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Multidimensional Effects of COVID-19 Lockdowns on Youth Athletes: Evidence from Slovenian Coaches

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Abstract

The COVID-19 pandemic, which emerged in early 2020, caused widespread disruptions to youth sport, including curriculum-based physical activity, organized sports, and active transportation. This study investigated the impact of repeated lockdowns on organized youth sport participation, physical fitness, skill development, and psychosocial well-being in Slovenia. An online survey was conducted between November and December 2021 with 116 coaches of U13–U19 athletes across multiple sports disciplines. Descriptive statistics and non-parametric analyses were employed to examine participation trends, training adaptations, and perceived athlete outcomes. Following the first lockdown, 14.6% of athletes dropped out, while 6.5% of teams reported increased membership. After the summer break, participation rebounded, and the second lockdown had a smaller impact, indicating partial resilience in youth sport engagement. Training frequency and modality were substantially affected, with 20% of coaches not implementing remote sessions and fewer than half conducting post-lockdown fitness assessments. Coaches reported declines in general physical fitness (71%) and sport-specific skills (70%), heterogeneous changes in body mass, and reduced self-confidence and motivation in over 50% of athletes, whereas team spirit remained relatively stable. A significant association between perceived changes in body mass and motivation highlighted the role of physical self-concept in supporting engagement. These findings demonstrate that prolonged interruptions to organized youth sport have multidimensional effects on physical, technical, and psychosocial development. Future research should explore long-term consequences, identify effective mitigation strategies, and consider sport-specific, age, and gender-related factors to enhance resilience in youth sports systems under exceptional circumstances.

Keywords: COVID-19 · youth sport · physical activity · physical fitness · psychosocial development · training adaptation

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Introduction

The COVID-19 pandemic, which emerged in early 2020 and led to widespread disruptions across societies, has had lasting effects on multiple sectors, including youth sport. In particular, curriculum-based physical activity (PA), organized sports, and active transportation were markedly reduced as a result of pandemic-related restrictions (Eaton et al., 2023). Early insights came from the study "Everyday Practices Before and During the COVID-19 Pandemic Measures" (Pišot et al., 2020). In collaboration with universities in Naples (Italy), Novi Sad (Serbia), Zagreb (Croatia), and Presov (Slovakia), the study surveyed 4,100 adults (18–80 years) to assess lifestyle changes during the first wave. Results showed a 50% increase in sedentary time (5.5 → 8.5 h/day), a 65% rise in screen time, a 43% reduction in walking, and a 24% drop in sports participation (Pišot et al., 2020). While these findings highlighted a substantial rise in inactivity among adults, the study did not include children and adolescents actively engaged in sport. The impact of the first wave of restrictions on youth was subsequently documented by the Faculty of Sport, University of Ljubljana, in September 2020. Their research revealed a marked decline in all motor abilities among primary school children, with the most pronounced reductions observed in endurance and whole-body coordination—skills primarily developed through organized school and club sports programs. Whole-body coordination decreased by 13.5% in both sexes, while endurance declined by 15.3% in girls and 18.5% in boys. Overall motor efficiency dropped by 13.9% in boys and 13.3% in girls. Sprint speed decreased by 11.1% in boys and 9.1% in girls, and upper-body strength by 8.7% in both. Furthermore, over half of the participants exhibited increased subcutaneous fat, and obesity prevalence rose by 20% within one year, indicating a significant emerging public health concern (Starc et al., 2020).

The closure of schools, gyms, and the suspension of school and club-based competitions between March 16 and mid-May 2020, with some sports remaining suspended until September 2020, led most clubs and associations to halt training and competitive activities. During the second wave of COVID-19 in autumn 2020, organized youth sport was again largely suspended from October 21 onward, with only professional senior-level competitions permitted to continue. Additionally, data from Project Play 2020 (Aspen Institute, 2020) indicate that 29% of youth participants reported a reduced interest in returning to sport following extended periods of inactivity.

