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24-hour Movement Behaviour study—Lithuanian protocol: a comprehensive overview of behaviours and health outcomes in adolescents

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ABSTRACT

The 24-hour Movement Behaviour (24-h MovBeh) paradigm, encompassing physical activity (PA), sedentary behaviour (SB) and sleep patterns, is recognised as a holistic approach to adolescent health. It emphasises promoting PA, reducing SB and ensuring sufficient sleep, especially in school environments. Understanding the links between lifestyle factors and health outcomes is crucial for clinical and public health, informing interventions for lifestyle changes among adolescents. This study aims to assess adherence to 24-h MovBeh among Lithuanian adolescents, examining the patterns, inter-relationships and impacts on socio-demographic status, 24-h MovBeh, health-related fitness, blood pressure, body composition, dietary patterns, health-related quality of life, mental health, physical and exercise motivation, other lifestyles and health indicators, and academic performance. The 24-h MovBeh study is a prospective cohort study beginning in 2025 with baseline data collected in schools. It will recruit 500 primary and secondary school adolescents (11–14 years old) from Klaipeda and Kaunas, Lithuania. The study will evaluate 11 main categories: Socio-demographic status, 24-h MovBeh, health-related fitness, blood pressure, body composition, dietary patterns, health-related quality of life, mental health, physical and exercise motivation, other lifestyles and health indicators, and academic performance. Statistical analysis will estimate adherence to 24-h MovBeh and its inter-relationships with individual and environmental factors and health outcomes. The 24-h MovBeh study will be a crucial step towards establishing a monitoring system for health and lifestyle outcomes, benefiting researchers, policymakers, adolescents, and parents, while laying the groundwork for future intervention studies.

INTRODUCTION

Recent data from the European Observatory on Health Systems and Policies reveals that Lithuanians have one of the lowest life expectancies in the European Union.[1 2] Additionally, unhealthy lifestyle choices and environmental risk factors, such as including dietary risks, tobacco smoking, alcohol consumption and low physical activity (PA), are responsible for nearly half of all deaths in Lithuania.[1 2] Unhealthy lifestyle choices are widely recognised for contributing to adverse health conditions including metabolic syndromes like obesity and hypertension, as

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WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ The 24-hour Movement Behaviour (24-h MovBeh) paradigm which recommends high levels of physical activity (PA) (≥60min of moderate-to-vigorous PA), low levels of sedentary behaviour (≤2hours of recreational screen time) and sufficient sleep (9–11hours for children or 8–10hours for adolescents) each day, is associated with various health outcomes in adolescents. These include better health-related fitness, lower obesity-related indicators and improved mental health indicators.

WHAT THIS STUDY ADDS

⇒ Although numerous cross-sectional studies have assessed the 24-h MovBeh in adolescents demonstrating simultaneous associations between exposure and outcome, none have reported data from Lithuania. Additionally, an overall lack of longitudinal research provides evidence of the association between isotemporal substitutions in movement behaviour and adolescent health outcomes. Therefore, this is the first prospective study in Lithuania specifically designed to assess the prevalence of adherence to 24-h MovBeh among adolescents. Our cohort will also assess the patterns, inter-relationships and impacts of 24-h MovBeh on socio-demographic status, 24-h MovBeh, health-related fitness, blood pressure, body composition, dietary patterns, health-related quality of life, mental health, physical and exercise motivation, other lifestyles and health indicators, and academic performance.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ This study describes the protocol for a prospective study on 24-h MovBeh among Lithuanian adolescents. Additionally, it will facilitate the development of a monitoring system for health and lifestyle outcomes, benefiting researchers, policymakers, adolescents, and parents, while also setting the foundation for future intervention studies.

well as mental disorders such as anxiety, depression and substance abuse.[1 2] These lifestyle factors also contribute to a lower quality of life and an increased risk of premature death.[1 2] Although these adverse health conditions often become clinically apparent in adulthood, their underlying processes begin during childhood and adolescence.[3 4]

