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FACTORS AND APPROACHES TO RESTORING PHYSICAL ACTIVITY IN SCHOOLCHILDREN IN THE POST-COVID-19 PERIOD: A SYSTEMATIC REVIEW

ЧИННИКИ ТА ПІДХОДИ ДО ВІДНОВЛЕННЯ РУХОВОЇ АКТИВНОСТІ ШКОЛЯРІВ У ПОСТПАНДЕМІЧНИЙ ПЕРІОД: СИСТЕМАТИЧНИЙ ОГЛЯД

Galan Y. P., Moldovan, A. D., Brazhaniuk, A. O.
Yuriy Fedkovych Chernivtsi National University, Chernivtsi, Ukraine
ORCID: 0000-0003-2856-8514
ORCID: 0000-0003-2992-8868
ORCID: 0000-0001-9422-0685

Abstracts

During the COVID-19 pandemic and in the post-pandemic period, the decline in physical activity (PA) among school-age children became more pronounced. It highlighted the need for systematic measures to support physical activity at the school and community levels. This exacerbated the risks to physical and mental health and increased the need for rapid, evidence-based solutions at the education level. At the same time, international and European policy frameworks explicitly emphasize the need to systematically promote Health-Enhancing Physical Activity (HEPA) as a resource for recovery, resilience, and long-term prevention, particularly in the educational environment.

The purpose of the study is to systematically analyse and summarize international experience on effective factors and approaches to increasing physical activity among schoolchildren aged 6–18 during the COVID-19 pandemic and in the post-COVID-19 period, identifying the most promising for adaptation and integration in the current conditions of Ukraine.

Research methods. A systematic review was performed according to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol by searching the Scopus database (TITLE-ABS-KEY) for open-access English-language articles for 2021–2024 on approaches to increasing the physical activity of schoolchildren aged 6–18 during the COVID-19 pandemic and in the post-pandemic period.

Results. The studies included in the analysis showed that in the post-pandemic (post-COVID-19) period, the recovery of physical activity among schoolchildren is uneven and does not occur automatically. Higher levels of physical activity and more favourable well-being indicators are more often associated with organized school-based forms of physical activity, an emphasis on vigorous physical activities (VPA), social and psychological support, stabilization of daily routines (sleep, reduction of screen time), and outdoor activities. In contrast, digital interventions of an informational nature without components of active involvement and support tend to have a limited effect.

Conclusions. To sustainably restore physical activity levels among schoolchildren aged 6–18 during the COVID-19 pandemic and after the easing or lifting of restrictive measures, it is advisable to implement multi-component programs in the school environment. In the post-pandemic (post-COVID-19) period, the recovery of physical activity among schoolchildren is uneven. It is most consistently supported by organized activities in the school environment, social and psychological support, normalization of sleep, and reduction of screen time.

Keywords: physical activity, school-based intervention, physical education, adolescents, schoolchildren, return to school, COVID-19, strategies, programs, digital models.

Під час пандемії COVID-19 та у постпандемічний період зниження рівня рухової активності дітей шкільного віку стало більш вираженим і актуалізувало потребу в системних заходах підтримки рухової активності на рівні шкіл і громад. Що загострило ризики для фізичного й психічного здоров'я та підвищило потребу у швидких, доказових рішеннях на рівні освіти. Водночас міжнародні та європейські політичні рамки прямо акцентують на необхідності системного просування оздоровчої рухової активності як ресурсу відновлення, стійкості та довгострокової профілактики, зокрема в освітньому середовищі.

Метою дослідження є системний аналіз та узагальнення міжнародного досвіду щодо ефективних чинників і підходів підвищення рівня рухової активності школярів 6–18 років під час пандемії COVID-19 та в постпандемічний період з визначенням найбільш перспективних для їх адаптації та інтеграції в сучасних умовах України.

Методи дослідження. Систематичний огляд виконано за керівними принципами PRISMA 2020 шляхом пошуку в базі Scopus (TITLE-ABS-KEY) англомовних статей відкритого доступу за 2021–2024 років щодо підходів до підвищення рухової активності школярів 6–18 років під час пандемії COVID-19 та в постпандемічний період.