These findings informed the primary research questions of the present study: How have repeated disruptions in organized youth sport influenced participation in structured sport activities among young athletes in Slovenia? How have prolonged sport suspensions affected youth engagement, physical fitness, and psychosocial well-being? To address these questions, we analysed dropout rates across multiple youth sports disciplines, examined the use of alternative training strategies during disruption periods, and explored coaches' perceptions of the long-term effects of sport suspensions on athlete development and retention.

Method

Design and study sample

An online survey titled "Youth Participation in Organized Sport: Returning to Sport During COVID-19 Restrictions" (Ethics Commission ZRS, No. 0624–107/21, 16 November 2021), conducted within the framework of the program "Youth Sport under the Impact of COVID-19 Measures: Potential Implications for Elite Sport", was implemented by the Institute for Kinesiological Research at ZRS Koper. The primary aim of the survey was to examine the impact of repeated disruptions in youth sport caused by COVID-19 measures on participants across various sports disciplines.

The survey targeted coaches of U13–U19 selections (athletes aged 12–19) from Slovenian clubs in athletics, Alpine and Nordic skiing, gymnastics, basketball, football, swimming, and handball. Data collection took place between 18 November and 10 December 2021 (22 days). Invitations, including detailed information for coaches, were distributed via the relevant national sports federations, which forwarded them to clubs, and subsequently to coaches. Survey respondents were informed about the study's purpose, the voluntary nature of participation, and the measures taken to ensure anonymity. Data handling complied with applicable personal data protection legislation and the General Data Protection Regulation (GDPR). The survey was implemented using the open source 1KA platform, developed by the Social Science Informatics Centre at the Faculty of Social Sciences, University of Ljubljana, which also holds the corresponding intellectual property rights. The study encompassed multiple periods during which organized youth sport activities were suspended due to COVID-19 restrictions (12 March 2020 to May 2021).

Data analysis

All data were summarized using descriptive statistics. Categorical variables are presented as frequency counts and percentages, whereas continuous variables are reported as means with standard deviations and minimum values. This approach provides a comprehensive overview of the sample characteristics and the distribution of key variables. Statistical analyses were conducted using IBM SPSS 27.0 (IBM Corp, Armonk, NY, USA). The non-parametric Mann–Whitney U test was used to compare continuous variables. For comparisons of categorical variables related to observed physiological and psychological changes, the Chi-square test was used. Statistical significance was determined using p-values, with a threshold of $p < 0.05$ indicating meaningful differences between groups. The Bonferroni correction was applied to adjust for multiple comparisons.

Results

Survey Sample

In the online survey, which included 29 questions with 107 variables, there were 386 clicks on the introduction page. A description of the survey sample, i.e., the participating coaches (n=116) is presented in Table 1.

Table 1. Survey Sample with demographic Characteristics

Variable	Category	n	%
Gender	Male	93	80.2
	Female	23	19.8
	Other	0	0.0
	Total	116	100.0
Qualification	Level 1	37	31.9
	Level 2	56	48.3
	Master Coach / Pro License	21	18.1
	Other	2	1.7
	Total	116	100.0
Education	1 – Primary education or less	1	0.9
	2 – Vocational education	6	5.2
	3 – Secondary vocational or general education	39	33.9
	4 – Higher vocational education (college-level)	14	14,0
	5 – Higher professional or university education	39	33.9
	6 – Master's degree (or specialist)	14	12.1
	7 – Doctorate	2	1.7
	8 - Other	1	0.9
	Total	116	100.0

The sample (N = 116) was predominantly male (80.2%), with females representing 19.8%. Most participants held Level 2 coaching qualifications (48%), followed by Level 1 (32%) and Master Coach/Pro License (18%). Educational attainment was diverse, with the largest groups having secondary vocational/general education (33.9%) or higher professional/university education (33.9%). Additionally, the sample comprised coaches with a wide age range (21–69 years; 41.7 ±10.8) and varied coaching experience (1–45 years; 13.4± 9.83), reflecting a spectrum of professional expertise from novice to highly experienced individuals.