Adolescence is a period of rapid physiological and psychological development.[5 6] Previous reports have indicated that Lithuanian adolescents exhibit high rates of smoking, unhealthy dietary habits, low levels of PA and consequently, a high prevalence of obesity and mental health issues.[1 2]

Additionally, a study demonstrated that health outcomes are positively affected by movement behaviours such as those encompassed in the 24-hour Movement Behaviour (24-h MovBeh) framework.[7] The 24-h MovBeh paradigm is a useful model that might help to create new opportunities to analyse daily activities (PA, sedentary behaviour (SB) and sleep time) in complex ways to test their inter-relationships and to understand how they synergistically contribute to the health and well-being of populations including children and adolescents.[8 9]

Systematic reviews with meta-analysis have shown that time reallocation between 24-h MovBeh may be associated with health outcomes in adolescents including better health-related fitness, lower overall obesity-related indicators and better mental health indicators.[7 10 11] Although numerous cross-sectional studies have assessed 24-h MovBeh in adolescents demonstrating simultaneous associations between exposure and outcome, none have reported data from Lithuania. Additionally, there is a lack of longitudinal research providing evidence on the association between isotemporal substitutions in movement behaviour and health outcomes among adolescents.[12]

Therefore, we aim to establish the first cohort study in Lithuania specifically designed to assess the prevalence of adherence to 24-h MovBeh among Lithuanian adolescents. Additionally, our cohort will assess the patterns, inter-relationships and impacts of 24-h MovBeh on socio-demographic status, 24-h MovBeh, health-related fitness, blood pressure, body composition, dietary patterns, health-related quality of life, mental health, physical and exercise motivation and academic performance.

METHODS
Study design
This prospective cohort study will be involves students in Klaipeda and Kaunas, Lithuania and has two phases (figure 1):

Phase 1: Participants will be recruited from primary and secondary schools in these cities. Invitation letters will be sent to school headmasters or physical education teachers. Schools far from the city or lacking enough eligible students will be excluded. Headmasters will be met to confirm participation. All fifth to seventh graders will be invited, and parents will receive flyers and an invitation to an informational meeting. Informed consent will be obtained from parents/guardians at these meetings. Baseline data collection will occur from March to November 2025 on regular school days excluding holidays.

