



**TAIKOMIEJI TYRIMAI
STUDIJOSE IR PRAKTIKOJE**

APPLIED RESEARCH IN STUDIES AND PRACTICE

No. 19

TAIKOMIEJI TYRIMAI STUDIJOSE IR PRAKTIKOJE
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Published since 2008

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ISSN 2029-1280
eISSN 2669-0071

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SUSTAINABLE EDUCATION FOR A SUSTAINABLE FUTURE: INCORPORATING GREEN SKILLS IN HIGHER EDUCATION

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Abstract. The relevance of sustainability in today's ever-changing world has reached new heights. With the increasing severity of global challenges like climate change, resource depletion, and environmental degradation, it is crucial to provide future generations with the necessary knowledge and skills to tackle these urgent issues. Higher education institutions play a crucial role in shaping students' perspectives and preparing them for what lies ahead. Therefore, integrating green skills into higher education is a vital step towards promoting sustainable development. This paper examines the concept of green skills, emphasizes the significance of sustainable education and the incorporation of green skills in higher education, assesses the importance of the 3LoE project in fostering the development of green skills, and showcases the findings of a study that evaluates the relevance of green skills for employers.

Keywords: green skills, sustainability, higher education

INTRODUCTION

In today's rapidly changing world, the need for sustainability has become more crucial than ever. As global challenges such as climate change, resource depletion, and environmental degradation continue to escalate, it is imperative to equip future generations with the knowledge and skills necessary to address these pressing issues. Higher education institutions play a vital role in shaping the minds of students and preparing them for the future (Moscardini et al., 2020). Hence, incorporating green skills into higher education is an essential step towards fostering sustainable development.

This paper focuses on the concept of sustainable education for a sustainable future, with a specific emphasis on the integration of green skills in higher education. Green skills encompass a range of knowledge, competencies, and values necessary to understand and address environmental challenges effectively. By incorporating these skills into various courses and study programmes, higher education institutions can empower students to become agents of change and contribute to the transition towards a more sustainable society. The comprehensive provision of green skills is a key priority of 3LoE project - Three-level centres of professional excellence: qualification, entrepreneurship and innovation in the green economy. The project is 80 percent funded by the Erasmus+ Education programme. The members of the Hanse Parliament, 50 chambers, SME associations, vocational schools and further education institutions from 13 countries and 24 colleges and universities from 7 countries are supporters of the project.

The aim of the research: investigate the incorporation of green skills into higher education curricula with the goal of promoting sustainable education for a sustainable future. The objectives of the research: 1. To present the concept of green skills. 2. To highlight the importance of sustainable education and the integration of green skills in higher education. 3. To review the importance of the 3LoE project in green skills development. 4. To discuss the outcomes of a study that assessed the value of green skills to employers and should be fostered by higher education institutions.

Research methods: analysis of scientific literature, questionnaire.

The rest of this paper is structured as follows. Section 1 of this article explores concept of green skills. Section 2 analyzes sustainable education and the relevance of green skills in higher education. Section 3 presents 3LoE project - Three-level centres of professional excellence: qualification, entrepreneurship and innovation in the green economy and its importance in green skills development. Section 4 presents the results of a conducted study aimed at assessing the importance of individual green skills for employers. Finally, Section 5 presents conclusions.

GREEN SKILLS CONCEPT: LITERATURE REVIEW

The idea of green skills has arisen as a critical element in the transition towards a sustainable future in the face of escalating environmental issues and the urgent need to battle climate change. Concerns about climate change are being addressed globally, and efforts are being made to switch to zero- or low-carbon energy systems (Minnini & Hiteva, 2023). As in the past ten years, there have been significant efforts made throughout the world (IRENA, 2019; UNFCCC, 2015 etc.) to combat climate change and move towards low- or net-zero carbon energy systems Bray, Montero, Ford (2022) note. This transformation will impact millions of people needing to upgrade their skills and have highly in-demand abilities so called green skills. Since the development of green technology, the phrase green skills have been popular (Minnini & Hiteva, 2023). People with green skills may handle environmental problems, promote sustainable practices, and successfully contribute to the green economy in a variety of industries. Even though there is no one definition of green skills, they can be broadly defined as a combination of technical, social, and personal competencies that empower individuals to understand, protect, and enhance the environment. They are the skills needed by the workforce, in all sectors and at all levels, to help the products, services, and processes adapt to the changes due to climate change and to

environmental requirements and regulations, according to CEDEFOP. The greening of the economy will require new skills, competencies, and qualifications linked to the creation of new markets and activities which can be largely acquired through on-the-job retraining (White, Bradley, Packer & Jones, 2022). These abilities are sometimes used interchangeably with other phrases like climate emergency skills and decarbonization skills, and they are related to those needed by STEM (science, technology, engineering, and math) employment, Minnini & Hiteva (2023) emphasize. Green skills often consist of three aspects when combined, notably *knowledge* (cognitive dimension), *skills/abilities* (psychomotor dimension), and *attitudes/values* (affective dimension) needed by workers to promote sustainable development (Sern, Zaimė & Foong, 2018). Knowledge of environmental preservation may be seen as a component of green skills from a cognitive perspective. From a psychomotor standpoint, a green skill is the capacity to, say, limit energy usage or lessen greenhouse gas emissions. The term green skills also refers to an emotional component, such as the drive to protect the environment.

Depending on the responsibilities and tasks, different sectors frequently need certain skills. Academic literature suggests that there is disagreement over the quantity and kind of essential green skills training. There are two categories of green skills, *technical and general*, according to the findings. According to White et al. (2022), technical green skills are hard skills that include the competencies required for the design, construction, and evaluation of technology tasks often performed by engineers and technicians. General skills are necessary for achieving organizational and cultural change quickly and guaranteeing the effectiveness of green initiatives: project management, change management, leadership, education management, and communication skills.

More specifically, Sern & et al. (2018) note that recognized green SKILL also include *design, leadership, management, city planning, landscaping, energy, finance, procurement, waste management, and communication*. Particularly, the ability to design is recognized as a crucial green skill since it is used in numerous industries, including architectural design, machine design, and circuit design. In addition, management and leadership abilities are crucial since they are required to alter the organizational structure, operation, and function to support green initiatives like lean manufacturing or life-cycle management. City planning and landscaping expertise are also regarded as two of the most crucial green skills for the present and the future. Another essential green skill, according to Sern & et al. (2018) is the ability to manage energy. To limit the use of non-renewable resources in energy production and consumption, as well as to replace those with ones that are safer and more environmentally friendly. Financial competencies are seen as green since they balance the revenue and duty for environmental protection, an organization's expenditures must be under control (Krechovská, 2015). In the context of green industries, procurement expertise is crucial to ensuring that the materials acquired are eco-friendly to limit the environmental effect throughout their life cycle (Bohari & Xia, 2015). The capacity to minimize, reuse, and recycle garbage via effective design, execution, and coordination of waste management systems is referred to as waste management expertise Sern & et al. (2018) conclude. The term communication skill refers not only to the ability required for verbal and non-verbal communication but also to technological communication skills that reduce energy consumption and lean more towards environmentally friendly communication methods. Pavlova (2015) insists that these generic green skills, which are crucial for the greening of all industries and must be developed in all institutions of higher education.

SUSTAINABLE EDUCATION AND GREEN SKILLS IN HIGHER EDUCATION

Employers are beginning to search for individuals with green abilities in addition to technical and general skills, which are crucial for promoting sustainable growth in the social, economic, and environmental spheres. The economy, society, and higher education have not given this issue enough attention even though the green industries require employees with green skills. Education and training are essential for the creation of a skilled and educated green workforce. Higher education institutions (HEIs) have a specific obligation to the future and to advance the development of a sustainable society. During the last two decades, HEIs have been incorporating sustainability into their systems (Lozano et al., 2021). Building a sustainable future depends on incorporating green skills into formal education curriculum, vocational training programmes, and professional development activities (Pirzada, G., Naz, M., & Jamil, M., 2023). Institutions of higher learning must provide their students with the skills and information necessary for a thorough comprehension of the complicated situations they will encounter after graduation. They must master certain skills related to sustainable development (Finnveden & Schneider, 2023). What should be taught to students about sustainable development is still an issue that requires discussion, the authors stress as far as there does appear to be a disconnect between acquired skills and industry demands. Moreover, there isn't enough research describing the sustainability skills that industry representatives need.

Several authors have suggested lists of competencies related to education for sustainability and their usage in recent years. The green skills were listed in the chapter above but the essence Finnveden & Schneider (2023) note is how satisfied industries are with the sustainability skills available in candidates on the job market. The overall response was that while there are good and adequate levels of professionals in this subject, there is still a need for an evolution towards more universally accepted understanding of sustainability challenges. Here are a few examples of answers to the query of what kinds of skills need to be further developed: *acquire how to effectively acquire and process new knowledge; sustainability in all topics* (sustainability has to be broadly embraced); *knowing how sustainability concerns relate to and impact company* (risks, opportunities, financial ramifications), as well as having the *capacity to communicate and work with individuals* from diverse cultural backgrounds, languages, and open minds. As a result, there was a strong desire to have instruction for these abilities substantially integrated into all university courses. There was a focus on

improving the integration of these themes into the existing university curricula. Another idea was to collaborate with businesses, NGOs, and universities to create courses that would focus on real-world issues. A truly comprehensive sustainable education requires an interdisciplinary approach. Higher education institutions should encourage collaboration among various departments and faculties to develop cross-cutting courses and research projects. The importance of having interdisciplinary courses was also stressed (Finnveden & Schneider, 2023, p. 4). By breaking down traditional silos, students can gain a broader understanding of sustainability issues and develop innovative solutions that address complex challenges from multiple perspectives. A few of the goals also included: discussing real-world examples and developing thorough business cases; understanding and managing relationships with stakeholders; understanding various organizations and initiatives in the sustainability field; and being able to reflect on the subject taught in relation to sustainable practices. To successfully implement sustainable education and green skills, higher education institutions must invest in faculty development and research. Educators need to be well-versed in sustainability principles and teaching methodologies that promote active learning and critical thinking. Encouraging research on sustainability topics not only expands the knowledge base but also fosters a culture of innovation and continuous improvement within the institution (Nölting, Molitor, Reimann, Skroblin & Dembski, 2020). As companies put more emphasis on these skills, more conversation is needed about the abilities that all prospective managers and experts need as well as the competencies that should be widely included in the HEI's curriculum.

THE IMPORTANCE OF THE 3LOE PROJECT IN GREEN SKILLS DEVELOPMENT

The 3LOE project (code No. 620870-EPP-1-2020-1-DE-EPPKA3-VET-COVE), which stands for Three-Level Centres of Professional Excellence: Qualification, Entrepreneurship, and Innovation in the Green Economy, is crucial to advancing the development of green skills and fostering a society that is more environmentally conscious and sustainable. Panevėžio kolegija/State Higher Education Institution participates in this project. A primary priority of 3LoE is the full provision of green skills. The 3LoE creates Centres of Vocational Excellence on the Green Economy and implements a wide variety of vocational education, training, and higher education initiatives involving the green economy, digitization, and entrepreneurship to address the issues of energy, climate, and environmental protection (<https://3-loe.eu/>). The goals pursued are: to strengthen the competitiveness of SMEs in the green economy by upgrading skills sustainably, securing the need for young professionals/managers, and encouraging young entrepreneurs; realize energy savings, employ renewable energy sources, and safeguard the environment and the climate through skilled and creative SMEs. The expected results include the following: the implementation of dual vocational training in higher education, training, and education, with close cooperation between the learning environments (businesses and centres); the creation of long-term partnerships between centres of excellence and SMEs that are planned out and permanently safeguarded by chambers; and the improvement of SME managers' and professionals' abilities in green economy activities, including fostering green economy entrepreneurship and securing green economy jobs. For this reason, The "3LOE" significantly contributes to green skills development in these ways:

- Comprehensive skill development: offer comprehensive training programs and courses tailored to the needs of the green economy by integrating green skills development into formal education curricula from an early stage;
- Promoting sustainable entrepreneurship: by offering support, mentorship, and resources, aspiring green entrepreneurs can develop the skills and knowledge required to create and run environmentally friendly businesses;
- Addressing skill gaps: identify these gaps and design targeted training programs to bridge them;
- Hands-on learning and practical experience: allows learners to gain valuable experience and become better prepared for the challenges of the green economy;
- Networking and Collaboration Opportunities: serve as hubs for networking and collaboration among professionals, entrepreneurs, researchers, and industry experts in the green sector.

RESULTS OF THE STUDY

The pilot study was conducted with the primary aim of enhancing comprehension regarding the implementation of green skills practices in enterprises and their significance in fostering sustainability and environmental responsibility. Research design: this study employed quantitative data collection method. Structured questionnaires were distributed to employees and management in selected enterprises to measure the extent of green skills practices implementation and their perceived impact. The sampling strategy was purposive, selecting enterprises known for their commitment to sustainability and green skills practices. Employee and management participants were chosen from different departments within these enterprises to ensure diversity. Survey questionnaires were developed based on established scales for measuring green skills practices and environmental responsibility. Anonymity and confidentiality of participants were maintained throughout the study. The research criteria for this study aligned with the following research objectives: 1. To assess the extent of implementation of green skills practices in enterprises. 2. To examine the perceived significance of green skills practices in fostering sustainability and environmental responsibility within enterprises 3. To explore the challenges and barriers faced by enterprises in implementing green skills practices. 4. To identify the collaboration areas in creating green skills with higher education institutions The research enlisted the participation of 47 companies situated in the Panevezys region. Among these enterprises, 11 percent were identified as large companies, 42 percent as medium-

sized companies, and 47 percent as small companies, as illustrated in Figure 1. Remarkably, a majority of the participating companies, accounting for 47 percent, were primarily engaged in manufacturing as their main business activity.

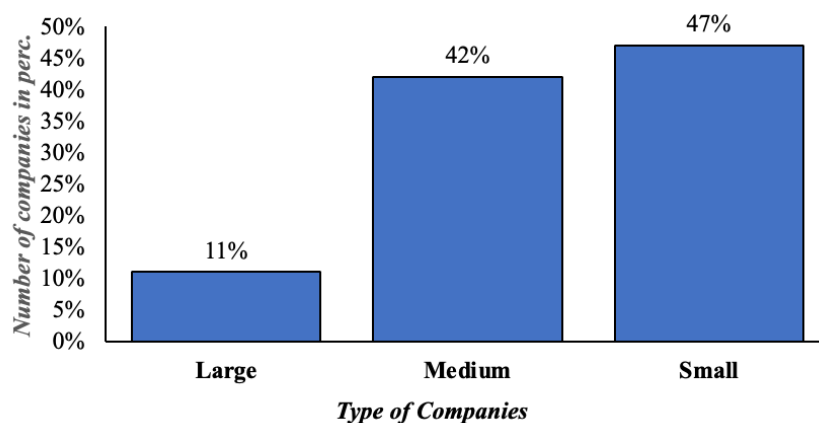


Figure 1. Distribution of companies by size

In the research survey, the enrolled companies were requested to assess their degree of acquaintance with the notion of green skills and their pertinence to sustainability practices in business. The evaluation was conducted on a five-point scale, where a score of 1 denoted a complete lack of knowledge about green skills and their correlation with business sustainability, while a score of 5 indicated a comprehensive familiarity with green skills and their significant role in fostering sustainability practices within enterprises. After conducting the research, it was determined that larger companies slightly better evaluate their knowledge related to the concept of green skills and their significance in promoting sustainability practices in companies (see Figure 2).

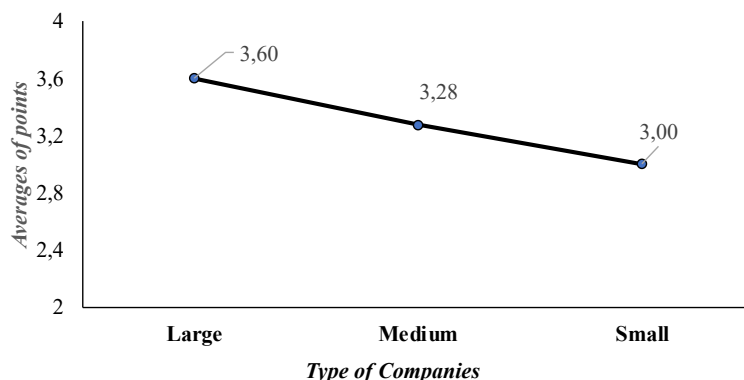


Figure 2. Familiarity of companies with the concept of green skills and their relevance to sustainability practices in businesses

The surveyed companies identified the following as the most important green skills: energy efficiency (87 percent), sustainable resource management (62 percent), renewable energy technology (51 percent), waste management and recycling (47 percent) (see Table 1).

Table 1. Importance green skills for companies

No	Green skills	Number of companies in percent
1.	Renewable Energy Technology	51
2.	Energy Efficiency	87
3.	Sustainable Resource Management	62
4.	Circular Economy Practices	28
5.	Eco-design and Sustainable Production	34
6.	Green Building and Sustainable Construction	6
7.	Waste Management and Recycling	47
8.	Water Management	9
9.	Green Finance and Investment	19
10.	Sustainable transportation and logistics	34
11.	Sustainable Agriculture and Agroecology	2

Although 93 percent of the surveyed companies believe that employees with green skills contribute to the overall sustainability and environmental responsibility of their enterprise, even 51 percent of the participating companies

indicated that they do not have a dedicated strategy emphasizing the development of green skills among their workforce. Conversely, 36 percent of the companies reported having a well-defined strategy already in place, while 13 percent indicated that they are presently in the process of developing such a strategy (see Figure 3).

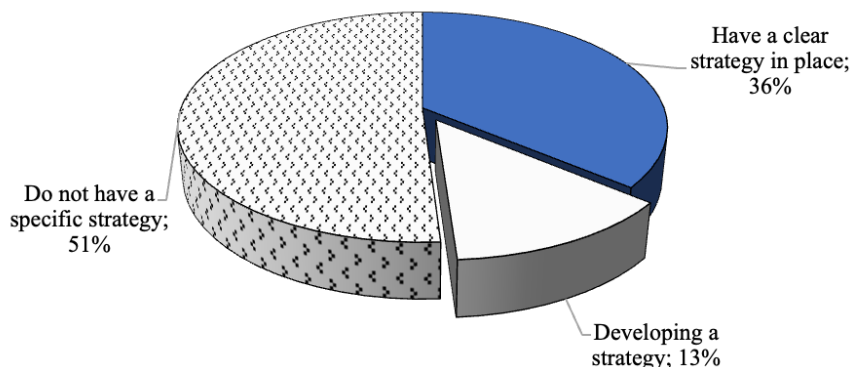


Figure 3. Enterprise strategy or policy for green skills development

The importance of green skills is also demonstrated by the training programs organized by companies for their employees in these skills. As much as 63 percent of the surveyed companies indicated that they rarely provide training for their employees aimed at improving green skills. Only 13 percent of the companies reported conducting such training systematically, 15 percent occasionally and 9 percent – never (see Figure 4).

