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SCHOOL-BASED UNIVERSAL PREVENTION OF SUBSTANCE USE AND ADDICTIONS IN HUNGARY

PhD thesis

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List of Abbreviations

APA	American Psychiatric Association
BEP	Balassagyarmat Health Education Program
CBT	Cognitive Behavioral Therapy
CG	Control Group
CI	Confidence Interval
COM-B	Capability-Opportunity-Motivation-Behavior
COREQ	Consolidated Criteria for Reporting Qualitative Research
COVID-19	Coronavirus Disease 2019
DFFITS	Difference in Fits
ESPAD	European School Survey Project on Alcohol and Other Drugs
EU	European Union
GEE	Generalized Estimating Equations
HBSC	Health Behaviour in School-aged Children
HHP	Holistic Health Promotion
HTP	Heated Tobacco Products
ICD-11	International Classification of Diseases 11th Revision
IG	Intervention Group
LR	Likelihood Ratio
MD	Mean Difference
OECD	Organisation for Economic Co-operation and Development
OR	Odds Ratio
PPS	Percentage Points
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RCT	Randomized Controlled Trial
SEL	Social-Emotional Learning
SES	Socioeconomic Status
SHE	Schools for Health in Europe Network Foundation
TREND	Transparent Reporting of Evaluations with Nonrandomized Designs
WHO	World Health Organization

1 Introduction

School is an important and multifaceted setting for health promotion. Substance use prevention has long been, and still is, a priority in schools. New challenges have emerged with the introduction of novel nicotine delivery systems or psychoactive substances, while cigarette and alcohol use among school-age children remains prevalent – alarmingly, the latter is increasing. At the same time, the use of digital technology has also become widespread. The use of the internet, smartphones, social media, or gambling and gaming are also behaviors with addictive potential. Technology use begins before school age and continues to rise, with addiction-like use patterns among school-aged children showing an increasing trend. Existing evidence indicates that both substance and technology use behaviors can lead to a range of adverse health and academic outcomes, underscoring the need for further public health investigation and interventions. This thesis aims to contribute to this work, with a particular focus on the Hungarian context, by providing an overview of current school-based prevention and expanding knowledge about evidence-based interventions.

1.1 Substance and Technology Use and Addictions in the Underage Population

The underage population requires special attention regarding substance and technology use behaviors (terms referring to all usage patterns, excluding addiction in this thesis), which typically begins in this age group (ESPAD Group, 2020), bearing the risk of several negative consequences, including the development of addictions to these behaviors (Belisle & Dixon, 2020). Technology use encompasses social media, smartphone, and internet use, and also gaming and gambling in this thesis, as these activities are primarily performed online or through digital devices within this age group (Derevensky et al., 2019).

1.1.1 Health Consequences and Other Associates

Developing addiction is a common risk of substance and technology use. Addiction is a mental and behavioral disorder in which the repetition of a particular behavior over a longer period, caused by dependence, results in significant impairment (WHO, 2024). Additional characteristics include a reduced ability to control the behavior, an increasing priority of the behavior at the expense of other previously personally important activities, continuation despite adverse consequences, tolerance (the need for higher doses or more intense experiences to achieve the desired effect) and the appearance of withdrawal

symptoms (e.g., cravings) when the behavior is blocked, causing distress that motivates repeated engagement in the behavior (Koronczai & Demetrovics, 2015). In the International Classification of Diseases 11th Revision (ICD-11), the two main categories of addiction are substance dependence, in which a psychoactive substance causes dependence, and disorders due to addictive behaviors (or behavioral addictions), which are based on behaviors with reward-inducing capacities (WHO, 2024). Behavioral addictions encompass gambling and gaming disorders in ICD-11, involving both online and offline activities. Several researchers argue that other, novel forms of technology use, not yet included in diagnostic schemes, such as smartphone or social media use, are also behaviors of addictive potential (Kardefelt-Winther et al., 2017). Internet addiction is being considered as a possible new diagnostic category, shown by its appearance in the Appendix of the 5th edition of the Diagnostic and Statistical Manual of Mental Disorders of the APA (American Psychiatric Association, 2013). 'Problematic use' is the term frequently applied to technology use showing characteristics of addiction without a diagnostic category, or signifying positive screening results for behavioral addiction (Boniel-Nissim et al., 2024). In this thesis, addictions refer to both substance dependence and the abovementioned behavioral addictions related to technology use.

Substance use, even without dependence, can cause health harm to both the user and others. When harm is already detectable, it is called harmful use in ICD-11, and such health consequences typically occur in cases of substance dependence as well (WHO, 2024). These include health problems resulting from intoxication-related behaviors, which are often caused by increased risk-taking under the influence of the substance. Injuries from accidents or fights related to substance use are frequent among young people (Thomasius et al., 2022). The health harm can be caused by a harmful route of administration (e.g., blood-borne infections related to intravenous drug use), or the toxic effects of the substances (e.g., intoxication) as well. As an example, cannabis use was reported as a cause of psychosis, suicide attempts, and depression (Marconi et al., 2016; Silins et al., 2014; Thomasius et al., 2022). The latter may also be caused by tobacco use or experimentation with drugs, and a higher intensity of substance use increased the strength of association (Bozzini et al., 2021; Esmaeelzadeh et al., 2018). Both alcohol, nicotine, and cannabis use are described to disrupt brain development and cognitive functions in an age-sensitive manner, where earlier onset typically signifies a higher risk

(Fadus et al., 2019; Spear, 2015; Thomas et al., 2013). For cannabis, this relationship again showed a dose-response pattern. Problematic gaming and smartphone use were also associated with mental health problems (Derevensky et al., 2019).

When the risk of future health harm exists but serious health consequences have not yet appeared, it is considered hazardous use, which applies to substance use, gambling, and gaming in ICD-11 (WHO, 2024). Tobacco, alcohol, and drug use were all described to be antecedents of risk behaviors, such as aggression, criminality, and unsafe sex (Bozzini et al., 2021; Thomasius et al., 2022). Both nicotine and cannabis use were reported to be risks of developing substance dependence later in life, and the risk was higher if the first encounter occurred at a younger age (Fadus et al., 2019; Ren & Lotfipour, 2019; Silins et al., 2014; Thomasius et al., 2022). No safe level of alcohol use or smoking could be distinguished (Anderson et al., 2023; Hackshaw et al., 2018). Health risks associated with technology use were lower physical activity, problems with sleep quality, vision, or muscle pain, and aggressive behavior was linked to gaming disorder (Derevensky et al., 2019).

The public health relevance of the above detailed possible consequences is underlined by the fact that transport injuries were the leading causes of death among youth in 2013 globally, of which the leading risk factor was alcohol use; while the primary causes of disability were mental health disorders and substance misuse for young people, and among the leading risk factors unsafe sex, alcohol and drug use were listed (Mokdad et al., 2016).

Among further consequences, lower school attainment or dropout were reported for substance use (Silins et al., 2014; Thomasius et al., 2022), and some evidence also pointed to problematic gaming and smartphone use as reasons for poorer school performance (van den Eijnden et al., 2018), with earlier smartphone ownership leading to worse results (Gerosa et al., 2024). Technology use, although offering several benefits and opportunities, involves risks of experiencing violent content and misinformation, unhealthy marketing, being bullied, and privacy issues (OECD, 2021a). Some positive associates were also found: social support and relationship with peers were better among children who smoked, used alcohol frequently, or were characterized by non-problematic but heavy gaming or social media use (Frobel et al., 2022; van den Eijnden et al., 2018).

Given the wide range of adverse health consequences related to substance use, including addiction, and addiction being a definite health risk related to technology use, this thesis focuses on ways to prevent the onset, delay, or reduce substance use and prevent the development of addictions to both substances and technology at an early age is a public health priority. As a first step, an epidemiological overview is provided.

1.1.2 Epidemiology

Substance use, such as smoking, e-cigarettes, alcohol, and cannabis use, can be detected as early as lower secondary school and increases significantly by upper secondary school. Data from the Health Behaviour in School-aged Children (HBSC) study 2021/22 show that 4% of 11-year-olds have tried cigarettes in their lifetime and 2% have smoked currently (in the past month), outgrown by similar indicators for e-cigarettes use (5%, 3%) and alcohol use (15%, 6%) in Europe, Central Asia and Canada (Charrier et al., 2024). At age 11, 2% reported being drunk both at least twice in their lifetime and at least once in the last 30 days. These indicators exhibit a 2-5-fold increase by age 13 and a 4-20-fold increase by age 15, with the largest changes in drunkenness and current e-cigarettes use. Cannabis, the most widely used illicit drug, was reported to be used for the first time at age 13 or younger in 2.4% among 15-16-year-olds who had ever used it in Europe (16%), and current use reached 7.1% according to the European School Survey Project on Alcohol and other Drugs (ESPAD) results (2020). Additionally, the lifetime prevalence of new psychoactive substance use was 3.4% in the same study. Regarding dependence, although nicotine and alcohol showed higher addictive potential, the transition from substance use to dependence appeared to be sufficiently fast (< 5 years) to screen for it among school-age children only in the case of cannabis (Lopez-Quintero et al., 2011). Overall, 4% of 15-year-olds were detected to be at risk for cannabis dependence in 2020 in Europe, with higher rates among boys (ESPAD Group, 2020).

Trends vary across substances, and new types of substance use are emerging. Rates of smoking declined; however, rates of alcohol use decreased only among boys, and cannabis remained largely stable over the past 4 years of the HBSC study, including the time of the coronavirus disease 2019 (COVID-19) pandemic (Charrier et al., 2024). On the other hand, the global trend of e-cigarettes showed an increase among adolescents (Njie et al., 2023). Additionally, the use of heated tobacco products (HTP) and nicotine pouches has also appeared in Europe. Alarmingly, younger age groups experimented

more with these, and when HTP rates were measured with smoked tobacco products, the declining trend of the latter was reversed (European Commission, 2024; WHO, 2020). For new psychoactive substances, the advent of which caused great concern in the past decades, some evidence suggests that the rate is at least not increasing in Europe (ESPAD Group, 2020). The traditional gender gap in substance use (with boys dominating) disappeared; moreover, the trend reversed for older girls in many cases, except for illicit drug use (Charrier et al., 2024).

In the last decade, intensive technology use has also become prevalent, which emerges earlier than substance use, shows higher rates in lower secondary school, and in most cases, continues to increase in upper secondary school. The onset of smartphone use was estimated around 4 years of age (with a decreasing trend), and ownership was recorded to begin around the age of 10 in some recent studies (Gerosa & Gui, 2023; Park & Park, 2021). However, the latest data from the United Kingdom show that a quarter of 3-4-year-olds already owned a device (Statista, 2024), and in Wales, almost one-third of 7-8-year-olds used social media, and more than 60% played computer games regularly (Donaldson et al., 2023). Thirty-one percent of 11-year-olds were in continuous online contact with their friends and others throughout the day, which showed an 8-percentage-point increase to age 15 based on the HBSC study 2021/22. This change was mainly due to the increasing tendency of girls to be in continuous contact with their close friends. More than one-fourth of girls and almost half of boys played games daily at age 11; however, it only increased among boys till the age of 13. Additionally, in 2020, more than one in five 15-year-olds in Europe gambled for money in the last 12 months, and almost 8% did so online, with male dominance (ESPAD Group, 2020). Problematic use of technology was also detected in school-age children, sometimes at higher rates. More than 10% demonstrated problematic social media use (showing an increasing trend from 2018) and gaming (with the dominance of girls for the former and boys for the latter), between 1.5–8.2% for problematic internet use (De-Sola Gutiérrez et al., 2016; Weinstein & Lejoyeux, 2010) and 1.4% for problem gambling (ESPAD Group, 2020). Notably, estimates can vary considerably depending on the measures used, and this is due to the lack of standardized diagnostic criteria, cut-off values, and definitions of addiction (Throuvala et al., 2019).

Technology use behaviors have only begun to be systematically monitored in international surveys, but there is some evidence of their increasing trends (Boniel-Nissim et al., 2024; Burns & Gottschalk, 2019; Odgers & Jensen, 2020). COVID-19 may have contributed to this increase (Kovačić Petrović et al., 2022). As a next step towards prevention, risk and protective factors are detailed in the next section.

1.2 Shared Risk and Protective Factors for Substance Use and Addictions

Substance use behaviors among underage people and substance/behavioral addictions are all multifactorial conditions, occurring in the case of the predominance of risk factors. These conditions share numerous risk and protective factors that can be related to the individual, the family, the school, or the community.

Regarding individual-level risks, several genetic predispositions of addictions are described, including those affecting the brain's reward system, which can manifest in Reward Deficiency Syndrome. This condition, characterized by hypodopaminergia (lower levels of dopamine release to ordinary stimuli), is suspected to underlie a wide range of addictions, which could explain the frequent co-occurrence of different substance and behavioral addictions, described below as well (Blum et al., 2022). Further examples of shared risks of substance use and addictions related to the individual's mental well-being are loneliness; existing substance use (especially from an early age) or the presence of mental health issues like addiction, behavior or conduct problems, depressive symptoms, anxiety, attention deficit and hyperactivity, and aggressive behavior; specific personality traits, for example, impulsivity and sensation or novelty-seeking (which together predispose risk-taking); and poorer social competence, involving problem-solving, decision-making, self-control, impulse control, emotion regulation (in which drugs or rewarding behaviors are used as an escape from unpleasant feelings), and self-esteem (Bozzini et al., 2021; Busch & McCarthy, 2021; De-Sola Gutiérrez et al., 2016; Derevensky et al., 2019; Griffin et al., 2001; Kelly & Leung, 2021; Koo & Kwon, 2014; Lam, 2014; Lochman & Wells, 2002; Lozano-Blasco et al., 2022; Nawi et al., 2021; Paulus et al., 2018; Peeters et al., 2018; Ren & Lotfipour, 2019; Romer et al., 2024; Silins et al., 2014; Spear, 2015; Wartberg et al., 2021; Weinstein & Lejoyeux, 2010). Steep delay discounting, a phenomenon related to both impulsivity and decision-making processes and referring to the tendency that an individual values more immediate small rewards over delayed larger ones, is also characteristic of both addiction types (MacKillop

& Ray, 2018; Weinsztok et al., 2021). The male gender can represent a higher risk of illicit drug use and problem gaming and gambling, while the female gender carries a higher risk of problems with social media use and alcohol and nicotine use (Boniel-Nissim et al., 2024; Charrier et al., 2024; ESPAD Group, 2020). On the other hand, enhanced social competence, including assertiveness (Evren et al., 2014; Lozano-Blasco et al., 2022), effective coping (Das et al., 2016; Koo & Kwon, 2014; Throuvala et al., 2019), and resilience (Derevensky et al., 2019; Robertson et al., 2018; Zeleeva & Petrova, 2016) can be listed among shared protective factors.

Family-related problems can also increase risk, such as experience of maltreatment, attachment problems, absence of a parent, low parental control, low parental education, and substance use in the family (Bozzini et al., 2021; Derevensky et al., 2019; Lozano-Blasco et al., 2022; Nawi et al., 2021; Paulus et al., 2018; Weinstein & Lejoyeux, 2010). Higher family affluence may increase the risk for e-cigarettes and alcohol use, but not for smoking and cannabis use (Badura et al., 2024; Boniel-Nissim et al., 2024). Generally, lower socioeconomic status (SES) of the family was described as a risk for the development of substance dependence (Thomasius et al., 2022); however, there is evidence on high SES being a risk for alcohol and drug use (Humensky, 2010) and higher family income for problematic smartphone use (De-Sola Gutiérrez et al., 2016; Fischer-Grote et al., 2019). At the same time, family cohesion, parental attention, and secure attachment can decrease the risk (Bozzini et al., 2021; Derevensky et al., 2019).

Among community or school-related risk factors, high perceived drug accessibility, substance use among friends and peers, low school connectedness, and poor academic performance can be mentioned (Bozzini et al., 2021; Derevensky et al., 2019; Lozano-Blasco et al., 2022; Nawi et al., 2021). However, among protective factors are academic motivation, school engagement, successful adjustment to school, and positive school climate, along with effective anti-substance policy (Bozzini et al., 2021; Das et al., 2016; Derevensky et al., 2019; Dunne et al., 2017; Koo & Kwon, 2014; Lozano-Blasco et al., 2022).

1.3 School-Based Universal Substance Use and Addiction Prevention Programs

Regarding the onset of these behaviors, prevention of substance use and addictions needs to begin during school years. The school represents an ideal setting for prevention and health promotion programs for children (Pulimeno et al., 2020; WHO & UNESCO,

2021), of whom the majority can be reached during the years of compulsory education (European Commission: European Education and Culture Executive Agency et al., 2022). The use of the World Health Organization's (WHO) 'whole school' approach (WHO & UNESCO, 2021) is recommended for school health promotion, including the prevention of substance use and addictions, and points out that schools can link efforts targeted at the family and the community too. This approach includes making school a health-promoting setting where the well-being of the whole school community is supported by healthy social norms and environment. Such an approach targets all students, and thus can be called universal (Gordon, 1983). The European recommendations for substance use prevention (EMCDDA, 2019), in line with the United Nations International Standards on Drug Use Prevention (UNODC & WHO, 2018), include school-based universal activities. The Council of Europe's (n.d.) Digital Citizenship Education program, and OECD (Organisation for Economic Co-operation and Development) policy recommendations (2024b) also include school-based elements, where teachers can engage children in classroom activities to help them acquire the skills they need for healthy technology use. However, at the time of writing this thesis, I have been unable to find similar recommendations for Europe that include specific measures to prevent addictions related to technology use. At the same time, the European Union (EU) Digital Services Act was enacted to ensure the privacy and safety of minors online, and it identifies addiction as a potential risk (European Parliament & Council, 2022). Lastly, the European Commission's (2014) policy for preventing online gambling among minors also includes regular educational activities but provides no further practical details.

This thesis focuses primarily on school-based universal programs, justified by the fact that substance and technology use is widespread among school-aged children (as shown in Section 1.1.2). School-based universal programs have shown effectiveness in preventing substance use and addictions and could additionally reduce inequalities (Das et al., 2016; Moore et al., 2015; Throuvala et al., 2019). The recommendations (described above) also support the use of universal programs, partly because they avoid stigmatizing the vulnerable (EMCDDA, 2019), and can help shape norms (WHO & UNESCO, 2021). However, the value and need for selective (involving only subgroups) and indicated (targeting those with non-negative screening results) interventions are acknowledged, as these may show greater effectiveness, e.g., in preventing substance use among older

adolescents (Onrust et al., 2016). Moreover, universality may not always be sufficient to ensure equal benefits for all members of the priority population (Moore et al., 2015): higher SES students generally profit more from educational interventions. The next sections introduce universal interventions by their theoretical background, content, and delivery methods.