Phase 2: Follow-up evaluations will be conducted 5 years later. Communication with participants will be
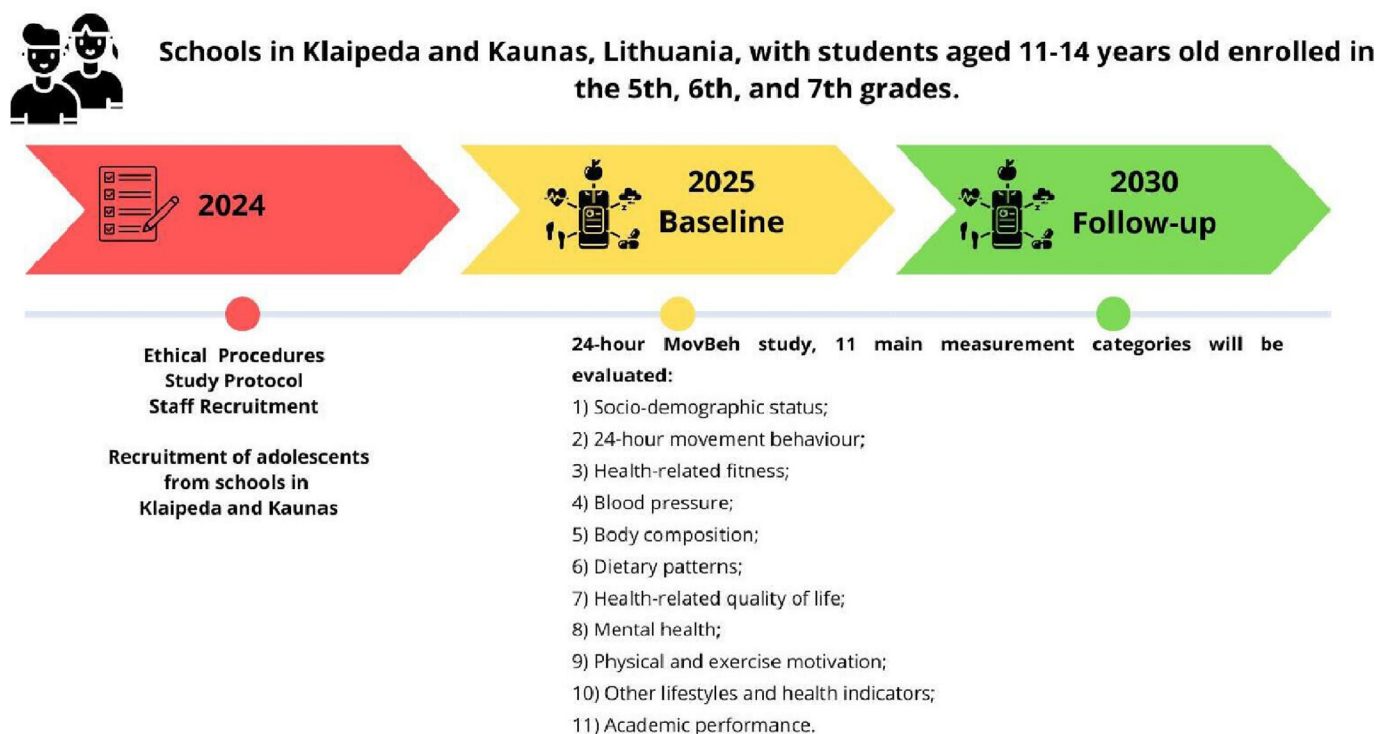
Figure 1 General procedure of the study. 24-h MovBeh, 24-hour Movement Behaviour.

maintained via phone calls and emails. Changes in 24-h MovBeh and incidence of adverse health outcomes will be re-evaluated.

Sample size

Sample size estimates were based on a significance level of α=0.05, an effect size of 0.5 and a statistical power of 0.8, with a 20% expected attrition rate. Students will be recruited from stratified schools in Kaunas (population 299 466) and Klaipeda (population 192 307). Considering a 10% annual attrition rate, the study anticipates recruiting approximately 500 adolescents and their parents.

Inclusion and exclusion criteria

Participants will be healthy adolescents from primary and secondary schools in Klaipeda and Kaunas, enrolled in fifth to seventh grades (aged 11–14 years) at baseline, with no physical, intellectual or sensory disabilities or health issues that limit PA. It will exclude subjects currently taking medications.

Data collection

Data collection will be conducted by researchers, physical education teachers and health professionals. The protocol includes both self-reported data and objective measurements. A summary of the variables analysed in the study is presented in table 1. The Lithuanian language questions are detailed in online supplemental file 1.

Outcomes measures

Socio-demographic status

Parents or guardians will complete a questionnaire that includes standardised questions on socio-demographic factors such as sex, age, birth date, place of birth and duration of residency in Lithuania.

