**Summary**

*Aim* The main aim of the doctoral thesis is to determine patterns of physical activity during high-school. Three specific goals for three independent studies (Study 1, Study 2 and Study 3) were set. Study 1 aimed to evaluate: (1) the objectively assessed physical activity (PA) patterns in urban 15-year-old male and female adolescents according to school type and (2) to assess the differences in PA between school days and weekend days. Study 2 aimed to evaluate PA, SBs and SP changes between 1st and 2nd grade of high school in urban adolescents. Study 3 aimed to evaluate the extent of tracking of physical activity (PA), sports participation (SP) and sedentary behaviors (SB) over 4 years of high school education among the Croatian Physical Activity in Adolescence Longitudinal Study (CRO-PALS) cohort. *Study 1 methods* In this cross-sectional study, participants were 187 secondary-school male and female adolescents (61.4% females) attending grammar and vocational schools. Patterns of PA were objectively evaluated using a multi-sensor body monitor for 5 consecutive days. Confounders assessed included biological age, socio-economic status, sum of 4 skinfolds, maximal temperature and the amount of rainfall. *Study 1 results* Males and females from grammar schools achieved higher total daily energy expenditure (TEE) and active energy expenditure (AEE) compared to their peers from vocational schools (TEE: $50 \pm 12$ kcal/kg/day vs. $47 \pm 12$ kcal/kg/day, $p = 0.02$; AEE: $23 \pm 5$ kcal/kg/day vs. vocational $= 21 \pm 6$ kcal/kg/day, $p = 0.04$). No differences in time spent in light (LPA), moderate (MPA) or vigorous (VPA) physical activity were noted between the two groups ($p = 0.16$–$0.43$). Next, a significant decline in TEE and MPA between school days and weekends was observed ($p < 0.001$ and $p = 0.02$, respectively), while VPA remained the same throughout the week ($p = 0.76$). Weekly patterns of PA did not show differences by school type or gender ($p$ for interactions $= 0.21$–$0.50$). In addition, significantly lower amount of MPA was accumulated during weekends compared to school days, resulting in lower TEE, regardless of school type or gender. *Study 1 conclusion* Policies and strategies

on PA in adolescents should focus vocational schools and weekend days. ***Study 2 methods*** In this one year follow-up study, participants were 81 secondary-school students (28 boys and 53 girls) aged 15.5 years at the baseline. PA was assessed with the SenseWear Armband multi-sensor activity monitor, while SBs were assessed by using School Health Action, Planning and Evaluation System (SHAPES) physical activity questionnaire. SHAPES questionnaire was supplemented with 2 questions inquiring about SP in organized sports in school and outside of school. ***Study 2 results*** PA decreased markedly in both genders between the 1$^{st}$ and 2$^{nd}$ grade of high school. Total energy expenditure was reduced by 13 kcal/kg/day on average in boys and by 10 kcal/kg/day in girls (p for both <0.001), while mean daily active energy expenditure decreased by 7 kcal/kg/day (p<0.001) and 3 kcal/kg/day (p=0.04) in boys and girls, respectively. Similarly, the amount of moderate physical activity declined by 49 min/day in boys and 21 min/day in girls (p for both <0.001). At the same time vigorous physical activity was cut by 14 min/day (p<0.001) and 3 min/day (p=0.003) in boys and girls, respectively. Conversely, time spent in SBs did not show any change. ***Study 2 conclusion*** In conclusion, a decline in PA between 1st and 2nd grade of high school was marked, but was not accompanied with an increase in SBs. Policies aimed at increasing PA should be targeting the period of entering secondary school in order to offset the observed drop in PA. ***Study 3 methods*** In this investigation, participants were 844 high school students (15.6 years at baseline; 49% girls). SHAPES questionnaire was used to assess PA, SP and SB at ages 15, 16, 17, and 18 and continuous tracking was assessed by stability coefficients and odds ratios calculated using generalized estimating equations. ***Study 3 results*** Tracking coefficients for the duration of moderate and vigorous PA and physical activity energy expenditure (PAEE) were similar in both genders and indicated moderate tracking (0.49-0.61), while the stability of SB tended to be somewhat higher over the 4 years of follow-up (0.60-0.72 in boys and 0.60-0.70 in girls). In addition, youth that participated in sports at baseline had16 to 28 time higher odds of

continued participation at follow-up, depending on sport type and gender. Finally, both low physical activity and high screen time showed strong tracking in both genders. ***Study 3 conclusion*** In conclusion, PA and SB tracked moderately between age 15 and 18, the tracking of SB being slightly stronger compared to PA. Moreover, strong tracking of low PA and high screen time indicates that detection of these risk factors at the beginning of high school should be strongly recommended.

**Key words:** children, adolescence, epidemiology, Sensewear Armband, high school type, energy expenditure, secondary school, students, lifestyle habits, exercise, screen time, longitudinal analysis, sitting-time, physical inactivity, sustainability, generalized estimating equations