1.3.1 Theoretical Background

Preventive efforts targeting substance use and addictions aim at promoting healthy behavior or behavior change. It is recommended that such programs use behavior change theories that help develop a deeper understanding of the determinants of the behavior and identify the content and methods that promote change (Bartholomew et al., 2016), thus ensuring effectiveness (Glanz & Bishop, 2010). Different theories are applied in universal school-based health programs and substance use prevention efforts; the theory of planned behavior, social learning theory, and the transtheoretical model of change were used in several cases (Cadri et al., 2024; Moore et al., 2015; Onrust et al., 2016).

Michie et al. (2011) reviewed numerous theories to compile a comprehensive behavior change intervention framework in which behavior (B) is generated by three interacting components: capability (C, meaning physical and psychological skills and knowledge), opportunity (O, referring to the physical and social environment), and motivation (M, representing both automatic processes like habits or emotions and reflective motivations or plans). According to the model, all components except for reflective motivation are needed for a behavior to occur. Accordingly, school-based interventions designed using the COM-B aimed to target most components (Eörsi et al., 2020; McQuinn et al., 2022; Nagy-Pénzes et al., 2022). Elements of effective universal programs are discussed below, along with the components of the COM-B model.

1.3.2 Content of Effective Programs

The following elements (highlighted in bold) showed effectiveness both in reducing or preventing substance use or dependence and addictions to technology use.

Capabilities. **Knowledge** of the potential harms of substance and technology use, as well as aspects of healthy usage and psychosocial skills, was targeted in effective programs (Das et al., 2016; Pulimeno et al., 2020; Theopilus et al., 2024; Throuvala et al., 2019). The latter included **social competence** (Thomas et al., 2013), referring to general life skills for self-management (e.g., problem-solving and decision-making),

emotional well-being (e.g., stress management and self-esteem), and social skills (e.g., assertiveness). Effectiveness was most assured when social competence curricula were combined with skills development to help overcome **social influence**, such as refusal skills, and dealing with peer pressure (Faggiano et al., 2014; Foxcroft & Tsertsvadze, 2012).

The development of social competence is recommended, as it is expected to have benefits in many areas of health (Foxcroft & Tsertsvadze, 2012; Throuvala et al., 2019). Regarding stress as a risk factor for students' mental and physical health (Gilgoff et al., 2020; Pascoe et al., 2020), targeting stress management, including adaptive coping and resilience that can both mitigate the adverse effects of stress (Greenglass & Fiksenbaum, 2009; Shonkoff et al., 2021), is of particular importance.

Opportunities. Applying the 'whole school' approach (WHO & UNESCO, 2021), and targeting schools' social and physical environment (e.g., organization, policies, arrangement of common areas) may effectively complement student-focused intervention elements (Fletcher et al., 2008; Langford et al., 2015). This includes creating a **positive school ethos and climate**, providing **increased** opportunities for **student participation**, **improving student-teacher relationships, shaping peer norms**, **addressing disaffection and truancy**, **establishing safe school areas,** and **decreasing bullying and violence** (Das et al., 2016; Dunne et al., 2017; Spanemberg et al., 2020).

Motivation. Interventions increasing **school engagement** (good emotional relationships with peers and teachers, commitment to learning), **enhancing reflective motivation** by correcting students' misconceptions, and raising awareness of social influences were effective (Dunne et al., 2017; Faggiano et al., 2014; Lee & Henry, 2022).

1.3.3   Delivery Methods

Effective delivery methods of the abovementioned elements were not detailed in the meta-analyses examining the effectiveness of preventive programs (though planned in most cases), and it was concluded that they should be reported more rigorously and consistently for pooled analyses (Faggiano et al., 2014; Foxcroft & Tsertsvadze, 2012). Adapting the methods of an intervention to the actual context is crucial for effectiveness (Bartholomew et al., 2016), which further complicates pooled analyses because a meaningful summary can only be made from sufficiently similar contexts. However, results from the field of education propose several ways of effective knowledge transfer

and skill-building in the classroom, through online platforms, or using the combination of these two such as group work, whole-group discussion, role-play, case-study, including information communication technology tools, using the experiential learning model and providing continuous feedback or applying gamification (Killen, 2016; Nah et al., 2014; Wurdinger & Carlson, 2009). All of these can facilitate participant engagement, enhancing the effectiveness of substance use and mental health programs (Dunne et al., 2017).

Intervention methods also vary by deliverer or implementer. Peer education is used in many substance use and addiction prevention programs, drawing on the social learning theory and hypothesizing that students will imitate peer educators as role models (Bandura, 1977). Although in some cases peer education showed benefits over adult or teacher-led programs for alcohol, drug, and internet use, there were insufficient data to confirm their superiority in meta-analyses (Faggiano et al., 2014; Foxcroft & Tsertsvadze, 2012; Throuvala et al., 2019). Moreover, some pooled evidence favored adult-led programs for smoking (Thomas et al., 2013), and the potential of teachers' involvement in health promotion was also emphasized (Pulimeno et al., 2020).

1.3.4   Factors Influencing Implementation

Even with existing evidence-based content and methods, programs' effectiveness relies greatly on the quality of their implementation (Bartholomew et al., 2016). According to Domitrovich's Multi-Level Model (2008), the implementation quality in the school setting depends on the characteristics of the intervention, its support system (e.g., the training of deliverers), macro-level (e.g., policy environment), school-level (e.g., the school size, organizational health, resources, and personnel expertise), and individual-level factors (e.g., mental health and attitudes of deliverers to the intervention). Coordination and monitoring of these help to achieve the desired impact.

Examples of most of these factors were found in a recent study exploring factors influencing the implementation of the 'whole school' approach in 5 European countries (Bartelink & Bessems, 2021). The following six aspects emerged from interviews with health promotion and education professionals: 1) the approach itself (=the intervention and its support system in Domitrovich's model), 2) the educational staff (=school-level factor), 3) the school as an organization (=school-level factor), 4) the school's partners (=support system and school-level factor), 5) and its environment (=school-level factor),

and finally 6) national policies (=macro-level factor). These results highlight the importance of school-level factors and the support system, in line with a study on a smoking prevention program (Bast et al., 2017) and mental health interventions (Forman et al., 2009).

1.4 Introduction to the Hungarian Context

1.4.1 National Prevalence Rates

The National HBSC 2022 report provides evidence that both substance and problematic technology use and gambling are prevalent among Hungarian students aged between 11-17 years and require attention (Németh, 2024). Only current cannabis use affected less than 10% of students. Problematic social media use, gaming, and past-month gambling were above 10%; current use of cigarettes, e-cigarettes, and HTP, together with the one-month prevalence of being drunk, were above 20% (cannabis, HTP use, problem gaming, and gambling were measured only among 15-17-year-olds). Likewise, symptoms similar to internet addiction were common in more than 20% of Hungarian 7-16-year-olds, and this even applied to 9-10-year-olds, according to the Digital Parenting Study 2020 (NMHH, 2021). The indicators increased with age, which was also true for 15-17-year-olds (except for social media use and gambling problems). Regarding trends, the previous decreasing trend in national HBSC data stopped in several cases (e.g., lifetime prevalence of alcohol use or drunkenness). Moreover, regular smoking showed an increase from earlier data, along with problematic social media use and gaming. Gender differences were like the international trends described in Section 1.1.2. As for the use of technology by younger people (7-8 year olds, as measured by the Digital Parenting Study 2020), similar to the international trends described above, the trend in Hungary is towards an increasing prevalence of having their own smartphone (24%, almost doubled compared to 2017) and a registered social media account (10%, more than tripled), as well as gaming devices in the household (22%, also almost doubled).

In further comparisons with international survey results, Hungary differed more in terms of substance use. Rates of smoking, e-cigarettes, and alcohol use were above the HBSC average in almost all indicators in all age groups, which positioned Hungary among the top ten countries (Charrier et al., 2024). Only cannabis use rates were around the average. Perceived accessibility, as a potential mediator, showed the same patterns (ESPAD Group, 2020). In the case of cigarettes and alcohol this may be due to high rates

among the adult population (OECD, 2023), low enforcement of the legal ban on sales to minors (Joó et al., 2024), lower prices, and less stringent alcohol advertising rules (Noel, 2019; OECD, 2023; WHO, n.d.). However, the regulations on cannabis in Hungary are among the strictest in Europe (EMCDDA, 2023).

Regarding technology use and problematic patterns, the data for Hungarian adolescents showed rates similar to or slightly lower than the HBSC or the European average (Boniel-Nissim et al., 2024; ESPAD Group, 2020). In the case of gambling, increased availability, liberalization in policies, high adult gambling, and perceived normality were claimed to be responsible for higher rates. In Hungary, minors are not allowed to participate in such games and enter casinos where slot machines can only be placed (Országgyűlés, 1991). Also, rates of adult problem gambling were among the lower ones in Europe (Kun et al., 2012). Differences in social media use and gaming may reflect slight differences in access to devices (ESPAD Group, 2020).

The results of the Hungarian ESPAD group identified important geographical and SES-related differences between clusters of students characterized by different risk behaviors (Elekes, 2020), consistent with the risk factors described in Section 1.2.

1.4.2   Universal Substance Use and Addiction Prevention in Hungarian Schools

In Hungary, compulsory education (provided by elementary and secondary schools) lasts until the age of 16, and institutes are of three funding types: state, public, and church schools (European Commission: European Education and Culture Executive Agency et al., 2022; Scholaro Database, n.d.).

The national legislation on school health promotion prescribes the evidence-based and recommended content and methods of universal substance use and addiction prevention listed above. Schools are required to include a school health promotion program in the school's pedagogical program, and involve all students in Holistic Health Promotion (HHP) based on a decree in force since 2012 (EMMI, 2012). HHP accounts for health promotion activities aimed at promoting 1) a healthy diet, 2) physical activity, 3) health literacy and health-related knowledge, and 4) social competence and school performance through mental health promotion to prevent the development of behavioral addictions and substance use among others (e.g. early school leaving, violence). These activities should be adapted to students' biological, social, and age-specific characteristics (EMMI, 2012; Országgyűlés, 2003). HHP follows the 'whole school' approach; thus, the

country is a member of the SHE: Schools for Health in Europe Network Foundation (Bessems et al., 2020). Concerning further policy implementation, however, the integration of HHP in the Hungarian National Core Curriculum is only partial, as health promotion is treated as an additional element of physical education (Lipták & Tarkó, 2021). Regarding deliverers of the HHP, teachers play a crucial role, emphasized by a regulation limiting the possibility to cooperate with external experts and organizations (Országgyűlés, 2021).

Since the HHP Decree entered into force, no data on its implementation in schools at the national level has been available. Hungary participated in a few cross-national monitoring studies (Bartelink et al., 2020; Driessen-Willems et al., 2023; Vilaça et al., 2019); however, reports of these provided insight into implementation indirectly, only from the SHE coordinators' perspective. Therefore, Study 1 of this thesis assessed the implementation of HHP, specifically its elements on substance use and addiction prevention, and analyzed factors influencing implementation. Elementary schools, where problems begin (Németh, 2024), were involved directly. Of the influencing factors, the focus was on school-level factors and the support system (in our case, the training of teachers as key deliverers), which were identified as important (see Section 1.3.4). In addition, we examined teachers' related perceptions to gain a deeper understanding.

The HHP requires the development of social competence, with stress management as an important element in preventing substance use and addictions (see Section 1.3.2). However, previous meta-analyses of such school-based interventions are either outdated (Kraag et al., 2006) or did not focus primarily on stress management (van Loon et al., 2022). Moreover, no recent meta-analysis has looked at stress simultaneously with coping and resilience, guiding effective methods. Therefore, to provide recommendations for implementing HHP, a meta-analysis of existing school-based stress management practices was conducted in Study 2 of this thesis.

1.4.2.1 *Illustrative Examples of Programs*

Despite the lack of national-level implementation data, reports on universal health promotion programs developed and implemented sporadically during the last decades in Hungary are available. Here, a non-exhaustive list relevant to the topic is provided. For further information, see Herczeg (2023) or the 100(1) issue of Népegészségügy.

Some programs focused specifically on substance use prevention, like the Dohányzás, Alkohol, Drog, AIDS (D.A.D.A., an adaptation of the Drug Abuse Resistance Education program) program for elementary schools, or the ELLEN-SZER for 10-11th graders (Mizsei, 2012) or the VoltEgySzer project (Kapitány-Fövény, 2023). Some applied a generic approach (provided life skills in general) and covered substance use and other health-related topics. The Complex Health Program for Children in the Buda region focused on addictions and obesity and aimed to prevent smoking through training teachers to promote social competence in elementary schools (Rákosy et al., 2023). Three such peer education programs also took place in the past years: 1) the STAnD (TANTUdSZ in Hungarian) program for elementary schools in Budapest targeting mental health and online safety including internet addiction, among others (Feith & Falus, 2019), 2) the program by Nagy-Pénzes et al. (2022) for an upper secondary school from a rural town in the Northern Great Plain region covering substance use and mental health and 3) the Balassagyarmat Health Education Program (BEP) also for upper secondary schools located in a rural town in Northern Hungary region, targeting smoking, alcohol and drug use with a wide range of health-related topics (Eörsi et al., 2020).

Reports on systematic evaluation and detailed description of these programs, which would be necessary for a broader and sustained implementation, are often lacking. One exception to this is Nagy-Pénzes's program (Nagy-Pénzes et al., 2022), which showed promising evidence in increasing knowledge of smoking, alcohol, and addiction and the rates of abstinence from alcohol. BEP was very similar to this program: in addition to what is described above, these were both universal interventions based on the COM-B model. However, evaluation of the effectiveness of BEP has not yet been completed. Therefore, as a first step, in Study 3 of this thesis, its impact on smoking-related knowledge was evaluated. The importance of this evaluation is that, like the program of Nagy-Pénzes, BEP was run in a disadvantaged region (KSH, n.d.). Given that lower SES is a known risk factor for addictions (Thomasius et al., 2022), confirmed by national data (Elekes, 2020), it is crucial to find evidence-based good practices that also work for schools in low SES regions to ensure a healthy childhood for all students.

2 Objectives

The overall aim of this thesis was to advance universal substance use and addiction prevention in Hungarian schools. It addressed three significant research gaps in its area of interest: the lack of national-level data on the implementation of statutory substance use and addiction prevention programs, the lack of an up-to-date summary of evidence regarding programs targeting a recommended life skill for prevention: stress management, and the lack of evaluation results of a recent health education effort. Therefore, the detailed objectives were to:

1. Examine the implementation of health promotion programs with a focus on universal substance use and addiction prevention in Hungarian elementary schools (Study 1)

    a. Assess the quality of implementation based on national regulations and the 'whole school' approach

    b. Investigate how school-level factors (funding, school size, and the diversity of program implementers) and the intervention support system (teacher support through training) impact implementation quality

    c. Explore teachers' views on ways to enhance implementation and effectiveness

2. Summarize existing evidence on the effectiveness of school-based stress management programs with a focus on stress, coping, and resilience (Study 2)

    a. Identify the conditions under which these programs showed to be most effective: priority population (age and recruitment of participants), delivery methods, length of interventions, and the type of control group applied

3. Evaluate the effectiveness of a Hungarian health education program, BEP, in enhancing students' knowledge of the harms of smoking (Study 3)

    a. Provide a detailed and theory-based description of the intervention's smoking, alcohol, drugs, and mental health modules

3 Methods

3.1 Study 1 – Mixed-Methods Evaluation of the Implementation of Universal Substance Use and Addiction Prevention in Hungarian Elementary Schools

This mixed-methods research project, including a survey-based and a focus group-based study, was conducted between October 2019 and February 2020. The following methodological description is based on my work published before (Árva et al., 2024).

3.1.1 Survey-Based Study

3.1.1.1 Participants and Procedure

The survey-based study was part of a broader evaluation of the implementation of HHP in Hungarian elementary schools (grades 1–8). The Ministry of Human Capacities invited the principals of all Hungarian elementary schools (N = 3601) to participate by email. The survey was open for two weeks in February 2020. All schools with complete answers were included in the study. Participation was voluntary and anonymous, with respondents providing data solely about their institution, without including personal information.

3.1.1.2 Instrument

The self-developed survey, which targeted the whole spectrum of HHP activities in schools, consisted of 32 questions. We used data from 14 of these questions, which can be categorized into three blocks.

Basic characteristics of schools. The type of school by funding was assessed with a single-choice question *(state/private/church).* The school size was given by the number of pupils enrolled. Three categories of school size (based on the number of pupils enrolled) were created: small: ≤ 150 children, medium: 151–450 children, and large: ≥ 451 children (Andl, 2020; Balogh, 2009). Lastly, the regional location of the school was determined based on the county of operation (KSH, n.d.). Pest County and Budapest were considered as one region, called Central Hungary.

Institutional conditions and support for HHP implementation. A yes-no question assessed whether a school health promotion program was incorporated into the school's pedagogical program. Then a multiple-choice question listed the developers of such a program *(teacher/school physician/school health-visitor [aka 'iskolavédőnő' (NNGYK, n.d.)]/school psychologist/parents' working group/pupil).* Responses were classified into

three categories: (1) only the teacher was selected, (2) other developer(s) in addition to the teacher were selected, and (3) none of the listed developers were selected.

Program implementers were assessed by a multiple-choice question listing five options: *school personnel/persons working for the school on a contract (e.g., school health-visitors and physicians)/parents with an educational background in medicine or health sciences/external expert speakers/organizations or associations providing programs approved by experts*. The diversity of implementers was calculated from the number of different types of partners involved (0-5).

Support for teachers in their health promotion activities was assessed through three questions. The first was a multiple-choice question on available training opportunities, with response options grouped into three categories for analysis: (1) only health-related information, (2) health-related information and skills training – to enhance teachers' resilience, coping strategies, and mental well-being, and (3) any other response. Then a question examined the types of support available for teachers' work with pupils in need of help for mental health (*individual counseling for pupils with a mental health professional/consultation about pupils with a mental health professional/both/none)*. The final question assessed the frequency of community-building and recreational events for teachers: *more than once a year/once a year/never*.