Table 1	The variables analysed in the 24-h MovBeh study-LT	
Measurement categories	**Type**	**Outcome measurement tool and method**
Socio-demographic status	Parent-reported	Family Affluence Scale 10 by HBSC—6 questions.
The 24-hour Movement Behaviour	Objective	24-h MovBeh (physical activity, sedentary time and sleep duration) GENEActiv triaxial accelerometer
	Self-reported	Physical activity (HBSC)—1 question. Sedentary behaviour (HBSC)—3 questions. Sleep time—1 question.
Health-related fitness	Objective	Anthropometric parameters.
	Objective	Cardiorespiratory fitness—20-metre shuttle run test.
	Objective	Muscular strength— Digital handgrip dynamometer (TKK 5001, Grip-A, Takei, Japan)
Blood pressure		Blood pressure—Dynamap vital signs monitor (model BP 8800; Critikon, Tampa, Florida, USA).
Body composition		Bioimpedance analysis.
Dietary patterns	Self-reported	Based on HBSC questions—4 questions.
Health-related quality of life	Self-reported	Health-related quality of life—KIDSCREEN—10 questions.
Mental health	Self-reported	WHO-5 Well-being Index—5 questions.
		Problematic social media use—9 questions.
		Body Appreciation Scale 2-Children (BAS2-C)—10 questions.
		Body surveillance—OBC—Youth—4 questions.
Physical and exercise motivation	Self-reported	Behavioural Regulation in Exercise Questionnaire–2 BREQ-2 modified for children—12 questions.
		Basic Psychological Needs in Physical Education Scale (BPNES)—12 questions.
Other lifestyles and health indicators	Self-reported	Smoking habits—2 questions.
	Self-reported	Pubertal stage—Tanner criteria—2 questions.
	Self-reported	Nature exposure and active transportation to school—12 items.
Academic performance	Self-reported	Average grades from the last semester in three main subjects (Lithuanian, mathematics and foreign language) and the rate of overall satisfaction with academic achievement within the last semester/year—4 questions.

HBSC, Health Behaviour in School-Aged Children; 24-h MovBeh, 24-hour Movement Behaviour; LT, Lithuania; OBC, Objectified Body Consciousness.

Socio-economic status

The Family Affluence Scale 10 will be used to determine the socio-economic condition of the adolescents.[13] Based on six questions, the scale ranges from 0 to 13 points. The highest socio-economic position is indicated with a score of 13. The responses will be added together and a continuum variable will be created for statistical analysis.[13]

The 24-h MovBeh

Objective and self-report measures will assess the 24-h MovBeh. As recommended, adolescents will be considered to have met the 24-hour guidelines if, on average, they met the time-specific recommendations for PA, recreational screen time and sleep duration.

Objective measure

The objective PA measures will be derived from the raw acceleration data measured by a triaxial accelerometer worn on the waist with an elastic belt above the right hip bone, which will be utilised (GENEActiv, Activinsights, Kimbolton, UK).[14] A joint meeting will be held with researchers, parents, school representatives and teachers to familiarise all participants with the research process, measurements and accelerometer usage. Students will be instructed on how to wear the accelerometer which will begin monitoring their movement behaviour at midnight following the initial appointment. Participants will be instructed to wear the device continuously even during sleep and to remove it only if completely submerged such as during showering or swimming. An objective measure of 24-h MovBeh with accelerometyry (24 hours/day; 7 consecutive days, during weeks with a regular school schedule) complemented with caregivers' logs for contextual information (eg, time spent in screen time while in SB) and sleep quality questionnaires. The accelerometer will be set to record data at a sampling rate of 30 Hertz. Raw accelerometer data will be downloaded using software and then transformed into 10 s epoch files. The intensity threshold for PA will be determined by the cut point established by Vanhelst *et al.*[14] After 1 week, accelerometers will be collected by research team members. After completing the 24-hour monitoring and data processing, parents will receive individualised feedback through graphical sheets with explanatory comments.

Self-reported measure
Self-reported PA

The measurement of PA will be based on the following questions: 'Over the past 7 days, how many days were you physically active for a total of at least 60 minutes per day?'. Response options will range from 0 to 7 days per week in 1-day increments. PA will be defined as less than 60 min of PA per day on at least 7 days per week.[15] Also, the measurement of vigorous PA activities will be based on the following question: 'Outside school hours: how often do you usually exercise in your free time so much that you get out of breath or sweat?' The response choices ranged from every day to never.[15]