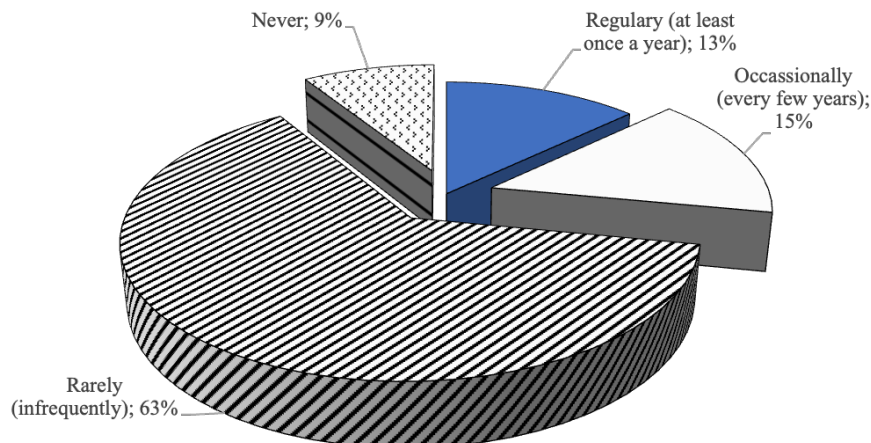


Figure 4. Evaluating the frequency of employee training for green skills

While 38 percent of surveyed companies stated that they do not encounter problems when developing their employees' green skills, other companies highlighted issues such as the lack of motivation among employees to adapt to sustainable development goals (36 percent), shortage of professionals capable of conducting such training (36 percent), a shortage of resources for employee training (31 percent), the lack of employee understanding regarding the importance of green skills hampers the company's future prospects (31 percent) (see Table 2).

Table 2. The challenges that company face when developing green skills

No	Types of challenges	Number of companies in percent
1.	The lack of employee understanding regarding the importance of green skills hampers the company's future prospects	31
2.	The lack of motivation among employees to adapt to sustainable development goals	36
3.	A shortage of resources for employee training	31
4.	Unclear forms and methods for developing green skills	29
5.	Lack of collaboration among individual departments	11
6.	Shortage of professionals capable of conducting such training	36

The surveyed companies indicated various forms of collaboration with higher education institutions in the development of green skills: collaboration in the development of new study programmes and the process of updating existing content (57 percent), organizing joint seminars for green skills development (55 percent), collaboration in the development of instructional materials on the topic of green skills development (49 percent), providing students with

internship opportunities in a company to acquaint them with the significance of green skills in specific workplaces (38 percent) (see Table 3).

Table 3. Collaboration with higher education institutions in developing green skills

No	Types of collaboration	Number of companies in percent
1.	Collaboration in the development of new study programmes and the process of updating existing content	57
2.	Collaboration in the development of instructional materials on the topic of green skills development	49
3.	Organizing joint seminars for green skills development	55
4.	Providing students with internship opportunities in a company to acquaint them with the significance of green skills in specific workplaces	38
5.	Collaboration in formulating topics for students' final projects and semester assignments related to the relevance of green skills	23
6.	Conducting joint scientific research on the topic of green transformation	21
7.	Contributing to the development and implementation of informal education programs related to green skills development.	21

The study aimed to enhance understanding of green skills practices in enterprises, involving 47 companies from the Panevezys region, with various sizes and business activities. It revealed that while many companies acknowledge the significance of green skills among employees, over half of them lack a specific strategy for fostering these skills, highlighting the importance of collaboration with higher education institutions to promote green skills.

CONCLUSIONS

Even though there is no one definition of the knowledge, skills, beliefs, and attitudes required to live in, build, and support a society that lessens the effects of human activities on the environment is referred to as green skills needed by the workforce, in all sectors and at all levels recognized as having three components: knowledge (cognitive dimension), skills/abilities (psychomotor dimension), and attitudes/values (affective dimension). These components include design, leadership, management, city planning, landscaping, energy, finance, procurement, waste management, and communication.

Since there does seem to be a gap between learned abilities and market demands, what should be taught to students regarding sustainable development is still a topic that needs discussion. Additionally, there isn't enough data in the literature detailing the sustainability competencies that industry representatives require.

In response to the question of what sorts of abilities need to be further developed, businesses give a few examples: learn how to effectively take in and process new information, embrace sustainability across all subject areas, understand how sustainability issues relate to and affect businesses and be able to interact and collaborate with people of all backgrounds, tongues, and perspectives. Enhancing the incorporation of these ideas into the current HEI's curricula was a priority.

The 3LOE initiative, which stands for Three-Level Centres of Professional Excellence: Qualification, Entrepreneurship, and Innovation in the Green Economy, is essential for improving the development of green skills and promoting an ecologically conscious and sustainable society through the collaboration of industries and HEIs

The survey found that while most companies believe that employees with green skills contribute to the overall sustainability and environmental responsibility of the company, most companies do not have a strategy to develop these skills and only a small number of them provide systematic training in this area. The companies surveyed identified various forms of cooperation with higher education institutions to promote green skills. These include developing and updating new study programmes, organizing joint seminars, developing teaching materials and providing internship opportunities for students. These results underline the importance of bridging the green skills gap in enterprises through effective cooperation with higher educational institutions.

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PREVALENCE OF ELECTRONIC CIGARETTES AMONG YOUNG PEOPLE

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Abstract. Smoking is a global epidemic that has posed serious health concerns for many years. Recently, e-cigarettes and innovative heated tobacco products have become increasingly popular among young people in various European countries, including Lithuania. The increased prevalence of e-cigarette use among youth is attributed to several factors, including the misconception that e-cigarettes are harmless. One of the primary reasons why adolescents use e-cigarettes is social acceptance and companionship. Given the rapid spread of e-cigarette use among young people and the fact that the long-term consequences of their use may not be less than those of conventional tobacco products, it is important to analyse in detail their use patterns and causes in order to reduce their spread. This study aims to determine the prevalence, habits, and causes of e-cigarette smoking among young people aged 18-35 in a north-eastern Lithuanian town. To achieve the objective of the study, a descriptive research design was employed and primary data were collected by means of a survey method, based on a questionnaire developed by the authors of this study. 351 young people aged between 18 and 35 in the north-eastern Lithuanian town participated in the survey, over the course of March and April 2023. Study shows that of all respondents, 44.4% had smoked (vaped) at least once in the last 12 months and 10% had smoked (vaped) at some point in the past 12 months but had quit. The largest proportion (34%) smoke only e-cigarettes and 25% only heated tobacco products (HTPs). More than half (54.5%) of young smokers in the city of study have smoked (vaped) for more than five years and almost 39% for more than one year. Almost 90% of smokers smoke and/or vape daily. 31% smoke and/or vape 6-10 times a day. Almost 14% of smokers smoke and/or vape more than 20 times a day.

Keywords: young people, electronic cigarettes, prevalence

INTRODUCTION

The prevalence of smoking has become a global pandemic. In recent years, the use of electronic cigarettes and other innovative smokeless tobacco products has become increasingly popular among young people in many European countries, including Lithuania.

While implementing tobacco control measures the number of daily smokers in Lithuania has decreased from 24.5% to 18.9% between 2005 and 2019. Although the largest decrease was observed in the 25–34 age group, there were no changes in the youngest 15–24 age group, where the number of smokers remained at around 20% (Statistics Lithuania, 2020). Eurobarometer surveys in Lithuania showed that in 2020, 37% of those who smoked electronic cigarettes (hereinafter referred to as e-cigarettes) were 15–24 years old, and 36% of smokers were 25–39 years old. During the COVID-19 pandemic, the use of tobacco products has become an even more pressing problem, as this infection is particularly dangerous for people with smoking-related diseases (Vaitkevičiūtė et al., 2022).

The increasing number of young people using e-cigarettes is due to a number of factors, one of which is the prevailing young people's attitude that e-cigarettes are harmless to health. One of the main rationales of adolescents who use e-cigarettes is companionship.

In Lithuania, the control of both traditional and novel tobacco products is implemented by the Tobacco, Tobacco Products and Related Products Control Act of the Republic of Lithuania. In 2014, a version of the law was adopted that transferred the provisions of the European Parliament and Council Directive 2014/40/EU of 3 April 2014 into national law, which strengthened the regulation that was in force before. The law defines conditions for the sale and use of novel tobacco products and regulates their restriction on the sales to minors. Currently, persons under the age of 18 are prohibited from using these devices or possessing them. The regulation of modern tobacco products is not much different from that of traditional tobacco products. The sale, manufacture, and distribution of these products are subject to a comprehensive regulatory framework that includes licensing requirements, excise duty obligations, advertising prohibitions, including hidden advertising, remote sales prohibitions, and mandatory labelling and warnings regarding potential health risks. Since July 1, 2022, e-cigarettes and their cartridges with liquid have been banned if they contain flavouring substances, except for tobacco flavour and taste (*Law on Control of Tobacco, Tobacco Products and Related Products of the Republic of Lithuania*, 1995; *Directive 2014/40/EU*, 2014). Since October 23, 2023, an amendment to the Law on Tobacco, Tobacco Products and Related Products has been adopted, which prohibits the sale of heated tobacco products with added flavour or taste.

Successful smoking prevention and support for people who want to quit smoking helps to effectively and economically improve individual and public health indicators. The Lithuanian Health Strategy for 2025 aims to reduce the prevalence of tobacco use by 3% from the 2020 level (*Lithuanian Health Strategy 2014-2025*, 2014). To achieve this goal, it is very important to understand the trends and habits of consumption of different nicotine-containing products.

Innovative tobacco products, such as e-cigarettes and heated tobacco products, have entered the market relatively recently, so it is very important to monitor the trends in consumption of these products, the habits of consumers and to study their impact on health.

The tobacco industry is generally making a lot of effort to try to circumvent tobacco control restrictions, reduce the effectiveness of control measures, and grow a new generation of nicotine-dependent consumers. According to the manufacturers, heated tobacco products are safer because they do not burn, and e-cigarettes are better because they do not contain tobacco. Great attention is paid to creating a more attractive image of these products (World Health Organization, 2021; Vaitkevičiūtė et al., 2022), the variety of flavours and tastes encourages young people to use (McKelvey et al., 2018).

THE RESEARCH METHOD

Given the rapid spread of e-cigarettes among young people and the fact that the long-term consequences of their use may not be less than those of conventional tobacco products, it is important to analyse in detail their use patterns and causes in order to reduce their spread.

The aim of the study was to determine the prevalence, habits and causes of e-cigarette smoking among young people aged 18–35 in the north-eastern Lithuanian town.

Objectives of the study:

1. To find out the smoking habits of electronic cigarettes among young people in the north-eastern Lithuanian town.
2. To determine the reasons behind the prevalence of e-cigarette smoking among young people.

To achieve the objective of the study, a descriptive research design was chosen and primary data were collected by means of a survey method, based on a questionnaire developed by the authors of this study.

351 young people aged between 18 and 35 in the north-eastern Lithuanian town participated in the survey. The study period: April-May 2023.

Organisation of the survey. The questionnaire was posted on the website www.manoapklausa.lt. The survey was sent to students of City Training Centre and Panevėžio kolegija/State Higher Education Institution.

RESULTS OF THE STUDY

Characteristics of the subjects. The survey was completed by 351 young people (aged 18–35 years). 45.6% of respondents had never smoked, 44.4% had smoked (vaped) e-cigarettes and/or smoked heated tobacco products (hereafter HTPs) at least once in the last 12 months, and 10% had smoked at some point in the past but had given up. A quarter of the respondents were male – 23.1% and 74.1% were female, while 2.8% did not want to disclose their gender. The age distribution was as follows: almost half of the respondents were between 18 and 25 years of age, a fifth were between 26 and 30 years of age, and the remaining 34% were between 31 and 35 years. The majority of respondents had below than higher education level, lived in the city, were working or in education.

Use of tobacco and other products. Almost half of the respondents (45.6%) reported not smoking at all, while a tenth said they used to smoke but had quit. Of the remaining 156 smokers, 3.8% smoke both HTP and conventional cigarettes and 17.3% smoke both electronic and conventional cigarettes. Meanwhile smoking only e-cigarettes was reported by 34% and only HTP by 25% of respondents (see Figure 1). 9.6% of respondents answered smoking only conventional cigarettes. It is easy to see that e-cigarettes are the most popular.

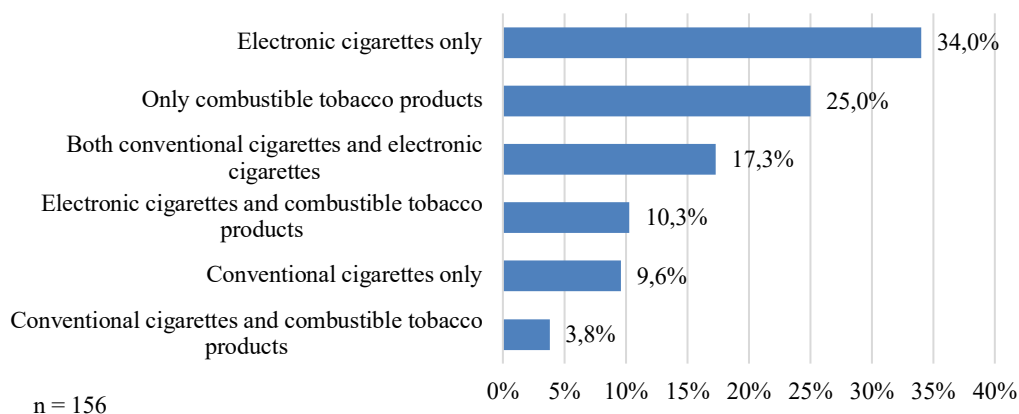


Figure 1. Distribution of respondents by products consumption (%)

Respondents were asked how long they have been smoking for. More than half (54.5%) have been smoking for more than five years and almost 40% have been smoking for more than one year. Almost 6% were those who started

smoking a few months ago (see Figure 2). Two respondents said they smoke irregularly, one smokes very rarely, and one is not addicted, usually smokes when friends get together.

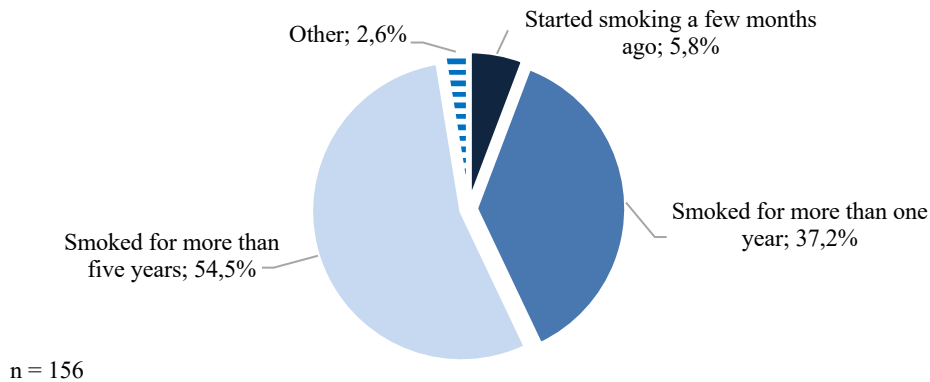


Figure 2. **Distribution of respondents by years of smoking (%)**

Subjects were divided into two groups based on the frequency of use of e-cigarettes and/or HTPs (in the last 12 months): frequent users and infrequent users. Frequent users were those who reported using e-cigarettes and/or HTPs daily or several times a week; infrequent users were those who reported using e-cigarettes and/or HTPs several times a month or less (see Figure 3).

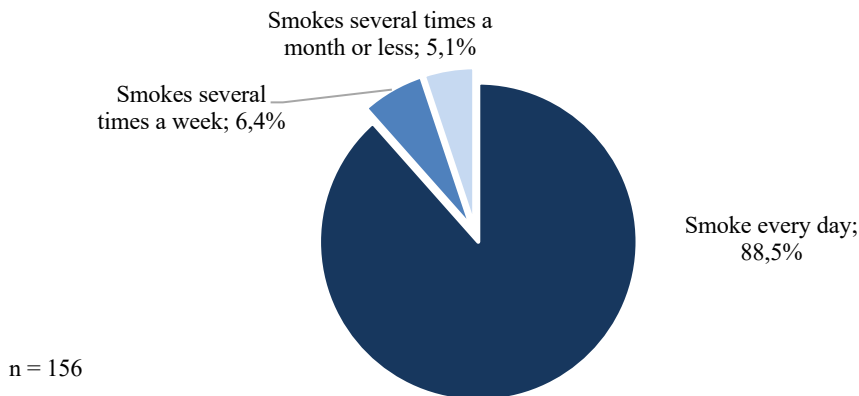


Figure 3. **Distribution of respondents by frequency of smoking (vaping) in the last 12 months (%)**

The survey found that almost 95% of smokers smoke and/or vape regularly, either daily or at least several times a week. Only 5% smoke and/or vape several times a month or less. This latter result suggests that these respondents are not addicted to smoking.

Around a third of daily e-cigarette and/or HTP users smoke between 6 and 10 times a day, 12.3% smoke between 16 and 20 times a day and 13.8% smoke more than 20 times a day (see Figure 4).

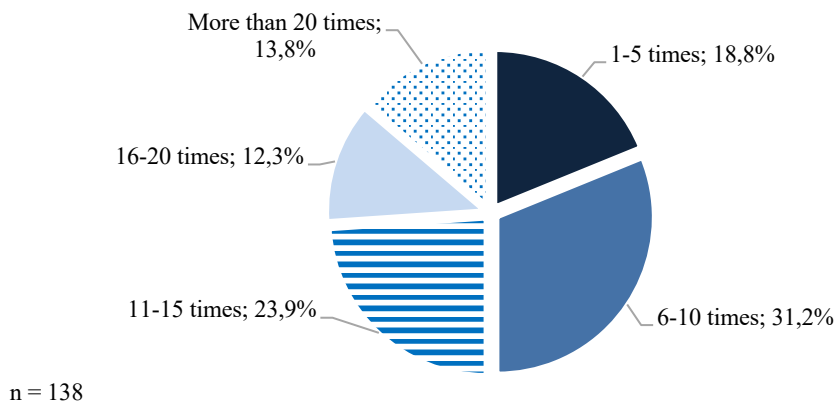


Figure 4. **Distribution of respondents who smoke e-cigarettes and/or HTPs on a daily basis, by frequency of use per day (%)**

A third of e-cigarette and/or HTP users reported that they first tried smoking (vaping) e-cigarettes and/or HTPs between the ages of 18 and 24 years. Notably, 42.3% reported that they had tried e-cigarettes and/or vaping HTPs when they were minors, i.e. under 18 years of age. Around 20% tried smoking/vaping when they were slightly older (see Figure 5).