Implemented universal substance use and addiction prevention programs. The methods of building social competence used on a daily basis by teachers *(cooperative teaching method/interactive teaching method/assertive communication techniques*) as well as the topics covered by programs *(smoking/alcohol/drug/internet gaming disorder and problem gambling/problematic use of internet and electronic devices/online and offline bullying)*, were both evaluated with multiple-choice questions. A 10-point Likert scale *(from fully disagree to fully agree)* measured whether regular programs supporting students' mental health were provided and whether the school atmosphere and facilities (e.g., classrooms, corridors, schoolyard) were friendly and safe. Each answer to the last three questions was then grouped into: 1) disagree: 1–5 points, 2) moderately agree: 6–8 points, and 3) fully agree: 9–10 points.

3.1.1.3 Statistical Analysis

Pearson's chi-squared tests were applied in univariate analyses to examine the associations between basic characteristics and the institutional conditions, as well as the

implemented programs. In certain cases, the relationships between institutional conditions and the implemented programs were also analyzed using Pearson's chi-squared test and a non-parametric trend test.

To assess implementation quality, participating schools were categorized into two groups: good-quality implementers/performers were schools implementing the effective elements of school-based substance use and addiction prevention included in the HHP regulation, and adhering to the 'whole school' approach, while all other schools were considered low-quality performers. We used answers from the survey for this categorization, and schools were considered good-quality performers if:

1) the school health promotion program was included in the pedagogical program and

2) they used at least one of the above-listed methods of building social competence and

3) their programs covered at least three of the above-listed topics related to substance use and addiction prevention and

4) fully agreed that the school provided regular programs supporting students' mental health and

5) fully agreed that the school atmosphere was friendly and safe and

6) fully agreed that school facilities were friendly and

7) they provided at least one type of support for teachers' work with pupils needing mental health support.

To identify factors influencing schools' performance in implementing universal addiction prevention, a multiple binary logistic regression model was used. The model tested the relationship between basic characteristics and institutional conditions (of which the type by funding, school size, and the number of types of program implementers are school-level factors in Domitrovich's model [2008], while the support for teachers through training is an element of the intervention support system) with implementation quality and corrected for the regional location. To decide whether the number of types of program implementers should be included as either a categorical or continuous variable to improve model fit, the likelihood ratio test (LR test) was applied. All statistical analyses were carried out using STATA/SE 16.1 software.

3.1.2   Focus Group-Based Study

The study is reported using the COREQ: Consolidated Criteria for Reporting Qualitative Research (Tong et al., 2007).

3.1.2.1   Participants and Procedure

We aimed to explore the perspectives of Hungarian elementary school teachers involved in or interested in the prevention of substance use and addictions, so we aimed to include teachers from different regions. Additionally, we assumed that the general socioeconomic conditions of the areas where teachers worked might influence their perceptions of addiction prevention in schools, as these conditions are linked to substance use behaviors (OECD, 2021c). Hence, we recruited participants from a convenience sample of 21 schools located in two counties from two regions: Borsod-Abaúj-Zemplén, one of the most deprived counties (Nándori, 2021), and Pest county, specifically its western part (Buda region), one of the wealthiest parts (Kis & Goda, 2013). Principals were informed about the study via telephone and email and were asked to share participation details with interested colleagues. Eligibility criteria required participants to be teachers with valid employment contracts, while administrative staff with no direct contact with students were excluded. Given the available resources, we planned to conduct four focus group discussions.

Thirty-seven teachers (15 from 10 schools of Borsod-Abaúj-Zemplén, 22 from 11 schools of Pest county; 8 primary school, and 29 lower secondary school teachers; 34 women, and 3 men) participated in this study.

Participation was voluntary and required written consent. The discussions, lasting between 75-120 minutes, were held with 7 and 8 teachers in Borsod-Abaúj-Zemplén County, and with 8 and 14 teachers in Pest County. Each focus group took place outside the school grounds in a community space. The discussions were led by a facilitator with the presence of an assistant (intervening only if the guide was not followed). The facilitators had experience in focus group techniques and were instructed about the focus group discussion guide before data collection. The Ethical Review Board of the National Korányi Institute of Pulmonology (Reg. No. 14/2019) approved the study.

3.1.2.2   Instrument

A focus group discussion guide was developed by two members of the research team and then finalized through triangulation with other team members to ensure alignment with research objectives and a non-directive approach. To maintain consistency across focus groups, we selected the most critical questions (including the ones below), centered on

the factors influencing implementation and ways to support it, to be asked in each session. In this study, responses to the following questions were analyzed:

– *What are your thoughts on improving addiction prevention and communicating the importance of related mental health promotion in your own work?*

– *What are the most significant barriers to these programs in your school?*

– *How can such a program be implemented in schools?*

– *What message could be used to persuade the teaching staff to support the program?*

3.1.2.3 Data Analysis

The discussions were audio-recorded and transcribed verbatim, and the Classic Analysis Strategy of Krueger and Casey (Krueger & Casey, 2015), with roots in grounded theory, was then applied to the transcripts. In this inductive approach, the constant comparative method is used to code responses to questions, and then findings are structured around repeatedly emerging themes. The analysis was performed by a member of the research team (also helping with the development of the guide) with experience in using this method. The first draft of the findings was presented to the facilitators to ensure that the emphases, irony, and emotion had been understood correctly by the analyst working from the transcripts alone. The refined results were revised and finalized to improve coherence and clarity with the help of a newly involved member of the research team. For information on positionality and credibility strategies, see the original text (Árva et al., 2024).

3.2 Study 2 – Meta-Analysis of the Effectiveness of School-Based Stress Management Programs

This section is based on the methodological description of the study (Juhász et al., 2024). This study followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021).

3.2.1 Systematic Literature Review

A systematic literature search was performed to find the relevant articles in the following eight databases: ProQuest, ERIC, Cochrane Library, PubMed, Web of Science, Science Direct, PsycArticle, and Educational Research Complete. The search period lasted until April 2021. Articles were also added manually based on, e.g., relevant meta-analyses (Kraag et al., 2006; van Loon et al., 2020). The search terms included were: "intervention OR program OR training OR prevention AND randomized controlled trial OR RCT OR

quasi experiment OR experiment OR randomized control AND stress OR cortisol OR psychosocial risk OR distress OR anxiety OR well-being OR resilience OR psychosomatic AND school OR classroom OR student OR school-based" (Juhász et al., 2024, p. 4). Reference management software (Zotero, Version 6.0.8) was used to handle the search results.

"Studies were included if the (a) sample consisted of school-aged children from Grades 1 to 12, (b) intervention was implemented in a school setting, (c) research design was a randomized controlled trial (RCT), (d) intervention targeted stress management and/or coping/resilience building, and (e) outcomes were quantitative measurements of stress and coping/resilience. Quasi-experimental studies, interventions focused on post-traumatic stress disorder or the effects of war, and studies involving clinical samples were excluded. Furthermore, reviews, study protocols, and case studies without quantitative data were also removed from the meta-analysis" (Juhász et al., 2024, p. 4).

The literature search, study selection, and data extraction were performed by five independent researchers. A consensus discussion was held after the selection and data extraction process, with a third researcher (either the first or second author) consulted to resolve disagreements or ambiguities. The following information was extracted from the studies: "(a) author(s), (b) year of publication, (c) country, (d) age of study participants, (e) sample characteristics, (f) elements of the intervention, (g) length of the intervention and follow-up, (h) type of outcome, (i) agent of delivery, (j) type of control condition, and (k) necessary data required to calculate effect sizes" (Juhász et al., 2024, p. 5). Authors of studies with missing critical information were contacted, and of the 15 authors approached, two provided the requested data.

The effect modifiers (i.e., moderators) analyzed in this study, as described below, were primarily based on van Loon et al. (2020):

1. Target population: (a) universal intervention targeting the whole population without selection or (b) selective intervention working with a narrower sample typically chosen through a screening process.

2. Age of participants: (a) young students under 10 years of age, (b) early adolescents between or equal to 10–14 years, and (c) older adolescents above 14 years. The age groups were determined based on the typical transition points between different school types or grades in most educational systems.

3. Control condition type: (a) wait-list control condition, (b) passive control condition (with no intervention or business as usual), and (c) active control condition (with specific structured activities).

4. Delivery type: delivered by (a) mental health professionals (including the articles' authors and researchers), (b) the school staff, or (c) other (e.g., via online platforms). When an intervention was delivered by both teachers/school counselors and mental health professionals/researchers, it was assigned to the mental health professionals' category, and interventions not only delivered by teachers or mental health professionals but also using other means (e.g., online) were categorized as "other".

5. Length of the intervention: We calculated this by multiplying the session duration by the frequency of sessions. If the session duration was not explicitly stated but referred to as a standard lesson, it was estimated as 45 minutes. For interventions reporting a range for the length, the median value within the range was used.

6. Content of the intervention: In line with van Loon et al. (2020), we evaluated the most used stress management techniques: mindfulness, relaxation, yoga, cognitive behavioral therapy (CBT), social-emotional learning (SEL), exercise, psychoeducation, and counseling. The studies were characterized by the primary techniques used in the intervention.

3.2.2 Quality Assessment

Research quality was assessed according to van Loon et al. (2020) using the Quality Assessment Tool for Quantitative Studies (Thomas et al., 2004), a scale frequently used for health promotion interventions. The scale measures six components on a 3-point scale with scores of 0 (weak), 1 (moderate), or 2 (strong), with the maximum quality score at 12 points. Components were (a) selection bias (representativeness and the participation rate), (b) study design, (c) confounders (indicating the rate of confounders that were controlled for), (d) blinding, (e) data collection methods (validity and reliability of the measurement tools), and (f) withdrawals/dropouts (indicating the follow-up rate). The quality assessment was conducted by six independent coders. Studies that achieved the highest scores were those that used reliable and widely accepted measurements, included balanced samples (e.g., across genders), maintained an 80% participation rate with a drop-out rate of less than 20%, and ensured that both participants and coders were blinded to the research questions.

3.2.3 Statistical Analysis

3.2.3.1 Effect Size

The included studies employed various measurement tools to assess stress and/or coping and resilience. Hedges's *g,* the standardized mean difference between study groups in the first post-intervention measurement, was used as the effect size for both outcomes. Negative values indicated a positive effect for stress, i.e., a reduction in stress levels, while for coping/resilience, positive values signaled an improvement. "Hedges' *g* corrects for small samples (Murad et al., 2019). Generally, 0.20, 0.50, and 0.80 are considered the cutoff points for small, moderate, and large effects, respectively (Cohen, 1988). Although several measurement tools were used to measure the same outcome within each study, we were able to include all measures using robust variance estimation. If the measurement tool was composed of subscales and no summary measure was available for that tool, then all subscale results were included. In some instances, the results were presented by subgroups only (e.g., by sex and grade). These were separately included in the analysis. We estimated the overall effect size by meta-regression with robust variance estimation and correction for small sample size using the STATA robumeta module and applying a hierarchical model weighting scheme to account for the dependency of multiple effect sizes from the same study because of multiple arms, effect measures and/or outcomes (Hedberg, 2011; Hedges et al., 2010; Tanner-Smith & Tipton, 2014; Tipton, 2015). The outliers were defined based on the difference in fits (DFFITS) values (Belsley et al., 1980). An observation was deemed to be an outlier if the absolute value of its DFFITS value was greater than $\sqrt{\frac{k+2}{n-k-2}}$ where *k* is the number of predictors and *n* is the sample size." (Juhász et al., 2024, p. 5-6). The overall effect size was calculated with and without outliers as well.

3.2.3.2 Effect Modifiers and Publication Bias

Intercept-only multilevel random-effects meta-regression models were used to estimate the overall effect by each outcome. To test effect modifiers, we first added them independently in these models. A significance level was set at $p < .25$ to decide on including the covariates in the final multiple regression model. Outliers were excluded from this analysis.

After removing outliers, the funnel plot was visually examined for asymmetry, which may suggest publication bias. Publication bias was further evaluated using Egger's asymmetry test (Egger et al., 1997).

3.3 Study 3 – Non-Randomized Controlled Trial of the Effectiveness of BEP in Enhancing Students' Knowledge of the Harms of Smoking

The following description is a summary based on three works published before (Árva, 2023; Árva & Eörsi, 2023; Eörsi et al., 2020) and prepared according to the Transparent Reporting of Evaluations with Nonrandomized Designs (TREND) statement (Des Jarlais et al., 2004).

BEP was a school-based health education intervention evaluated with a non-randomized, controlled survey study. The project was run in three intervention waves between 2018 and 2021 in upper secondary schools of Balassagyarmat (a city in Northern Hungary). The main features of the modules on substance use and mental health are described below, with a general description of the project in Eörsi's book (2023). Ethical approval of the project was granted by the Semmelweis University Regional and Institutional Committee of Science and Research Ethics (2/276/2017).

3.3.1 Design and Recruitment

Students from all five upper secondary schools in the city participated in this project. Two institutions offered only high school education, two provided both vocational secondary and vocational school education, and one offered only vocational school education. The first two education types end with a school leaving exam after 4 or 5 years, the second two teach sectoral knowledge to prepare students for a job.

Participation in the survey study was voluntary and anonymous. An intervention group (IG) and a no-intervention control group (CG) were created. Recruitment was done with the help of teachers in three waves parallel to the intervention waves. The first recruitment wave took place in the academic year of 2017/18: all 9th-grade students were invited to the IG, while all 10th graders were invited to the CG. In the second and third waves, all 9th-grade students of the academic years of 2018/19 and 2019/20 were invited to the IG, except for those repeating an academic year, as it would result in taking part twice in some of the intervention modules and missing others. Students with parents who asked to opt out were also excluded from the study. No make-up occasion was organized for students absent on the day of data collection. Additionally, data of students were

excluded from the analyses in case of providing incomplete answers for most questions, or participating only at post-intervention (T1) in the IG. Lastly, T1 data of IG students repeating an academic year were also excluded for the abovementioned reason.

To detect change, the IG provided data twice, in 9th grade at baseline (T0, before the start of the intervention) and 10th grade, post-intervention (T1, after the end of the intervention), while the CG provided data only once in 10th grade (before the start of any interventional activity in schools). We use CG data as T1 data, as it was assumed to be comparable to the post-intervention data of a business-as-usual control group.

3.3.2 Intervention

A multidisciplinary team designed BEP, prepared a lesson plan and slides for each topic, and trained near-peer educators delivering the intervention (Major & Eörsi, 2023). The universal intervention targeted all components of the COM-B model (Michie et al., 2011) to promote positive health behavior (Eörsi et al., 2020). Supplementary Table 1. details the included content, delivery methods, and incentives grouped by COM-B components.

BEP covered several health-related topics during school hours in a classroom setting (or online during COVID-19) throughout one year, and it targeted smoking, alcohol, and drug use in three 45-minute lessons (Major & Eörsi, 2023). The program started in the second semester of 9th grade. After the lessons, additional e-learning activities were made available to students online. These could be completed in 10-15 minutes and consisted of 6-8 short exercises (e.g., gap-fills, find the pair, quizzes, and memory games). Further information about the content and activities related to substance use prevention is given in Supplementary Table 2. Lesson plans and e-learning activities are published at: http://www.egeszsegneveles.hu/.

Near-peer educators, i.e., educators being a few academic years ahead of their students (Olaussen et al., 2016), delivered the intervention. They were students of Semmelweis University who volunteered to take part and were granted a small financial reward for their work. Educators received a 36-hour training, including both general pedagogical skill-building and specific preparation for each lesson. During the latter, to enhance fidelity, educators were provided with lesson plans, slides for lessons, and additional background information on the topics, and activities were also demonstrated. Two or three groups of a maximum of 15 students (larger classes were divided by teachers) were allocated to a pair of educators.

Overall, implementation of the intervention was high for lessons and lower for e-learning activities. All lessons were held during the first two intervention waves. However, in the third wave, due to the different distance learning schedules and methods adopted by the participating schools during the pandemic, it was not possible to organize online lessons for all groups, and only smoking, alcohol use, and mental health were covered in topics related to substance use prevention. Both the rate of students who registered for the e-learning and who got engaged in activities related to substance use prevention were low (approximately one-third in the average of the three intervention waves, and among them between 0-15%, respectively). Regarding educators, although it was planned that they would work with their student groups for the entire year of the intervention, this was not always feasible, due to, among other things, the competing academic tasks, loss of motivation, or acute illness of the educators. In total, 99 educators were involved in BEP, some holding only one lesson, and some participating in all three intervention waves.

3.3.3 Data Collection and Outcomes

Data collection occurred in the second semester of the academic year in all waves and study groups. Students filled out the online survey during school hours (completion time was 20-45 minutes) either in the computer rooms of schools supervised by research assistants or, during the COVID-19 lockdowns, from home on their own devices. Every participant received an ID so that baseline and post-intervention data could be linked. The survey consisted of 6 main topics and was assembled using existing and self-developed measurement tools, see Figure 1 for further details.

Only four outcomes related to knowledge (Capability in the COM-B model) on smoking are detailed below, as these were included in the unpublished, preliminary analysis reported here (the preregistration and results of future analyses will be available in our repository: https://osf.io/yvk73/). These were measured with self-developed questions. One yes-no question measured if smoking was considered a cause of disease, where the correct answer was 'yes'. A multiple-choice question tested whether smoking consequences include lung disease, tumors, and infarction of the heart. These were treated as three separate yes-no questions in the analyses, and here again, the correct answer was 'yes' in all cases.

The letters in brackets refer to the sources used to assemble the survey:
a) Hungarian version of the Health Behaviour in School-aged Children Survey 2014
b) Hungarian adaptations of widely used questionnaires
c) Hungarian Youth Survey 2016
d) Self-developed questions

Figure 1. Structure of the survey monitoring the Balassagyarmat Health Education Program, based on the manuscript of Árva (2023). The pie chart shows the number of items included per survey topic.

Among covariates, we included gender (male or female, measured with a single-choice question), and school type (high or vocational secondary school or vocational school, provided based on participant ID) as they were associated with health-related knowledge of teenagers and how they react to interventions in previous studies (Moore et al., 2015). The categories of high and vocational secondary school (both providing students with a school-leaving exam) were combined to increase statistical power.