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Результати дослідження. Включені до аналізу дослідження показали, що у постпандемічний період відновлення рухової активності школярів є нерівномірним і не відбувається автоматично. Вищі рівні рухової активності та більш сприятливі показники благополуччя частіше пов'язані з організованими шкільними формами рухової активності, акцентом на інтенсивніші навантаження, соціальною й психологічною підтримкою, стабілізацією режиму дня (сон, зменшення екранного часу) та активностями на відкритому повітрі. Натомість цифрові втручання інформаційного характеру без компонентів активного залучення й супроводу переважно мають обмежений ефект.

Висновки. Для стійкого відновлення рівня рухової активності школярів 6–18 років під час пандемії COVID-19 та в період після послаблення або скасування обмежувальних заходів, доцільним є впровадження багатокомпонентних програм у шкільному середовищі. У постпандемічний період відновлення рухової активності школярів є нерівномірним і найбільш стійко підтримується організованими заходами в шкільному середовищі, соціально-психологічною підтримкою, нормалізацією сну та зменшенням екранного часу.

Ключові слова: рухова активність, шкільні заходи, фізичне виховання, підлітки, школярі, повернення до школи, COVID-19, стратегії, програми, цифрові моделі.

Introduction. Healthy and protected children are a strategic priority for any country, and restoring and increasing the level of physical activity among schoolchildren requires special attention, given its proven contribution to physical and mental health and stress resistance, especially in the post-pandemic period after the easing of COVID-19 restrictions [14, 21, 22, 31, 44].

The World Health Organization (WHO) guidelines on physical activity and sedentary lifestyles emphasize the need for systematic provision of sufficient daily physical activity for children and adolescents, and the COVID-19 pandemic, which the WHO officially recognized as a pandemic on March 11, 2020, has exacerbated the problem of physical inactivity and unequal access to physical activity [47].

At the European Union level, the promotion of healthy lifestyles and cross-sectoral approaches to HEPA is reflected in key policy initiatives and recommendations, including the European Commission's HealthyLifestyle4All campaign [9, 17] and the Council Recommendation on promoting HEPA [9].