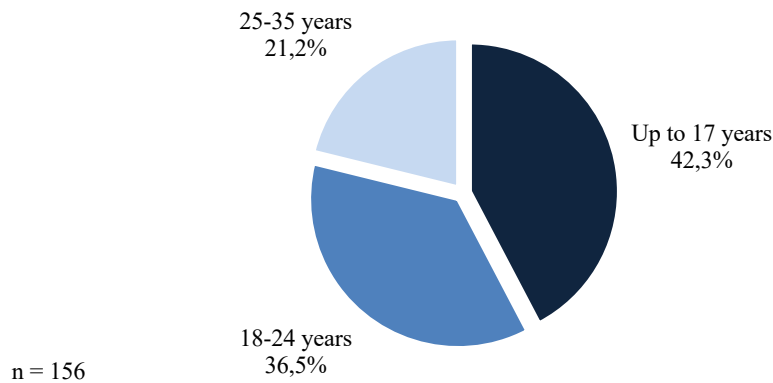


Figure 5. **Age distribution of respondents' age at first attempt to smoke/vapour e-cigarettes and/or HTPs (%)**

Respondents were asked how much they spend on average per month on liquids or heated tobacco products. Around a third of smokers reported spending on average between 11 and 20 euros per month on e-cigarettes and e-liquids. 25.6% spend up to 10 euros and around 19% spend 40 euros or more (see Figure 6).

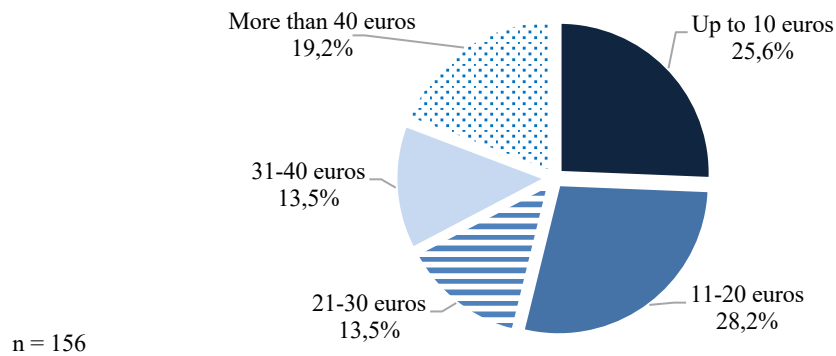


Figure 6. **Distribution of respondents by average monthly spending on e-cigarettes and e-liquids (%)**

Subjects were asked if they had ever tried to quit vaping e-cigarettes. About one fifth of the respondents indicated that yes, they had tried to quit smoking e-cigarettes in the last 12 months. 28.2% said they had tried to quit more than a year ago, and 29.5% said they had not tried to quit smoking e-cigarettes and had no plans to do so. Only one fifth of respondents would like to quit smoking (see Figure 7).

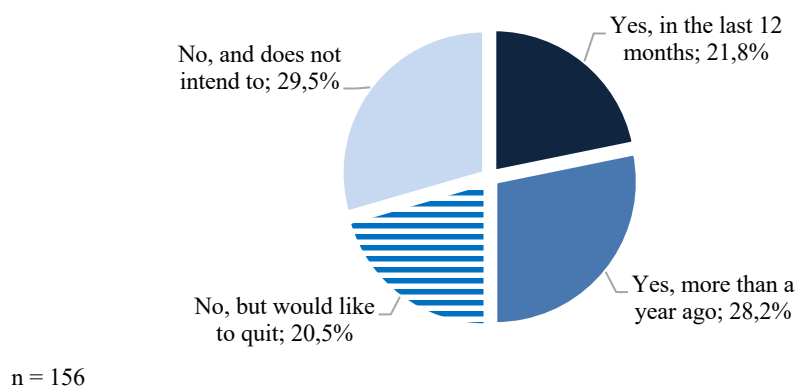


Figure 7. **Distribution of respondents' views on their intention to quit smoking (vaping) e-cigarettes (%)**

Almost half of the respondents, 49.4%, answered that they usually buy e-cigarettes, e-liquids and/or HTPs from regular outlets (e.g. grocery stores, petrol stations, cafes, newsagents, etc.). A significant number of people also reported buying these products in specialised tobacco shops – 45.5%. 4.5% of respondents searched for e-cigarettes, e-liquids or HTPs on the internet or social networks (see Figure 8).

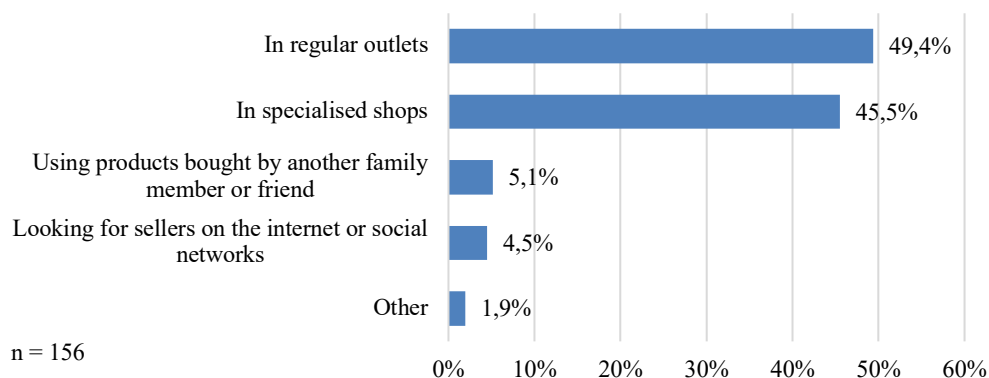


Figure 8. Distribution of respondents according to their reported place of purchase of e-cigarettes, e-liquids and/or HTPs (%)

It should be noted that one respondent indicated that e-cigarettes, e-liquids and/or HTPs are purchased illegally as other possible alternatives, while one respondent buys from an acquaintance who mixes liquids at home.

The main factors influencing the choice to start using e-cigarettes and/or HTPs were the desire to try the novelty (42.3%) and the example of friends, colleagues or others who smoked novel smokeless tobacco products (35.9%), also the availability of a wide range of different flavours and fragrances (28.2%) (see Figure 9).

The desire to stop smoking conventional cigarettes or to reduce the number of conventional cigarettes smoked was cited as a key factor by just over one sixth of respondents – 12.8%. However, almost one fifth of respondents indicated that the fact that e-cigarettes and/or HTPs can be smoked in places where conventional cigarettes are prohibited (e.g. cafes, bars, public transport, airports, residential areas) was a motivating factor for them to quit smoking regular cigarettes. Respondents are also attracted by the appearance of the devices (9.6%) and the price of tobacco and liquids (9%) (see Figure 9). It should be noted that similar surveys carried out at national level also show that one of the main reasons why young people smoke e-cigarettes is flavours.

It is worth noting that other reasons behind starting vaping was that e-cigarettes do not smell as strong as regular cigarettes, that they simply need to quench their nicotine cravings, that smoking is a way to relax, or that they smoke just for the sake of not having anything to do.

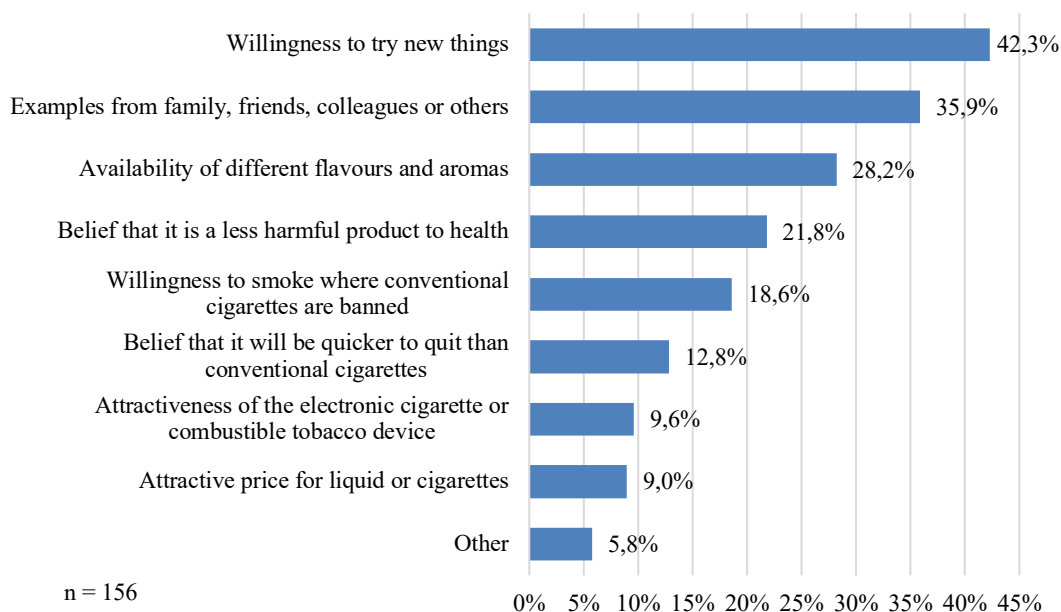


Figure 9. Distribution of respondents' opinions on the reasons for choosing to smoke e-cigarettes and/or HTPs (%)

Prevention of smoking e-cigarettes or heated tobacco. Research shows that e-cigarettes are rich in a variety of heat-irresistant organic particles that break down when heated into various toxic substances such as acetaldehyde,

acrolein and formaldehyde, which are strong respiratory irritants and known carcinogens. There is already evidence that the consumption of these products by young people is linked to an increase in the incidence and exacerbation of asthma, wheezing, chronic obstructive pulmonary disease, and the development of bronchiectasis. There is also no doubt that e-cigarettes have a negative impact on the cardiovascular system (Department of Drugs, Tobacco and Alcohol, 2022).

Respondents were further asked whether they were aware of the health effects of such smoking. The results showed that more than half of the respondents are aware of the health effects but do not pay attention to them. Just over a third of respondents (34.6%) are not concerned about the health effects of vaping. 9% of respondents do not know anything about the health effects of e-cigarettes (see Figure 10). The results of the survey suggest that the preventive measures used against smoking do not reach all young people in the city under study.

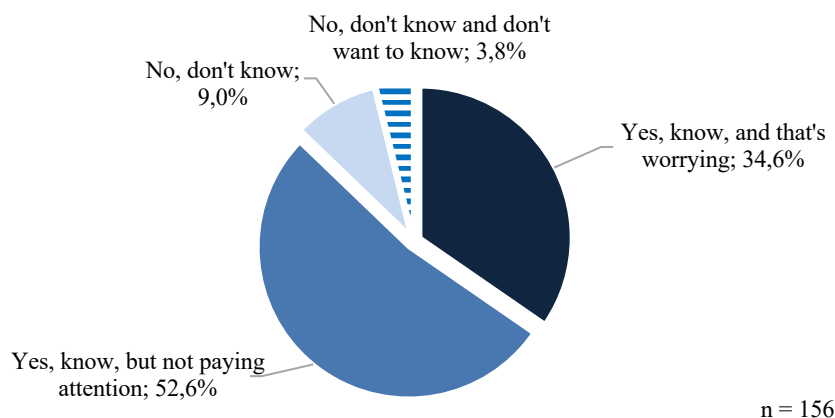


Figure 10. Distribution of respondents' attitudes towards e-cigarettes and/or HTPs in relation to health harms (%)

However, it is also noteworthy that even if they had more information about the health effects of smoking, a tenth of respondents would not quit smoking, while two-thirds (68.6%) of respondents are unsure. (see Figure 11).

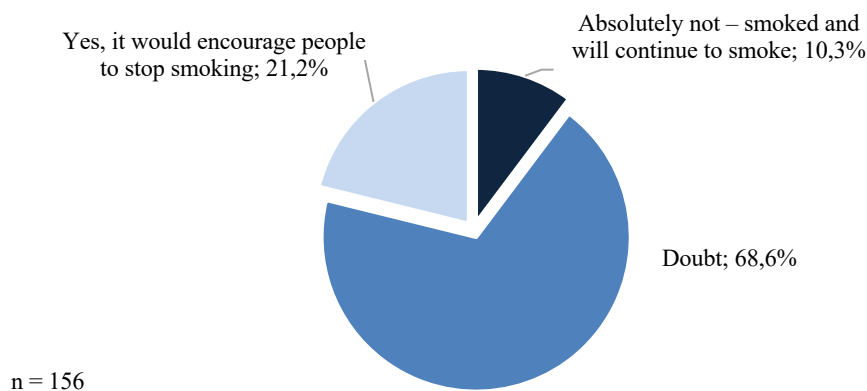


Figure 11. Distribution of respondents' opinions on the impact of information on their intention to quit smoking (%)

There are many prevention programmes offered to the public, but according to the experts, they are rarely consistently implemented. The Ministry of Health is planning a major publicity campaign for prevention, a helpline and a mobile app. The Ministry of Education, Science and Sport is also developing programmes to prevent the use of psychoactive substances. However, as many as two thirds of respondents think that no preventive measures will help unless the smoker is willing to quit. This question was answered by all (351) respondents.

CONCLUSIONS

Of all respondents, 44.4% had smoked (vaped) at least once in the last 12 months and 10% had smoked (vaped) at some point in the past 12 months but had quit. The largest proportion (34%) smoke only e-cigarettes and 25% only heated tobacco products (HTPs). More than half (54.5%) of young smokers in the city of study have smoked (vaped) for more than five years and almost 39% for more than one year. Almost 90% of smokers smoke and/or vape daily. 31% smoke and/or vape 6-10 times a day. Almost 14% of smokers smoke and/or vape more than 20 times a day.

The main reasons for choosing to start using e-cigarettes and/or HTPs were the desire to try new products (43.2%), the example of friends, colleagues or others who smoked innovative heated tobacco products (36%) and the availability of different flavours and aromas (28.2%). The results showed that almost 30% of respondents have not tried to quit smoking/vaping and do not intend to, while 21% have not tried to quit but would like to.

A tenth of respondents would not quit smoking even if there were more information about the health effects of smoking while two thirds (68.6%) are unsure. 21.8% of smokers have not tried to quit but 20.5% would like to. 29.5% of respondents have not tried and do not intend to quit smoking. E-cigarettes and heated tobacco products were mostly smoked in places where conventional cigarettes are banned, such as cafés, bars, public transport, and other public places.

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NEED FOR MANAGERIAL COMPETENCIES IN SOCIAL WORK PRACTICE

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Abstract. Competencies of the social worker are the key factor that helps to respond appropriately to the occurring changes and adapt. Regulation of social work, cultural and mental environment differ, affecting the needs of the population and work practice. With this research, we aim to reveal the need for managerial competencies in the practice of social work. The qualitative research was applied. Managerial competencies enable the social workers to attain more effective results at work; however, when working with different groups of service recipients, priorities of competencies and abilities differ.

Keywords: managerial competencies, social work, care services

INTRODUCTION

Social work as an occupation functions under constantly changing economic, social, political and cultural conditions. This results in emergence of new work methods, new customer groups, or change of the needs of the existing customer groups. Competencies of the social worker is the key factor helping respond appropriately to the occurring changes and adapt. As a multifunctional and multidimensional activity by its nature, creating the preconditions for application of knowledge of different fields of research, social work encourages to employ new approaches, acknowledge and understand the changes in the functioning of the subject of the profession (Eidukevičiūtė et al., 2014).

Over the last few years, the contents and scope of social work in Lithuania changed substantially. Social employees deal with the situation and problem assessment and are included in a multitude of social planning activities; they also implement social programmes (Adomaitienė et al., 2017), lead the team, students, and volunteers and have to ensure effective use of resources (Bagdonaitė-Stelmokienė et al., 2014). The growing complexity of activities implies that the number of decisions made at the level of specialists is increasing, thus enhancing the need for managerial competencies of social workers (Adomaitienė et al., 2017).

Competencies of social workers are among the interests of researchers; however, more recent studies by Lithuanian researchers are lacking. Petkevičiūtė et al., (2003) studied the trends of managerial competence expression among the executives of social service establishments; Bagdonaitė-Stelmokienė et al. (2014) explored the development of managerial competencies in social work studies; Adomaitienė et al., (2017) investigated the competencies of individuals working in social service sector and possibilities for their improvement, whereas Kavaliauskienė et al., (2022) examined the expression of competencies of prospective social workers in the reflections of professional activity practices. More recently, Kavaliauskienė et al., (2022) noted that Lithuanian researchers have analysed the prestige of the social work profession and motivation of students to study social work, importance of supervision in social work practice, and significance of supervision for the acquisition of reflection skills, and explored the experiences of students in practice. Researchers of foreign countries have accumulated a greater volume of papers pertaining to social worker competencies. Karpetis (2017) conducted a narrative study and summarised the skills of social workers, Mettilda et al., (2019) scrutinised the professional competencies of social work students, while Petrū et al., (2023) analysed the competencies required for the executives of social service institutions.

It is important to emphasise that research findings revealed by foreign researchers are inherent to individual countries, as social work systems vary from one country to another. Regulation of social work, cultural and mental environment differ, affecting the needs of the population and work practice.

It is noteworthy that the focus of researchers on managerial competencies in social work practice in Lithuania remains limited and does not disclose the social worker's professional reality. Analysis of managerial competencies enables determining the competence elements crucial in social work practice and identifying the ones that should be focused on in the training process. The latter factor is particularly significant when raising the question concerning the social worker specialisation and enhancing their ability to work with different groups of service recipients.

The most pressing social work quality issues in Lithuania nowadays call for deeper insights into the sources of effective functioning of social work in order to be able to acknowledge and understand them and to assess the need for managerial competencies. This paper aims at revealing the need for managerial competencies in the practice of social work.

EXPRESSION OF MANAGERIAL COMPETENCIES OF SOCIAL WORKERS WHEN DEALING WITH DIFFERENT GROUPS OF SERVICE RECIPIENTS

In social work, the need for specific competencies is not static, whereas the prioritisation of abilities can be determined by situations and environment, as shown by the challenges of the COVID-19 pandemic, flows of migrants fleeing the threat of war, and difficulties caused by yet-unknown intercultural differences. Those working in the social domain have encountered all of those directly.