3.3.4 Statistical Analysis

Descriptive statistics, including a χ^2 test to check for the differences in the distribution of covariates between study groups at T1, were run. Then, generalized estimating equations (GEE) were applied to compare the change from T0 to T1 in the rate of students providing correct answers within and across study groups (IG and CG). Data from the CG were presented as post-intervention data (T1) in the model. The model estimated the change for the CG using the T0 data of the IG. The change was calculated as a mean difference (MD) expressed in percentage points (pps), and the difference in the change between groups was presented as differences in MDs, also expressed in pps. Separate models were generated for all outcomes. All results were adjusted for covariates. The significance level was set at $p < .05$, and IBM SPSS Statistics 29 was used to conduct analyses.

4 Results

4.1 Study 1 – Implementation of Universal Substance Use and Addiction Prevention in Hungarian Elementary Schools

These results are described based on my previous work (Árva et al., 2024).

4.1.1 Results of the Survey-Based Study

Overall, 80.3% of elementary schools in Hungary completed the survey (for descriptives on their type and size, see Table 1).

4.1.1.1 Institutional Conditions and Support for Implementation

The school health promotion program was included in the pedagogical program in 68.5% of schools (68.5%, 60.8%, and 70.9% of state, private, and church schools, respectively; $n = 2806$). Table 1 summarizes data on the remaining institutional conditions and support for HHP implementation and their associations with school type and size. Large schools involved more developers, provided health information and skills training, and community building more frequently. In the latter's case, church schools were also in a leading position. Medium and state schools, however, were more likely to provide both types of student mental health support.

4.1.1.2 Implemented Universal Substance Use and Addiction Prevention

Both school personnel (64.5%), someone in a legal relationship with the school (76.9%), and external experts (66.9%) were involved in the implementation of health promotion programs in most schools. Table 2 shows further results on the implementation and its associations with the type and size of schools. In cases where the methods of building social competence and coverage of substance use and addiction prevention topics by programs were linked to school type or size, large and state schools showed higher rates, except for teaching assertive communication (which was done more frequently by private schools). Programs supporting mental health were most frequently provided regularly by church and small schools, while private and small institutions were more likely to ensure a friendly and safe environment.

The number of topics covered showed a significant positive correlation with the diversity of implementers ($p < .001$). Having a safe and friendly school environment was more likely in institutions that organized community-building activities more than once a year (Table 3).

4.1.1.3 *Implementation Quality and Its Determinants*

Among schools, 20.4% were found to be good-quality performers in implementing universal substance use and addiction prevention. Without evidence of a better model fit with the number of types of implementers presented by a categorical variable, it was included as a continuous variable (LR test p = .8).

The odds of good-quality performance was twice as high in state schools as in private schools (Table 4). Compared to schools with teacher training containing only health-related information, the odds was less than 0.5 for schools providing support that did not include such information. Every increase in the number of types of implementers increased the odds of good-quality performance by 11.1%.

Table 1. Institutional conditions and support for the implementation of school health promotion programs in Hungarian elementary schools, from the authors' manuscript of Árva et al. (2024)

No. (%)	Total	Type of school[a]			p-value[b]	School size[c]			p-value[b]
		State	Private	Church		Small	Medium	Large	
	2892 (100)	2330 (100)	158 (100)	404 (100)		805 (100)	1297 (100)	790 (100)	
Developers of school health promotion program									
Teachers only	40 (1.4)	33 (1.4)	2 (1.3)	5 (1.3)		14 (1.8)	18 (1.4)	8 (1.0)	
Teachers and others[d]	385 (13.3)	308 (13.2)	26 (16.4)	51 (12.6)	0.803	80 (9.9)	156 (12.0)	149 (18.9)	**<0.001**
Not specified	2467 (85.3)	1989 (85.4)	130 (82.3)	348 (86.1)		711 (88.3)	1123 (86.6)	633 (80.1)	
Support for teachers through training									
Only health-related information	741 (25.6)	616 (26.4)	32 (20.3)	93 (23.0)		234 (29.0)	336 (25.9)	171 (21.7)	
Health-related information and skills training[e]	1918 (66.3)	1521 (65.3)	113 (71.5)	284 (70.3)	0.162	498 (61.9)	859 (66.2)	561 (71.0)	**0.004**
Other	233 (8.1)	193 (8.3)	13 (8.2)	27 (6.7)		73 (9.1)	102 (7.9)	58 (7.3)	
Support for teachers' work with pupils in need of help for mental health									
Individual counseling for pupils with a mental health professional	390 (13.5)	311 (13.4)	21 (13.3)	58 (14.4)		121 (15.0)	140 (10.8)	129 (16.3)	
Consultation about pupils with a mental health professional	346 (12.0)	260 (11.2)	36 (22.8)	50 (12.4)	**0.002**	117 (14.5)	161 (12.4)	68 (8.6)	**<0.001**
Both	2145 (74.2)	1750 (75.1)	100 (63.3)	295 (73.0)		565 (70.2)	990 (76.3)	590 (74.7)	
None	11 (0.3)	9 (0.3)	1 (0.6)	1 (0.2)		2 (0.3)	6 (0.5)	3 (0.4)	
Community-building/recreational events for teachers									
More than once a year	1828 (63.2)	1432 (61.4)	110 (69.6)	286 (70.8)		419 (52.0)	853 (65.8)	556 (70.4)	
Once a year	1009 (34.9)	852 (36.6)	41 (26.0)	116 (28.7)	**<0.001**	358 (44.5)	425 (32.8)	226 (28.6)	**<0.001**
Never	55 (1.9)	46 (2.0)	7 (4.4)	2 (0.5)		28 (3.5)	19 (1.4)	8 (1.0)	

[a] Type of school by funding; [b] Pearson's chi-squared test, p < 0.05 highlighted in bold; [c] School size: small: ≤ 150, medium: 151-450, large: ≥ 451 children ; [d] Others: school physician; school health-visitor, school psychologist, parents' working group, pupil; [e] Skills training: training to help build teachers' resilience, coping strategies and mental well-being

Table 2. Universal substance use and addiction prevention in Hungarian elementary schools, based on the authors' manuscript of Árva et al. (2024)

No. (%)	Total	Type of school[a] State	Type of school[a] Private	Type of school[a] Church	p-value[b]	School size[c] Small	School size[c] Medium	School size[c] Large	p-value[b]
	2892 (100)	2330 (100)	158 (100)	404 (100)		805 (100)	1297 (100)	790 (100)	
Methods of building social competence used[d]									
Cooperative teaching method	2256 (78.0)	1832 (78.6)	106 (67.1)	318 (78.7)	**0.003**	576 (71.6)	1037 (80.0)	643 (81.4)	**<0.001**
Interactive teaching method	2051 (70.9)	1689 (72.5)	89 (56.3)	273 (67.6)	**<0.001**	551 (68.5)	930 (71.7)	570 (72.2)	0.187
Assertive communication techniques	568 (19.6)	421 (18.1)	54 (34.2)	93 (23.0)	**<0.001**	140 (17.4)	254 (19.6)	174 (22.0)	0.066
Topics covered[d]									
Smoking	2127 (73.6)	1764 (75.7)	80 (50.6)	283 (70.1)	**<0.001**	580 (72.1)	948 (73.1)	599 (75.8)	0.205
Alcohol	1789 (61.9)	1487 (63.8)	71 (44.9)	231 (57.2)	**<0.001**	476 (59.1)	802 (61.8)	511 (64.7)	0.074
Drug	2061 (71.3)	1703 (73.1)	89 (56.3)	269 (66.6)	**<0.001**	514 (63.9)	932 (71.9)	615 (77.9)	**<0.001**
Internet gaming disorder and problem gambling	545 (18.9)	442 (19.0)	34 (21.5)	69 (17.1)	0.452	137 (17.0)	221 (17.0)	187 (23.7)	**<0.001**
Problematic use of internet and electronic devices	1762 (60.9)	1413 (60.6)	93 (58.9)	256 (63.4)	0.504	471 (58.5)	791 (61.0)	500 (63.3)	0.147
Online and offline bullying	1472 (50.9)	1216 (52.2)	63 (39.9)	193 (47.8)	**0.004**	331 (41.1)	331 (52.3)	463 (58.6)	**<0.001**
	2806 (100)	2265 (100)	153 (100)	388 (100)		772 (100)	1272 (100)	762 (100)	
Regular programs supporting students' mental health[e]									
Disagree	150 (5.3)	129 (5.7)	12 (7.8)	9 (2.3)		35 (4.5)	66 (5.2)	49 (6.4)	
Moderately agree	1111 (39.6)	939 (41.5)	58 (37.9)	114 (29.4)	**<0.001**	293 (38.0)	489 (38.4)	329 (43.2)	**0.035**
Fully agree	1545 (55.1)	1197 (52.8)	83 (54.3)	265 (68.3)		444 (57.5)	717 (56.4)	384 (50.4)	
The school atmosphere is friendly and safe[e]									
Disagree	51 (1.8)	45 (2.0)	1 (0.6)	5 (1.3)		18 (2.3)	18 (1.4)	15 (2.0)	
Moderately agree	878 (31.3)	752 (33.2)	27 (17.7)	99 (25.5)	**<0.001**	220 (28.5)	395 (31.1)	263 (34.5)	0.066
Fully agree	1877 (66.9)	1468 (64.8)	125 (81.7)	284 (73.2)		534 (69.2)	859 (67.5)	484 (63.5)	
School facilities are friendly and safe[e]									
Disagree	113 (4.0)	100 (4.4)	3 (2.0)	10 (2.6)		18 (2.3)	45 (3.6)	50 (6.6)	
Moderately agree	942 (33.6)	794 (35.1)	34 (22.2)	114 (29.4)	**<0.001**	223 (28.9)	415 (32.6)	304 (39.9)	**<0.001**
Fully agree	1751 (62.4)	1371 (60.5)	116 (75.8)	264 (68.0)		531 (68.8)	812 (63.8)	408 (53.5)	

[a] Type of school by funding; [b] Pearson's chi-squared test, p < 0.05 highlighted in bold; [c] School size: small: ≤ 150, medium: 151-450, large: ≥ 451 children ; [d] These were yes-no type questions, and data are only provided on the number and proportion of 'yes' answers; [e] On a 10-point Likert scale: disagree: 1-5 points; moderately agree: 6-8 points; fully agree: 9-10 points

Table 3. Frequency of community-building events for teachers and the safety and friendliness of the school environment in Hungarian elementary schools ($n = 2806$), based on the authors' manuscript of Árva et al. (2024)

	Community building/recreational events for teachers			
	More than once a year	Once a year	Never	*p*-value[a]
The school atmosphere is friendly and safe[b] (%)				
Disagree	45.1	51.0	3.9	
Moderately agree	56.2	40.8	3.1	**<0.001**
Fully agree	67.8	31.0	1.2	
School facilities are friendly and safe[b] (%)				
Disagree	59.3	36.3	4.4	
Moderately agree	59.8	37.7	2.5	**0.001**
Fully agree	66.1	32.6	1.3	

[a] *Pearson's chi-squared test, p < 0.05 highlighted in bold*
[b] *On a 10-point Likert scale: disagree: 1-5 points; moderately agree: 6-8 points; fully agree: 9-10 points*

Table 4. Associations of good-quality implementation of universal substance use and addiction prevention in Hungarian elementary schools with the school type, size, the support for teachers, and the diversity of implementers ($n = 2806$), based on the authors' manuscript of Árva et al. (2024)

Determinant	OR[a] (95% CI)	*p*-value[a]
Type of school[b]		
State	reference	
Private	0.509 (0.305-0.848)	**0.009**
Church	1.215 (0.937-1.575)	
School size[c]		
Small	reference	
Medium	0.897 (0.716-1.124)	0.100
Large	0.750 (0.575-0.977)	
Teacher support		
Only health-related information	reference	
Health-related information & skills training	1.145 (0.920-1.424)	**<0.001**
Other	0.462 (0.286-0.747)	
No. of types of program implementers[d]	1.111 (1.038-1.189)	**0.002**

[a] *Odds ratios (OR) with 95% confidence intervals (CI) and p-values were derived from a multiple binary logistic regression model using the quality of implementation as outcome (the odds of good-quality implementation were calculated in reference to the odds of low-quality implementation) and correcting for regional location*
[b] *Type of school by funding*
[c] *School size: small: ≤ 150, medium: 151-450, large: ≥ 451 children*
[d] *Treated as a continuous variable*

4.1.2   Results of the Focus Group-Based Study

Five themes emerged from the group discussions: *development of addictions and mental health, health education, role of teachers in addiction prevention: attention and commitment, factors hindering addiction prevention in schools, and factors supporting addiction prevention and its implementation in schools*. Detailed descriptions of the themes, along with illustrative quotes, can be found in the original text (Árva et al., 2024).

4.2   Study 2 – Effectiveness of School-Based Stress Management Programs

The description of the results is based on the work of Juhász et al. (2024).

4.2.1   Study Selection and Included Studies

The study selection is presented in Figure 2. Overall, 55 studies were included in this meta-analysis. The majority were conducted in North America (n_{US} = 19, n_{CAN} = 2) and Europe (n = 17), followed by Asia (n = 9) and Australia (n = 7). There was one study from South America and no studies from Africa.

According to their outcomes, 29 studies targeted stress, 18 coping/resilience, and 8 both outcomes. With some studies examining both outcomes or providing more than one estimate (from different interventions, measurement tools, subscales, or subgroups), from a total of 58 interventions, 66 and 47 comparisons were made for the stress and coping/resilience outcomes, respectively. The quality of studies ranged from 4 to 11, with an average of 7.1.

By moderators, most comparisons examined universal interventions (n = 71). Equal proportions involved older adolescents (n = 46), and early adolescents (n = 58), with 6 involving a mixed age group including also older adolescents, but only 3 focused on young students. Most comparisons used active controls (n = 50), 37 used passive, and 26 applied a wait-list control group. Of the interventions, 37 were implemented by researchers and mental health professionals, 17 by teachers or school counselors, and 4 in other formats (e.g., online). The average length of interventions was 714 minutes. SEL was the most frequently applied content in interventions (n = 30), followed by psychoeducation (n = 26), relaxation (n = 25), and mindfulness (n = 23). Cognitive-behavioral techniques (n = 13), yoga (n = 10), exercise (n = 6), and counseling (n = 5) were less commonly used. For characteristics of each study, see the original text of Juhász et al. (2024).

Figure 2. PRISMA flowchart (Moher et al., 2009) on study selection, from the authors' manuscript of Juhász et al. (2024)

