research.*2007;16(8), 1347-1356. doi:10.1007/s11136-007-9240-2
23. Ravens-Sieberer U., Gosch A., Rajmil L., Erhart M., Bruil J., Power M., Duer W., Auquier P., Cloetta B., Czemy L, Mazur J., Czimbalmos A., Tountas Y., Hagquist C., Kilroe J.; KIDSCREEN Group. The KIDSCREEN-52 quality of life measure for children and adolescents: psychometric results from a cross-cultural survey in 13 European countries. *Value in Health.*2008;11(4), 645-658. doi:10.1111/j.1524-4733.2007.00291.x
24. Gil-Lacruz M, Gil-Lacruz AI, Gracia-Pérez ML. Health-related quality of life in young people: the importance of education. *Health Qual Life Outcomes.* 2020;18(1):187. doi: 10.1186/s12955-020-01446-5.
25. Sunden S. (2019). Perceptions of Academic Success and Quality of Life Issues Among Undergraduate University Students [dissertation]. Concordia University, St.Paul;2019.167p. Retrieved from. https://digitalcommons.csp.edu/cup_commons_grad_edd/327
26. Degoy E, Berra S. Differences in health-related quality of life by academic performance in children of the city of Cordoba-Argentina. *Qual Life Res.* 2018;27(6):1463-1471. doi: 10.1007/s11136-018-1849-9.
27. Asigbee FM, Whitney SD, Peterson CE. The Link Between Nutrition and Physical Activity in Increasing Academic Achievement. *J Sch Health.* 2018;88(6):407-415. doi: 10.1111/josh.12625.
28. Von Stumm S, Plomin R. Socioeconomic status and the growth of intelligence from infancy through adolescence. *Intelligence.* 2015;48,30-36. doi:10.1016/j.intell.2014.10.002
29. Aldridge J, Fraser B, Fozdar F, Ala'i K, Earnest J, Afari E. Students' perceptions of school climate as determinants of wellbeing, resilience, and identity. *Improving Schools.* 2015;19, 1-22. doi:10.1177/1365480215612616
30. Gatt JM, Alexander R, Emond A, Foster K, Hadfield K, Mason-Jones A, Reid S, Theron L, Ungar M, Wouldes TA, Wu Q. Trauma, Resilience, and Mental Health in Migrant and Non-Migrant Youth: An International Cross-Sectional Study Across Six Countries. *Front Psychiatry.* 2020;10:997. doi: 10.3389/fpsy.2019.00997.
31. Kökçam A, Kubat C. A model for measuring school performance. In: Proceedings of the 3rd International Symposium on Innovative Technologies in Engineering and Science (ISITES 2015); 2015 Jun; Valencia, Spain. 2015.

ANNEX

TABLE 1. Characteristics of study participants overall and by school grade, separately for boys and girls