Exceptionally turbulent environment, uncertain situations, and transformation of relations with the service recipients strengthened the need for managerial competencies in social work practice. Managerial competencies in social work allow for better understanding of the approaches to effective use of resources, promote social innovations and leadership. Lara et al., (2019) suggested that managerial competencies could be defined as personal qualities that have a causal relationship with the effective performance of work.

A professional social worker leverages managerial competencies in the fields of empowerment, development or integration of individuals as well as in the governance activities whose success depends on the knowledge of effective management principles. For example, social work organisers and social workers coordinate the work of individual care specialists and also help new employees socialise by performing the mentor's function (Coulshed et al., 2018).

Interaction with people while helping others attain their goals, supervising their efforts and consulting with various sources before making the decisions, problem solving, presentation and management of the change process – these are the tasks common both to a social worker and a manager. Manager's skills could be adapted while deploying certain social work intervention methods and approaches. Furthermore, social workers at all levels, similar to the managers, observe the required standards while managing the resources (Coulshed et al., 2018).

In research papers on the topic of social worker competencies, much attention is paid to effective planning (Brahim et al., (2015); Kavaliauskienė et al., 2022). Effective planning is significant when planning multi-agency interventions. An intervention plan applied in case management requires a multisectoral eclecticism of several parties, such as police, educational and health care institutions. Adomaitienė et al., (2017) and Berger et al. (2020) noted that planning in social work encompassed various technical abilities: assessment, data analysis, development and evaluation of an optimal community future scenario. Here, planning includes all actions, starting with the acknowledgment of problems to action taking when solving them.

Bagdonaitė–Stelmokienė et al., (2014) carried out a study of the development of managerial competencies in social work studies and found that the following areas of managerial competencies were important in social work: *public relations competencies, leadership competencies, competencies in the field of economy, performance quality guarantee, intercultural competencies, and interpersonal competencies*. According to the authors, public relations competencies are revealed when representing an organisation and its values, drawing attention to the organisation's programmes and activities, attracting volunteers, and fostering the cooperation and strategic relations. Leadership competencies are important for motivating, leading and supporting the co-workers, students, and volunteers, for evaluating, analysing and improving teamwork, analysing the workload and distributing the tasks within the team appropriately. Competencies in the field of economy reveal the ability to perform work functions cost-efficiently. Performance quality guarantee is perceived as the “attention to quality (ability to assess and maintain the performance quality)” (Bagdonaitė–Stelmokienė et al., 2014). This competence is characterised by the abilities of the social employee to plan their activities and follow the guidelines of their work, to collect independently information about legal and political conditions pertaining to any domain of social work and to analyse this information as well as to apply theoretical knowledge in practice. Intercultural competencies are defined by the ability to recognise and understand intercultural differences (value, lifestyle), to apply legal and social knowledge of social work in solving migration, racism, and discrimination problems, to apply suitable methods when working with clients and colleagues from other cultures to ensure effective and conflict-free cooperation, and to communicate in a foreign language. Interpersonal competencies important in social work refer to the ability to work independently, to assume the responsibility, to work in a team, to apply critical thinking and to improve one's qualification. As noted by Adomaitienė et al., (2017), constantly increasing changes in all spheres of life and work require for constant refreshment of knowledge.

In accordance with the post-modernist approach, social work and competencies important for performing it can be perceived as a complex activity that changes depending on the participants of the social work process – workers, clients, and context (Adomaitienė et al., 2017). The issue of the need for managerial competencies when dealing with different service recipients and providing different services remains open.

RESEARCH METHODOLOGY

Seeking to reveal the essential management competencies of social employees when working with different groups of service recipients, an ethnomethodological direction of research was selected. It enables reviewing a broader spectrum of social activities and understanding of the way people interact in social contexts where they find themselves and of the way they perceive and manage their environment. A semi-structured interview was applied. The survey included social workers who held at least higher qualification category, had more than 5 years of practical experience and directly provided social care services to children deprived of parental care or elderly or disabled people in establishments.

The survey was carried out in one of the largest service centres that offers social care services to both groups of service recipients.

Care services in Lithuania are licensed and have specific descriptions regulating them. However, in practice, there remains space for development of work functions by enhancing and individually tailoring the services offered. In total, the research included 20 informants (5 – providing services to elderly and/or disabled people, 15 – providing care services to children in a community children care home).

RESEARCH FINDINGS. APPLICATION OF MANAGERIAL COMPETENCIES OF SOCIAL WORKERS WHEN PROVIDING SOCIAL CARE SERVICES

Social care is defined as the entirety of services provided in establishments where an individual lives permanently or for a lengthy period of time, or arrives to spend a part of the day (Adomaitienė et. al., 2017). Managerial competencies can manifest when providing care services in different activities and at different intervals. The research aimed at identifying the key managerial competencies, i.e. those applied frequently or regularly when providing social care services. Although the services are of the same type – care – the research allowed identifying the need for different managerial competencies when working with different groups of service recipients. One of major differences pertained to public relations competencies. Social workers who provide social care services to elderly individuals regularly collaborate with administration when to draft various information and promotional materials. They are particularly actively engaged in the dissemination of the information on services offered, their availability, and procedural changes to the health care specialists. Social workers contribute to the shaping of the public attitude to the elderly and disabled, thus reducing their discrimination (Kavaliauskienė, et. al., 2017). For this purpose, various publicity measures are invoked, for instance, open door days. Public relations competence is less salient for those social workers who work with children placed in care. According to the informants, children care in a community home is not a service that should be exposed to publicity, seeing that the children's situation is the outcome of painful circumstances. On the other hand, in the society, stigmas and taunting in respect of children in care are still widespread. This notwithstanding, social workers working with both groups participate in various public activities representing the values of the establishment. Cooperation furthering function that characterises the public relations competence is inherent to both groups of workers, albeit for different purposes. They cooperate closely with the employees of the adoption service, social workers of the municipality, and care centre and social partners to strengthen the ties between the child and their biological family and to prepare the child for care in a family or adoption. For social workers providing care services to the elderly, cooperation with non-governmental organisations uniting the disabled or elderly people without relatives is of essence. It is important when providing short-term care services, where eventually the individual returns to live in their environment. Direction of such person or their relatives to various associations helps reduce social exclusion and the feeling of loneliness and obtain more information about different methods and means of assistance.

Among the managerial competencies applied in practice, the ability to motivate, lead and support the co-workers, to analyse the workload and to distribute the tasks within the team appropriately is the most notable. Irrespective of the group of service recipients they work with, social workers coordinate the work of individual care specialists and provide them with methodological assistance. However, social workers who deal with children in care tend to support their colleagues and distribute the tasks more frequently. Children are placed in care from complicated family situations, quite often with unsuitable behaviour models already formed. Social workers encounter wilful elopement of children from their place of residence, truancy, and other problems that need to be solved urgently. The children can be brought to the community children care home without a separate arrangement or preparation at any time of the day and the specifics of work dictate the necessity for flexibility and quick orientation.

Competencies in the field of economy are linked with effective management of resources, generally more inherent to the employees in executive positions. Social workers apply this competence in practice when drawing up, controlling and documenting the budget of projects, if any. In most cases, social workers are in charge of the municipal level projects and their administration.

Performance quality guarantee competencies are strongly expressed through effective planning skills that are significant for social workers working with both groups of service recipients. Workers draw up plans of their activities and reports as well as plans of work with service recipients, i.e. together, they plan for actions and measures aimed at achieving positive changes in the situation of service recipients. For both groups of social workers, ability to follow the guidelines of work, i.e. internal documents of the establishment and documents governing social care, is relevant.

Need for intercultural competencies, especially the knowledge of a foreign language and understanding the intercultural differences became more evident as the number of the war refugees from the Ukraine increased. The need for these competencies is more prominent in the group of workers dealing with children in care. Social workers working with refugees sometimes also have to make the effort to understand cultural differences and traditions of other nations better and simultaneously explain the values that we cherish and our laws without offending the dignity of foreigners.

The expression of interpersonal competence, particularly in the field of responsibility, is first and foremost linked with the service recipients. For the child placed in care, the establishment is often the legal representative that does more than just take care of their health and safety. When providing social care services to the elderly, naturally, the responsibility for their safety, health, protection of confidential information, and effective provision of services remains.

However, when adopting the decisions of strategic importance for the service recipient, generally, it is possible to discuss it with their next of kin or family.

In summary, it can be stated that the need for managerial competencies of social workers who work with children in care can be prominently seen in more diverse areas as compared to the social workers who work with the elderly or disabled in an establishment. Both those working with children in care and with the elderly feel the need for collaboration and establishment of partnership relations in practice.

CONCLUSIONS

Managerial competencies enable the social workers to attain more effective results at work; however, when working with different groups of service recipients, priorities for competencies and abilities differ. This was confirmed by the findings of the survey of two groups of social workers working with different service recipients.

Public relations competencies are more prominently expressed in the group of workers working with the elderly. In the meantime, in the group of those working with children in care, public relations competencies more often play the role of inclusion rather than information provision or positioning.

Competencies of cooperation are significant when carrying out the direct functions of work included in the content of the service as well as when ensuring an integrated approach to the services provided and multiagency inclusion.

The need for the ability to motivate and interpersonal competencies is more expressed in the group of those working with children in care. This need is largely determined by the specifics of the service and nature of responsibility.

It is noteworthy that the competencies in the field of economy were more prominently expressed among employees administering projects and substantially less dependent on service recipients.

Performance quality guarantee, especially planning skills, are relevant when working with both groups of service recipients.

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PSYCHOSOCIAL DISTRESS IN EMERGING ADULTHOOD

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Abstract. The paper analyses and comprehensively identifies the biological and social factors that promote and constrain the development of young adults. According to the study, as many as 35% of medical and health science students are at high risk of exposure to psychosocial stress due to high academic workload and financial burden. Students cope with high levels of stress by smoking more cigarettes and taking anti-stress medication. Targeted social support in the Republic of Lithuania should be aimed at medical and health science students, especially women, who may not be able to manage psychological distress.

Keywords: psychosocial risk, psychological distress, emerging adulthood, health, students

INTRODUCTION

In the last decade, a new stage has been identified at the age of 18-29 years, known as emerging adulthood or the young adult developmental stage of emerging adulthood (Arnett et al., 2000, 2014, 2015; Matud et al., 2020). Emerging adulthood is considered to be a critical, most unstable period in life (Arnett et al., 2014; Saikkonen et al., 2018), correlating with changes in lifestyle, relationships, learning and employment (Arnett, 2000; Bonnie et al., 2015). Changes in relationships, employment at work, school, and residence during emerging adulthood have been implicated as psychosocial stressors that can negatively affect quality of life and mental and physical health outcomes in later life (Almeida, 2005, Arnett, 2014, Bell & Lee, 2008, Howland et al., 2017, Lane, 2014, Lane et al., 2017, Renna et al., 2020).

Medical and health sciences students are a population group with higher levels of psychosocial stress. Among other things, medical and health sciences degree programmes are among the most demanding due to increased academic requirements (Wolf, 1994), and students need more time and emotional effort to obtain the necessary professional qualifications.

Students' persistent psychosocial stress can negatively affect their psychological well-being (Mosley, 1994), leading to increased symptoms of depression and anxiety (Aktėkin et al., 2001). This has been supported by research evidence showing that 30% of medical and health science students in Europe who were exposed to elevated psychosocial stress experienced anxiety and depressive symptoms (Andrews & Slade, 2001, Haldorsen et al., 2014, Moutinho et al., 2017). Symptoms of specific mental health disorders were also higher among students experiencing high financial burdens (Shao et al., 2020).

In contrast to the international level, there is a lack of scientific data at the national level describing psychosocial stress in a cohort of young adults. In Lithuania, it is important to conduct research to comprehensively identify the biological and social factors that promote and constrain the development of young adults enrolled in medical and health sciences programmes and that may affect their mental health, with an additional focus on the links between psychological distress and physical health status of students. **The aim of the research** is to investigate and comprehensively assess the biological and social factors that promote and limit sustainable mental health and quality of life in young adults.

To achieve the aim of the study, the following **objectives** were set:

1. To identify and assess the expression, causes, determinants and coping methods of psychological distress experienced by medical and health sciences students.
2. To assess the relationship between psychological distress experienced by medical and health science students and quality of life.

ORGANISATION AND METHODOLOGY OF THE SURVEY

A cross-sectional, single-item survey was carried out between February and June 2021 using a questionnaire survey method. The target population consisted of bachelor and full-time students of Vilnius University Faculty of Medicine (N = 2194). A total of 483 students aged 20.7 ± 1.9 years from five study programmes (medicine, physiotherapy, pharmacy, dentistry, public health) in the field of medicine and health sciences were recruited and examined. More detailed characteristics of the respondents are presented in Table 1. The survey questionnaire consisted of open-ended and closed-ended questions about the severity, causes, coping methods and consequences of psychosocial stress. The level of psychological distress experienced by the subjects was determined using the Reeder Stress Rating Scale (Metcalf et al., 2003). Based on the scores, the respondents were classified as high (7 to 14), medium (15 to 21) and low (22 to 28) psychosocial stressors. The SF-36 (Medical Outcomes Study 36-item Short Form) questionnaire was used to assess

quality of life (Staniūtė, 2007). The SF-36 was used to score eight quality of life domains (from 0 to 100 points), which were then combined into two categories describing physical and mental health.

Table 1

Sociodemographic data of respondents		
Indicators		Average ± SD or % (n)
Age, year		20,7 ± 1,9
Biological gender	Male	19,0 (92)
	Female	81,0 (391)
Study programme	Physiotherapy	17,0 (82)
	Medicine	52,4 (253)
	Public health	16,8 (81)
	Pharmacy	4,6 (22)
	Dentistry	9,3 (45)
Course	I (first)	27,3 (132)
	II (second)	33,5 (162)
	III (third)	20,5 (99)
	IV (fourth)	17,4 (84)
	V (fifth)	0,8 (4)
	VI (sixth)	0,4 (2)
Place of residence	Dormitories	23,6 (114)
	Apartment for rent	27,1 (131)
	With relatives	1,0 (5)
	Own accommodation	7,0 (34)
	With friends	1,4 (7)
	With parents	39,8 (192)

Statistical analysis of the data was carried out using SPSS (Statistical Package for Social Sciences) v.25.0. Arithmetic means, standard deviations (SDs) and 95% confidence intervals (CIs) were calculated for the analysis of some of the data. The significance of the differences between the attributes analysed was determined using the Student's t-test and the Phi (ϕ) coefficient was used to determine the strength and reliability of the relationship. The level of statistical significance was set at $\alpha = 0.05$. Linear and logistic regression analyses were performed to assess the association between the attributes analysed.

RESULTS

THE CAUSES, CONSEQUENCES AND COPING METHODS OF PSYCHOSOCIAL STRESS

According to the study, low levels of psychosocial stress were found among 8.9%, medium levels among 56.3% and high levels among 34.8% of medical and health science students. High levels of stress were more common in women than in men (38.9 vs. 17.4%, $p < 0.0001$) (Figure 1).

The main causes of psychosocial stress among health science students were heavy study load (77.2%), rushing to lectures and work (41.4%), disagreements with friends and family (35.2%), financial problems (21.5%), and combining work and studies (16.8%). Respondents identified the impact of stress on health (88.2%), mood changes (68.9%), the development of headaches (50.7%) and the quality of communication (40%). In addition, 36.2% to 50.7% of the students coped with Psychological distress, regardless of its severity, by getting extra sleep, eating more, exercising more, and doing their favourite activities. Unhealthy ways of coping with psychosocial stress, such as increased smoking, alcohol consumption and use of anti-stress medication, were used by 17.2%, 13.9% and 14.1% of the subjects respectively. An analysis of the causes, effects and consequences of psychosocial stress according to the biological sex of the students revealed that, unlike men, women's stress was caused to a greater extent ($p < 0.05$) by a high academic workload, rushing to lectures and work.

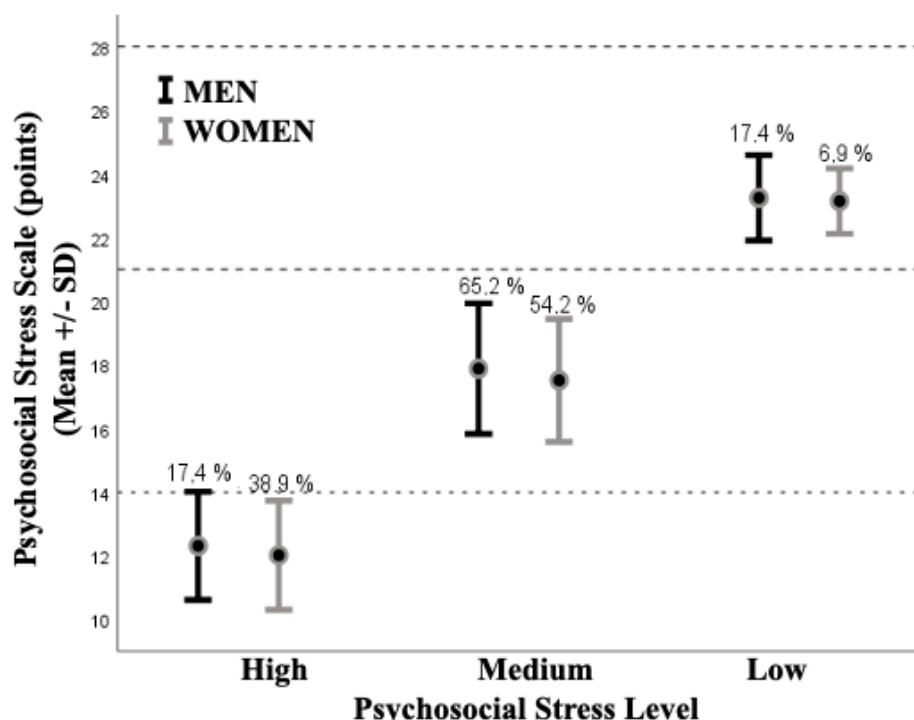


Figure 1. Distribution of students according to psychosocial stress (by mean ± SD and frequency (%) of Reeder scale scores)

Women were more likely than men to experience mood swings, headaches, conflicts and communication problems as a result of stress. Female students coped with stress more often by sleeping and eating. Meanwhile, male students were more likely to choose psychological coping methods such as exercising and smoking cigarettes more often (Table 2).