4.2.2 Overall Effect of Stress Reduction and Coping/Resilience-Enhancing Programs

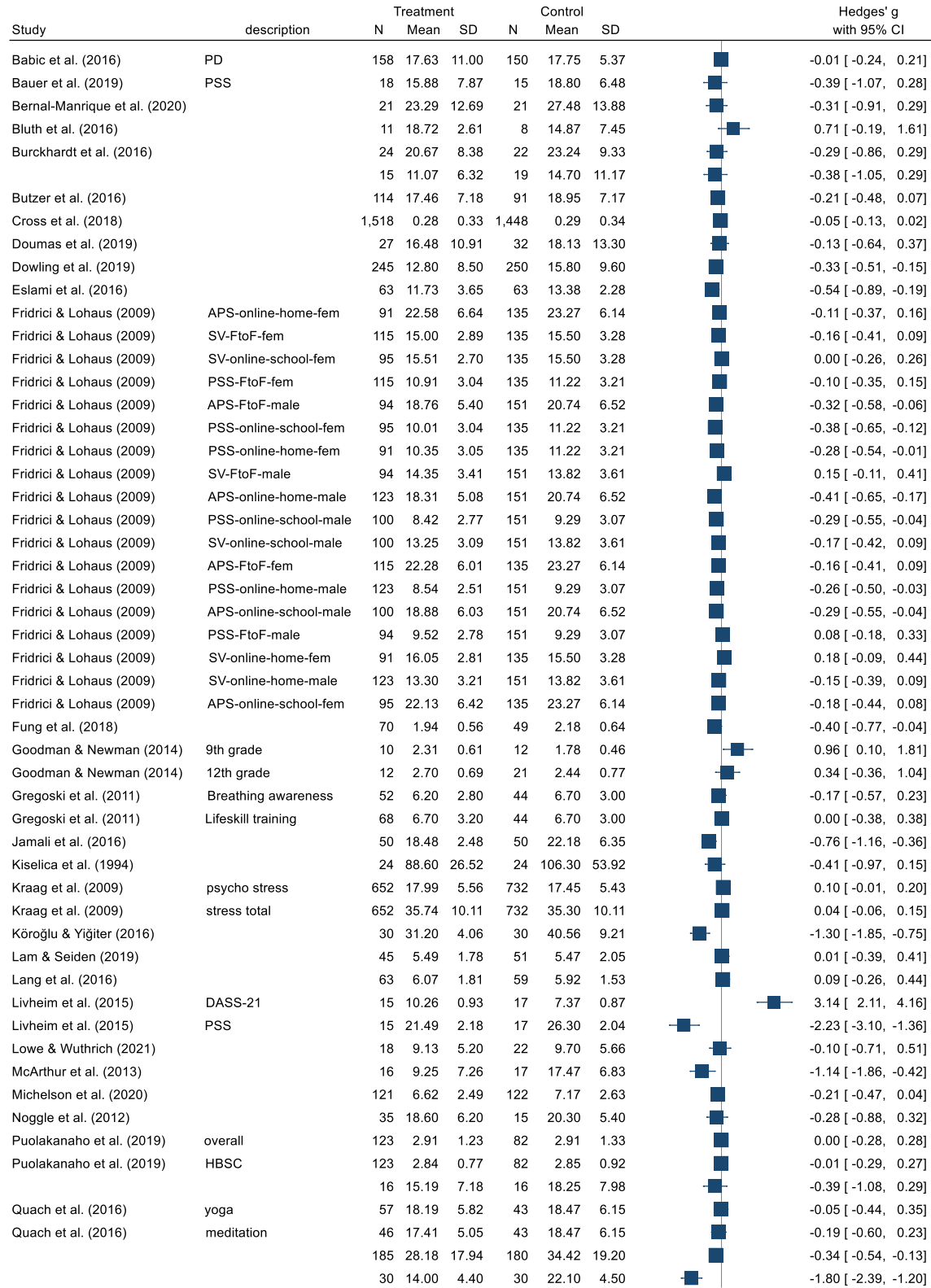| Study	description	Treatment N	Mean	SD	Control N	Mean	SD	Hedges' g with 95% CI
Babic et al. (2016)	PD	158	17.63	11.00	150	17.75	5.37	-0.01 [-0.24, 0.21]
Bauer et al. (2019)	PSS	18	15.88	7.87	15	18.80	6.48	-0.39 [-1.07, 0.28]
Bernal-Manrique et al. (2020)		21	23.29	12.69	21	27.48	13.88	-0.31 [-0.91, 0.29]
Bluth et al. (2016)		11	18.72	2.61	8	14.87	7.45	0.71 [-0.19, 1.61]
Burckhardt et al. (2016)		24	20.67	8.38	22	23.24	9.33	-0.29 [-0.86, 0.29]
		15	11.07	6.32	19	14.70	11.17	-0.38 [-1.05, 0.29]
Butzer et al. (2016)		114	17.46	7.18	91	18.95	7.17	-0.21 [-0.48, 0.07]
Cross et al. (2018)		1,518	0.28	0.33	1,448	0.29	0.34	-0.05 [-0.13, 0.02]
Doumas et al. (2019)		27	16.48	10.91	32	18.13	13.30	-0.13 [-0.64, 0.37]
Dowling et al. (2019)		245	12.80	8.50	250	15.80	9.60	-0.33 [-0.51, -0.15]
Eslami et al. (2016)		63	11.73	3.65	63	13.38	2.28	-0.54 [-0.89, -0.19]
Fridrici & Lohaus (2009)	APS-online-home-fem	91	22.58	6.64	135	23.27	6.14	-0.11 [-0.37, 0.16]
Fridrici & Lohaus (2009)	SV-FtoF-fem	115	15.00	2.89	135	15.50	3.28	-0.16 [-0.41, 0.09]
Fridrici & Lohaus (2009)	SV-online-school-fem	95	15.51	2.70	135	15.50	3.28	0.00 [-0.26, 0.26]
Fridrici & Lohaus (2009)	PSS-FtoF-fem	115	10.91	3.04	135	11.22	3.21	-0.10 [-0.35, 0.15]
Fridrici & Lohaus (2009)	APS-FtoF-male	94	18.76	5.40	151	20.74	6.52	-0.32 [-0.58, -0.06]
Fridrici & Lohaus (2009)	PSS-online-school-fem	95	10.01	3.04	135	11.22	3.21	-0.38 [-0.65, -0.12]
Fridrici & Lohaus (2009)	PSS-online-home-fem	91	10.35	3.05	135	11.22	3.21	-0.28 [-0.54, -0.01]
Fridrici & Lohaus (2009)	SV-FtoF-male	94	14.35	3.41	151	13.82	3.61	0.15 [-0.11, 0.41]
Fridrici & Lohaus (2009)	APS-online-home-male	123	18.31	5.08	151	20.74	6.52	-0.41 [-0.65, -0.17]
Fridrici & Lohaus (2009)	PSS-online-school-male	100	8.42	2.77	151	9.29	3.07	-0.29 [-0.55, -0.04]
Fridrici & Lohaus (2009)	SV-online-school-male	100	13.25	3.09	151	13.82	3.61	-0.17 [-0.42, 0.09]
Fridrici & Lohaus (2009)	APS-FtoF-fem	115	22.28	6.01	135	23.27	6.14	-0.16 [-0.41, 0.09]
Fridrici & Lohaus (2009)	PSS-online-home-male	123	8.54	2.51	151	9.29	3.07	-0.26 [-0.50, -0.03]
Fridrici & Lohaus (2009)	APS-online-school-male	100	18.88	6.03	151	20.74	6.52	-0.29 [-0.55, -0.04]
Fridrici & Lohaus (2009)	PSS-FtoF-male	94	9.52	2.78	151	9.29	3.07	0.08 [-0.18, 0.33]
Fridrici & Lohaus (2009)	SV-online-home-fem	91	16.05	2.81	135	15.50	3.28	0.18 [-0.09, 0.44]
Fridrici & Lohaus (2009)	SV-online-home-male	123	13.30	3.21	151	13.82	3.61	-0.15 [-0.39, 0.09]
Fridrici & Lohaus (2009)	APS-online-school-fem	95	22.13	6.42	135	23.27	6.14	-0.18 [-0.44, 0.08]
Fung et al. (2018)		70	1.94	0.56	49	2.18	0.64	-0.40 [-0.77, -0.04]
Goodman & Newman (2014)	9th grade	10	2.31	0.61	12	1.78	0.46	0.96 [0.10, 1.81]
Goodman & Newman (2014)	12th grade	12	2.70	0.69	21	2.44	0.77	0.34 [-0.36, 1.04]
Gregoski et al. (2011)	Breathing awareness	52	6.20	2.80	44	6.70	3.00	-0.17 [-0.57, 0.23]
Gregoski et al. (2011)	Lifeskill training	68	6.70	3.20	44	6.70	3.00	0.00 [-0.38, 0.38]
Jamali et al. (2016)		50	18.48	2.48	50	22.18	6.35	-0.76 [-1.16, -0.36]
Kiselica et al. (1994)		24	88.60	26.52	24	106.30	53.92	-0.41 [-0.97, 0.15]
Kraag et al. (2009)	psycho stress	652	17.99	5.56	732	17.45	5.43	0.10 [-0.01, 0.20]
Kraag et al. (2009)	stress total	652	35.74	10.11	732	35.30	10.11	0.04 [-0.06, 0.15]
Köroğlu & Yiğiter (2016)		30	31.20	4.06	30	40.56	9.21	-1.30 [-1.85, -0.75]
Lam & Seiden (2019)		45	5.49	1.78	51	5.47	2.05	0.01 [-0.39, 0.41]
Lang et al. (2016)		63	6.07	1.81	59	5.92	1.53	0.09 [-0.26, 0.44]
Livheim et al. (2015)	DASS-21	15	10.26	0.93	17	7.37	0.87	3.14 [2.11, 4.16]
Livheim et al. (2015)	PSS	15	21.49	2.18	17	26.30	2.04	-2.23 [-3.10, -1.36]
Lowe & Wuthrich (2021)		18	9.13	5.20	22	9.70	5.66	-0.10 [-0.71, 0.51]
McArthur et al. (2013)		16	9.25	7.26	17	17.47	6.83	-1.14 [-1.86, -0.42]
Michelson et al. (2020)		121	6.62	2.49	122	7.17	2.63	-0.21 [-0.47, 0.04]
Noggle et al. (2012)		35	18.60	6.20	15	20.30	5.40	-0.28 [-0.88, 0.32]
Puolakanaho et al. (2019)	overall	123	2.91	1.23	82	2.91	1.33	0.00 [-0.28, 0.28]
Puolakanaho et al. (2019)	HBSC	123	2.84	0.77	82	2.85	0.92	-0.01 [-0.29, 0.27]
		16	15.19	7.18	16	18.25	7.98	-0.39 [-1.08, 0.29]
Quach et al. (2016)	yoga	57	18.19	5.82	43	18.47	6.15	-0.05 [-0.44, 0.35]
Quach et al. (2016)	meditation	46	17.41	5.05	43	18.47	6.15	-0.19 [-0.60, 0.23]
		185	28.18	17.94	180	34.42	19.20	-0.34 [-0.54, -0.13]
		30	14.00	4.40	30	22.10	4.50	-1.80 [-2.39, -1.20]

Figure 3. Study-specific effect estimates and heterogeneity statistics for the stress outcomes, from the authors' manuscript of Juhász et al. (2024), *continued on the next page*
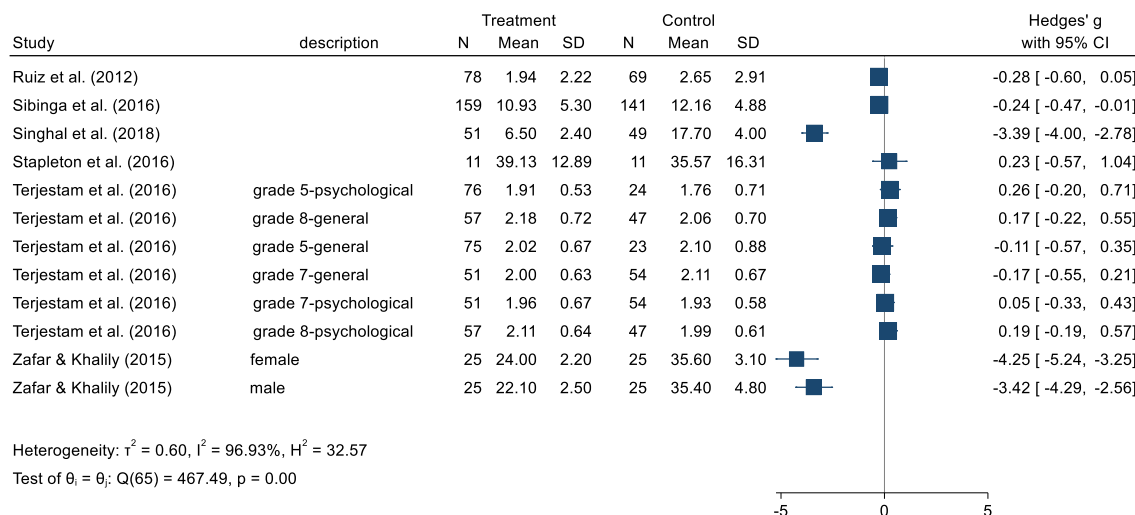
Study	description	N	Treatment Mean	SD	N	Control Mean	SD		Hedges' g with 95% CI
Ruiz et al. (2012)		78	1.94	2.22	69	2.65	2.91		-0.28 [-0.60, 0.05]
Sibinga et al. (2016)		159	10.93	5.30	141	12.16	4.88		-0.24 [-0.47, -0.01]
Singhal et al. (2018)		51	6.50	2.40	49	17.70	4.00		-3.39 [-4.00, -2.78]
Stapleton et al. (2016)		11	39.13	12.89	11	35.57	16.31		0.23 [-0.57, 1.04]
Terjestam et al. (2016)	grade 5-psychological	76	1.91	0.53	24	1.76	0.71		0.26 [-0.20, 0.71]
Terjestam et al. (2016)	grade 8-general	57	2.18	0.72	47	2.06	0.70		0.17 [-0.22, 0.55]
Terjestam et al. (2016)	grade 5-general	75	2.02	0.67	23	2.10	0.88		-0.11 [-0.57, 0.35]
Terjestam et al. (2016)	grade 7-general	51	2.00	0.63	54	2.11	0.67		-0.17 [-0.55, 0.21]
Terjestam et al. (2016)	grade 7-psychological	51	1.96	0.67	54	1.93	0.58		0.05 [-0.33, 0.43]
Terjestam et al. (2016)	grade 8-psychological	57	2.11	0.64	47	1.99	0.61		0.19 [-0.19, 0.57]
Zafar & Khalily (2015)	female	25	24.00	2.20	25	35.60	3.10		-4.25 [-5.24, -3.25]
Zafar & Khalily (2015)	male	25	22.10	2.50	25	35.40	4.80		-3.42 [-4.29, -2.56]

Heterogeneity: $\tau^2 = 0.60$, $I^2 = 96.93\%$, $H^2 = 32.57$

Test of $\theta_i = \theta_j$: $Q(65) = 467.49$, $p = 0.00$

-5   0   5

Figure 3. Study-specific effect estimates and heterogeneity statistics for the stress outcomes, from the authors' manuscript of Juhász et al. (2024). For references to studies, see the original text.

PD: psychological distress; PSS: Perceived Stress Scale; SV-FtoF-fem: stress vulnerability, face-to-face, female; SV-FtoF-male: stress vulnerability, face-to-face, male; SV-online-school-fem: stress vulnerability, online at school, female; SV-online-school-male: stress vulnerability, online at school, male; SV-online-home-fem: stress vulnerability, online at home, female; SV-online-home-male: stress vulnerability, online at home, male; PSS-FtoF-fem: physical stress symptoms, face-to-face, female; PSS-FtoF-male: physical stress symptoms, face-to-face, male; PSS-online-school-fem: physical stress symptoms, online at school, female; PSS-online-school-male: physical stress symptoms, online at school, male; PSS-online-home-fem: physical stress symptoms, online at home, female; PSS-online-home-male: physical stress symptoms, online at home, female; APS-FtoF-fem: adolescents psychological stress symptoms, face to face, female; APS-FtoF-male: adolescents psychological stress symptoms, face to face, male; APS-online-school-fem: adolescents psychological stress symptoms, online at school, female; APS-online-school-male: adolescents psychological stress symptoms, online at school, male; APS-online-home-fem: adolescents psychological stress symptoms, online at home, female; APS-online-home-male: adolescents psychological stress symptoms, online at home, males; DASS-21: Depression Anxiety and Stress Scale 21; HBSC: Health Behaviour in School-aged Children

The study-specific estimates of stress ranged from -4.25 (95%CI [-5.24, -3.25]) to 3.14 (95%CI [2.11, 4.16]) and showed significant heterogeneity (Figure 3). Four outlier studies with 6 comparisons (Livheim et al., 2015; Rentala et al., 2019; Singhal et al., 2018; Zafar & Khalily, 2015) were excluded based on their DFFITS values. These were all selective interventions from Asia.

Study-specific effects of coping/resilience ranged from -0.63 (95%CI [-1.17, -0.09] to 5.95 (95%CI [5.00, 6.90]) and were also heterogeneous (see Figure 4). Three outlier studies with 3 comparisons (Katz et al., 2020; Mendelson et al., 2010; Singhal et al., 2018) were excluded based on their DFFITS values. These were universal interventions from North America.
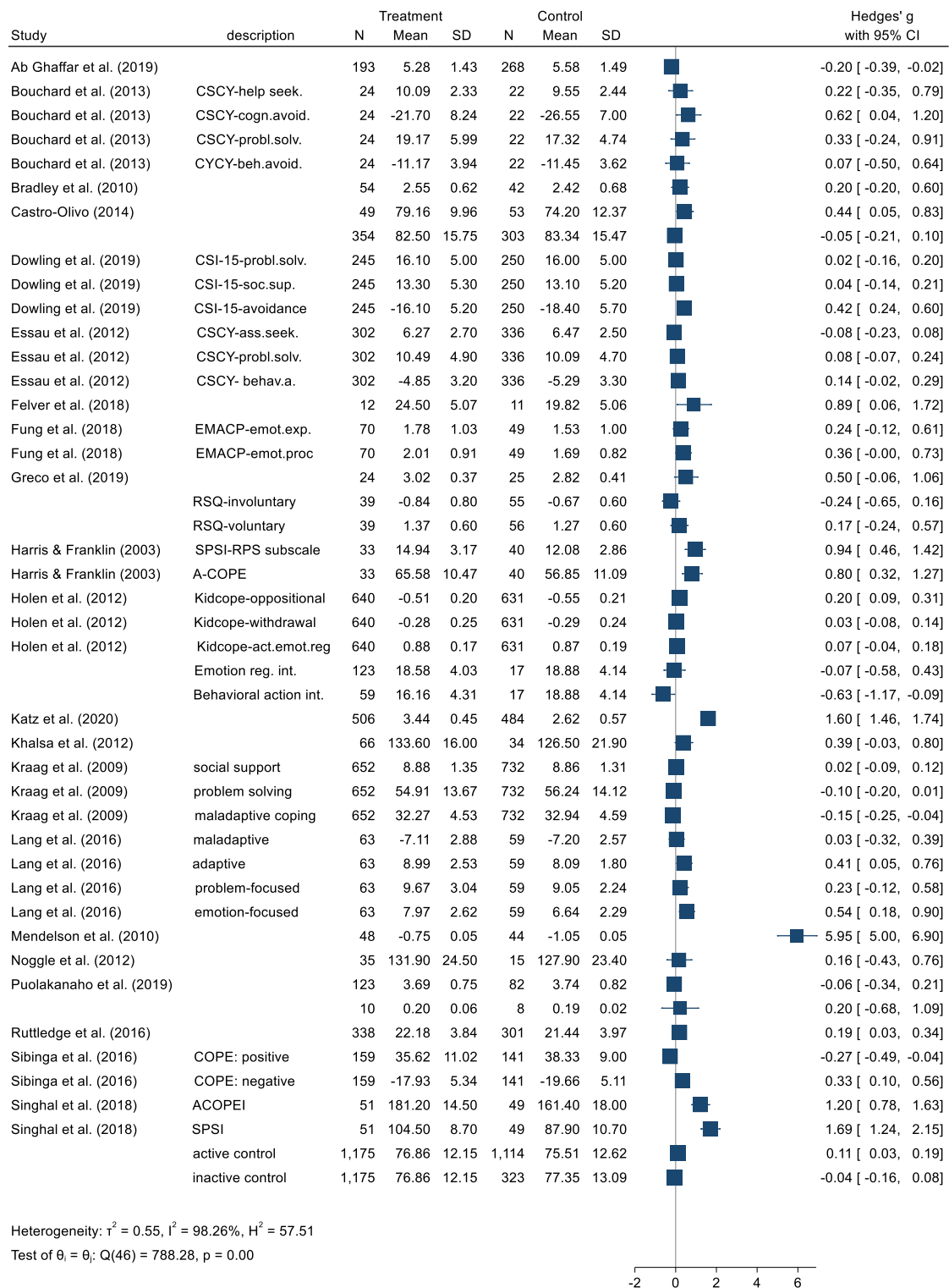
Study	description	Treatment N	Mean	SD	Control N	Mean	SD	Hedges' g with 95% CI
Ab Ghaffar et al. (2019)		193	5.28	1.43	268	5.58	1.49	-0.20 [-0.39, -0.02]
Bouchard et al. (2013)	CSCY-help seek.	24	10.09	2.33	22	9.55	2.44	0.22 [-0.35, 0.79]
Bouchard et al. (2013)	CSCY-cogn.avoid.	24	-21.70	8.24	22	-26.55	7.00	0.62 [0.04, 1.20]
Bouchard et al. (2013)	CSCY-probl.solv.	24	19.17	5.99	22	17.32	4.74	0.33 [-0.24, 0.91]
Bouchard et al. (2013)	CYCY-beh.avoid.	24	-11.17	3.94	22	-11.45	3.62	0.07 [-0.50, 0.64]
Bradley et al. (2010)		54	2.55	0.62	42	2.42	0.68	0.20 [-0.20, 0.60]
Castro-Olivo (2014)		49	79.16	9.96	53	74.20	12.37	0.44 [0.05, 0.83]
		354	82.50	15.75	303	83.34	15.47	-0.05 [-0.21, 0.10]
Dowling et al. (2019)	CSI-15-probl.solv.	245	16.10	5.00	250	16.00	5.00	0.02 [-0.16, 0.20]
Dowling et al. (2019)	CSI-15-soc.sup.	245	13.30	5.30	250	13.10	5.20	0.04 [-0.14, 0.21]
Dowling et al. (2019)	CSI-15-avoidance	245	-16.10	5.20	250	-18.40	5.70	0.42 [0.24, 0.60]
Essau et al. (2012)	CSCY-ass.seek.	302	6.27	2.70	336	6.47	2.50	-0.08 [-0.23, 0.08]
Essau et al. (2012)	CSCY-probl.solv.	302	10.49	4.90	336	10.09	4.70	0.08 [-0.07, 0.24]
Essau et al. (2012)	CSCY- behav.a.	302	-4.85	3.20	336	-5.29	3.30	0.14 [-0.02, 0.29]
Felver et al. (2018)		12	24.50	5.07	11	19.82	5.06	0.89 [0.06, 1.72]
Fung et al. (2018)	EMACP-emot.exp.	70	1.78	1.03	49	1.53	1.00	0.24 [-0.12, 0.61]
Fung et al. (2018)	EMACP-emot.proc	70	2.01	0.91	49	1.69	0.82	0.36 [-0.00, 0.73]
Greco et al. (2019)		24	3.02	0.37	25	2.82	0.41	0.50 [-0.06, 1.06]
	RSQ-involuntary	39	-0.84	0.80	55	-0.67	0.60	-0.24 [-0.65, 0.16]
	RSQ-voluntary	39	1.37	0.60	56	1.27	0.60	0.17 [-0.24, 0.57]
Harris & Franklin (2003)	SPSI-RPS subscale	33	14.94	3.17	40	12.08	2.86	0.94 [0.46, 1.42]
Harris & Franklin (2003)	A-COPE	33	65.58	10.47	40	56.85	11.09	0.80 [0.32, 1.27]
Holen et al. (2012)	Kidcope-oppositional	640	-0.51	0.20	631	-0.55	0.21	0.20 [0.09, 0.31]
Holen et al. (2012)	Kidcope-withdrawal	640	-0.28	0.25	631	-0.29	0.24	0.03 [-0.08, 0.14]
Holen et al. (2012)	Kidcope-act.emot.reg	640	0.88	0.17	631	0.87	0.19	0.07 [-0.04, 0.18]
	Emotion reg. int.	123	18.58	4.03	17	18.88	4.14	-0.07 [-0.58, 0.43]
	Behavioral action int.	59	16.16	4.31	17	18.88	4.14	-0.63 [-1.17, -0.09]
Katz et al. (2020)		506	3.44	0.45	484	2.62	0.57	1.60 [1.46, 1.74]
Khalsa et al. (2012)		66	133.60	16.00	34	126.50	21.90	0.39 [-0.03, 0.80]
Kraag et al. (2009)	social support	652	8.88	1.35	732	8.86	1.31	0.02 [-0.09, 0.12]
Kraag et al. (2009)	problem solving	652	54.91	13.67	732	56.24	14.12	-0.10 [-0.20, 0.01]
Kraag et al. (2009)	maladaptive coping	652	32.27	4.53	732	32.94	4.59	-0.15 [-0.25, -0.04]
Lang et al. (2016)	maladaptive	63	-7.11	2.88	59	-7.20	2.57	0.03 [-0.32, 0.39]
Lang et al. (2016)	adaptive	63	8.99	2.53	59	8.09	1.80	0.41 [0.05, 0.76]
Lang et al. (2016)	problem-focused	63	9.67	3.04	59	9.05	2.24	0.23 [-0.12, 0.58]
Lang et al. (2016)	emotion-focused	63	7.97	2.62	59	6.64	2.29	0.54 [0.18, 0.90]
Mendelson et al. (2010)		48	-0.75	0.05	44	-1.05	0.05	5.95 [5.00, 6.90]
Noggle et al. (2012)		35	131.90	24.50	15	127.90	23.40	0.16 [-0.43, 0.76]
Puolakanaho et al. (2019)		123	3.69	0.75	82	3.74	0.82	-0.06 [-0.34, 0.21]
		10	0.20	0.06	8	0.19	0.02	0.20 [-0.68, 1.09]
Ruttledge et al. (2016)		338	22.18	3.84	301	21.44	3.97	0.19 [0.03, 0.34]
Sibinga et al. (2016)	COPE: positive	159	35.62	11.02	141	38.33	9.00	-0.27 [-0.49, -0.04]
Sibinga et al. (2016)	COPE: negative	159	-17.93	5.34	141	-19.66	5.11	0.33 [0.10, 0.56]
Singhal et al. (2018)	ACOPEI	51	181.20	14.50	49	161.40	18.00	1.20 [0.78, 1.63]
Singhal et al. (2018)	SPSI	51	104.50	8.70	49	87.90	10.70	1.69 [1.24, 2.15]
	active control	1,175	76.86	12.15	1,114	75.51	12.62	0.11 [0.03, 0.19]
	inactive control	1,175	76.86	12.15	323	77.35	13.09	-0.04 [-0.16, 0.08]