Self-reported SB

SB will be based on the following questions: How many hours a day, in your free time, do you usually spend watching TV, videos, DVDs and other entertainment on a screen?, How many hours a day in your free time, do you usually spend playing games on a computer, games console, tablet (like iPad) or smartphone or other electronic devices (not only including moving or fitness games)?, How many hours a day, in your free time, do you usually spend using electronic devices such as computers, tablets (like iPad) or smartphones for other purposes, for example, homework, emailing, tweeting, Facebook, chatting, surfing the internet?[16] The total daily sedentary screen time will be determined by summing the durations of various daily screen time activities.[16] Additionally, total screen time for both weekdays and weekends will be calculated.[16]

Self-reported sleep time

Sleep time will be based on the following question: 'How many hours do you usually sleep per day on average (including sleep at night and during the day?'[17]

Health-related fitness
Anthropometric parameters

Standing height will be measured in bare feet using a SECA 213 stadiometer (Hamburg, Germany). Participants will be instructed to stand with their heels together and touch the base of the vertical measuring column with their back straight and their head positioned in the Frankfurt horizontal plane.[18] The standing height will be recorded to the nearest 0.1 cm. Sitting height will be measured using the SECA 213 stadiometer and a wooden box. Body weight will also be measured in bare feet and light clothing using a SECA electronic scale (Scale 869) and recorded to the nearest 0.1 kg.[18] Body mass index will be calculated by dividing the weight in kilograms by the square of height in metres. Waist and hip circumferences will be quantified in duplicate employing a non-elastic anthropometric tape positioned horizontally while participants stand upright. The waist circumference measurement will occur directly on the skin, locating the minimal girth between the inferior margin of the rib cage and the iliac crest, following a normal exhalation.[19] The hip circumference will be ascertained at the buttocks' maximal protrusion. These measurements will be documented with a precision of one millimetre. Should the discrepancy between the initial two measurements exceed three centimetres, a tertiary measurement will be conducted and the two most proximal values are subsequently averaged for analysis.[18]

Cardiorespiratory fitness

Cardiorespiratory fitness will be evaluated using the 20-metre shuttle run test,[20] a widely used method for assessing cardiorespiratory fitness in adolescents. During

this test, participants run back and forth between two lines 20 metres apart. The test begins at a running speed of 8.5 kilometres per hour and increases by 0.5 kilometres per hour every minute until it reaches 18.0 kilometres per hour at the 20th minute. Each speed change is indicated by audio signals played on a tape player. Participants are instructed to maintain the pace until they cannot continue. The test concludes if the participant fails to reach the end lines in synchronisation with the audio signals on two consecutive occasions or if they voluntarily stop due to fatigue. Throughout the test, participants will receive verbal encouragement from the investigator to strive for maximal performance. The test will be performed once and the number of shuttles completed by the participant will be recorded. This data will be then used to calculate maximal oxygen consumption using the Léger equation. Participants will be classified as fit or unfit.[20]

Muscle strength
Muscle strength will be measured using a handgrip dynamometer (TKK 5001, Grip-A, Takei, Japan) with adjustments for each adolescent's sex and hand size.[20] Participants will be instructed to stand with their arms fully extended, gradually and continuously squeezing the handgrip until they reach their maximum strength, maintaining the pressure for at least 2 seconds. The test will be repeated twice with participants alternating hands each time. The highest score achieved for each hand will be recorded in kilograms.[20] The handgrip score (in kilograms) will then be calculated as the average of the left and right scores and expressed relative to the participant's body weight.[20]

Blood pressure
The blood pressure will be assessed using a Dynamap vital signs monitor (model BP 8800; Critikon, Tampa, Florida, USA). An appropriately sized cuff will be used for each participant. Trained nurses will take measurements. The European Society of Hypertension-ESH 2016 guidelines for hypertension staging criteria in children and adolescents will be applied.[21]

Body composition
Body composition will be measured by the Smart Full Body Composition Analyser Scale 2020.[22]