Table 2

Distribution of students according to the causes, impact and coping methods of psychosocial stress

Variables		Men, % (n)	Women %, (n)	φ	p
Reasons	High learning load	60,9 (56)	81,1 (317)	0,19	< 0,001
	Rushing to lectures and work	28,3 (28,3)	44,5 (174)	0,13	< 0,01
Impact	Spoiling the mood	54,3 (50)	72,4 (283)	0,15	< 0,001
	Poorer quality of communication	25 (23)	43,5 (193)	0,15	< 0,001
	Conflicts	23,9 (22)	45,8 (201)	0,17	< 0,001
	Headaches	25 (23)	56,8 (245)	0,25	< 0,001
Ways of overcoming	Sleep	39,1 (36)	60,1 (235)	0,17	< 0,001
	Eating more often	26,1 (24)	38,6 (151)	0,1	0,02
	Smoking	23,9 (22)	15,6 (83)	- 0,87	0,05
	Playing sports	56,5 (52)	41,2 (161)	- 0,12	< 0,01

An assessment of the causes of psychosocial stress using multinomial logistic regression revealed that, irrespective of biological sex, students were between 2.6 and 3.9 times more likely to be experiencing a high level of stress (on the Reeder scale: 7 to 14), only because of a high study load (OR /odds ratios = 3.9, 95% CI/confidence intervals: 1.8 to 8.2) and because they were suffering financially from a high level of financial problems (OR = 2.6, 95% CI: 1.0 to 6.8) (Table 3).

Table 3

Factors contributing to psychosocial stress

High stress level (7 - 14 points) ^a	β	SP	The Wald criterion	p	OR (95 % CI)
High learning load	1,4	0,4	12,7	< 0,001	3,9 (1,8 – 8,2)
Financial problems	0,9	0,5	3,9	0,05	2,6 (1,0 – 6,8)
Rushing to lectures and work	0,4	0,4	1,4	0,24	1,5 (0,8 – 3,2)
Constanta	- 2,4	1	5,9	0,02	0

Note: ^a is the reference category of low levels of psychosocial stress (22-28 points); β is the estimated coefficient with standard error (S.E.E.) (< 5); Criteria for assessing the goodness of fit of the model are: $\chi^2 = 57.2$, $p < 0.001$; Nagelkerke's R-square (R-squared) = 0.2; and the regression model was fitted by controlling for students' biological gender.

When assessing the effects of Psychological distress according to the predictive logistic regression model constructed in this study (Table 4), it was found that high levels of stress experienced by students were associated with headache (OR= 7.2, 95% CI: 2.7 - 18.8), poorer quality of communication (OR = 3.2, 95% CI: 1.2 - 8.7), negative self-assessment of one's own health (OR = 3.1, 95% CI: 1.0 - 9.4), the occurrence of conflicts (OR = 3.6, 95% CI: 1.3 - 9.8), and insomnia (OR = 3.0, 95% CI: 1.1 - 8.7).

Table 4

Effects of psychosocial stress					
High stress level (7 - 14 points) ^a	β	SP	The Wald criterion	p	OR (95 % CI)
Communication problems	1,2	0,5	5,2	0,02	3,2 (1,2 – 8,7)
Conflicts	1,3	0,5	6,3	0,01	3,6 (1,3 – 9,8)
Health effects	1,1	0,6	4,1	0,04	3,1 (1,0 – 9,4)
Headaches	2	0,5	16,1	< 0,001	7,2 (2,7 – 18,8)
Insomnia	1,1	0,5	4,3	0,04	3,0 (1,1 – 8,7)
Constanta	- 8,4	1,3	39,8	< 0,001	0

Note: ^a is the reference category of low levels of psychosocial distress (22-28 points); β is the estimated coefficient with standard error (S.E.E.) (< 5); Criteria for assessing the goodness of fit of the model are: $\chi^2 = 142.9$, $p < 0.001$; Nagelkerke's R-square (R-squared) = 0.3; and the regression model was fitted by controlling for students' biological gender.

A more detailed assessment of the association of the severity of psychological distress with coping methods showed a 4.6-fold increase in smoking (OR = 4.6, 95% CI: 1.3-7.0) and a 5.5-fold increase in the use of anti-stress medication (OR= 5.5, 95% CI: 1.2-24.5) amongst the students who were exposed to a high level of psychological distress (Table 5).

Table 5

Ways of coping with psychosocial stress					
High stress level (7 - 14 points) ^a	β	SP	The Wald criterion	p	OR (95 % CI)
More frequent smoking	1,5	0,6	5,3	0,02	4,6 (1,3 – 17)
Alcohol consumption	0,5	0,6	0,7	0,42	1,6 (0,5 – 4,7)
Taking anti-stress medication	1,7	0,8	5,1	0,02	5,5 (1,2 – 24,5)
Constanta	- 2,4	1,2	4,2	0,04	0

Note: ^a is the reference category of low levels of psychosocial distress (22-28 points); β is the estimated coefficient with standard error (S.E.E.) (< 5); Criteria for assessing the goodness of fit of the model are: $\chi^2 = 55.4$, $p < 0.001$; Nagelkerke's R-square (R-squared) = 0.2; and the regression model was fitted by controlling for students' biological gender.

THE RELATIONSHIP BETWEEN PSYCHOSOCIAL STRESS AND QUALITY OF LIFE

According to the survey, health science students scored best on the physical activity, pain, activity limitation due to physical problems, and social relationships scales, and worst on the vigour and vitality, activity limitation due to emotional state, and emotional state scales (Table 6). Respondents rated their physical health better than their mental health (77.3 ± 14.5 vs. 58.1 ± 18.2 , $p < 0.0001$).

Female students, in contrast to male students, rated their physical (75.7 ± 14 vs. 84 ± 11.7 , $p = 0.01$) and mental (55.7 ± 18 vs. 68.7 ± 15.4 , $p < 0.001$) health lower. More specifically, respondents scored statistically significantly ($p < 0.05$) worse on physical activity, pain, general health assessment, social relationships, emotional state, vigour and vitality scales (Table 6).

Table 6

Results of the students' SF-36 quality of life domains according to biological gender				
SF-36 quality of life domains	Total (n = 483)	Biological gender		Error
		Men (n = 92)	Women (n = 391)	
Mean ± SN (points)				
<i>Areas of physical health</i>	77,3 ± 14,5	84 ± 11,7	75,7 ± 14,6	0,01
Physical activity	94,5 ± 9,2	97,9 ± 3,7	93,8 ± 9,9	0,03
Pain	78,4 ± 21,1	87,2 ± 16,5	76,4 ± 21,5	0,01
Activity limitation due to physical problems	71,7 ± 32	79,3 ± 25,9	69,9 ± 33,1	0,16
<i>General health assessment</i>	64,6 ± 19,1	71,6 ± 17,4	63 ± 19,1	0,03
Mental health domains	58,1 ± 18,2	68,7 ± 15,4	55,7 ± 18	< 0,001
Social relationships	69,6 ± 22,1	83,1 ± 15,4	66,5 ± 22,2	< 0,001
Emotional state	56,4 ± 17,2	68,0 ± 15,2	53,8 ± 16,6	< 0,001
Energy and vitality	52,5 ± 15,5	59,3 ± 16,4	50,9 ± 14,9	0,01
Activity limitation due to emotional state	54,6 ± 37,6	64,4 ± 29,5	52,3 ± 38,9	0,12

A more detailed analysis of the data confirmed that the high levels of psychosocial stress experienced depended on the students' biological gender. A linear regression analysis revealed that high levels of psychosocial stress experienced by female students were associated with poorer emotional well-being ($\beta = 0.14$; 95% CI: 0.1 - 0.2) and activity limitation due to physical problems ($\beta = 0.02$; 95% CI: 0.01 - 0.04) (Table 7).

Table 7

The impact of psychosocial stress experienced by female students on different domains of quality of life

Psychosocial stress level (points)		β	95 % CI	error
SF-36 quality of life measurement domains	Emotional state	0,14	(0,1 – 0,2)	< 0,0001
	Restriction of activity due to physical problems	0,02	(0,01 – 0,04)	< 0,01

Note: $F(2,481) = 81,1$, error < 0,001, $R^2 = 0,39$.

Meanwhile, high levels of psychological distress experienced by male students were only associated with activity limitation due to emotional state ($\beta = 0.1$; 95% CI: 0.03 - 0.12) (Table 8).

Table 8

The impact of psychosocial stress experienced by male students on different domains of quality of life

Psychosocial stress level (points)		β	95 % CI	error
SF-36 quality of life measurement domains	Restriction of activity due to emotional state	0,1	(0,03 – 0,12)	0,003

Note: $F(1,482) = 10,4$, error = 0,003, $R^2 = 0,28$.

FINDINGS

The developmental stage of emerging adulthood in young adults is a time when people have the opportunity to make changes in their lives (Arnett, 2015, Matud et al., 2020), and the potential negative impact of psychosocial stress on health is a matter of great international concern (Wiklund, 2010). Stressors affecting young adults are major life changes, including different social roles (Bell & Lee, 2008), which significantly increase the risk of developing specific mental health disorders (Arnett, 2014). In our study, experiencing high levels of psychosocial stress was found among 35% of medical and health sciences students. High academic workload and financial problems were key factors in the likelihood of experiencing high levels of stress in the study population, which was between 2.6 and 3.9 times higher. In contrast to male students (17.4%), more than twice as many females (38.9%) were at risk of high levels of psychosocial stress and, as a consequence, were more likely to experience mood swings, headaches, conflicts and communication problems. On the one hand, our findings correlate with findings published by other researchers on the significantly higher psychosocial stress experienced by women (Drapeau et al., 2010, Matud et al., 2015, Matud & Garcia, 2019, Mousteri et al., 2020, Roberts et al., 2012, Weissman et al., 2020). On the other hand, the dynamics and causes of stress cannot be assessed solely on the basis of physical and mental health attributes. The latter need to be considered in combination with the social dimension (Au, 2017, Pearlin & Bierman, 2013). In conclusion, the physical effects of psychosocial stress in health science students that we found were not only consistent with the biological stress model (physiological alertness and exhaustion), but were also assessed from a social perspective. Among other things, gender refers to the socially constructed norms, behaviours, activities, relationships and characteristics that society deems appropriate for women and men, and it is recognised as an important social predictor of health (Manandhar et al., 2018, Fleming & Agnew-Brune, 2015, World Health Organization, 2010). It must also be taken into account that young adults have problems identifying themselves. When young men and women have to explore their future options, gender can play a crucial role in identity development, in relationships with romantic partners, friends and family, and in the consequences of risky behaviours and associated mental health inequalities (Norona et al., 2010). Similarly, in our study, we found that medical and health sciences students had poorer mental health status compared to physical health status. Exceptionally, the physical and mental health status of female students in our study was poorer compared to that of male students. More specifically, female students' higher levels of psychological distress were associated not only with poorer emotional well-being, but also with limitations in daily activities due to physical problems. In contrast, high levels of stress experienced by men were only associated with limitation of daily activities due to poorer emotional state.

Researchers have found that stress can lead to behavioural changes. This most commonly includes 'escape practices' such as alcohol or substance abuse (Au, 2017). More specifically, according to the World Health Organization (WHO) World Mental Health International College Student Project, 31% of students at 19 colleges in Australia, Belgium, Germany, Mexico, Northern Ireland, South Africa, Spain, and the United States identified at least one anxiety, depression, or substance abuse-related disorder that had occurred in the past 12 months (Auerbach et al., 2018). Similarly, our study found a 4.6-fold higher likelihood of smoking and a 5.5-fold higher likelihood of taking pre-stress medication among medical and health sciences students with high levels of stress. Female students were significantly more likely to cope with high levels of psychosocial stress by sleeping and eating, while male students were more likely to exercise and smoke cigarettes. On the other hand, coping is a multidimensional construct that encompasses the actions (thoughts and behaviours) people use to manage stress (Folkman, 2010). Thus, different ways of coping with stress can promote not only physical and mental health coherence but also social well-being (Folkman & Lazarus, 1980).

CONCLUSIONS

Medical and health sciences students, especially women, experience high levels of psychosocial stress due to high academic workloads and financial burdens. Late adolescents cope with psychological distress by smoking more cigarettes and taking anti-stress medication.

This study found that higher levels of psychological distress are associated with poorer mental and physical health for men and poorer physical and mental health for women.

The empirical findings from our study are useful for planning and implementing psychological distress management measures by targeting emotional and instrumental social support among medical and health science students of high socioeconomic status, especially when the benefits of social support have been demonstrated in Finland and Spain (Au, 2017, Matud et al., 2015, Pearlin & Bierman, 2013, Santini et al., 2015, Saikkonen et al., 2018).

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APPLICATION OF PV/T TECHNOLOGY IN LITHUANIA

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Abstract. PVT technology combines solar PV and solar thermal energy in the same PVT panel. In this way, the PVT panel produces both electricity and heat. Compared to PV technology and solar heating technology, PVT technology is in the early stages of the market, but the demand for panels has grown rapidly in the past two years.

This paper summarizes best practices for PVT technology, which is still in rapid development. Commercial systems with different types of PVT panels, different types of PVT systems with different components for different applications are reviewed. Possible advantages and disadvantages of PVT systems in Lithuanian market conditions are presented.

Keywords: solar energy, PVT system, PVT training module, Renewable energy technologies

INTRODUCTION

PV/T hybrid modules combine photovoltaic and solar collector modules in the same component, which allows the simultaneous production of heat and electricity, similar to combined heat and power (CHP) plant. Photovoltaic (PV) modules made from semiconductor cells have one drawback: a decrease in work efficiency due to temperature. At noon on a sunny day, when the PV would be expected to work at full capacity, the module temperature can reach more than 80° C. The manufactured modules are tested under STC (Standard Test Conditions). Those conditions correspond to a module temperature of 25°C and an illumination of 1000 (kWh/m²)/year. Therefore, at a temperature of 80°C, the optimal efficiency of an average PV module drops to as much as 20% (S. Navakrishnan et al., 2021).

PV/T collectors extract the excess thermal energy generated by the PV cells by using a coolant, which is a mixture of water and antifreeze, for heat transfer (Abora data sheet, 2023). The coolant circulating in the PV/T collectors reduces the temperature of the PV module while increasing the overall efficiency of the PV cell as the module temperature approaches STC conditions. Reducing the temperature can increase the efficiency of PV modules by 10-25% (S. Navakrishnan et al., 2021, Herrando et al., 2023, Dual sun Wave data sheet, 2023, Solink heat pump collector data sheet, 2023). PV/T technology is particularly important and attractive when roof space is limited. The PV/T market is gaining momentum in various European countries. In recent years, more and more specialized PV/T technology suppliers have entered the European markets.

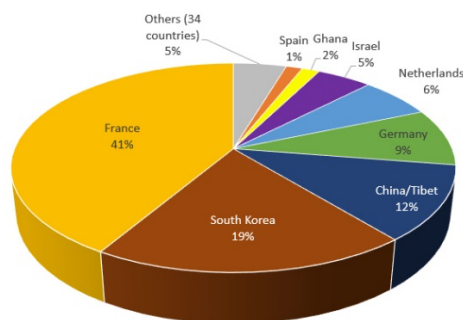


Figure 1. Global PV/T Market Development 2021 (IEA 60 systems overview)

Demand for PV/T collectors has grown rapidly over the past two years. In 2020, 1,235,176 m² of PV/T modules were installed in the world. Annual sales of PV/T modules in 2021 increased by 16.8% and 207,420 m² were installed per year. Total PV/T installed area in 2021 reached 1.4 million m², most of which were installed in Europe (0.8 million m²). The world's largest markets for new PV/T modules in 2021 were France, South Korea, China, Germany, Holland, Israel, and Spain. France achieved its highest annual growth rate in 2021, almost six times more PV/T modules were installed (97,165 m²) than in 2020 (Application of PV/T collectors, IEA 60 systems overview). Global PV/T Market Development 2021 shown in Figure 1.

BEST PRACTICES FOR PV/T TECHNOLOGY

Although PV/T collectors have emerged recently, they have been improved every year and now PV/T collectors can be classified according to various characteristics (Herrando et al., 2023, Diwania et al., 2019, Evangelisti et al., 2019), but the main ones can be arranged by PV elements type, the type of thermal solar collector, what kind and

how the working fluid is being used in PV/T collector, whether there is additional glazing, and last but not least, they can be sorted by what kind of heat absorber is being used (Figure 2).

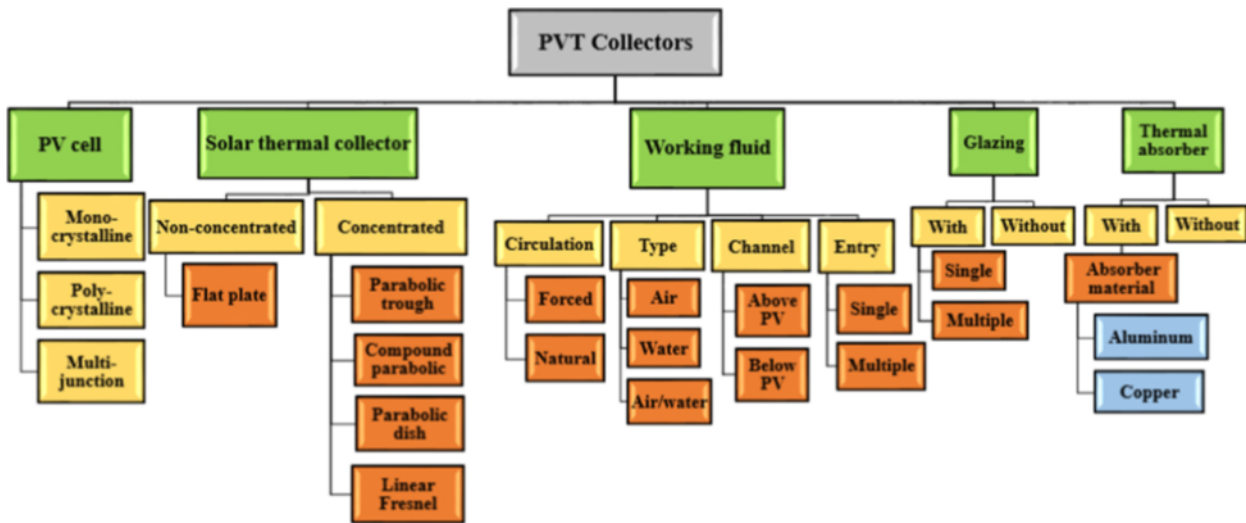


Figure 2. Classification of PV/T solar collectors (Herez et al., 2020)

Depending on how the PV/T modules are assembled thermal, electrical, and total efficiencies may be in the range 35-75%, 7-20% and 36-85% respectively (Herez et al., 2020).

PV/T systems can be used for many different applications and many different PV/T system designs are possible. Figure 3 gives an overview of PV/T panel technologies and PV/T applications for different temperature levels.