Heterogeneity: $\tau^2 = 0.55$, $I^2 = 98.26\%$, $H^2 = 57.51$

Test of $\theta_i = \theta_j$: $Q(46) = 788.28$, $p = 0.00$

Figure 4. Study-specific effect estimates and heterogeneity statistics for the coping/resilience outcomes, from the authors' manuscript of Juhász et al. (2024). For references to studies, see the original text.

EMACP = Emotional Approach Coping Scale; emot.exp. = emotional expression subscale; emot.proc = emotional processing subscale; RSQ = Response to Stress Questionnaire; A-COPE = Adolescent Coping Orientation for Problem Experiences; SPSI-RPS subscale = Social Problem Solving Inventory - rational problem solving; Kidcope-act.emot.reg = Kidcope - active emotional regulation; Emotion reg. int. = emotion regulation intervention; Behavioral action int. = behavioral action intervention; COPE = Coping Orientation to Problems Experienced; ACOPEI = Adolescent Coping Orientation to Problems Experienced Inventory

Without outliers, very small, significant overall effects on stress ($g = -0.15$; $p < .005$) and coping/resilience ($g = 0.14$; $p = .01$) were detected. With outliers, the effect sizes increased markedly for both outcomes ($g_{stress} = -0.26$; $p = .022$; $g_{coping/resilience} = 0.30$; $p = .009$).

4.2.3 Effect Modifiers and Publication Bias

Nine comparisons were not included in the effect modification analysis by age (the only 3 involving young students, and 6 that included both early and older adolescents). According to the univariate analysis, only delivery type modified significantly (at $p < .25$) the effect of stress reduction programs: interventions delivered by mental health professionals were more effective (-0.18; 95%CI [-0.33, -0.03]) than those implemented by teachers. However, for coping/resilience, both the target population, the age of participants, and interventions containing CBT were found to be potential effect modifiers in the univariate analysis. In the multivariate model, all of these were found to be effect modifiers (though the p-value for selective samples was slightly above the conventional threshold for significance), showing that programs were more effective in selective samples (0.46; 95%CI [-0.008, 0.92]), in older adolescents (0.20; 95%CI [0.09, 0.32]), and if they contained CBT elements (0.18; 95%CI [0.03, 0.34]).

Publication bias was not indicated, in the case of stress, either by the funnel plot or Egger's test ($p = .87$). However, for coping/resilience, fewer small than large studies with no or inverse effects (i.e., negative standardized mean difference) were depicted on the funnel plot, and Egger's test was also significant ($p = .004$). See plots in the original text of Juhász et al (2024).

4.3 Study 3 – Effectiveness of BEP in Enhancing Students' Knowledge of the Harms of Smoking

Preliminary, unpublished results are presented below.

4.3.1 Participants

A total of 1271 students were found eligible for the IG (in the three waves: $n_1 = 454$; $n_2 = 386$; $n_3 = 431$), and 432 for the CG. We analyzed data of 1021 students at T0 and 664 at T1 in the IG, and 317 students in the CG. The attrition rate in the IG was 35% (41%, 39%, and 24% in order of intervention waves). The number of participants included in the analysis by wave is given in Table 5.

Table 5. The number of participants included in the analysis of the effectiveness of Balassagyarmat Health Education Program, with rates (in brackets) in proportion to the eligible, based on the manuscript of Árva (2023)

Year	T0 - 9th grade[a]	T1 - 10th grade[a]
2017/18	397 (87%)	317 (73%)[b]
2018/19	292 (76%)	234 (52%)
2019/20	332 (77%)	179 (46%)[c]
2020/21	-	251 (58%)[c]

Shades reflect recruitment waves.
[a] *T0 = baseline data; T1 = post-intervention data*
[b] *Data of the control group (providing data only once)*
[c] *Data collection through students' own devices during the pandemic*

4.3.2   Descriptives on Students' Knowledge, Gender, and School Type

Descriptive data on the outcomes and covariates are presented in Table 6. The distribution of gender ($p = .144$) and school type ($p = .251$) did not differ statistically between groups at T1.

Table 6. Descriptive data from the survey study measuring the effectiveness of Balassagyarmat Health Education Program

	Intervention Group		Control Group
	T0 – 9th grade[a]	T1 – 10th grade[a]	T1 – 10th grade[ab]
Outcomes			
Smoking is a cause of disease			
Yes	880 (92%)	630 (95%)	291 (92%)
No	76 (8%)	34 (5%)	25 (8%)
Smoking causes lung disease			
Yes	860 (90%)	617 (93%)	285 (90%)
No	96 (10%)	47 (7%)	32 (10%)
Smoking causes tumors			
Yes	636 (67%)	486 (73%)	204 (64%)
No	320 (33%)	178 (27%)	113 (36%)
Smoking causes infarction			
Yes	423 (44%)	361 (54%)	142 (45%)
No	533 (56%)	303 (46%)	175 (55%)
Covariates			
Gender			
Female	489 (48%)	342 (52%)	147 (47%)
Male	532 (52%)	322 (48%)	169 (53%)
School type			
High or vocational secondary school	746 (73%)	550 (83%)	253 (80%)
Vocational school	275 (27%)	114 (17%)	64 (20%)

The number of participants may differ from the one in Table 5 due to missing values.
[a] *T0 = baseline data collected in 9th grade; T1 = post-intervention data collected in 10th grade*
[b] *The control group provided data only once.*

4.3.3 Estimated Change in Students' Knowledge Within and Between Groups

Results of GEE on the four outcomes are presented in Table 7. The proportion of students providing correct answers increased significantly in the IG in the case of the outcomes about tumors and infarction. When comparing this with the estimated change in the CG, a significant increase of around 10 pps was detected for these outcomes.

Table 7. The effectiveness of Balassagyarmat Health Education Program in increasing students' awareness of the consequences of smoking

	Change in knowledge in percentage points (95% CI)	Significance (p)
Smoking is a cause of disease ($n = 1302$)		
IG (T0 → T1)[a]	2 (0-5)	0.090
CG ('T0 → T1)[b]	–1 (–5-3)	0.645
Difference in the change between IG – CG[c]	3 (–1-8)	0.139
Smoking causes lung disease ($n = 1303$)		
IG (T0 → T1)[a]	2 (–1-5)	0.179
CG ('T0 → T1)[b]	–1(–6-3)	0.578
Difference in the change between IG – CG[c]	3 (–1-8)	0.160
Smoking causes tumors ($n = 1303$)		
IG (T0 → T1)[a]	**5 (1-9)**	**0.021**
CG ('T0 → T1)[b]	–4 (–11-3)	0.234
Difference in the change between IG – CG[c]	**9 (2-16)**	**0.009**
Smoking causes infarction ($n = 1303$)		
IG (T0 → T1)[a]	**10 (5-14)**	**< 0.001**
CG ('T0 → T1)[b]	0 (–6-6)	0.966
Difference in the change between IG – CG[c]	**10 (3-17)**	**0.004**

The number of participants differs due to missing values. Significant ($p < .05$) results of the generalized estimating equations, adjusted for gender and school type, are highlighted in bold. CI = confidence interval.

[a] The mean difference (MD) in the rate of students providing correct answers for the questions in the intervention group (IG) was calculated in the model by subtracting the estimated values for T0 from T1.

[b] The mean difference (MD) in the rate of students providing correct answers for the questions in the control group (CG) was calculated in the model by subtracting the estimated values for 'T0 (based on data of the IG) from T1.

[c] The difference between the changes in study groups was calculated in the model by subtracting the MD of the CG from the MD of the IG.

5 Discussion

This thesis aimed to guide the development and improvement of universal substance use and addiction prevention in Hungarian schools. For this purpose, three studies were conducted to assess the current situation and identify possible steps forward, both in terms of implementation quality and applied interventions. We used a wide range of methods to do so, including a national questionnaire asking schools about their implementation practices, focus group interviews with teachers as key stakeholders of the context, a meta-analysis on programs for stress management (an evidence-based element of substance use and addiction prevention), and a longitudinal evaluation of a possible concrete local good practice.

According to our results on the implementation of such programs, one-fifth of Hungarian elementary schools provided good quality implementation. Teacher training, collaborations, leadership commitment, and funding were the main influencing factors on performance. Existing school-based stress management programs showed low overall effectiveness. Additionally, few interventions were found for children under 10, and sample, deliverer type, and program elements modified effectiveness. Finally, BEP proved its effectiveness in raising students' awareness of smoking-related health consequences. This discussion is based on Árva et al. (2024) and Juhász et al (2024).

A low rate of quality implementation was detected regarding universal substance use and addiction prevention in Hungarian elementary schools. By involving 80% of schools, we provided the first national overview on the subject, 8 years after the decree on school health promotion was introduced. Implementation quality was evaluated based on compliance with the legal requirements, including the evidence-based elements of substance use and addiction prevention and the 'whole school' approach. Four-fifths of the participating schools did not fully comply, although the majority of them implemented some programs targeting specific substance use or addiction prevention topics (read more below on the coverage of topics). A similar pattern was detected in several European countries: most schools made some effort to promote health, but the implementation of the 'whole school' approach was much less widespread (Bartelink et al., 2020; Vennegoor et al., 2023).

There is a pressing need to increase the rate of quality implementation in light of national epidemiological data and given that schools are key settings for the prevention

of substance use and addictions (Pulimeno et al., 2020; WHO & UNESCO, 2021). The rate of preventable mortality in Hungary was more than two times higher than the EU average in 2021 (OECD, 2024a), for which lung cancer, ischemic heart disease, and alcohol-related disease were largely responsible, besides COVID-19 (OECD, 2023). These are all linked to smoking and alcohol consumption, which, accordingly, accounted for a greater share of mortality in Hungary than in the EU (OECD, 2023). The country has had similar data for a long time, with higher than average preventable mortality, adult and adolescent smoking in the years before the pandemic and the decade before (Eurostat, 2025; OECD, 2009, 2021b). There were negative changes in trends of smoking and alcohol consumption among adolescents in 2022, in addition to current rates again exceeding the EU average (Németh, 2024). Moreover, adolescents' mental health showed a downward trend in Europe during the pandemic, and this was also associated with technology use (OECD, 2024a), which recently showed an increase among Hungarian students (Németh, 2024). These data further underline the urgent need to improve prevention among school-age children. The 'whole school' approach, as a possible solution, was proven to be effective for the prevention of tobacco use (Langford et al., 2015). Furthermore, when looking at countries showing the lowest substance use and technology addiction prevalence in the latest HBSC study (Boniel-Nissim et al., 2024; Charrier et al., 2024), those that also participated in the SHE monitoring study (e.g., Iceland, Ireland, Portugal) generally reported high estimated rates of implementing the 'whole school' approach (SHE, n.d.). Finally, the case of Iceland is particularly convincing, where the rate of substance use among adolescents has fallen significantly following the introduction of a prevention model centered around schools, in line with the 'whole school' approach (Kristjansson et al., 2020).

Below, to clarify the steps needed for improvement, national implementation data on the elements of quality implementation are first discussed. Then we propose methods to improve two of these: social competence building and the coverage of smoking. This is followed by a discussion of factors influencing good-quality implementation, and then, after pointing out limitations and future research directions, the practical implications of the results are presented.

5.1 Elements of Quality Implementation

Implementation of all elements of good-quality performance requires improvement in at least one-fourth of participating Hungarian elementary schools, except for the 'provision of at least one type of support for teachers' work with pupils needing mental health', which was assured in almost all schools. However, a 2021 study described a high level of unmet need in Hungarian schools regarding the availability of school psychologists (Lannert, 2021). This is to be clarified by future studies, as our results cannot distinguish between theoretical and real, timely access.

Most of these elements are also required or recommended in several European countries as part of the 'whole school' approach (Vilaça et al., 2019). In our study, teachers, participating in program implementation in two-thirds of schools, applied cooperative or interactive teaching every day in >70% of schools. Regarding the coverage of topics, our data showed similarities with the European context where smoking was addressed most, in around 70% of schools (Rajvong et al., 2024), followed by alcohol, and drug use, while less attention was given to mental health, with no data on technology-related problems in the SHE monitoring report (Bartelink et al., 2020), with the coverage of gaming and gambling being especially low in our study. One reason for this may be the paucity of evidence-based programs on the latter topics (Zurc & Laaksonen, 2023). Active educational methods were common in European schools as well, but lectures with external experts were also widely applied (Vilaça et al., 2019).

Our results represent an improvement in the previous national practice. In the 2000s, most programs were short, used frontal-type education, and were led by external presenters (Paksi & Demetrovics, 2011). School-based smoking prevention programs from 2012 also showed the dominance of lectures, but these were mostly delivered by teachers (Fekete et al., 2016). In the same year as our study, however, the SHE national coordinator reported that passive learning methods are predominantly used in Hungarian schools (Bessems et al., 2020). In any case, cooperative and interactive teaching are recommended in all schools as they improve social interactions and academic outcomes (Giorgdze & Dgebuadze, 2017; Roseth et al., 2008). Frontal education is not the most appropriate methodology for the Z and Alpha generations (with shorter attention span, multitasking, continuous access to information through the web), and its motivational approaches are not or only partially effective (Fromann, 2017; Holubova, 2024).