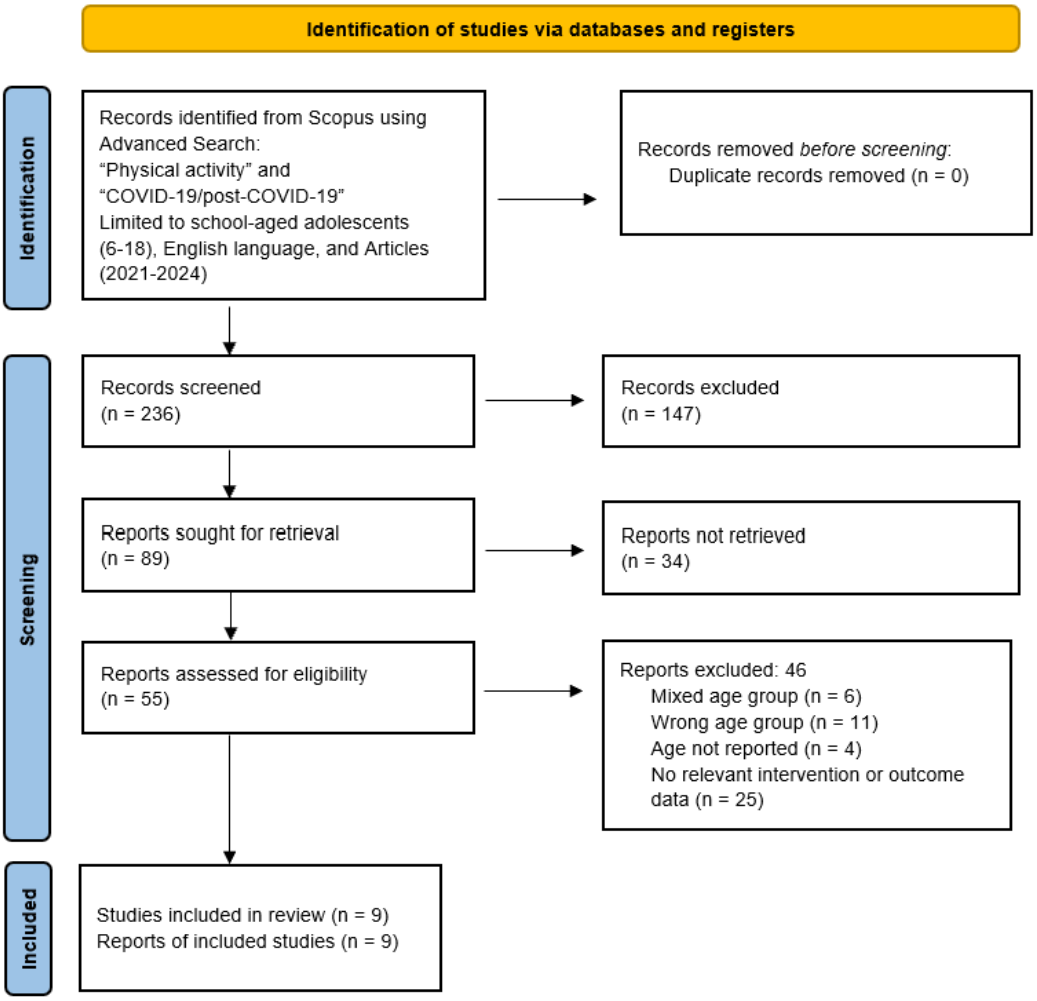

Figure 1. PRISMA 2020 flow diagram of study selection.

Table 1

Literature search strategy and parameters in the Scopus database

Parameter	**Description**
Database	Scopus
Search fields	TITLE-ABS-KEY
Search Period	2021–2024
Document Type	Article (peer-reviewed)
Date of last search	February 2026
Search concepts	(1) Physical activity/PE; (2) Adolescents/schoolchildren; (3) COVID–19 period: during COVID–19 and post-COVID–19 /post-pandemic; (4) Approaches/interventions/programs
Search Query (Scopus)	TITLE-ABS-KEY (("physical activity" OR exercise OR MVPA OR "moderate-to-vigorous" OR "physical education" OR PE) AND (school* OR "school-based" OR "after-school" OR "physical education") AND (adolescen* OR teen* OR "schoolchildren" OR "secondary school" OR "middle school" OR "high school") AND (COVID-19 OR coronavirus OR "SARS-CoV-2") AND ("post-pandemic" OR "post pandemic" OR "after COVID-19" OR "post-COVID-19" OR "post COVID-19" OR "return to school" OR "school reopening" OR intervention* OR program* OR strateg* OR initiative*)) AND PUBYEAR > 2020 AND PUBYEAR < 2025 AND NOT TITLE-ABS-KEY (lockdown OR "school closure*" OR quarantine OR "remote learning" OR "online learning") AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (LANGUAGE , "English"))

According to scientists, the level of insufficient physical activity among schoolchildren aged 6–18 remained very high, indicating the need for systematic approaches to increase it [2, 3, 19, 26, 34, 38, 45].

Physical activity is one of the most important and effective factors in maintaining physical and mental health throughout the lifespan [19, 28]. It has a positive effect on the prevention of certain diseases, such as cardiovascular disease, type 2 diabetes, etc. [5, 43, 48]. Regular physical exercise and sports are essential for maintaining physical and mental fitness [4, 21, 40, 45].

At the global level, the 2030 Agenda for Sustainable Development sets benchmarks where physical activity and sport are considered as a tool for achieving sustainable development goals [42], while the UN General Assembly separately calls for the integration of physical activity and sport into COVID-19 recovery plans [47, 48] and national sustainable development strategies [6].

In the current situation, it is relevant for European countries and Ukraine to identify and justify effective mechanisms to improve physical activity among schoolchildren aged 6–18 in the post-pandemic period following the easing of COVID-19 restrictions. Given the consistently high levels of insufficient physical activity among school-age children worldwide and the proven effectiveness of comprehensive approaches, it is vital to summarize international experience and identify the most effective practices for further adaptation to the national context. This approach is consistent with European policy on the integrated promotion of sport and physical activity in the educational environment and EU priorities regarding HEPA [1, 9, 11, 12, 15, 39, 41].