Among the 116 coaches surveyed football was the most represented sport (27.6%), followed by alpine and Nordic skiing combined (20.7%), including coaches of freestyle skiing, snowboarding, biathlon, ski jumping, cross-country skiing, and Nordic combination. Handball (17.2%), athletics (15.5%), and basketball (11.2%) comprised the remaining major groups, while swimming (4.3%) and gymnastics (3.45%) were the least represented disciplines.

Participation (Drop out)

Following the first lockdown (May 2020), 14.6% of teams' members drop out but on the other way some team reported increase members for 6.5%, while 3.6% of coaches reported no data of participation available, indicating that most teams experienced a decline or no change in membership. After the summer break (August – September 2020), membership trends reversed: teams were gain members for 19.2% while reported 9.6% decreased during the open period likely reflecting the reorganization and formation of new team selections at the beginning of the season and it is a common trend in normal seasons. Following the second lockdown (February 2021), 9.9% of teams experienced a decrease and 5.8% an increase in

membership, indicating a smaller impact than the first lockdown. Overall, team membership was most affected by the first lockdown, recovered after the summer, and showed only a modest decline following the second lockdown, highlighting that youth sport participation is sensitive to lockdowns but can rebound during periods of normal activity.

Training Session Adaptation

During the COVID-19 lockdown, youth sports were markedly disrupted, with reductions in training frequency, duration, and specificity. Coaches were surveyed on the implementation of remote training sessions between the first and second lockdowns. Results indicated that 20% of coaches did not conduct remote training from March to May 2020, while approximately 25% conducted sessions three times per week and 23% conducted four or more sessions weekly. No significant difference was observed in the frequency of online training between the first and second lockdowns. Coaches were also queried regarding post-lockdown physical fitness assessments. Of respondents, 42.2% conducted assessments, 28.4% did not, 20.7% conducted assessments twice, and 8.6% conducted them three or more times. There was no statistically significant association between the frequency of remote training sessions during lockdown and the implementation of post-lockdown fitness assessments, nor between the conduct of remote training and subsequent physical fitness evaluation following the resumption of sports activities.

Coaches were asked to provide assessed data or systematic observations regarding alterations in body mass, general physical fitness, and sport-specific movement techniques among youth athletes following their return to organized training after the prolonged COVID-19 lockdown period (Table 2).

Table 2. Assessed or observed changes in body mass, general physical fitness and sport specific movement technique in %

Category	Decline/ Worsen very much	Decline/ Worsen	Remained Unchanged	Increase / Improve	Increase/ Improve very much	Cannot estimate
Body Mass	5.2	32.8	29.3	27.6	0.0	5.2
General Fitness	6.0	65.5	18.1	6.0	1.7	2.6
Sports Specific Tecnique	11.2	59.5	25.9	0.9	0.0	2.6

Changes in body mass were distributed across the sample, with 29.3% of athletes exhibiting no noticeable change, 38.0% demonstrating a decrease, and 27.6% showing an increase. These data suggest that individual differences in training engagement, nutritional behaviour, and lifestyle adaptation during the lockdown may have contributed to heterogeneous responses in body composition. More substantial effects were reported in performance-related measures. A decline in general physical fitness was observed in 71.5% of athletes, while fewer than 19.0% maintained their pre-lockdown performance levels. This deterioration likely reflects reductions in neuromuscular efficiency, coordination, and aerobic and anaerobic conditioning, attributable to restricted access to structured and sport-specific training environments. Similarly, for sport-specific movement techniques coaches observed a declined in nearly 70.0% of athletes, while 25.9% showed no change. The high prevalence of both perceived and objectively measured declines in technical skills underscores the particular vulnerability of skill retention and execution precision to prolonged periods of reduced practice and competitive exposure.