5.1.1 Existing Programs to Build Stress Management Skills

In our meta-analysis on school-based stress management interventions, the overall effect of both stress reduction and programs aimed at increasing students' coping or resilience was found to be significant but below the cutoff for a small effect according to Cohen's (1988) rule of thumb (Hedges's g = -0.15, and g = 0.14, respectively). Regarding conditions modifying the effect, in the case of stress, existing programs delivered by mental health professionals were more effective compared to those delivered by teachers. In the case of coping and resilience, programs targeting older adolescents (vs. early adolescents), a selective sample (vs. universal), and those including CBT elements (vs. those not including them) showed greater effectiveness.

Although Feiss et al. (2019) did not find a significant effect of school-based programs on stress, several previous meta-analyses showed larger effects. Kraag et al. (2006) described large positive effects on both stress and coping. Another study examining only mindfulness programs (Zenner et al., 2014) found small overall effects of these on stress (g = 0.39) and resilience (g = 0.36). A more recent meta-analysis on stress (van Loon et al., 2020) detected a moderate effect. One explanation for our smaller effect sizes may be that we only included RCTs (Schäfer & Schwarz, 2019), whereas the abovementioned analyses also included quasi-experimental studies that tend to overestimate effect (Grimshaw et al., 2000). In both Zenner et al.'s (2014) and van Loon et al.'s (2020) work, a quasi-experimental design was applied in almost one-third of the examined studies, which was also reflected in the lower overall study quality score measured by the latter. Another reason may be that we excluded outliers, which resulted in a halving of the effect sizes in our study. This reason is also confirmed by the fact that all 4 studies that were deemed outliers in our analysis on stress were included in van Loon et al.'s (2020) study. We opted to include only RCTs and exclude outliers to increase credibility (Zhang et al., 2023).

Context also determines the relevance of the calculated overall effect size. An effect size of g = 0.15 signifies that the difference between the means of the outcome in the intervention and the control group was 15% of the pooled standard deviation (i.e., the average of the standard deviation of the groups weighted by their size) and is considered very small according to Cohen's cutoffs (Lakens, 2013). However, such an effect can have a major impact depending on the examined outcome and its public health relevance

(Durlak, 2009), especially when a risk factor is common in the population and is a correlate of the social environment. In these cases, such as mental health issues of youth (Cosma et al., 2023), the population strategy of prevention is to be used (Rose et al., 2008). The essence of this is, referred to also as the 'prevention paradox', that even a small shift in the population-level distribution of the risk towards lower values can result in a significant decrease in the number of cases and the attributable burden. On the other hand, traditional cutoffs were only meant to be used for interpreting effect sizes when there was no previous evidence in the field (Cohen, 1988). Panjeh et al. (2023) argue that cutoffs should be based on an effect-size distribution representing the likely and observable effects in the field, presented, for example, in meta-analyses. Accordingly, they used data from a meta-analysis of RCTs of school-based anti-bullying programs with an overall effect size of $d = -0.15$ (Fraguas et al., 2021). The cutoffs for small, medium, and large effects fell at 0.07, 0.123, and 0.227, respectively, using the 25th, 50[th,] and 75th percentiles of the effect-size distribution (Panjeh et al., 2023). The similarity in the underlying meta-analysis and the size of the overall effect suggests that this method would yield significantly similar effect size thresholds in our case. Thus, our estimated overall effect sizes would be classified as medium to large.

Similar to earlier meta-analyses (Kraag et al., 2006; van Loon et al., 2020; Zenner et al., 2014), our analysis showed considerable heterogeneity of studies for both outcomes. However, publication bias (which can result in inflation of effect) was only detected for studies on coping and resilience in our study, although it was present in earlier works for stress as well. When assessing constructs such as stress management, the heterogeneity of measurement tools can also increase heterogeneity in estimates (Kraag et al., 2006). Regarding moderating factors that can account for heterogeneity, we found evidence on the importance of the deliverer in case of stress; sample type, age of participants, and content in the case of coping and resilience. In line with our results, the benefits of using CBT (Caldwell et al., 2019) and mental health professionals as deliverers were demonstrated when examining programs on anxiety (Zhang et al., 2023). However, interventions without CBT were found to be more effective for stress by van Loon et al (2022). Findings are also conflicting on whether psychosocial interventions provided by teachers can have similar effects as those provided by professionals (Durlak et al., 2011; Franklin et al., 2017). However, teachers' involvement in mental health promotion is

crucial for ensuring sustainability (Han & Weiss, 2005), but to ensure that teacher-delivered interventions are as effective as those delivered by mental health professionals, teachers may require continuous help from school mental health professionals (Franklin et al., 2012). The superiority of selective interventions was already described by earlier meta-analyses as well (Feiss et al., 2019; van Loon et al., 2020). This may stem from lower scores at baseline (leaving more space for improvement, as shown for some outcomes of BEP, see below) and a resulting greater motivation of participants (van Loon et al., 2020). Regarding age, greater effectiveness among older adolescents was also found by Zhang et al. (2023), but there was evidence for the contrary as well (Barrett et al., 2005). Further evidence is needed to clarify this, and also because although several recommendations argue that intervention should start as early as possible (UNICEF, 2024; WHO, 2021), meta-analyses either did not include students below the age of 10 (van Loon et al., 2020; van Loon et al., 2022) or did not examine its modification role (Zenner et al., 2014). We were also unable to conduct such an analysis with this age group due to the small number of studies found. Surprisingly, the length of intervention did not show a significant modification effect in our study; however, longer interventions showed benefits in Zenner et al. (2014), and recommendations usually advise for longer, sustained programs (WHO & UNESCO, 2021). These mixed results point out the complexity of schools as a context, where the impact of interventions can depend on numerous interacting factors (Zenner et al., 2014).

Based on these results, Hungarian elementary schools are recommended to implement stress reduction programs for universal social competence building in lower secondary grades, and, if possible, involve mental health professionals (e.g., the school psychologist) in their delivery (the same applies to secondary schools). To enhance the coping/resilience of students, programs including CBT elements are to be chosen, where pre-intervention screening can further increase effectiveness. Secondary schools can benefit even more from such coping/resilience programs. Additionally, schools should await or design more effective stress-management programs, and more specifically, viable options for primary school students, and better coping/resilience programs both for lower secondary grades and universal use, as these could foster the implementation of the 'whole school' approach.

5.1.2 One Example to Cover Smoking with Health Education: BEP

BEP was effective in increasing knowledge about smoking as a cause of tumors and infarction of the heart. No change was found in smoking as a cause of disease in general or lung disease, but high levels of student awareness were detected even before the intervention. The improvement of smoking-related knowledge was one element of the intervention's overall aim, which was to benefit students' substance use-related health by targeting all components of the COM-B model (Michie et al., 2011).

Our intervention applied near-peer education, interactive small-group sessions, experience-based learning, and gamification to produce its impact. Our results align with Dodd et al.'s meta-analysis (2022), stating promising results of peer education interventions in increasing knowledge on substance use. The mechanisms used in BEP ('peerness' and the resulting credibility of educators, which was even greater in the case of older peer educators, who otherwise shared characteristics of learners; role modeling and informal and innovative teaching) were frequently used in school-based peer education programs on substance use according to the review of Widnall et al. (2024). Prior interventions that engaged health professionals as near-peer educators could also increase substance use-related knowledge in the same age group using interactivity, group work, and information communication technology tools (Moore et al., 2018; Nagy-Pénzes et al., 2022). Widnall et al. highlighted influencing school values and culture as important mechanisms, especially in mental health interventions, which is more difficult with external educators. However, BEP targeted all 9th-grade students of the city from three consecutive academic years to influence norms and culture.

BEP dedicated one 45-minute lesson to smoking above the e-learning materials, which showed an impact on knowledge. This is in line with the results of other similar interventions mentioned above: one has also achieved a significant knowledge increase at post-test, after a 60-minute interactive session (Moore et al., 2018), and another study from Hungary (with a smaller sample size) also showed a significant increase in students' awareness of risk behaviors after two or three 45-minute lessons (Nagy-Pénzes et al., 2022). We detected a 10-percentage point increase in the proportion of students providing correct answers; however, interventions apply various measures for knowledge on substance use (the abovementioned studies used summary test scores of self-developed questionnaires), and post-testing occurs in different follow-up intervals, which makes

comparisons difficult (Dodd et al., 2022). In the case of smoking as a cause of disease in general and lung cancer, our results were similar to the ones of Asian & Sahin (2007), which may explained by the ceiling effect: when the majority of participants already have a high level of knowledge at baseline, no change can be detected (Staus et al., 2021). In such situations, Staus et al. (2021) propose a person-centered analytical approach to identify subgroups in which change has nevertheless occurred.

Our study confirmed the results of Nagy-Pénzes et al. (2022), that such an intervention can increase knowledge in a rural Hungarian town in a low SES area. Peer education, being cost-effective, is commonly used in low-resource areas (Russell et al., 2023). BEP data provide a valuable opportunity for further analyses, as the sample size was twice as large as in the Nagy-Pénzes et al. study, and the program was implemented in 3 different types of schools (high school, vocational secondary, and vocational school). School type, together with other SES variables, was shown to be associated with adolescents' substance use behavior (Elekes, 2020). Thus, our future analyses will aim to assess the program's impact (also on behavioral outcomes) through socio-economic factors to see if it helps to reduce inequalities, for which evidence is still scarce in the literature (Haataja et al., 2025; Moore et al., 2015). This, together with a standardized description of the intervention – often lacking in the existing literature (Dodd et al., 2022) – will allow the study to be included in future meta-analyses.

Although BEP targeted 9th-grade students, the adaptation of its methods is likely to be beneficial in grades 5-8 of Hungarian elementary schools as well as in higher secondary school years. This assumption is based on a meta-analysis (Dodd et al., 2022) showing that similar studies were effective among secondary school students (grades 5-12), who tend to rely heavily on information and influence from their peers (Abdi & Simbar, 2013).

5.2   Factors Influencing Quality Implementation

Our results confirmed the importance of school-level factors and the intervention support system as factors influencing the quality of implementation. Schools that performed well were more likely to be state or church-funded, to have a more diverse team of implementers, and to provide training that included health-related information for teachers, optionally supplemented with skills training. Teachers' views reinforced the importance of training and collaboration with staff and parents in implementation.

Regarding the differences by funding, the majority of schools working according to the 'whole school' approach were state schools in Europe as well (Vilaça et al., 2019). Church schools are perhaps better positioned in Hungary in terms of mental health promotion, as their local parish is responsible for supporting the whole school (Katolikus Egyház, 2015; Magyarországi Evangélikus Egyházi Zsinat, 2005; Magyarországi Református Egyház, 2013), which may be reflected in their higher provision of regular mental health support programs. Accordingly, the national ESPAD 2020 highlighted a 'protective role' of religious education, and showed lower rates of substance use in church schools, and in some indicators in state schools as well, compared to private schools (Elekes, 2020) in line with other previous studies (Estrada et al., 2019; Isralowitz & Reznik, 2015). Our results showed poorer performance in private schools, with lower rates of including health promotion in the pedagogical program, using cooperative and interactive teaching, and covering substance use and addiction prevention topics. However, attending such institutions was associated with positive long-term health outcomes and better health-related behaviors, like lower smoking rates, by Bann et al. (2016). Additionally, our results are surprising as sufficient funding was repeatedly mentioned as a facilitator of implementing the 'whole school' approach (Bartelink & Bessems, 2021; McIsaac et al., 2017; Vilaça et al., 2019), and private schools in Hungary are allowed to collect tuition fees from students (Országgyűlés, 2011). This may explain their seen advantage in providing a health-promoting environment. Private schools also covered the topics of technology use-related risks and assertive communication at higher rates, which may reflect their increased ability to innovate (Khan, 2020). However, less dependence on the state may lead to lower compliance with regulations (Jessiman et al., 2019; Rathi et al., 2018), and/or a possibly lower level of self-reporting bias (see Limitations as well). In sum, private institutions require further support based on our data.

Implementation quality was shown to benefit from the diversity of implementers, and teachers also pointed out that cooperation with parents and other professionals at schools can support implementation. This is in line with data from five European countries on facilitators of the 'whole school' approach, also confirming the importance of external and internal partners of schools (Bartelink & Bessems, 2021). Both international and national recommendations on substance use prevention and school health promotion emphasize the need for a multidisciplinary approach (Németh, 2024;

UNODC & WHO, 2018; WHO & UNESCO, 2021), and the involvement of parents and other professionals has also proved effective in practice (Das et al., 2016; Throuvala et al., 2019). These suggest that we should aim for a diverse team of implementers and sustain cooperation. However, the availability of other professionals at school is not only a school- but also a macro-level factor. Opportunities for cooperation with external experts and organizations have narrowed in Hungary since 2021 (after our study) due to a change in legislation (Országgyűlés, 2021). It states that only registered external partners can be involved in school health promotion on topics such as the harms of the internet and drug use, among many others. However, such a registry is not yet available; thus, the provision of these activities has become the sole responsibility of the teaching staff and the school health services specialists. This seriously complicates the application of the 'whole school' approach in practice and may negatively affect the prevention of substance use and addictions. Regarding the availability of health professionals, school size determines the number of personnel to be employed in Hungary. Schools with fewer than 800 pupils should employ one full-time school health-visitor and one part-time school physician (Népjóléti Minisztérium, 1997). One part-time school psychologist should be ensured per 500 pupils (Magyar Kormány, 2013). However, many institutions experienced a need for more help from professionals as the regulation is insensitive to differences in the student populations, and not all positions are filled (Lannert, 2021).

In our model, size did not show a significant influence on implementation quality. This may seem surprising, as larger schools may benefit from the presence of health professionals, a larger teaching staff, and the resulting higher personnel expertise, as well as higher funding, as financial support is partly distributed based on the number of pupils (Jordán, 2019). Aligning with this, large schools were found to provide better conditions for HHP implementation. Also, they showed higher coverage of several topics; however, they provided mental health programs and a health-promoting environment less frequently. In line with these results, a review on school size indicated the advantage of large schools in students' academic attainment and cost/pupil, and the advantage of small schools in terms of a more positive attitude to the school by students and teachers (Newman et al., 2006). These factors presumably balanced each other out. Similar to our findings, Bast et al. (2017) and Nathan et al. (2015) did not find differences through school size in implementation.

Implementation quality was better in schools supporting teachers with health-related information. Teachers also identified increasing children's and parents' health literacy as an important task that requires appropriate health information. Our regression model did not show significant benefits of health information training complemented with skills related to developing their own and their students' resilience and mental well-being (though the odds was higher). In contrast, teachers expressed their need for such skills and good practices and identified these as facilitators of implementing health promotion, as was reported in other qualitative (Bartelink & Bessems, 2021) and quantitative studies (Bast et al., 2017) too. In addition, previous studies pointed out the key role of competent and trained teachers in improving students' social competence, which in turn was associated with fewer conduct problems and better academic performance of students (Durlak et al., 2011). This is relevant as teachers in our study cited students' increasing academic duties, large class size, and discipline problems among the barriers to implementation, and also that parents, not aware of the above association, expect schools to provide academic progress rather than health promotion. These barriers were also mentioned in the studies of McIsaac et al. (2017) and Bartelink & Bessems (2021). Teachers' mental well-being (which may also be supported through skills training) was associated with effective teaching and the mental well-being of students (Lever et al., 2017; see next paragraph for more details). Our survey results indicated that teachers still lack complex health information and skills training in one-third of schools. Along these lines, teacher training and parental involvement to promote a better understanding of social competence development are possible areas for improvement.

Committed leadership that supports health promotion efforts, a positive attitude of teachers and parents, and staff cohesion were mentioned by teachers as facilitating factors, in line with other studies (Bartelink & Bessems, 2021; Bast et al., 2017; Forman et al., 2009; McIsaac et al., 2017). Our survey also highlighted that schools investing in community building were more able to create a mental health-friendly school environment. Teachers emphasized that they could do the most for children's mental well-being and that maintaining their mental health is key to doing this, in line with previous findings (Lever et al., 2017; McIsaac et al., 2017). Mental health improving skills training (Ferrer, 2004) and community building can have similar two-way benefits: engaging staff and helping to create a healthy workplace, leading to a more positive school climate and

better mental health for students and teachers. Leadership can have a great impact on these factors.

5.3   Limitations and Recommendations for Future Research

As for the limitations of Study 1, with the cross-sectional survey, we only provide an overview of the situation in February 2020. The closed-ended questions limited the detection of fine differences, and the self-developed survey may have led to misinterpretations. However, the high participation rate was partly due to the short and simple format. Self-report bias cannot be ruled out, and respondents' knowledge of actual implementation may have varied. Regarding the qualitative data, sampling bias cannot be excluded, and the opinions of teachers willing to discuss issues related to the prevention of substance use and addictions cannot be generalized. Member checking was not possible, as we communicated with teachers only through the principals. Future monitoring of implementation should be a regular context-sensitive process that evaluates data on students' and teachers' health behavior together with those on implementation using mixed-methods (Bartelink, van Dongen, et al., 2022; Lawson & Owens, 2024; Lyon et al., 2024; Vennegoor et al., 2024). A refined, pilot-tested version of our survey could be used to assess implementation, including information on the data provider, and the methods used to cover substance use and addiction topics, as a previous Hungarian study showed that 'program' from teachers' perspective can mean a wide range of activities (Paksi & Demetrovics, 2011). In a subsample of schools, direct observations and interviews with all stakeholders of the school community could be conducted to increase the validity of the data and better understand the influencing factors, as in the study of Jourdan (2010). Regarding health outcomes, secondary data from occupational health examination of teachers and school health monitoring of students (Népjóléti Minisztérium, 1997; Országgyűlés, 1993), complemented with information on substance use, addictions, and mental health, could be used. Lastly, extending the monitoring to secondary schools is needed, as data on these are still lacking.

In the case of Study 2, the heterogeneity of estimates and publication bias limit the strength of our conclusions (Zenner et al., 2014). Publication bias for coping/resilience studies may be partly because our meta-analysis did not include grey literature, often containing negative or non-significant results (Conn et al., 2003). Selecting only RCTs has advantages, but including quasi-experimental studies could have

increased the number of comparisons in the analysis and the strength of modification analyses. Developing better stress management interventions (see more on designing programs below) and programs for children under 10 is needed, given the low overall effectiveness of programs, the adverse trends in mental health, and exposure to addictive technology at a very young age (Donaldson et al., 2023). It is recommended to repeat this meta-analysis when a significant amount of new evidence is available to clarify the contradictory results on effect modifiers. This should be done with the inclusion of non-RCT studies and grey literature; however, sensitivity analyses excluding these and outliers are also advised. Lastly, as there may be large differences between generations of students and their needs (Vakili & Vakili, 2024), the date of study may be considered for sensitivity analysis too.