Materials and methods. This systematic review was conducted in accordance with the PRISMA 2020 guidelines [27] to ensure transparency and reproducibility of the procedures for identifying, selecting, and synthesizing scientific sources. The literature search was conducted in the Scopus database using a predefined search strategy. Selected records were exported for further processing and duplicate removal. Publications were selected sequentially through title and abstract screening and full-text evaluation according to inclusion/exclusion criteria (Figure 1).

Search strategy

The search for scientific publications was conducted in the Scopus database using the TITLE-ABS-KEY fields, Boolean operators, and predefined keywords. The search strategy, selection parameters (2021–2024), and the whole search query are presented in Table 1.

Eligibility criteria

The review included open access English-language articles indexed in Scopus, published in 2021–2024, concerning the increase in physical activity (PA) among schoolchildren aged 6–18 during the COVID-19 pandemic and in the post-pandemic period. The inclusion and exclusion criteria are summarized in Table 2.

Study Design

The study was conducted as a systematic review of scientific publications indexed in the Scopus database. The analysis included open access English-language articles in the field of physical education and sports that highlight approaches to increasing the level of physical activity among schoolchildren aged 6–18 during the period of COVID-19 pandemic restrictions and/or in the post-pandemic period after their relaxation or cancellation. The results were summarized through narrative synthesis, with the identified approaches grouped thematically.

Table 2

Inclusion and exclusion criteria for scientific sources in the systematic review

Category	Inclusion Criteria	Exclusion Criteria
Publication Type	Original peer-reviewed scientific articles	Reviews, editorials, letters, conference abstracts, protocols, books/chapters
Indexing Database	Scopus	Not indexed in Scopus
Language	English	Others languages
Access	Open access (full text available)	No full text available / Not open access
Years	2021–2024	Outside the 2021–2024 range
Participants	School-aged children/adolescents aged 6–18 (or data for this age group can be analysed separately)	Age does not match or results for the 6–18 age group cannot be isolated
Topic	Physical activity/PE/school-based and out-of-school approaches; PA factors; programs/strategies; the link between PA and mental health/well-being in the COVID-19 context.	Topics not related to PA/PE of schoolchildren in the COVID-19 context
Context	COVID-19 pandemic period or post-pandemic period	No link to the COVID-19 or post-pandemic period
Results	Presence of physical activity (PA) and/or sedentary behaviour indicators (MVPA, steps, duration/frequency, screen time as a related factor, etc.) and/or assessment of the approach/intervention to increase PA	Lack of relevant PA/sedentary behaviour indicators or no data/conclusions regarding approaches/interventions

Table 3

Characteristics of the included studies and key findings on increasing physical activity among schoolchildren in the post-COVID-19 period

Authors	Setting and Year of Publication	Type of Study	Participants (Age Range) Sex (F; M)	Conclusions
Chmelík F et al. [8]	Poland, 2023	Retrospective cross-sectional	1541 participants (15–19 years) F = 900, M = 641	The study found that during the pandemic, adolescents were less likely to meet PA recommendations and had lower activity levels. Higher life satisfaction was associated with a greater likelihood of meeting PA recommendations before and during COVID-19. The results support the emphasis on vigorous PA and organized forms of activity as potentially key to recovery. This study provides new insights into the relationship between life satisfaction and types of physical activity in educational settings before and during the pandemic.
Dong R.-B & Dou [16]	China, 2023	Two-stage cross-sectional survey	2,635 participants 12–18 years) F = 1355, M = 1280	The article compared PA levels among adolescents at different stages of the pandemic and their relationship to mental health. It showed that PA varied unevenly between subgroups (particularly by grade/gender), and that higher activity levels were associated with better mental health outcomes. The authors emphasize that girls and older grades require special attention in the post-COVID-19 period.
Ferreira Silva R et al. [18]	Brazil, 2023	Quasi-experimental study	80 participants (15–17 years) F = 26, M = 54	The study showed that a 4-week WhatsApp education program on PA did not improve physical activity levels compared to the control group. At the same time, there was a tendency toward a reduction in sedentary time in the intervention group, but without a statistically significant effect. The results show that stronger components of engagement and behavior support are needed for real change.
Galan Y et al. [20]	Ukraine, 2024	Pedagogical experiment	103 participants (12–13 years) F = 64, M = 39	Significant problems in the psychophysical condition of 12–13-year-old schoolchildren in the post-COVID period against the backdrop of war have been identified: a high risk of psychoemotional difficulties according to the SDQ (especially in boys) and a decrease in physical fitness. Statistically significant differences between articles in physical development indicators have also been recorded, emphasizing the need for individualized programs to improve physical activity and targeted psychological and pedagogical measures.