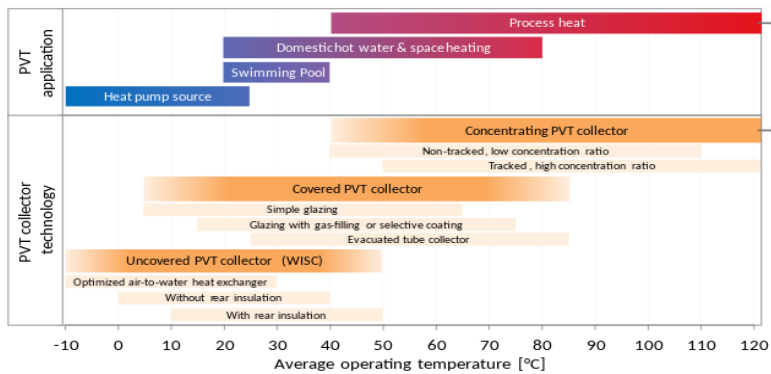


Figure 3. PV/T technology and applications for different temperature levels (Lämmle et al, 2020)

Currently, approximately half of the installed PV/T area of all operating PV/T systems consists of air-cooled PVT panels (IEA 60 systems overview). Air-cooled PV/T panels are suitable for buildings where air is used for heating. In these systems, air flow is the key factor in reducing the temperature of the solar cells, thereby increasing the overall energy efficiency of the system. The thermal efficiency of such PV/T panels is usually between 20% and 40% (Furbo et al., 2021).

Unfortunately, according to the report submitted by the IEA agency, in the table 1, we do not see either Lithuania or any other Baltic country. Currently, only a few flat PV/T modules are offered on the Lithuanian market. However, when we asked the suppliers if even one module was sold, the answer was negative. The leader in terms of the area of the PV/T installed collectors is France, where air-cooled PV/T systems prevail. And the leaders of liquid-cooled PV/T systems in Europe are Germany and the Netherlands.

Below we present the distribution of installed capacity per 1 m² of area by the type of PV/T collector (Figure 4). From this graph, we can see that the leader in terms of installed power is uncovered PV/T collectors, whose installed power per 1 m² of area is 0.72 kW/m², of which 74% is heat power. The installed capacity of covered PV/T collectors per 1 m² of area is 0.68 kW/m², of which 75% is for heat capacity. In air-cooled PV/T collectors, the situation is similar, as the installed capacity per 1 m² of area is 0.66 kW/m², of which 75% is heat capacity.

Cumulated installed collector area by PVT collector type and country, at the end of 2021

Country	Water Collectors [m ²]			Air Collectors [m ²]	Concentrators [m ²]	TOTAL [m ²]
	uncovered	covered	evacuated tube			
Albania	148	12	0	0	0	160
Australia	3,477	0	0	99	0	3,576
Austria	1,234	1,731	0	0	0	2,965
Belgium	2,314	0	32	290	15	2,651
Brazil	26	0	0	0	0	26
Bulgaria	517	43	0	0	0	560
Canada	0	32	0	0	0	32
Chile	213	113	0	0	10	337
China	141,721	1,034	0	0	171	142,926
Croatia	907	125	0	0	0	1,032
Denmark	109	0	0	0	0	109
Dubai	43	9	0	0	0	52
Ecuador	0	138	0	0	0	139
Egypt	0	0	0	0	21	21
France	49,633	949	0	547,575	0	598,157
Germany	122,738	4,196	0	512	195	127,640
Ghana	22,000	0	0	0	0	22,000
Iraq	0	16	0	0	0	16
Guadeloupe	0	4	0	0	0	4
Hungary	525	53	0	0	0	578
India	0	801	0	0	255	1,056
Iraq	0	30	0	0	0	30
Israel	68,575	0	0	0	0	68,575
Italy	13,793	2,334	0	0	0	16,127
Korea, South	280,814	0	0	0	0	280,814
Lesotho	0	48	0	0	0	48
Luxembourg	635	0	0	145	0	780
Macedonia	629	147	0	0	0	776
Maldives	0	0	0	0	21	21
Martinique	0	63	0	0	0	63
Netherlands	80,898	9,034	0	0	1,822	91,754
Norway	646	0	0	0	0	646
Pakistan	0	7	0	0	0	7
Paraguay	0	0	0	0	51	51
Peru	0	16	0	0	0	16
Poland	413	61	0	0	0	474
Portugal	335	338	0	0	0	672
Peru	0	50	0	0	0	50
Singapur	875	0	0	0	0	875
Slovakia	0	250	0	0	0	250
Slovenia	60	12	0	0	0	72
South Africa	0	79	32	0	767	878
Spain	1,552	18,946	0	0	0	20,498
Sweden	1,200	20	0	0	31	1,251
Sri Lanka	692	24	0	0	0	716
Switzerland	11,365	112	0	3,530	0	15,007
Tibet	24,000	0	0	0	0	24,000
Turkey	0	25	0	0	30	55
United Kingdom	891	426	252	348	135	2,051
United States	8,093	0	0	0	0	8,093
Uruguay	0	2	0	0	0	2
Other	629	3,250	16	0	15	3,910
Total	841,699	4,4527	332	552,499	3,538	1,442,596

Meanwhile, the share of thermal power installed in concentrated and vacuum PV/T collectors is higher than in other PV/T collectors and is 79% - in vacuum and 83% - in concentrated ones. This is because in them, due to the design features, the area of the PV cells is smaller than in other collectors.

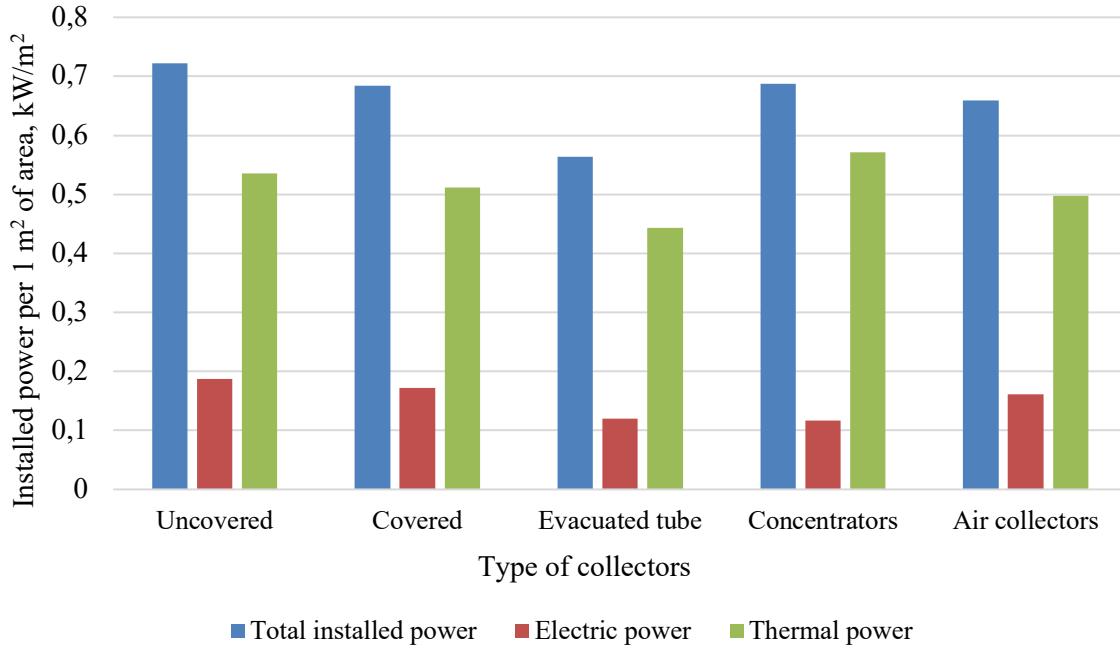


Figure 4. Distribution of installed capacity per 1 m² of area by type of PV/T collector

It should be noted that the most popular PV/T collectors are uncovered and air-cooled, the installed area of the all other collectors is ten times smaller. In addition, air-cooled PV/T collectors are common in only one country - France. Suppose the installed capacity of covered PV/T collectors in 1 m² is distributed similarly to uncovered ones, but the installed area is about 20 times smaller than that of uncovered PV/T collectors. In addition, based on the installed power, it is very difficult to judge the efficiency or the amount of energy per 1 m² of area. We will try to answer this question in the next chapter by modeling with Polysun and Abora programs, and presenting the prices of the expected project.

PERFORMANCE OF PV/T COLLECTORS

Solar radiation reaches the module at a solar irradiance of G where a fraction is lost to the ambient as Q_{loss} and the remaining portion empowers the PV module (Q_{el}) with a given electric efficiency (η_{el}). The accumulation of solar energy increases the temperature of the PV module and generates the thermal power of Q_{th} , depending on the fluid medium and module design which is transferred to the thermal module through a heat transfer mechanism with a thermal efficiency of η_{th} . Finally, thermal insulation obtained by reducing and eliminating the back and sides heat losses and makes the entire system more efficient. The general energy equation in a simple PVT module and overall efficiency (η_{PVT}) can be defined by equation Equation (1), Equation (2), Equation (3) (Ramos et al., 2019, Shakouri et al., 2020).

$$\eta_{el} = \frac{Q_{el}}{GA}, \quad (1)$$

$$\eta_{th} = \frac{Q_{th}}{GA}, \quad (2)$$

$$\eta_{PVT} = \eta_{el} + \eta_{th}. \quad (3)$$

Where G (W/m²) is the solar radiation and A (m²) is the aperture area of the module.

Electrical Efficiency

PV/T systems are two separate systems that consist of a single solar thermal collector and a PV module. They are attached together and work simultaneously to generate electricity and thermal energy. The performance of a PVT collector is reduced when the temperature of the system rises (Zondag et al., 2002).

For the separate PV module, electrical efficiency η_{el} is given by equation Equation (4).

$$\eta_{el} = \frac{I_m V_m}{G A_c}, \quad (4)$$

I_m stands for the maximum power point current, V_m for the maximum power point voltage, G for total solar irradiance in W/m² and A_c for the collector gross area in m² (Zondag et al., 2002). A special maximum power point tracking controller in the system assures that the PV modules operate at the best working point (I_m, V_m)

The reduction of the PV module performance with increasing temperature, is given by Equation (5), which represents the traditional linear expression for the PV electrical efficiency.

$$\eta_{el} = \eta_{0,el} (1 - \beta(T_c - T_{ref})), \quad (5)$$

where T_c is PV cell temperature, T_{ref} is reference temperature and β is the coefficient of temperature. Typically, the value of β is $0.0045 \text{ } ^\circ\text{C}^{-1}$. $\eta_{0,el}$ and β are normally given by the PV manufacturer. However, they can be obtained from flash tests in which the module's electrical output is measured at two different temperatures for a given solar radiation flux.

Thermal Efficiency

Based on ISO 9806:2017 at steady-state condition for glazed liquid heating collectors, the instantaneous efficiency η_{th} shall be calculated by statistical curve fitting, using the least squares method, to obtain an instantaneous efficiency curve of the form presented in Equation (6).

$$\eta_{th} = \eta_{0,th} - a_1 \frac{T_m - T_a}{G} - a_2 \frac{(T_m - T_a)^2}{G}, \quad (6)$$

where T_m is average temperature of heat transfer fluid ($^\circ\text{C}$), T_a is ambient air temperature ($^\circ\text{C}$), $\eta_{0,th}$ is peak collector efficiency (η_{th} at $T_m - T_a = 0$), G is hemispherical irradiance, a_1 is heat loss coefficient ($\text{W}/\text{m}^2 \cdot \text{K}$) and the temperature dependence of the heat loss coefficient comes as a_2 ($\text{W}/\text{m}^2 \cdot \text{K}^2$) (ISO9806:2017 ISO 9806). Figure 5 shows thermal efficiency of Abora aH72 PV/T.

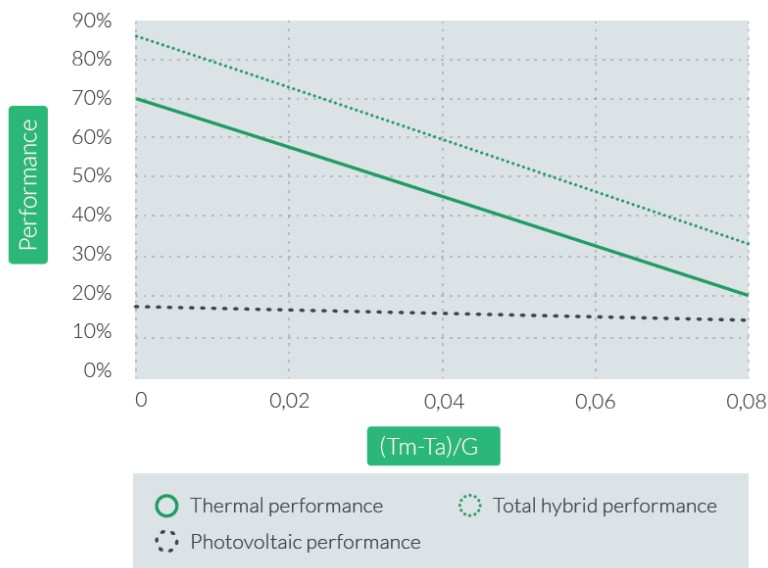


Figure 5. Abora aH72 PV/T collector efficiency dependence on fluid temperature (Abora aH72 data sheet)

Suppose the ambient temperature is 25°C and solar radiation $G=1000 \text{ m}^2$. We will consider two cases: 1) the temperature of the liquid entering the collector is 25°C , leaving 45°C ; 2) the temperature of the liquid entering the collector is 45°C , the outgoing liquid is 65°C . In the first case, the efficiency of the collector will be 65%, because the difference ($T_m - T_a$) will be 10°C , and in the second case, this difference will already reach 30°C and the efficiency factor will be 50%. In other words, the efficiency will be the highest if we will be able to immediately use all the heat produced in the collector, i.e. the temperature of the fluid entering the collector must be as low as possible.

PV/T TECHNICAL ASSESSMENT

The area of the roof to be built is 1100 m^2 . We predict that the collectors will cover an area of 400 m^2 . The modeling of the solar PV/T power plant and the forecasting of the amount of energy produced were carried out with the help of Polysun 2023 Simulation and Abora 2023 Simulation software, choosing the coordinates of a specific object. Preliminary project prices were obtained from manufacturers.

The diagram below was used for the simulation, in which the liquid heated in the PV/T collector circulates in a closed circle with the help of a pump, heating the storage tank. Water is taken from the storage tank for further heating and supplied to the user.

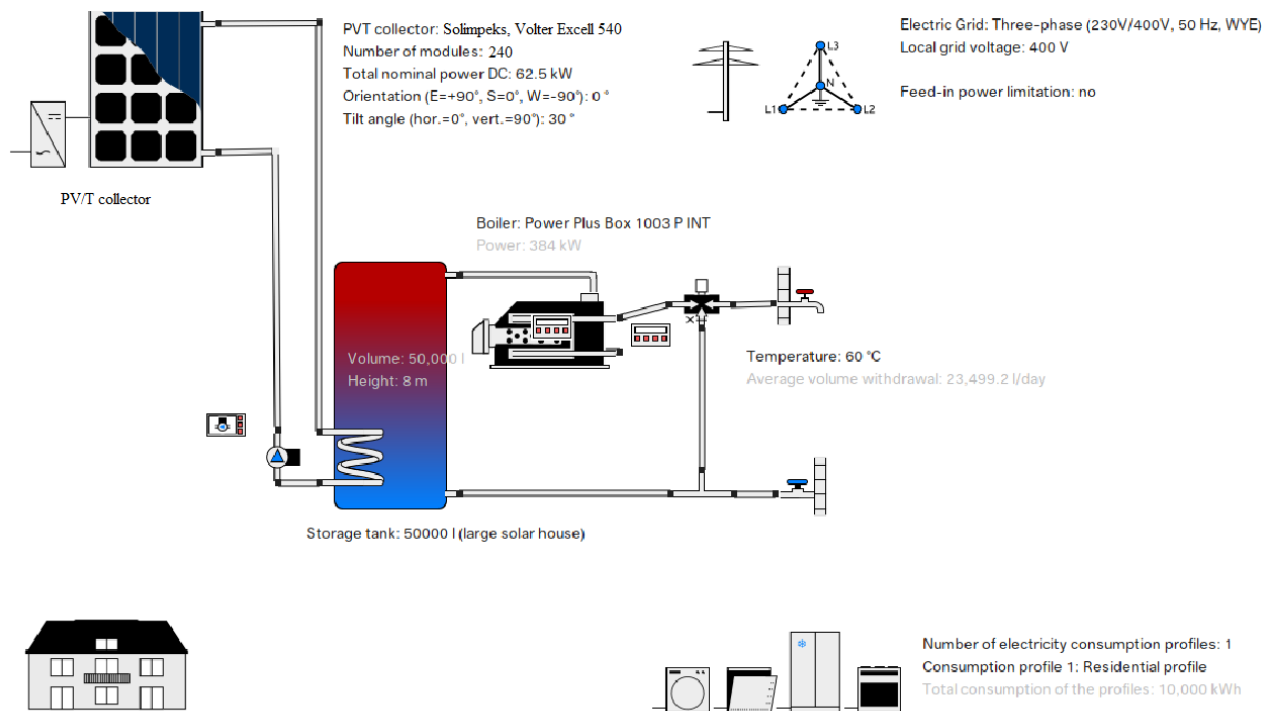


Figure 6. Scheme of domestic hot water preparation using PVT collectors

The table below shows the amounts of energy produced by flat covered PV/T, flat uncovered PV/T, monocrystalline PV, vacuum ST and vacuum PV/T solar collectors, the preliminary cost of the project, and CO₂ savings. These solar collectors were not chosen by chance, it was for them that the manufacturers sent the preliminary prices of the project.