	Total (N=440)					1st Grade (N=118)					2nd Grade (N=178)					3rd Grade (N=144)				
	Boys		Girls		p*	Boys		Girls		p*	Boys		Girls		p*	Boys		Girls		p*
	200		240			47		71			83		95			70		74		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD		
Age (years)	13.8	1.0	13.7	1.0	0.361	12.6	0.5	12.7	0.5	0.474	13.7	0.7	13.7	0.8	0.567	14.7	0.6	14.7	0.6	0.406
BMI (kg/m ²)	20.7	3.5	19.9	2.9	0.011	19.9	3.5	19.4	3.0	0.448	20.8	4.1	19.9	2.9	0.100	21.1	2.8	20.3	2.7	0.091
Overall subjective well-being (KID-SCREEN-46) – expressed as %	77.4	10.5	74.3	11.8	0.005	77.5	10.9	75.7	10.4	0.359	78.6	9.0	74.2	12.7	0.011	75.9	11.7	73.1	11.9	0.156
Score at Family Affluence Scale	5.2	1.7	5.1	2.0	0.738	5.2	1.8	5.1	1.7	0.780	5.2	1.6	5.1	1.9	0.703	5.1	1.7	5.1	2.3	0.975
	N	%	N	%		N	%	N	%		N	%	N	%		N	%	N	%	
Family Affluence Scale in categories					0.553					0.676					0.317					0.535
<i>Low(0-4)</i>	74	37.0	95	39.6		19	40.4	28	39.4		26	31.3	36	37.9		29	41.4	31	41.9	
<i>Intermediate (5-6)</i>	80	40.0	84	35.0		16	34.0	29	40.9		39	47.0	34	35.8		25	35.7	21	28.4	
<i>High (7-9)</i>	46	23.0	61	25.4		12	25.5	14	19.7		18	21.7	25	26.3		16	22.9	22	29.7	
Ethnicity					0.652					0.022					0.690					0.140
<i>Greek/Greek Cypriots</i>	148	74.0	173	72.1		40	85.1	47	66.2		65	78.3	72	75.8		43	61.4	54	73.0	
<i>Other</i>	52	26.0	67	27.9		7	14.9	24	33.8		18	21.7	23	24.2		27	38.6	20	27.0	
Parental educational attainment					0.346					0.540					0.172					<0.001
<i>Low or medium</i>	71	35.5	75	31.3		14	29.8	25	35.2		21	25.3	33	34.7		36	51.4	17	23.0	
<i>High at least one of them</i>	129	64.5	165	68.8		33	70.2	46	64.8		62	74.7	62	65.3		34	48.6	57	77.0	
Living with two parents / legal guardians					0.877					0.631					0.224					0.068
<i>No</i>	38	19.0	47	19.6		11	23.4	14	19.7		16	19.3	12	12.6		11	15.7	21	28.4	
<i>Yes</i>	162	81.0	193	80.4		36	76.6	57	80.3		67	80.7	83	87.4		59	84.3	53	71.6	

BMI: Body Mass Index SD: Standard Deviation

*p-value for statistical significance was calculated using chi-square test (χ^2) or t-test

TABLE 2. Median, Q1 and Q3 of the score achieved overall and in three core syllabuses (mathematics, language and history). Results presented overall, by school grade and gender.

	Total					Boys		Girls		<i>p-value* difference</i>
	Median	Q1	Q3	<i>min</i>	<i>max</i>	Median	Q1 - Q3	Median	Q1 - Q3	
	N=440					N=200		N=240		
Total										
Overall score	17	15	18.5	10	20	16	14.6 – 18	17.5	15.2 – 19	<0.001
Mathematics	16	13	18	9	20	15	13 – 18	16	14 – 18	0.012
Language	16	14	18	9	20	15	13 – 17	17	15 – 18	<0.001
History	16	13	18	9	20	15	12 – 17	17	14 – 19	<0.001
1stGrade	N=118					N=47		N=71		
Overall score	17.6	15.6	19	11	20	16.8	15.5 – 18.7	18	16 – 19	0.066
Mathematics	17	13.5	18	9	20	16	14 – 18	17	13 – 19	0.455
Language	17	15	19	10	20	16	14 – 18	18	15 – 19	0.087
History	17	15	19	10	20	17	15 – 19	18	15 – 19	0.702
2nd Grade	N=178					N=83		N=95		
Overall score	17	15	18.4	10	20	16	15 – 18	17.7	15 – 18.9	0.062
Mathematics	16	14	18	9	20	15	13 – 18	16	14 – 18	0.643
Language	17	15	18	9	20	16	14 – 18	17	16 – 18	0.006
History	15	13	18	9	20	15	12 – 17	16	14 – 18	0.019
3rd Grade	N=144					N=70		N=74		
Overall score	16	14	17.9	10	20	15	13 – 17.1	17	15 – 18.3	<0.001
Mathematics	15	13	18	9	20	14	12 – 17	16	14 – 18	0.002
Language	15	13	17	10	20	13	12 – 16	16	14 – 18	<0.001
History	15	12	17	9	20	14	11 – 16	16	13 – 18	0.003

*p-value for statistical significance of the difference in scores between boys and girls was calculated using the Mann-Whitney non parametric test.