Table 3. *Cont.*

Authors	Setting and Year of Publication	Type of Study	Participants (Age Range) Sex (F; M)	Conclusions
Kopp P et al. [29]	Germany, 2024	Prospective two-wave study (6-week tracking)	170 participants (6–18 years) F = 71, M = 94, Diverse = 5	This article tracked changes in physical activity among schoolchildren after COVID restrictions were eased. It showed an increase in PA over a short observation period, while improvements in mental health were less pronounced/not as direct. The authors emphasize that school remains the leading environment for restoring and maintaining activity after periods of crisis.
Lamoneda Prieto J. et al. [30]	Spain, 2024	One-group longitudinal intervention	114 participants (16–18) F = 65, M = 49	The article evaluated the effect of school PE intervention based on Self-Determination Theory (SDT), which included the periods "normal," "lockdown (online)", and "new normal" with three measurements (T1, T2, T3). The program supported indicators of satisfaction of basic psychological needs (competence, relatedness), interest/intentions to be physically active, and life satisfaction; at the same time, the need for autonomy increased significantly after the first intervention and continued to do so (T2–T1 p = .006; T3–T1 p = .019). At the same time, during the COVID period (T3), the intention to be physically active decreased compared to T2 (p = .014).
Matteucci I & Mario C [32]	Italy, 2024	Longitudinal web-based survey (retrospective pre-COVID comparison)	952 participants (11–14 years) F = 510, M = 442	This article examined how psychological mechanisms related to physical activity change in the post-COVID-19 period. It showed an increase in "habit/identity" indicators and their connection with vigorous PA and social support. The authors conclude that for a stable recovery of PA after COVID, it is important to strengthen not only opportunities for activity, but also support and the formation of an "active person identity."
Morales F et al. [33]	Chile, 2024	Quasi-experimental pre–post (no control group)	25 participants (9–10 years) F = 12, M = 13	The study showed that a 12-week gamified PE intervention increased students' motor development. The greatest changes were observed in locomotion and manipulative skills. The results support gamification as a practical approach to enhancing motor engagement through the development of basic motor skills.
Mullhall P et al. [34]	Ireland (UK), 2024	Clustered randomised controlled feasibility trial (cRCT) + embedded process evaluation	161 participants (9–19 years) F = 43, M = 118	The Walk Buds intervention was acceptable to students and staff, and attendance at the proposed walks was 84 %, reflecting good feasibility in schools. However, during COVID-19, difficulties arose with wearing/returning accelerometers and organizational constraints, so the authors propose minor changes to the data collection procedure and program implementation before a full-scale RCT.

Data analysis

The data were summarized using narrative synthesis, given the heterogeneity of study designs, approaches, and indicators of increased physical activity during the COVID-19 pandemic restrictions and/or in the post-pandemic period after their relaxation or removal. The data obtained from scientific publications were systematized and thematically grouped into categories of approaches to increasing physical activity levels among schoolchildren aged 6–18 years. The results are presented descriptively, highlighting recurring trends and key conclusions.

Results. The analysis of the included studies, presented in Table 3, shows that researchers working with school-aged children in different countries are increasingly combining organized school-based physical activity formats. Particular emphasis is placed on influencing everyday behavioural and psychosocial factors, including limiting screen time, normalizing sleep, maintaining a daily routine, developing social support, forming the habits and identity of a physically active person, and accounting for uneven recovery across subgroups of schoolchildren

In general, the scientific publications included in the review consistently confirm that during the period of pandemic restrictions and in the post-COVID-19 recovery phase, a significant proportion of school-age children did not reach the recommended levels of physical activity, and the recovery of indicators was uneven across subgroups, with girls and older schoolchildren being particularly vulnerable.