Dietary patterns
Dietary patterns will be based on the following questions: 'How many times a week do you usually eat fruits?' 'How many times a week do you usually eat vegetables?' 'How many times a week do you usually eat sweets?' and 'How many times a week do you usually drink coke/soft drinks?.'[15]

Health-related quality of life
The health-related quality of life will be assessed using the KIDSCREEN 10-item quality of life. The scale reflects physical and mental health-related quality of life in children and adolescents.[23]

Mental health
Well-being
Well-being will be assessed by the WHO Five Well-Being Index.[15] This questionnaire consists of 5 items. The answers are ranged on a Likert scale from 1 (sometimes) to 5 (all the time).[15]

Problematic social media use
Problematic social media use will be assessed by the following questions: 'In the past year, you: (1) Do you constantly notice that you can't think about anything else but the moment when you will be able to use social networks again (Facebook, Instagram, TikTok and others)?; (2) Do you constantly feel dissatisfied because you want to spend more time on social networks (Facebook, Instagram, TikTok and others)?; (3) Did you often feel bad when you could not use social networks (Facebook, Instagram, TikTok, etc)?; (4) Have you tried to spend less time on social networks (Facebook, Instagram, TikTok, etc) but failed?; (5) Do you often use social networks (Facebook, Instagram, TikTok, etc) to escape from negative feelings?; (6) Are you constantly arguing with others because you use social networks (Facebook, Instagram, TikTok, etc)?; (7) Do you constantly lie to your parents or friends about how much time you spend on social networks (Facebook, Instagram, TikTok, etc)?; (8) Did you regularly neglect other activities (eg, hobbies, sports) because you wanted to use social networks (Facebook, Instagram Facebook, Instagram, TikTok, etc)? and (9) Have you had serious conflicts with your parents and siblings due to the use of social networks (Facebook, Instagram, TikTok, etc)?'[15] Answer options will be Yes or No.[15] Additionally, we will apply the question, 'How often do you upload photos or videos of your face or body to social networks, follow their 'times' and comments, and respond to them?' Answer options will be 0—I do not use social networks; 1—never, 2—rarely, 3—sometimes, 4—often, 5—always.

Positive body image
Positive body image will be assessed by the Lithuanian version of the Body Appreciation Scale 2-Children.[24] The scale is unidimensional and consists of 10 items. The answers on a Likert scale range from 1 (never) to 5 (always). The answers are summed and averaged. The higher score indicates higher body appreciation.[24] The psychometric properties of the Lithuanian questionnaire for adults are good. The children's version of the instrument will be used for the first time and the psychometric properties will be assessed in the present study.

Body surveillance
Body surveillance will be assessed by the Objectified Body Consciousness—Youth.[25] The scale consists of four items. The answers are rated on a 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher scores

indicate higher body surveillance. The Lithuanian version will be used for the first time in adolescents and psychometric properties will be assessed.

PA and exercise motivation

Satisfaction of basic psychological needs during physical education: Satisfaction of basic psychological needs during physical education will be assessed by the Basic Psychological Needs in Physical Education Scale.[26] The 12-item self-report measure includes three subscales and measures autonomy, competence and relatedness. Participants will be asked to provide their responses on a 7-point Likert scale ranging from 1 (I do not agree at all) to 7 (I completely agree) with the midpoint of 4 (I moderately agree). The higher score reflects the greater satisfaction of the autonomy, competence and relatedness needs during physical education. The Lithuanian version will be used for the first time in adolescents and psychometric properties will be assessed.

Motivation quality will be assessed by the Behavioural Regulations in Exercise Questionnaire-2.[19] The scale consists of 12 items reflecting intrinsic, identified, introjected and extrinsic forms of behavioural regulations. Items of the scale will be scored using a 5-point Likert-type scale: 1 (not true for me) to 5 (very true for me). The Lithuanian version of the original scale showed good psychometric properties used in adolescents.