TABLE 3. Univariate logistic regression analysis between the risk of achieving performance below the median in the school environment (score < 17/20) and adolescents' characteristics.

	Overall score				Mathematics				Language				History			
	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
Overall subjective well-being (KID-SCREEN-46) – expressed as %	0.98	0.97	1.00	0.023	0.98	0.97	1.00	0.038	0.98	0.96	0.99	0.010	0.98	0.96	1.00	0.013
Age years)	1.32	1.10	1.60	0.004	1.20	0.99	1.45	0.061	1.27	1.05	1.54	0.013	1.36	1.12	1.65	0.002
Gender (Reference, Boy)																
<i>Girl</i>	0.42	0.29	0.60	<0.001	0.57	0.40	0.83	0.003	0.38	0.26	0.56	<0.001	0.44	0.30	0.64	<0.001
Family Affluence Scale in categories (Reference, Low [0-4])																
<i>Intermediate (5-6)</i>	0.61	0.40	0.93	0.021	0.58	0.38	0.90	0.014	0.63	0.41	0.97	0.035	0.61	0.40	0.94	0.025
<i>High (7-9)</i>	0.32	0.19	0.52	<0.001	0.33	0.20	0.53	<0.001	0.40	0.25	0.64	<0.001	0.39	0.24	0.63	<0.001
Junior high school grades (Reference, 1 st Grade)																
<i>2nd Grade</i>	1.33	0.85	2.10	0.213	1.47	0.93	2.31	0.097	1.04	0.66	1.64	0.854	2.17	1.37	3.43	0.001
<i>3rd Grade</i>	2.29	1.42	3.69	0.001	1.81	1.12	2.92	0.015	2.01	1.24	3.26	0.005	2.77	1.70	4.50	<0.001
Ethnicity (Reference, Greek /Greek-Cypriot)																
<i>Other</i>	4.64	2.94	7.32	<0.001	3.47	2.19	5.48	<0.001	4.91	3.02	7.97	<0.001	3.92	2.44	6.28	<0.001
Parental educational attainment (Reference, Low or medium)																
<i>High. at least one of them</i>	0.32	0.21	0.49	<0.001	0.31	0.20	0.48	<0.001	0.45	0.30	0.68	<0.001	0.38	0.25	0.57	<0.001
Living with two parents/ legal guardians (Reference, No [single-parent])																
<i>Yes</i>	0.55	0.34	0.89	0.015	0.88	0.55	1.42	0.611	0.59	0.36	0.96	0.035	0.78	0.48	1.25	0.296
Extent of internet use score (8q.)	1.03	1.00	1.06	0.034	1.02	0.99	1.05	0.256	1.03	1.00	1.06	0.040	1.05	1.02	1.08	0.001
Personal feeling of unsafety score (5q.) ¹	1.12	1.05	1.20	<0.001	1.07	1.01	1.14	0.031	1.08	1.02	1.15	0.012	1.09	1.02	1.16	0.010
BMI(kg/m ²)	1.07	1.01	1.14	0.021	1.06	1.00	1.13	0.038	1.11	1.04	1.17	<0.001	1.09	1.02	1.16	0.007
Hours spent on sedentary activities (Reference, up to 5 hours per day)																
<i>from 5 to 8 hours per day</i>	1.05	0.65	1.68	0.846	1.01	0.63	1.62	0.967	0.90	0.56	1.44	0.663	1.272	0.79	2.05	0.320
<i>more than 8 hours per day</i>	1.14	0.70	1.85	0.589	1.16	0.72	1.89	0.541	1.09	0.67	1.78	0.717	1.278	0.79	2.08	0.324
<i>missing</i>	2.25	1.04	4.86	0.039	2.67	1.17	6.09	0.020	1.96	0.89	4.30	0.093	2.380	1.07	5.31	0.034

BMI: Body Mass Index. CI: Confidence Intervals

¹ Higher values of the score reflect lower feeling of safety

TABLE 4. Multivariate logistic regression analysis between the risk of achieving performance below the median in the school environment (score <17/20) and adolescents' characteristics