An analysis of the generalised conclusions allowed us to identify the most common and promising mechanisms across countries: comprehensive school-based approaches combined with motivational and behavioural components.

Researchers most frequently describe the restoration of physical activity through strengthening the school component: more opportunities for movement during the school day, structured activities before, during, and after classes, and walking and extracurricular programs. An essential condition for effectiveness is supporting student engagement through motivational and behavioural mechanisms, in particular the formation of sustainable habits, an "active" identity, and social support from peers and family, sometimes using digital communication channels.

For the Ukrainian context, the most relevant approach is to combine these approaches into flexible, security-adapted school solutions that prioritize vulnerable groups and can be scaled up at the community level.

Discussion. Currently, maintaining an adequate level of physical activity (PA), particularly Moderate-to-Vigorous Physical Activity (MVPA) is considered one of the key evidence-based factors for maintaining physical and mental health, as confirmed by recent syntheses of scientific data [14; 22; 23; 45]. Physical culture and sports are an effective mechanism for restoring and strengthening the health of school-age children in post-pandemic conditions [23, 24, 25, 46].

In the post-COVID period, the restoration of adequate levels of physical activity among schoolchildren is not automatic and is uneven across different subgroups [5, 10, 20]. A significant proportion of adolescents maintain low levels of physical activity against a backdrop of increased screen time, disruptions to their daily routine, and climate change [13]. At the same time, more favourable well-being indicators are more often associated with higher physical activity and healthier daily practices, including spending time outdoors and participating in organized forms of physical activity [7, 8, 35]. At the same time, studies emphasize the importance of reducing screen time and maintaining healthy sleep as key factors associated with higher levels of physical activity and better well-being indicators [16].

Mental health should be considered a key element in the effectiveness of programs to increase physical activity in the post-COVID-19 period, particularly for vulnerable subgroups (girls and senior students). In these groups, the risks of psycho-emotional difficulties often coincide with lower activity levels [30, 36].

Schools are a leading environment for restoring and maintaining physical activity after the easing of COVID restrictions [4, 22, 29], and gamified physical education lessons can increase student engagement through the development of fundamental motor skills and demonstrate positive changes [33].

The most common mechanisms for supporting and increasing physical activity are described through the school environment as a key space for daily physical activity by expanding opportunities for movement during the school day, activities before and after school, walking initiatives, and comprehensive school models that take into account the interaction between school, family, and community [29]. An essential addition to organizational changes is the inclusion of motivational and behavioural determinants – such as habit formation, an "active" identity, and social support, which are associated with higher activity and a more stable return to physical activity practices [29, 32]. At the same time, data indicate that purely informational digital influences, without structured support for participation, may not lead to increased physical activity [18]. Walking programs require sufficient involvement and high-quality implementation; otherwise, the effect may be minimal. However, studies demonstrate their acceptability while also highlighting organizational barriers and measurement difficulties [34].

For Ukraine, the practical value of these results lies in the possibility of adapting multi-component solutions to the conditions of post-pandemic recovery, taking into account additional crisis factors (Figure 2), in particular security restrictions, which may be accompanied by increased psycho-emotional risks and a deterioration in the physical fitness indicators of schoolchildren [20].

A promising direction is the introduction of an approach with flexible implementation formats and systematic reinforcement of social support and motivational mechanisms [7, 18, 29, 37]. This creates a foundation for scalable programs that combine accessible opportunities for movement with feasibility control and monitoring of physical activity indicators.

Limitations. A limitation of the study is that the review covered only English-language peer-reviewed full-text open access publications indexed in the Scopus scientometric database (2021–2024), and the synthesis was performed using narrative synthesis due to the heterogeneity of designs and indicators, which may have affected the completeness of coverage and comparability of conclusions.