Other lifestyles and health indicators
Smoking habits

Adolescents will be asked to state the number of days they had smoked in the last 30 days, the number of cigarettes per week ('every day', 'at least once a week but not every day', 'less than once a week' and 'I do not smoke') and the frequency of smoking in the last 30 days ('not at all', 'less than one cigarette per week', 'less than one cigarette per day', '1–5 cigarettes per day', '6–10 cigarettes per day', '11–20 cigarettes per day' and 'more than 20 cigarettes per day').[16] Individuals who have never smoked will be categorised as exhibiting ideal smoking behaviour.

Pubertal stage

Participants will self-assess their pubertal stage based on secondary sex characteristics including breast and pubic hair development for girls and genital and pubic hair development for boys using the criteria established by Tanner and Whitehouse. These stages range from I to V indicating varying degrees of pubertal development.[27]

Nature exposure and active school transportation

Exposure to nature and active transport to school will be assessed using the scale of natural environment domains, measures of active commuting to and from school and the frequency of use of various means of transport.

Academic performance

Academic performance will be based on the following questions "How are average grades from the last semester in three main subjects: Lithuanian, Mathematics and a foreign language?' and 'How is the overall satisfaction rate with academic achievement within the last semester/year?'

Standardisation, harmonisation, management

The fieldwork process will be standardised during both the feasibility and follow-up phases of the 24-h MovBeh study. Workshops will be conducted to harmonise questionnaires, anthropometric measurements, PA assessments, fitness evaluations, and 24-h MovBeh assessments using accelerometers. A general workshop in Klaipeda at the beginning of 2025 will set a framework for sampling and data collection, with all responsible personnel attending. A detailed manual will guide participating research schools, outlining data collection methodologies, instrument descriptions, and data entry protocols to minimise errors. Standard protocols for quality control and initial data cleaning will be implemented. A central database and protocol for anonymous data cross-linkage and analysis will be developed. The project will collaborate with the Municipal Public Health Bureau and teachers' associations in Klaipeda and Kaunas to ensure school and teacher involvement and adequate sample sizes. The project will adapt to study needs and use social media for broader engagement. Results will be shared through international seminars, conferences, and reports to the Lithuanian Ministry of Health and Local Public Health Office, involving adolescents, parents, and stakeholders.

Consent and data protection

Consent will be obtained in accordance with the Helsinki Declaration and children's rights will be protected under the United Nations Convention on the Rights of the Child.

To ensure confidentiality and security, identifiable personal details will be kept separate from research outcomes using distinct computing systems and unique identifiers. Original datasets will be securely stored with encryption for backups, and access will be restricted to authorised personnel only. Participants will provide explicit consent for future contact to receive feedback on their physical and psychological assessments and for further analysis.

Statistical methods

Accelerometry data will be processed using GENE-Activ Software, employing standard procedures and age-appropriate cut-off points for PA intensities. Novel statistical methods will analyse 24-h MovBeh data focusing on intrinsic and synergistic associations between 24-h MovBeh and health outcomes. These methods offer clear advantages over traditional regression approaches by considering how variables are proportionally linked. Mixed models, time-lagged models and models of change will be applied to explore the relationships between diet, 24-h MovBeh and health indicators while accounting for potential confounders.

DISCUSSION

The 24-h MovBeh study in Lithuania aims to build a comprehensive database and generate evidence on the links between 24-h MovBeh and health indicators and quality of life. It will support future research by developing a database of health-related outcomes. The study will assess how PA, SB and sleep in school settings impact adolescents' metabolic health and well-being. It will also explore the relationship between the 24-h MovBeh and metabolic health factors such as body composition, blood pressure, nutritional status and psychological well-being. Additionally, the study seeks to identify personal, familial and environmental factors affecting cardiometabolic health and psychological well-being in Lithuanian adolescents.