	Overall score				Mathematics				Language				History			
	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p	OR	95% CI		p
Overall subjective well-being (KID-SCREEN-46) – expressed as %	0.99	0.97	1.01	0.182	0.99	0.97	1.01	0.234	0.99	0.97	1.01	0.219	0.99	0.97	1.01	0.192
Age (years)	0.99	0.68	1.46	0.976	0.97	0.68	1.40	0.891	1.01	0.70	1.47	0.948	0.87	0.60	1.27	0.461
Gender (Reference, <i>Boy</i>)																
<i>Girl</i>	0.44	0.28	0.69	<0.001	0.64	0.41	0.99	0.045	0.34	0.21	0.54	<0.001	0.47	0.30	0.75	0.001
Family Affluence Scale in categories (Reference, <i>Low [0-4]</i>)																
<i>Intermediate (5-6)</i>	0.99	0.59	1.64	0.954	0.79	0.48	1.29	0.338	0.92	0.56	1.54	0.763	0.93	0.55	1.56	0.781
<i>High (7-9)</i>	0.57	0.32	1.03	0.063	0.53	0.30	0.93	0.026	0.69	0.38	1.23	0.208	0.58	0.32	1.05	0.070
Junior high school grades (Reference, <i>1st Grade</i>)																
<i>2nd Grade</i>	1.40	0.72	2.73	0.318	1.69	0.90	3.19	0.104	0.93	0.49	1.79	0.839	2.84	1.46	5.55	0.002
<i>3rd Grade</i>	2.06	0.79	5.34	0.137	1.76	0.71	4.36	0.224	1.68	0.67	4.26	0.272	3.58	1.38	9.29	0.009
Ethnicity (Reference, <i>Greek /Greek-Cypriot</i>)																
<i>Other</i>	3.70	2.09	6.54	<0.001	2.20	1.27	3.83	0.005	4.42	2.45	7.99	<0.001	3.32	1.83	6.03	<0.001
Parental educational attainment (Reference, <i>Low or medium</i>)																
<i>High. at least one of them</i>	0.53	0.32	0.87	0.013	0.47	0.29	0.77	0.003	0.81	0.48	1.35	0.409	0.63	0.37	1.05	0.078
Living with two parents/ legal guardians (Reference, <i>No [single-parent]</i>)																
<i>Yes</i>	0.54	0.31	0.96	0.034	0.95	0.56	1.62	0.845	0.67	0.38	1.17	0.155	0.84	0.48	1.49	0.556
Extent of internet use score (8q.)	1.01	0.97	1.05	0.676	1.00	0.96	1.04	0.948	1.00	0.96	1.04	0.922	1.04	1.00	1.08	0.059
Personal feeling of unsafety score (5q.) ¹	1.11	1.02	1.20	0.020	1.04	0.96	1.13	0.348	1.01	0.93	1.10	0.738	1.10	1.01	1.20	0.024
BMI(kg/m ²)	1.05	0.99	1.13	0.128	1.05	0.99	1.12	0.124	1.10	1.03	1.18	0.005	1.06	0.99	1.13	0.104
Hours spent on sedentary activities (Reference, <i>up to 5 hours per day</i>)																
<i>from 5 to 8 hours per day</i>	1.19	0.68	2.07	0.538	1.14	0.67	1.93	0.632	0.97	0.56	1.68	0.927	1.30	0.75	2.25	0.358
<i>more than 8 hours per day</i>	0.99	0.54	1.80	0.968	1.08	0.61	1.91	0.805	1.07	0.59	1.94	0.815	0.83	0.46	1.52	0.547
<i>missing</i>	1.97	0.83	4.70	0.124	2.59	1.07	6.29	0.036	1.71	0.71	4.12	0.234	1.90	0.77	4.68	0.164

BMI: Body Mass Index. CI: Confidence Intervals

¹Higher values of the score reflect lower feeling of safety