In Study 3, collecting baseline data in the control group would have allowed for more accurate comparisons, although there is no reason to believe that the CG group differed significantly from the IG group in grade 9. In waves 2 and 3, the effect of the intervention may have already been indirectly reflected in the baseline data, like in other studies where students were located in the same schools, which may reduce the measured effect (Nagy-Pénzes et al., 2022). Attrition rates were between 24-41% throughout the three waves, while a maximum of 20% is expected from good trials. This is not rare; however, it may limit the validity of results, especially in the case of differential attrition (Foxcroft & Tsertsvadze, 2012). A lower proportion of vocational school students participated in T1 measurements of our study; however, we adjusted our analyses for school type. Implementation was partly hampered by COVID-19, and the low participation rates in the e-learning activities also limited the possibility of fully evaluating the program's impact, like in similar studies (Clarke et al., 2015; Nagy-Pénzes et al., 2022). Lastly, when assessing knowledge of smoking as a reason for infarction of the heart, the word *'szívinfarktus'* was applied instead of its lay term *'szívroham'*. This may have led to an underestimation of knowledge.

When designing future interventions, confidence intervals for means and correlation coefficients from survey data can be used to identify the relevant determinants of the behavior to be targeted (Crutzen et al., 2017). This also helps to avoid the ceiling effect. It is recommended to follow the control and the intervention groups as well, to provide make-up occasions to increase participation and decrease attrition rates.

Examining the components through which we expect the change to occur and determining the long-term impact are important as well (Bailey et al., 2020; Thomas et al., 2004; van Loon et al., 2020). It is also essential to monitor implementation and contextual factors together with effectiveness to understand the conditions under which the program works (Bartelink & Bessems, 2019; Bartelink, Kremers, et al., 2022; Vennegoor et al., 2024).

5.4 Practical Implications

Above, many interrelated needs for improvement were identified in elementary school-based substance use and addiction prevention. I organized these into three possible areas for action below.

5.4.1 Establishing a School Health Promotion Working Group

A school health promotion working group is advised to be established, consisting of students, teachers, parents, leaders/management, school health services professionals, non-teaching staff (e.g., maintenance), and someone with expertise in health promotion programs and the 'whole school' approach. The working group could ensure continuous contact with the local community, monitor health promotion activities, and tailor these to the needs of the school community (Bartelink & Bessems, 2019). The establishment of a dedicated working group was mentioned to facilitate implementation of the 'whole school' approach, and the example of Estonia or the Netherlands could be considered as a good practice (Bartelink & Bessems, 2021; Bartelink, van Dongen, et al., 2022).

The 'expert' may be a health promotion teacher (Tarkó & Lippai, 2023), a public health professional from the county-level Health Promotion Offices (Németh, 2024; Somhegyi, 2023), or public health authorities (Magyar Kormány, 2016). The public health perspective is of particular importance in the design of the physical environment: e.g., hygiene of sanitary blocks, water and air quality, waste management, equality and accessibility (WHO, 2004; WHO & UNESCO, 2021). Hungarian public health authorities have already provided some guidelines for schools on air quality (Kakucs et al., 2023), canteens (OGYÉI, n.d.), school shops (OGYÉI, 2022), and vending machines (NNGYK, 2025).

5.4.2 Teacher Training and the Provision of a Supportive Work Environment

Teachers are key stakeholders in assuring a mental health-friendly social environment in schools (Franklin et al., 2017; Lever et al., 2017). Engaging teachers may also ensure the

sustainability of programs (Han & Weiss, 2005). A cornerstone of empowering teachers and assuring quality implementation is adequate training and feedback, pointed out by Study 1, in line with other results (Bartelink & Bessems, 2021; Han & Weiss, 2005; WHO, 2004; WHO & UNESCO, 2021). Regarding university training in Hungary, the competencies needed are included in both primary school teachers' (EMMI, 2016) and secondary school teachers' training requirements (ITM, 2021), however, these are only tangentially covered in primary school teachers' bachelors and are mostly available in optional postgraduate specialist trainings or specialized master programs (Lippai, 2022). The modification of university curricula is the next step, which also requires macro-level support (Somhegyi, 2023). The Innovative Health Pedagogy I and II, elective courses of the Károli Gáspár University, are possible good practices (Sápi & Rákosy-Vokó, 2024).

Healthy working conditions and well-being are also needed for teachers to perform well, as pointed out in Study 1, in line with others (Bartelink & Bessems, 2021; Bartelink et al., 2020). However, it turned out from the focus groups that teachers face significant hindering factors, such as overload and burnout, as described elsewhere as well (Bartelink & Bessems, 2021). The teachers' workforce in Hungary is characterized by aging, high turnover, stress, and burnout (Bacsa-Bán, 2019; Hajdu et al., 2022; Mihály, 2002; Paksi et al., 2015). Teachers' duties are also becoming increasingly difficult due to the worsening trend in children's mental health in the country (Képviselői Információs Szolgálat Infojegyzet, 2022), the need to adapt existing teaching routines to the changing needs of children (Holubova, 2024), and the rise in the number of children with severe learning disabilities (KSH, 2024). The prestige of the teaching profession showed a decrease EU-wide, and in Hungary as well, causing a lack of human resources in educational systems (Lannert, 2021). Therefore, it is crucial to involve practicing teachers in training to improve their methodological skills, and their resilience and well-being, too, but also to encourage talented young people to choose the teaching profession. Both social recognition and financial incentives can work to achieve this (Psarouli et al., 2022; Somhegyi, 2023). A positive school climate (which needs, e.g., community building, leadership efforts) fosters cooperation among the school community (Bast et al., 2017; WHO & UNESCO, 2021), which can also induce pedagogical innovations (Khan, 2020). School health service professionals may provide training and support mental health of teachers (CDC, n.d.-b). Given the limited number of specialists in Hungary, they may

contribute more effectively to students' health by helping the teachers' community. A favorable environment also plays a role in sustaining intervention effects (Bailey et al., 2020), higher fidelity of implementation (Bast et al., 2017), and promotes greater implementation of the 'whole school' approach (McIsaac et al., 2017).

5.4.3   Macro-Level Changes

Macro-level support could manifest in increased cooperation between decision-makers of health and educational affairs, allocating additional funding to the implementation, or including health promotion in the national curriculum, especially with a sufficient "push" from the government to implement it (Bartelink & Bessems, 2021; Forman et al., 2009; Németh, 2024). Lack of teacher time was cited as a barrier, highlighting the priority of an 'add-in strategy' for curricular inclusion, where health education is an integral part of educational activities rather than an extra task (Bartelink & Bessems, 2019). Although health-related knowledge is included in the current Hungarian National Core Curriculum, it primarily focuses on physical health, and is rarely mentioned in the implementation documents, the framework curricula (Tarkó & Lippai, 2023). Updating the National Core Curriculum (Bartelink et al., 2020; Mihalic et al., 2008; Rohrbach et al., 1993) and framework curricula supported with tools like the Health Education Curriculum Analysis Tool (CDC, n.d.-a; Tarkó et al., 2023) to provide clear expectations would be of help.

As part of capacity building, updating teacher university training and addressing teacher shortages remain priorities, alongside reducing their workloads exceeding EU levels (Lannert, 2021). Allowing teachers to work beyond retirement while receiving a pension serves as a temporary incentive (Petróczi, 2023). To attract more professionals, the government raised teacher salaries in 2024, especially for early-career teachers (Magyar Kormány, 2023), but wages remained under 75% of the average for university graduates (KSH, 2025). A further raise followed in 2025 (Magyar Kormány, 2024b). More school health service professionals, including psychologists and 'experts' for the working groups are needed (Lannert, 2021), with training in the 'whole school' approach (Somhegyi, 2023). Given the importance of context, greater school autonomy can further enhance the success of programs (Payne, 2009; Payne et al., 2006), while allowing the involvement of external experts and universities would help ensure the diversity of implementers and the access to up-to-date health-related knowledge and evidence-based health promotion practices (Domitrovich et al., 2008; Somhegyi, 2023).

School-based preventive efforts would also benefit from being integrated into broader context prevention strategies (EMCDDA, 2019). However, the comprehensive national strategies on drug and alcohol use prevention are to be created or updated (Borbás, 2023; Nádor, 2025). A preventive approach is needed to complement the bans on illegal substances (Demetrovics, 2021). Regarding technology use prevention, the government has introduced a ban on cellphone use in school from the fall of 2024 (Magyar Kormány, 2024a), like several other EU countries (Chadwick, 2024). The Global Education Monitoring Report Team (2023) also argued for technology to be only used for educational purposes, but it is still an open question if these policies are effective and how mobile phones affect learning outcomes, with some evidence on their detrimental effect on secondary school students (Kates et al., 2018). At the same time, other risks, regarding privacy issues, for example, exist (OECD, 2021a), supporting some type of restriction.

5.5   New Evidence from the Thesis

In this thesis, we provided national-level data on the state and institutional conditions of the implementation of universal substance use and addiction prevention efforts in Hungarian elementary schools for the first time following the introduction of HHP legislation. Our data allowed us to identify the proportion of good-quality implementers and the factors influencing implementation quality. We also presented teachers' perspectives on the topic, including perceived barriers and facilitators.

To examine which programs are to be used, we performed an up-to-date meta-analysis of internationally existing school-based stress management programs, assessed the overall effect size of stress reduction and coping/resilience-enhancing interventions measured with RCTs, and we also examined their effect modifiers.

Lastly, we examined the effectiveness of a potential local good practice, a universal peer education program (BEP), in improving adolescents' knowledge of smoking-related harms, and meanwhile, we presented the average levels of knowledge in a low-SES region of Hungary.

6 Conclusions

Our findings underscore the need for substantial improvements and further investment in universal addiction and substance use prevention efforts in Hungarian elementary schools. This is underlined by the worsening trends in substance use, addictions, and mental health of children, and low rates of quality implementation.

Research and program development are needed to enhance student stress management interventions, given the low overall effectiveness of existing programs, and to further test the potential of peer education programs for use in disadvantaged areas. Establishing context-sensitive monitoring systems for effectiveness and implementation are also needed. To support implementation, teacher training containing up-to-date health-related information and helping them to build resilience must be systematically integrated into school routines and university training. Moreover, at the school level, fostering a healthy work environment, strengthening organizational capacity, and enhancing collaboration and participation among key stakeholders through a working group including students, parents, expert organizations, and the broader community are essential to ensure a multidisciplinary approach and sufficient engagement. Special attention should also be given to supporting private schools. Additionally, strong leadership commitment is critical for driving meaningful change. On a broader, macro level, intersectoral cooperation and governmental support, such as updates to legal regulations, improved and detailed monitoring frameworks, and coordination between the health and education sectors, can facilitate the successful implementation of substance use and addiction prevention programs in Hungarian schools. To achieve and successfully implement these changes, it is also recommended that international best practices be adopted.

7 Summary

This thesis includes 3 studies to inform policymakers and program developers on how best to promote the prevention of substance use and addictions in Hungarian schools.

The aim of Study 1 was to evaluate for the first time the implementation of universal health promotion programs for the prevention of substance use and addictions in Hungarian elementary schools using a mixed-methods approach. We found that only 20% of the schools achieved good quality implementation, meeting the legal requirements for health promotion in schools in Hungary and incorporating evidence-based elements using a 'whole school' approach. The quality of implementation was better in state and church schools, where teachers received health-related information, optionally supplemented by skills training, and where implementers from different backgrounds were involved. The quantitative findings were reinforced by teachers who emphasized the need for training and collaboration with staff and parents, supported by management, to improve implementation. Then our aim with Study 2 was to summarize the effectiveness of school-based (grades 1-12) programs on one effective component of preventing substance use and addictions: stress management. We found a significant, but very low overall effectiveness of stress reduction and coping/resilience-building programs ($g = -0.15$ and $g = 0.14$, respectively). Regarding stress, mental health professionals were more effective as deliverers compared to teachers, while regarding coping/resilience, programs for older adolescents (vs. early adolescents), a selective sample (vs. universal), and those using CBT elements were more effective. Finally, in Study 3, an accurate methodological description of the Balassagyarmat Health Education Program was offered, and we assessed its effectiveness in increasing 9-10th graders' knowledge of smoking. At the post-test, a significantly higher proportion of intervention students (+10 percentage points) were aware that smoking causes cancer and infarction. Conversely, there was no change in the perceptions of smoking causing disease or lung disease, yet knowledge rates were high even without intervention.

As required future steps, the development of effective stress management programs and context-sensitive monitoring of effectiveness and implementation, with supporting implementation through teacher training, and increased collaboration among stakeholders on the school level, and between the health and education sectors, were identified.

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10 Acknowledgements

Supplementary Materials

Supplementary Table 1. Intervention elements and delivery methods used in the Balassagyarmat Health Education Program in the framework of the Capability-Opportunity-Motivation-Behavior (COM-B) model by Michie (2011). Examples are given from the smoking module of the program. The table is based on the authors' manuscript of Eörsi et al. (2020).

COM-B component	Content and Delivery Methods	Examples
C	Empower students and increase self-efficacy to make healthy choices by providing up-to-date health information and skills through pedagogical methods approved by experts – interactive and group work, formative assessments, experiential learning, and gamification (all activities of students are rewarded with points in a point system, where points can be exchanged for prizes).	Group work with instant feedback and interactive whole group discussion: a quiz about smoking. Usage of recently learned facts: creating a poster about smoking.
	Repetition of the most relevant messages both during lessons and in the e-learning activities.	E-learning activities are provided after the lessons.
O	Shaping healthy social norms – working in small groups but reaching a whole community: all 9th-grade classes of the city from three consecutive years participate; teachers are also informed on program elements. The continuous presence of health messages between lessons is guaranteed through e-learning activities.	Through whole group discussions, the norm of smoking as harmful and avoidable is created. The creation of the poster helps students internalize this norm.
	Shaping the physical environment – the opportunities of BEP were rather restricted in this case.	Posters are displayed in the school buildings.

M	Near-peer education – educators build up a close relationship with their groups and serve as credible role models. Small group size and working with an educator pair help them to engage every student. Reinforcing all existing positive health habits of students and emphasizing health benefits available, rather than disseminating threatening content. Gamification.	Near-peer educators stand up for a smoke-free life and emphasize the health benefits of it with a non-judgmental approach. They listen to every argument of students during the discussion and facilitate the correction of common misconceptions by the group. Making the poster means taking up the role of health educator, which can enhance students' motivation to be smoke-free.

Supplementary Table 2. Description of substance use prevention modules of the Balassagyarmat Health Education Program, based on Eörsi et al. (2023)

Content and Aim	Setting	Activities
	Smoking	
→ to increase responsibility for the decision whether to start smoking, and to encourage students not to start → to shape healthy norms/attitudes on smoking → to explain health consequences → to point out sources of help to quit	**1 lesson** (45 mins.)	• Evaluate how much they agree with the given smoking-related statements individually, then discuss them in pairs followed by a whole group discussion. Statements and discussion are about smoking behavior of their own and their family (epidemiology and typical age of initiation), attitudes and norms (if smoking is "cool", and if it is okay to say), harms of smoking and passive smoking, addictive potential, and benefits and resources for quitting. • Create a poster promoting being smoke-free and hang it in the school or another public space (group work).
	4 e-learning activities	1. Consequences of smoking 2. Additional harms, passive smoking 3. Smoking-related diseases 4. Information about how to quit and available sources of help
	Alcohol	
→ to raise awareness of own consumption in light of recommendations	**1 lesson** (45 mins.)	• Take a quiz in pairs on epidemiology, types of drinks, differences in metabolism, and health risks in short- and long-term, legal regulations, then discuss with the whole group.

→ to shape healthy norms/attitudes about being drunk, and understand the risks for teenagers → to become capable of recognizing when the stage of tipsiness changes into drunkenness, and to be aware that it is recommended to stop drinking at this point → to become capable of recognizing when the stage of drunkenness changes into intoxication, and to take responsibility for their peers reaching this point → to raise awareness of the signs, and long-term health and social consequences of heavy drinking, and of sources of help	**4 e-learning activities**	• Discuss with the whole group the stages of being drunk and simplify it to 3 stages: tipsiness (euphoria), drunkenness (excitement and confusion), and intoxication (stupor, coma, death). Then list characteristics of stages (1 stage/group), discuss it with the whole group with recommendations on what to do in these, and how to help those in intoxication (e.g., lateral stable position, calling the ambulance). • Listen to and discuss a short presentation about the long-term consequences of heavy drinking (optional activity - if time is left). 1. Types of alcoholic drinks, standard drink to estimate consumption 2. Short-term effects of drinking alcohol (the stages), health risks 3. Long-term health consequences of heavy alcohol consumption 4. Cultural aspects of alcohol consumption

Drugs

→ to understand the motivational background of drug use (initiation) and its risks → to find more adaptive ways to satisfy the needs motivating drug use	**1 lesson** (45 mins.)	• List reasons/needs leading to drug use in pairs, then discuss and categorize them with the whole group. • Watch a short movie on the topic and refine answers from before. • Collect adaptive ways to satisfy the needs grouped in a category in a small group, then share with the whole group.

→ to build empathy towards users, decrease stigma → to point out sources of help and how to help peers	**4 e-learning activities**	1. Motivational, emotional background of drug use 2. Motivational, emotional background and risks of drug use 3. Addiction and its risks 4. Legal regulation and consequences of breaking the law
Mental health		
→ to increase emotional awareness → to understand the concept of mental health, and that sharp mood changes are characteristic of teenage years → to build skills of supportive communication and empathy → to identify personal strength and mental health resources (e.g., physical health, community, family) → to point out available sources of help for mental health	**1 lesson** (45 mins.)	• Guess the feelings of characters in the presented situations in pairs, then discuss with the whole group. • Find the empathic phrase from three possibilities in pairs (victim-blaming and paternalistic ones are given too) that could be said in situations from before, then discuss it with the whole group. • Write situations provoking hard/negative feelings and collect these in a hat, then pull one and phrase an empathic sentence. • Collect alternatives to finish this sentence: "What makes me happy in my life is…", choose one and write it on a paper wristband.
	4 e-learning activities	1. Characteristics of teenage years and stress 2. Understanding stress and anxiety 3. Safe internet use 4. Sources of help for mental health