The study also revealed psychosocial changes, with self-confidence and motivation exhibiting the greatest negative impact (Figure 1), over 50% of coaches reported observed decline or strong decline. In contrast, team spirit appeared more resilient, with approximately 24.5% of coaches reporting an improvement. This relative stability of team spirit suggests that the social aspects of sport may help buffer declines in psychological well-being, particularly in motivation and self-confidence.

When analysing observed physical and psychosocial changes a statistically significant relationship was found between perceived changes in athletes' body mass and reported motivation, χ^2 (16, N = 114) = 30.559, p = .015, Cramer's V = .259. This finding suggests that positive body self-perception may enhance motivation during post-lockdown training. Overall, the findings indicate that the lockdown had multidimensional negative effects on young athletes' physiology, technical skills, and physical fitness, highlighting the importance of maintaining structured physical activity and skill-specific engagement during prolonged interruptions to mitigate detraining and motivational decline.

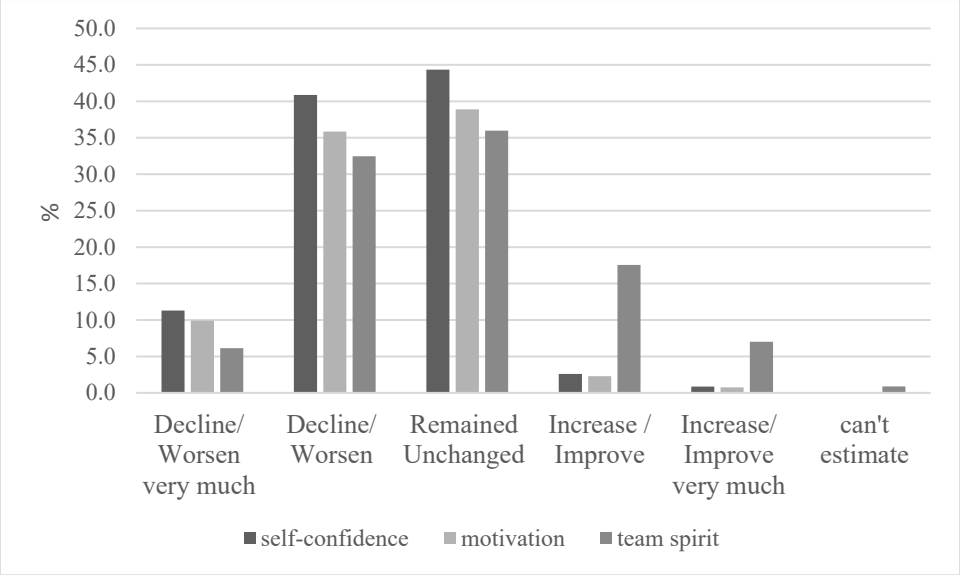

Figure 1. Perceived changes in psychosocial factors (self-confidence. motivation and team spirit)

Discussion

Analysis and Comparative Discussion

The present study examined the impact of COVID-19 lockdowns on youth sports participation, training practices adaptation and athlete development, based on a survey of coaches (n=116) representing a range of sports disciplines. As expected, the sample was predominantly male (80.2%) with diverse levels of coaching experience and education, ranging from novice to highly experienced professionals. Such heterogeneity in the sample could strengthens the generalizability of the findings across different coaching contexts and age groups.

Drop out of sport participation of youth organised sports

The results indicate that youth sport participation was sensitive to lockdown restrictions. Following the first lockdown in May 2020, coaches reported 14.6% decline in membership but on the other hand reported 6.5% increases. After the summer break, the trend reversed, with 19.2% of teams gaining members and only 9.6% losing members, reflecting typical seasonal recruitment patterns. The second lockdown in February 2021 had a smaller impact, suggesting that teams and athletes may have adapted to COVID-related restrictions over time. These findings underscore the resilience of youth sport participation when normal activity is resumed and highlight the importance of timely re-engagement strategies to mitigate participation losses during periods of disruption.