Table 2

Summary of economic and ecological calculations of PV/T power plant

Name of the module	Abora, aH72, PV/T	Solimpeks, Volter Excell 540	Solet TSA-370M2	Naked energy, Virtu ^{HOT}	Naked energy, Virtu ^{PVT}
Collector type	Flat covered, PV/T	Flat uncovered, PV/T	Monocrystalline PV	Evacuated tube ST	Evacuated tube PV/T
Installed electric power of the PV/T power plant, kW	70,7	78	77,7	0	34,7
Installed thermal power of the PV/T power plant, kW	277,14	173,6	0	246	173,4
The active surface area of a solar power plant, m ²	379,76	401	388	400	400
Number of modules, pcs.	202	240	210	615	615
Investment in PVT power plant, without VAT, Eur	370942	269464	80130	313384	359420
The amount of energy produced, DC, kWh/year	69262	74490	66822	0	34691
Electricity consumption for power plant purposes (DC to AC conversion, water pump*), kWh/year	8035	8245	2673	5265	6653
The amount of energy produced, AC (minus the electricity consumption for power plant needs), kWh/year	61227	66245	64149	-5265	28038
The amount of thermal energy produced, kWh/year	189116	121520	0	200315	125501
Amount of energy per 1 m ² , efficiency, kWh/m ²	659	468	165	488	384

Name of the module	Abora, aH72, PV/T	Solimpeks, Volter Excell 540	Solet TSA- 370M2	Naked energy, Virtu ^{HOT}	Naked energy, Virtu ^{PVT}
Electricity price component for 2022, excluding VAT (Nordpool), Eur/MWh	184,83	184,83	184,83	184,83	184,83
Variable heat price component for 2022, excluding VAT (pe.lt), Eur/MWh	33,69	33,69	33,69	33,69	33,69
Annual economic savings, Eur/year	17687,8	16338,1	11856,7	5775,5	9410,5
Reduce CO ₂ emissions **, t/year	78,67	61,85	26,94	53,88	46,92
Discount rate, %	5	5	5	5	5
Net present value, NPV, Eur	-143345	-62719	64410	-229913	-230614
Internal rate of return IRR, %	0	2	14	-8	-6
Payback period (PBP), year	21,0	16,5	6,8	54,3	38,2
Discounted payback period (DPBP), year	over 30	over 30	8,4	over 30	over 30

* It is planned that the system will use a 1.5 kW water pump, estimating the pump time per year (3510h), the electricity consumption for the pump is 5265 kWh/year, inverters, with an efficiency of 96%, are used to convert DC electricity to AC. Then the electricity consumption for the PV/T system will be:

electricity consumption for PV/T system = amount of DC electricity produced * 0.04 + 5265, kWh/year.

** The reduction of the amount of CO₂ equivalent emitted is calculated according to the methodology approved by the Lithuanian Environmental Protection Investment Fund, when the pollution coefficient of electricity is 0.42 t CO₂e/MWh, and heat is 0.28 t CO₂e/MWh (Order No. D1-275) according to the formula:

Amount of GHG emissions = activity data * pollution factor.

CONCLUSIONS

The performed calculations showed that the most efficient are the flat-covered PV/T collectors. Their efficiency is 659 kWh/m². The efficiency of flat-uncovered PV/T and evacuated tube ST is similar, 468 kWh/m² and 488 kWh/m², respectively. Meanwhile, monocrystalline PV efficiency is the lowest and reaches only 165 kWh/m².

The amount of CO₂ emitted into the atmosphere would be reduced the most by choosing flat-covered PV/T collectors, which would amount to 78.7 tons per year. The smallest CO₂ reduction would occur if we chose a system of monocrystalline PV modules, which would be 27 tons per year. Other collector systems would save from 47 to 62 tons per year.

After evaluating the preliminary cost of the project, the amount of energy produced and the annual savings for 20 years, monocrystalline PV modules would have the highest NPV and IRR indicators, i.e. 64410 Eur and 14% respectively. When at that time the NPV and IRR indicators of flat-uncovered PV/T modules would be -62719 Eur and 2%, respectively, the NPV and IRR indicators of flat-covered PV/T modules would be -143345 Eur and 0%, respectively. Meanwhile, both indicators of evacuated tube ST and PV/T systems are negative.

The lowest payback period (PBP) of the PV/T modules was flat-uncovered modules i.e. 16.5 years, while the PBP of flat-covered and evacuated tube PV/T modules were 21 and 38 years, respectively. The discounted payback period (DPBP) of all modules except monocrystalline was over 30 years.

Considering the NPV and IRR indicators, as well as the simple and discounted payback period, it is uneconomical to install PV/T systems at current energy prices and PV/T technologies. The NPV and IRR indicators show that a monocrystalline PV module system would be a better investment for today.

ACKNOWLEDGMENTS

The authors are thankful for the support given by company “AB Panevėžio energija”.

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EVALUATION OF THE THERMAL INSULATION PERFORMANCE OF THE GROUND FLOOR OF AN A++ CLASS PUBLIC BUILDING USING THE SAW METHOD

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Abstract. This paper investigates the Simple Added Weighting (SAW) method for evaluating the thermal insulation performance of the ground floor of an A++ class public building. Four alternative insulation materials (*ŠILPUTA EPS100*; *FF-EPS100S*; *FINNFOAM F-200*; *PAROC GRS 20*) were evaluated on the basis of six criteria: the compressive strength up to 10% deformation, the design value of thermal conductivity coefficient, the thickness of the thermal insulation layer, the cost (Q4 2023), the global warming potential (GWP) and the long-term water absorption of the insulation material. The results of the empirical research indicate that *FINNFOAM F-200* is the most effective thermal insulation material for the ground floor insulation of a nearly zero-energy public building. The highest relative performance score (0.87) was achieved by this material. Rock wool *PAROC GRS 20* is the least effective (0.51 points) alternative (from the four tested materials).

Keywords: thermal insulation layer; ground floor; nearly zero-energy public building; SAW method

INTRODUCTION

The European Commission through, via the EU Building Stock Observatory, has reported that the building sector is responsible for more than 40 % of the energy consumption and 36 % of greenhouse gas emissions, with the primary sources of emissions being construction, usage, renovation, and demolition. In the Net Zero Emission Scenario, the EU building sector, which currently comprises a significant portion of energy-inefficient buildings (approximately 75%), must reduce its carbon emissions by over 50% by 2030 and approach zero emissions by 2050 through decarbonization efforts (Fraska et al. 2023).

The new Energy Performance of Buildings Directive (EPBD) 2018/844 highlights the issue of energy efficiency in buildings and sets out certain requirements and objectives to be pursued. The aim is that both new and renovated buildings become zero-energy buildings, which have high energy efficiency, and in which renewable energy sources meet the greatest energy demand (Indre Siksnylyte-Butkiene et al. 2021). In Lithuania, nearly zero-energy buildings are required to meet the standards of A++ Class (STR 2.01.02:2016) buildings.

A wide range of scientific analysis of nearly zero energy buildings is available in the scientific literature (Abrahamsen, et al. 2023; López-Ochoa et al. 2023; Zhang, 2023; Jiang, 2023 and others). However, there is a lack of information on the multi-attribute evaluation of the performance of thermal insulation materials for ground floors in public buildings. Therefore, a typical ground floor detail of an A++ public building will be further investigated in this study. After the empirical analysis, the most effective ground floor insulation alternative will be identified.

The aim of this study is: to assess the performance of the thermal insulation layer of the ground floor of a class A++ public building using the SAW method.

The objectives of the research are:

1. Investigate the use of the SAW methodology for multi-attribute analysis.
2. Create a research model using a typical ground floor detail of an A++ public building.
3. Perform a multi-attribute evaluation study of the effectiveness of four different thermal insulation materials against six criteria.

Research methods: review of technical and scientific literature; empirical analysis; SAW method.

THE SAW METHOD

The Simple Additive Weighting (SAW) method is considered one of the most straightforward and widely adopted methods in decision-making. MacCrimmon (1968) summarized the method's rules. The Simple Additive Weighting (SAW) approach is categorised as a method for decision-making that incorporates quantitative measurements (Simanavičienė, 2011). Other researchers (Podvezko et al., 2014; Kraujalienė, 2019) have outlined the advantages and disadvantages of the SAW approach (Table 1).

Table 1

Advantages and disadvantages of the SAW decision-making method (Kraujalienė, 2019)

No	Advantages	Disadvantages
1	This tool is able to compensate among variables	The SAW method may be applied when all the variables are maximized (or transformed into maximized variables) before analysis.
2	Intuitive method for decision-makers; the way of measuring is quite simple and does not require several computer programs or tools.	All the values of the variables should be positive. The calculation depends on the type of transformation that converts them into positive dimensions.
3	This tool integrates the values of variables and weights into a single magnitude.	The largest dimension of the variable of the SAW tool maybe about unity, while the smallest dimension may reach the 0.
4	The calculation algorithm of this method is not complex and can be implemented without using a simple computer program or computer tools.	Estimates obtained by the SAW method do not always reflect the actual condition. The result may not follow logic because the measures of one particular variable are very different from other variables.
5	Normalized evaluation values help visually calculate differences between alternatives.	The SAW tool is based on normalization, reducing variables, and converting them into maximization.
6	This tool is suitable to evaluate a single alternative.	The result obtained may not be logical.

The Simple Additive Weighting method is one of the most common multi-attribute decision-making (MADM) methods. Finding the weighted sum of the performance ratings for each alternative considering all attributes is the basic concept of the SAW method (Taherdoost, 2023). Evaluating the efficiency of a SAW involves a number of successive steps (Simanavičienė, 2011; Wardana et al. 2020):

Step 1: Initial decision matrix P is established (1):

$$P = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \dots & \dots & \dots & \dots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix}; \quad (1)$$

where $i = 1, \dots, m$, and $j = 1, \dots, n$.

Step 2: All members of the decision matrix P to be maximised are normalised using Equation (2):

$$\overline{x_{ij}} = \frac{x_{ij}}{x_j^{max}}; \quad (2)$$

and those that need to be minimised – according to the Equation (3):

$$\overline{x_{ij}} = \frac{x_j^{min}}{x_{ij}}. \quad (3)$$

Step 3: Finding the weighted sum of the performance ratings by using Equation (4):

$$A = \{A_i | \sum_{j=1}^n q_j^* \cdot \overline{x_{ij}}\}; \quad (4)$$

where q_j^* , ($j = \overline{1, n}$) – significance values for the indicators; $\overline{x_{ij}}$ – is the normalized decision matrix.

Step 4: Ranking of the alternatives. The highest value obtained is the most efficient alternative.

THE RESEARCH MODEL

The research model was created by using a typical ground floor detail of an A++ public building. The area of heated floor – $A = 300.00 \text{ m}^2$; the perimeter of the heated floor – $P = 112.00 \text{ m}$. The tested layer – no 4 (Figure 1).

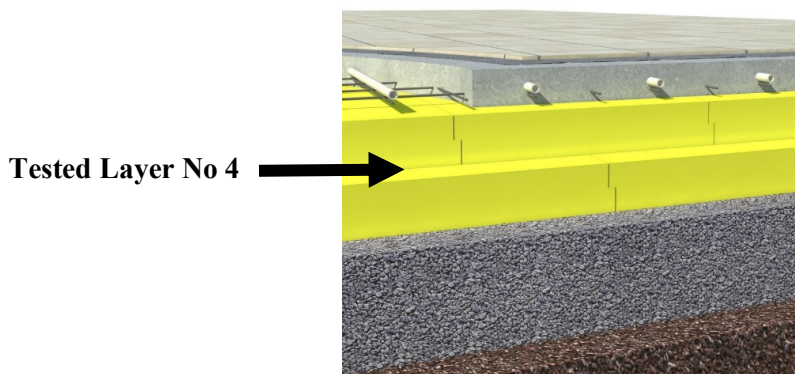


Figure 1. The research model – the ground floor detail of an A++ class public building (for the explanation of layers, see Table 2). Source: <https://finnfoam.lt/>

Following the Technical Regulations of Construction STR 2.01.02:2016 was calculated: a) the required heat transfer coefficient of an A++ Class public ground floor – $U=0.14 \text{ W/m}^2\text{K}$ and b) the thickness of different thermal insulation materials.

Table 2

The Ground Floor Layers		
No	Name of the layer	Thickness, mm
1	Floor covering	20
2	Tile Adhesive Mat	-
3	Reinforced concrete layer	80
4	Thermal insulation material (Tested layer)	170-210
5	Compacted gravel or crushed rock	-

In this study, four different thermal insulation materials – conventional polystyrene, graphite polystyrene, extruded polystyrene, and rockwool panels – were tested.

The SAW (Simple Additive Weighting) method was chosen for the multi-attribute assessment of the effectiveness of the four different thermal insulation materials against six criteria.

THE RESEARCH METHODOLOGY AND OUTCOMES

In the first step, a primary decision-making matrix (Table 3) is compiled and four different thermal insulation materials (*ŠILPUTA EPS100*; *FF-EPS100S*; *FINNFOAM F-200*; *PAROC GRS 20*) are assessed against six criteria derived from the technical specifications: compressive strength up to 10% deformation, design value of thermal conductivity coefficient, thickness of the thermal insulation layer, cost (as of Q4 2023), the global warming potential (in A1-A3 stages) and the long-term water absorption of the insulation material. The significance of all attributes is assumed to be equal (0.167).

Table 3

Tested alternatives/ Significances	Primary Decision-making Matrix					
	Attributes					
	<i>The compressive strength up to 10% deformation, kPa</i>	<i>The design value of thermal conductivity coefficient, W/(m·K)</i>	<i>The thickness of the thermal insulation layer, mm</i>	<i>The cost of the insulation material (Q4 2023), €/m²</i>	<i>The global warming potential (A1-A3), kgCO₂e /m²</i>	<i>The long-term water absorption, WL, %</i>
ŠILPUTA EPS100	100.00	0.041	190.00	11.71	11.80	5.00
FF-EPS100S	100.00	0.036	170.00	15.81	11.46	3.00
FINNFOAM F-200	200.00	0.038	180.00	22.87	13.72	0.70
PAROC GRS 20	20.00	0.045	210.00	19.66	23.11	3.00
Significance	0.167	0.167	0.167	0.167	0.167	0.167

In the second step, the primary decision-making matrix is normalized (Table 4).

Table 4

Normalized decision-making matrix

Tested alternatives/ Significances	Attributes					
	<i>The compressive strength up to 10% deformation, kPa</i>	<i>The design value of thermal conductivity coefficient, W/(m·K)</i>	<i>The thickness of the thermal insulation layer, mm</i>	<i>The cost of the insulation material (Q4 2023), €/m²</i>	<i>The global warming potential (A1-A3), kgCO_{2e}/m²</i>	<i>The long-term water absorption, WL, %</i>
ŠILPUTA EPS100	0.500	0.878	0.895	1.000	0.971	0.140
FF-EPS100S	0.500	1.000	1.000	0.741	1.000	0.233
FINNFOAM F-200	1.000	0.947	0,944	0.512	0.835	1,000
PAROC GRS 20	0.100	0.800	0.810	0.596	0.496	0.233

In the next step, the weighted normalized decision matrix is formed (Table 5).

Table 5

Weighted normalized decision-making matrix

Tested alternatives/ Significances	Attributes					
	<i>The compressive strength up to 10% deformation, kPa</i>	<i>The design value of thermal conductivity coefficient, W/(m·K)</i>	<i>The thickness of the thermal insulation layer, mm</i>	<i>The cost of the insulation material (Q4 2023), €/m²</i>	<i>The global warming potential (A1-A3), kgCO_{2e}/m²</i>	<i>The long-term water absorption, WL, %</i>
ŠILPUTA EPS100	0.084	0.147	0.149	0.167	0.162	0.023
FF-EPS100S	0.084	0.167	0.167	0.124	0.167	0.039
FINNFOAM F-200	0.167	0.158	0.158	0.086	0.139	0.167
PAROC GRS 20	0.017	0.134	0.135	0.099	0.083	0.039
Min./Max.	Max.	Min.	Min.	Min.	Min.	Min.

In the final step, the values are summed, and the alternatives are ranked (Table 6).

Table 6

Ranking alternatives

Tested alternatives	Sum of indicator values	Ranking
ŠILPUTA EPS100	0.73	3
FF-EPS100S	0.75	2
FINNFOAM F-200	0.87	1
PAROC GRS 20	0.51	4

Upon completion of the multi-attribute SAW evaluation study, the scores of efficiency was calculated for each thermal insulation material (Figure 2).

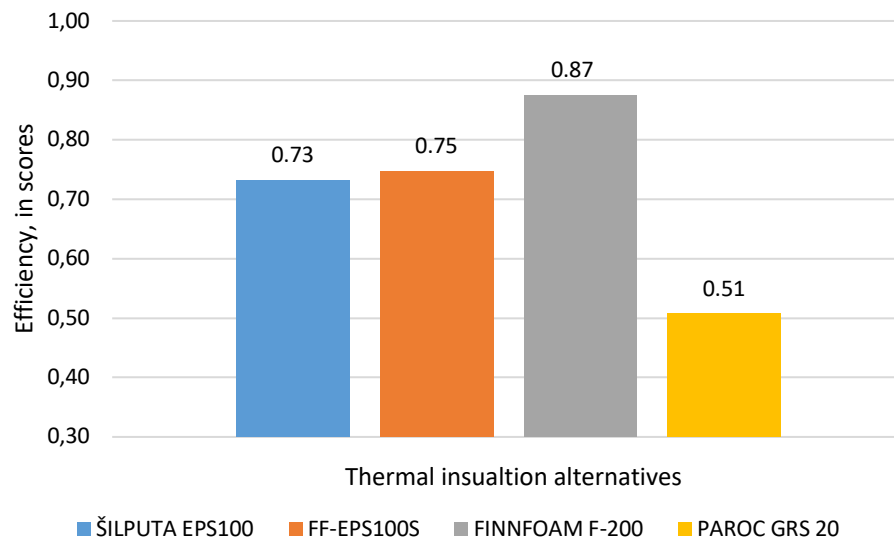


Figure 2. The evaluation of the efficiency of the ground floor thermal insulation layer

The empirical analysis reveals that, for a ground floor of a public A++ Class building, the most effective thermal insulation layer is the extruded polystyrene foam *FINNFOAM F-200*, while the least effective is rock wool *Paroc GRS20*, with a relative efficiency score of 0.51 points.

CONCLUSIONS

1. According to the SAW method, the empirical analysis showed that the most effective thermal insulation for the ground floors of A++ class public building, considering four material alternatives and six proportional indicators, is extruded polystyrene – *FINNFOAM F-200*. This alternative achieved the highest relative efficiency score of 0.87 points.
2. The least effective option among the four tested alternatives is rock wool – *Paroc GRS 20*, scoring 0.51 points. The difference between the best and worst alternatives is 41.38 percent.

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BIG DATA ANALYTICS IN CLOUD COMPUTING

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Abstract. The modern world witnesses an exponential growth in digital data generation from various sources. Big data exhibit exceptional volume, velocity, and diversity, predominantly comprising unstructured or semi-structured formats. Preserving their accuracy and value necessitates the application of advanced Big Data technologies. Cloud Computing has revolutionized data management, offering organizations virtually unlimited storage and computational resources through models Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS). This paper explores the potential of Big Data analytics within the context of cloud computing and evaluates data analytics effectiveness via Google's BigQuery platform.