Considering the constituent parts of the 24 hours, any change in one behaviour is necessarily done at the expense of the other making these components of the day time-dependent. However, movement behaviours have traditionally been assessed and promoted in isolation, ignoring the intrinsic and empirical interactions between them.[7 9] Yet, examining the evidence and prevalence of the combination of the behaviours that compose the 24 hours is the key to better understanding the complexity of the clustering and interactions of these behaviours and their health effects.[7 9] Based on these findings, the 24-h MovBeh Study will offer a comprehensive framework for integrating 24-h MovBeh into a unified approach. It will elucidate the inter-relationships between 24-hour movement patterns, individual and environmental factors and health outcomes in Lithuanian adolescents.

The assessment of 24-h MovBeh, encompassing PA, sedentary time and sleep duration, provides a comprehensive view of adolescent lifestyles and their impacts on health-related quality of life and mental health. A recent systemic review and meta-analysis summarised the studies on 24-hour movement guidelines among children and adolescents. Among the 39 studies included,[12] adherence to all three guidelines was positively associated with adiposity, cardiometabolic health, mental and social health, physical fitness, health-related quality of life, academic achievement, cognitive development, perceived health, dietary patterns and myopia. However, the authors emphasise the need for longitudinal and experimental studies to deepen our understanding of how these 24-hour movement guidelines relate to health indicators which will help refine and improve these guidelines.

This holistic approach recognises the interconnected nature of PA, SB and sleep and their cumulative effects on adolescent well-being. The findings from the 24-h MovBeh study will help determine the optimal balance between these behaviours to improve health-related quality of life and mental health in adolescents. Previous studies have highlighted that higher levels of PA and adequate sleep are consistently associated with better health outcomes including improved mood, greater self-esteem and lower levels of depression and anxiety.[7 9] Conversely, excessive SB, particularly screen time, is linked to poorer mental health outcomes including negative body image and reduced quality of life.[7 9] Finally, the present study will assess the impact of the basic psychological needs satisfaction during physical education on children's 24-h MovBeh and other outcomes. No studies up to date assessed motivation for physical education using the 24-h MovBeh paradigm.

The 24-hour MovBeh study will advocate for integrated guidelines that promote regular PA, SB, and ensure adequate sleep, all to improve adolescents' mental and physical health. The goal is to establish a monitoring system that tracks health and lifestyle outcomes, which will be beneficial to epidemiologists, policymakers, educators, and the general public. Furthermore, the study aims to provide data to enhance the training of teachers and public health specialists, thereby supporting more informed decision-making within schools.

The project aims to comprehensively understand adolescent health needs and their relationship with 24-h MovBeh, generating new evidence on this topic in Lithuanian adolescents. Results will be disseminated through academic publications, conferences, workshops and digital platforms to promote evidence-based interventions and healthy lifestyle practices for preventing chronic diseases among adolescents.

Contributors RES (https://orcid.org/0000-0002-5518-3479)—Substantial contributions to the conception or design of the work AND drafting the work final approval of the version to be published. GM (https://orcid.org/0000-0002-7800-2212)—Substantial contributions to the conception or design of the work AND revising it critically for important intellectual content AND final approval of the version to be published. VD (https://orcid.org/0000-0001-6959-1310)—Substantial contributions to the conception or design of the work AND revising it critically for important intellectual content AND final approval of the version to be published. RJ (https://orcid.org/0000-0001-5950-0884)—Substantial contributions to the conception or design of the work AND revising it critically for important intellectual content AND final approval of the version to be published. MB (https://orcid.org/0000-0002-9819-2316)—Substantial contributions to the conception or design of the work AND revising it critically for important intellectual content AND final approval of the version to be published. CA-S (https://orcid.org/0000-0001-9104-9042)—Substantial contributions to the conception or design of the work AND revising it critically for important intellectual content AND final approval of the version to be published AND agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The author, CA-S, is guarantor.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval The study protocol, procedures and data protection methods have been approved by the Ethics Committee of the University of Klaipeda (STIMC-BTMEK-02 2024).

Provenance and peer review Not commissioned; externally peer reviewed.

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