Additionally, lockdowns led to substantial changes in training frequency and modality. While a significant proportion of coaches implemented remote training, approximately 20% did not conduct any sessions during the first lockdown, indicating gaps in the adoption of alternative training strategies, mostly because of sports specific. Frequencies of online sessions varied, with nearly half of the coaches providing three or more sessions per week. Notably, no significant differences were observed in remote training frequency between the first and second lockdowns, suggesting persistent challenges in adapting training routines to online formats. Post-lockdown physical fitness assessments were conducted by less than half of the coaches, and there was no significant relationship between the frequency of remote training and subsequent fitness evaluations. This may reflect variability in resources, coaching expertise, or athletes' access to training environments during the lockdown periods. In the other hand training adaptations and athlete recovery suggest partial resilience in subsequent periods. Maintaining structured physical activity and technical engagement, including remote training and individualized support, is essential for mitigating the negative consequences of prolonged interruptions. Future research should investigate the long-term effects of good practice and identify strategies to mitigate the consequence and enhance resilience in youth sports systems during exceptional circumstances.

Lockdowns had also a pronounced impact on athletes' physical fitness and sport-specific skills. As caches estimated general physical fitness declined in 71% of athletes, while sport-specific movement techniques deteriorated in 70%. Body mass changes were heterogeneous, with 27% of athletes increasing, 6% decreasing, and 29.3% remaining

stable. These results highlight the multifactorial nature of detraining effects, including reductions in structured practice, limited access to sport-specific environments, and lifestyle factors. The magnitude of decline in technical skills emphasizes the particular vulnerability of motor coordination and precision to interruptions in regular practice schedules. In addition to physiological and technical consequences, coaches reported declines in athletes' self-confidence and motivation in over 50% of cases, whereas team spirit was relatively resilient, with some coaches noting improvements. The statistically significant association between perceived changes in body mass and motivation suggests that positive body self-perception may support engagement and drive during post-lockdown training. Consistent with the literature, youth athletes' perceptions of their physical competence and fitness (i.e., physical self-concept) are positively associated with autonomous motivation, and through this pathway potentially support higher levels of engagement and performance (Lohbeck et al., 2021 and Núñez et al., 2021).

Furthermore, the resumption of youth organised sports together with school-based physical activity (PA) following the end of lockdowns must account for the unique challenges and developmental losses incurred during the pandemic. This requires re-envisioning the post-pandemic environment to address the ongoing mental, emotional, and social needs of youth. The interruption of organized sports and physical education (PE) may have contributed to, or exacerbated, issues related to healthy weight, physical fitness, mental well-being, self-efficacy, and skill development (Carrel et al., 2007; Booker et al., 2015)

Conclusion

Overall, the findings of this study demonstrate that prolonged interruptions to youth sport exert significant multidimensional effects on the physical, technical, and psychosocial development of young athletes. While the first lockdown had the most pronounced impact on participation, it did not lead to a widespread or persistent decline in motivation to return to sport, contrasting with some previous reports (Aspen Institute, 2020). Nevertheless, these results reinforce concerns highlighted by prior research indicating substantial reductions in youth physical activity during the first 1.5 years of the pandemic, with variations across sub-populations based on age, gender, and activity context, including outdoor exercise and unstructured play (Do et al., 2022). The findings underscore the vulnerability of youth sport systems to disruptions and the importance of structured interventions to support physical, technical, and psychosocial development during periods of inactivity. Future research should investigate the long-term effects of these interruptions, evaluate targeted mitigation strategies, and account for sport-specific, age-related, and gender-specific factors to strengthen resilience and ensure the continuity of youth sports engagement under exceptional circumstances.

Declaration of interests: The authors report no conflicts of interest related to this study.

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