Conclusions. In the post-COVID-19 period, the recovery of physical activity among schoolchildren aged 6–18 is uneven and does not happen automatically. It is most strongly associated with the availability of purposefully organized opportunities for physical activity in the educational environment, as well as support for more intensive forms of physical activity. More effective approaches are demonstrated by multi-component interventions that combine the development of basic motor skills with motivational-behavioural mechanisms, in particular the formation of habits and a "physically active person identity," social support, normalization of sleep, and limiting screen time. At the same time, purely informational digital interventions without sufficient participant engagement do not usually lead to significant changes in physical activity levels.

The results indicate the need to develop and implement differentiated programs targeting vulnerable groups, primarily girls and high school students. In addition, a preliminary assessment of the quality of school program implementation is necessary before the scaling stage.

In the post-COVID-19 period, the most promising approaches for adaptation in schools and communities are multi-component strategies that combine a structured process with individualized physical activity programs. Such methods involve integrating psychosocial support, habit and motivation formation, as well as using gamification elements and regular reminders about the positive effects of physical activity. It is advisable to integrate them into the digital components of the school and community environment, in particular into the digital format system, teaching materials, and feedback tools. This approach will engage most participants in the educational process and bring about lasting behavioural changes in physical activity.

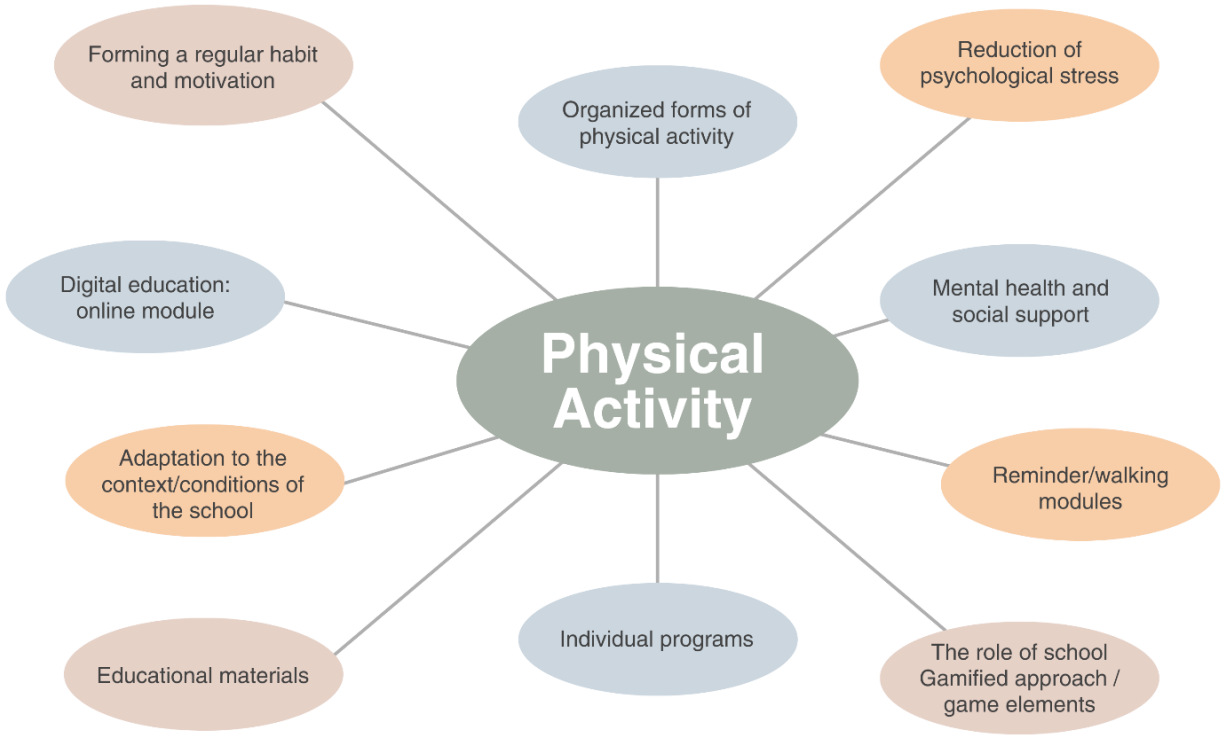

Figure 2. Conceptual model of key approaches for increasing physical activity levels among schoolchildren aged 6–18 in the post-COVID-19 period for adaptation and integration into the current Ukrainian context

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