Keywords: cloud computing, big data, data processing, BigQuery

INTRODUCTION

In today's world, digital devices collect and generate an increasing amount of data every day. If 20 or 30 years ago only 1 percent of the information produced was digital, now over 94 percent of this information is digital and it comes from various sources such as our mobile phones, servers, sensor devices on the Internet of things, social networks, etc. (Berisha, Mėzius & Shabani, 2022). These data are distinguished not only by their remarkable volume and the speed at which they require storage and processing but also by their diversity, with the majority being unstructured or semi-structured. The preservation of their accuracy and value necessitates the application of advanced Big Data technologies and techniques.

Cloud Computing has emerged as a transformative force, significantly simplifying the storage, processing, and analysis of large-scale data. By harnessing the power of the Cloud, organizations gain access to virtually limitless storage capacity and computational resources, offered by a multitude of vendors. Notably, Cloud delivery models like IAAS (Infrastructure as a Service) and PAAS (Platform as a Service) have become invaluable assets for diverse enterprises in their pursuit of more efficient and expeditious Big Data management.

The objective of the research is to examine the potential of Big Data analytics within the context of cloud computing, assess the effectiveness of data analytics using Google's BigQuery platform.

Research methods: analysis of scientific literature, analysis of Google BigQuery platform.

The rest of this paper is structured as follows. Section 1 of this article explores concept of big data. Section 2 analyzes possibilities of big data analytics in cloud computing. Section 3 presents the results of analysis of Google BigQuery platform that assesses the effectiveness of data analytics using Google's BigQuery platform. Finally, Section 4 presents conclusions.

BIG DATA CONCEPT: LITERATURE REVIEW

Big data refers to large and complex datasets that cannot be easily managed, processed, and analyzed using traditional data processing methods (Alam, Singh & Shahin, 2023). Big data are characterized by three Vs: volume, velocity, and variety. These characteristics were introduced by Gartner to define the various challenges in big data (Sandhu, 2022). With new generation architecture, data are now stored in different types of formats; hence, the three Vs may be extended to five Vs, namely, volume, velocity, variety, value, and veracity (Sandhu, 2022). The main characteristics of big data can be described:

- **Volume:** the dataset that conforms to the big data standard is constantly changing and increasing over time. In big data, there is a large amount of data with sizes ranging from terabytes to zettabytes.

- **Velocity:** big data is characterized by the rapid generation of data, which, in turn, necessitates the rapid processing of that data in order to derive useful insights.

- **Variety:** data comes in various types, including structured data such as database data, semi-structured data such as XML data, and unstructured data such as sound, images, videos, web pages, text, etc.

- **Veracity:** veracity refers to the quality, correctness, and trustworthiness of data. Therefore, maintaining veracity in data is mandatory (Sandhu, 2022).

- **Value:** value is an important characteristic of big data. It relates to how data can be dealt with and converted into meaningful information (Alam, Singh & Shahin, 2023).

In the table below, traditional, and big data are compared. Traditional data typically refers to structured data that is organized in a predefined manner. Traditional data represents information collected and stored over time, following

specific formats and standards. Traditional data is characterized by its reliability, accuracy, and consistency, making it relatively easy to manage and process using relational databases and analytical tools.

Table 1. Comparison of traditional data and big data

No	Features	Traditional data	Big data
1.	Volume	The volume of data is limited	Extremely large volumes of data
2.	Variety	Structured data	Semi-structured and unstructured data
3.	Velocity	Low velocity: slow rate at which data is generated, collected, and processed.	High velocity: data is produced rapidly and continuously, often in real-time or near real-time
4.	Veracity	It is reliable and comes from trusted sources	It can be prone to noise, inaccuracies, and inconsistencies
5.	Value	Lower potential value	Provide valuable insights of the data

In summary, big data extends far beyond the constraints of traditional data, embracing vast volumes, high velocity, diverse variety, and complex veracity, making it a multifaceted and dynamic field with profound implications for numerous sectors. Big data analysis and interpretation require sophisticated technologies, algorithms, and expertise, leading to innovative solutions and transformative discoveries.

BIG DATA ANALYTICS IN CLOUD COMPUTING

Cloud computing refers to the delivery of various services, including software, storage, databases, networking, analytics, and intelligence, over the internet to offer faster innovation, flexible resources, and economies of scale. Instead of owning and maintaining physical servers or computers, individuals and organizations can access computing resources on-demand from a cloud service provider (Balachandran & Prasad, 2017). Cloud computing services are typically categorized into three main models:

- **Infrastructure as a Service (IaaS):** IaaS provides virtualized computing resources over the internet. Users can rent virtual machines, storage, and networking components on a pay-as-you-go basis. This model eliminates the need for physical hardware and allows users to scale resources based on their requirements.
- **Platform as a Service (PaaS):** PaaS offers a platform that allows developers to build, deploy, and manage applications without dealing with the complexities of infrastructure. PaaS provides a development environment with tools and services that facilitate the development process, making it easier and more efficient to create and deploy applications.
- **Software as a Service (SaaS):** SaaS delivers software applications over the internet on a subscription basis. Users can access these applications through a web browser, eliminating the need for installation and maintenance. SaaS providers handle software updates, security, and performance, allowing users to focus on using the software rather than managing it.

Cloud computing offers several advantages, including cost efficiency, scalability, flexibility, and accessibility. It enables businesses and individuals to access computing resources and services without the need for significant upfront investments in hardware and software. Cloud computing also supports collaborative work, data storage, and analysis, making it a fundamental technology for various industries and applications.

With the generation of an enormous amount of data, cloud computing is playing a significant role in the storage and management of that data (Islam & Reza, 2019). Big data analytics in cloud computing refers to the process of analyzing large and complex datasets using advanced analytics techniques within a cloud computing environment. Big Data and Cloud computing are a major trend that are rapidly growing and new challenges and solutions are being published every day (Samir et. al., 2020).

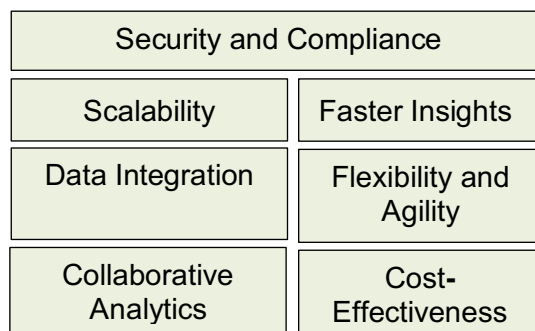


Figure 1. Advantages of integrating big data analytics with cloud computing

Because big data is now considered vital for many organizations and fields, service providers such as Amazon, Google and Microsoft are offering their own big data systems in a cost-efficient manner. These systems offer scalability for business of all sizes. This had led to the prominence of the term Analytics as a Service (AaaS) as a faster and efficient

way to integrate, transform and visualize different types of data (Berisha, Mëziu & Shabani, 2022). AaaS provides a faster and scalable way to integrate different types of structured, semi-structured and unstructured data, analyze them, transform and visualize them in real time (Islam & Reza, 2019). Big data analytics in cloud computing opens up a wide range of possibilities and opportunities for businesses and organizations (Figure 1).

Scalability: Cloud computing platforms offer virtually unlimited scalability, allowing businesses to store and process massive volumes of data. As data grows, cloud resources can be easily scaled up to handle increased computational and storage demands.

Cost-Effectiveness: Cloud computing operates on a pay-as-you-go model, where businesses pay only for the resources they use. This cost-effective approach is particularly beneficial for big data analytics projects, where processing requirements can vary over time.

Faster Insights: Cloud-based big data analytics solutions can rapidly process and analyze large datasets, providing businesses with real-time or near-real-time insights. This speed is crucial for making data-driven decisions and gaining a competitive edge.

Flexibility and Agility: Cloud platforms offer a variety of tools and services for big data analytics, allowing organizations to choose the most suitable technologies for their specific needs. This flexibility enables businesses to adapt their analytics strategies quickly in response to changing requirements or technological advancements.

Data Integration: Cloud-based big data analytics solutions can integrate with various data sources, including structured and unstructured data. Businesses can analyze data from diverse sources such as social media, IoT devices, customer interactions, and more, gaining comprehensive insights into their operations and customer behavior.

Collaborative Analytics: Cloud-based big data platforms facilitate collaboration among teams and departments. Multiple users can access and analyze data simultaneously, share insights, and collaborate on analytics projects in real-time, regardless of their physical locations.

Security and Compliance: Cloud providers invest heavily in security measures to protect data, including encryption, access controls, and compliance certifications. This ensures that sensitive data used in big data analytics is secure and meets regulatory requirements.

The integration of big data analytics with cloud computing provides businesses with powerful tools and capabilities to harness the potential of large datasets, gain valuable insights, and drive innovation and growth. The possibilities are vast and continually expanding as technology advances.

EVALUATION OF BIGQUERY PLATFORM

Google Cloud Platform provides a variety of services tailored for analyzing and processing large datasets. Among these services, BigQuery stands out as a fully managed, serverless data warehouse designed for scalable analysis over petabytes of data. Operating as a Platform as a Service (PaaS), it supports queries using ANSI SQL and boasts built-in machine learning capabilities. Rather than being kept in a line shape, the data is stored as columns, allowing for storage to be oriented (Sharma & Kumar, P, 2022). Only the columns that are required for data analysis are searched, resulting in a significant reduction in latency (Sharma & Kumar, P, 2022). Query processing and aggregation amongst different nodes with thousands of servers is done using a binary tree.

Since its inception in 2011, BigQuery has garnered widespread popularity, with numerous major companies leveraging its capabilities for their data analytics needs. From a user perspective, BigQuery has an intuitive user interface which can be accessed in several ways depending on user needs. The simplest way to inter-act with this tool is to use its graphical web interface. The most straightforward approach to interact with this tool is through its graphical web interface. Within the BigQuery web interface, users have the flexibility to add or select existing datasets, schedule and formulate queries, transfer data, and view results. This user-friendly platform empowers businesses and analysts to efficiently explore and analyze vast datasets, making data-driven decision-making processes streamlined and accessible. Evaluation of BigQuery platform according different criteria is presented in table 2.

Table 2. Evaluation of BigQuery platform

No	Criteria	Description
1.	Storage	Columnar storage: the data is organized into tables and stored in a columnar format, which allows for efficient query execution.
2.	Architecture	BigQuery uses a distributed architecture for data storage and processing.
3.	Permissions	Multiple permissions: it's possible to handle various access permissions, such as read-only, editing, and owner.
4.	Access methods	Multiple access methods: a BigQuery Browser, a BigQuery Command-line tool, a REST-based API.
5.	Security	SSL (Secure Sockets Layer) is used in the solution to assure security.
6.	SQL Compatibility	BigQuery supports standard SQL queries.
7.	Integration	BigQuery seamlessly integrates with other Google Cloud services, such as Google Cloud Storage and Google Data Studio.

Google BigQuery operates as an exceptionally rapid analytics database, providing customers with unparalleled performance and the freedom to explore vast datasets without limitations. The actual speed of BigQuery is a topic of interest, prompting an investigation into the factors influencing its performance. Google BigQuery has numerous Public Datasets. Bigquery-samples:wikipedia_benchmark tables were chosen for experiment (size of tables ranges from was 1k to 10B). This dataset consists of a single row of data for every Wikipedia revision/update, this includes the contributor_username who updated the article, and the article title itself, it also has language and contributor IP. The experiment showed that the execution of a simple SQL query with WHERE clause and GROUP BY statement in the largest table took about 10 seconds (Figure2). Query execution time depends on table size but increase slowly.

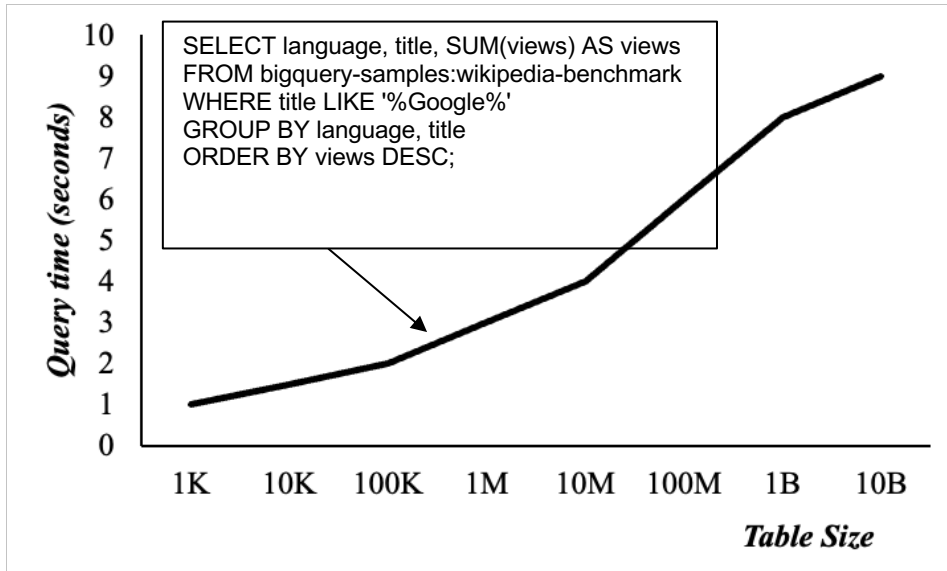


Figure 2. Query execution in different size tables

Google Cloud Platform offers a range of services for processing large datasets, with BigQuery standing out as a serverless data warehouse that supports scalable analysis over vast amounts of data using ANSI SQL and built-in machine learning features. Utilizing column-oriented storage and a binary tree-based processing system, BigQuery delivers rapid query performance, enabling users to explore extensive datasets efficiently, as demonstrated performed experiment.

CONCLUSIONS

Big data's scope exceeds traditional data limitations, embracing extensive volume, high speed, diverse types, and intricate complexities, leading to profound implications across various sectors. Analysis and interpretation of big data demand advanced technologies and expertise, fostering innovation and transformative discoveries.

The fusion of big data analytics with cloud computing equips businesses with potent tools to leverage large datasets, extract valuable insights, and fuel innovation and expansion. The potential is vast and continuously expanding with technological advancements.

Within the Google Cloud Platform, BigQuery stands out as a serverless data warehouse, supporting scalable analysis over vast datasets using ANSI SQL and integrated machine learning features. Its efficient column-oriented storage and binary tree-based processing system enable rapid query performance, showcasing its effectiveness for exploring extensive datasets.

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MATHEMATICAL LOGIC AND PROGRAMMING

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Abstract. The article presents the history of the emergence of mathematical logic. It is analyzed what is the meaning and application of mathematical logic in programming. The purpose of the article is to determine what is the relationship between mathematical logic and programming. The work is aimed to study how students of information systems evaluate knowledge of mathematical logic and the ability to apply knowledge in programming. It provides how programming knowledge can be applied to solve the tasks of mathematical logic. After analyzing, the opinion of the students of the Panevėžys College/ State Higher Education Institution, information systems study program about the knowledge of mathematics logic and the ability to programming, it was found that students assess their knowledge of mathematical logic and programming 6-7 points. The students of the program of the study of information systems were faced with a situation where knowledge of mathematical logic helped to solve the programming task more effectively. Assessment the difference in scores between mathematical logic and programming self-assessment is small enough for students. Emphasized that mathematical logic is very important in programming, especially when creating complex information systems or computer games. After analyzing how programming can be used to solve the tasks of mathematical logic, it was found that "Matlab" is perfect, which can solve the tasks of logical reasoning by creating a Script file.

Keywords: mathematical logic, programming application, mathematical relationship between logic and programming

INTRODUCTION

Logic is the basis of programming. The link between mathematics and programming begins with mathematical logic.

Computers may also be a way to give mathematical and computer science studies a symbolic form and to allow other algorithms, which operate on symbolic data, to operate on it. (Prudhomme, 2019)

Logic is the study of the principles and techniques of reasoning. It originated with ancient Greeks, led by the philosopher Aristotle, who is often called the father of logic. (Koshy).

The pioneers of mathematical logic: B. Russell, D. Hilbert, K. Gödelis. Until the middle of the 20th century, the main objects of the study of mathematical logic were various logarithmic calculations, the main components of which are the languages of calculations, axioms and rules of derivation. (Norgėla).

Logic plays a central role in the development of mathematics and computer science. Topological methods have been employed in a number of other areas of importance in computing, including digital topology in image processing, software engineering (Hitzier, P., Seda, A)

One of the more important achievements of mathematical logic is the discovery of an algorithm, an effective procedure for solving a task or problem, the discovery of an exact definition (clarification) of the concept. (Norgėla)

Mathematical logic is especially needed in programming, creating a program algorithm.

The relationship between logic programming and argumentation has attracted increased attention in the last years. (Gaggl, S.A., Nieves, J. C., Strass, H., Torroni, P)

Purpose of the research: To study the relationship between mathematical logic and programming.

The objectives of the research are:

1. To research the opinion of students about the knowledge of mathematical logic and to be able to program the relationship with each other.
2. To estimate the relationship between mathematical logic and programming evaluations.
3. To analyze an example of how complex tasks of mathematical logic can be solved with the help of programming.

APPLICATION OF PROGRAMMING TO SOLVE PROBLEMS OF MATHEMATICAL LOGIC

Programming can be successfully used to solve problems of mathematical logic. We will give an example of how we can solve the task of logical reasoning using the Matlab program.

Example: The task of logical reasoning.

If the student learns programming more, then he could write programs better. If he learns more to programming, he would at the same time improve his knowledge of mathematical logic. If he spent more time studying, then he would

find more like-minded friends and better learn to program. If he had more like-minded friends, then his chances of finding a job would increase.

Consequently: *if the student improved his knowledge of mathematical logic, learns to programing and spend more time studying, then his chances of finding a job would increase.*

This assumption needs to be verified.

Hypothesis: If a student improved his knowledge of mathematical logic and learned to programing, then his chances of finding a job would increase.

Let's note the statements:

S1="Student learns more programming"

S2="The student learns better to programing"

S3="Improves knowledge of mathematical logic"

S4="Find more like-minded friends "

S5="It's easy to find a job"

S6= "More time to study"

We write down the assumptions and conclusion:

$S1 \leftrightarrow S2$

$S1 \leftrightarrow S3$

$S6 \Rightarrow (S4 \wedge S2)$

$S4 \Rightarrow S5$

Conclusion: $S2 \wedge S3 \wedge S6 \Rightarrow S5$

We change the implication using the formula:

$$(p \rightarrow q) \leftrightarrow (\neg p \vee q) \quad (1 \text{ formula})$$

We change the equivalence using the formula:

$$(p \rightarrow q) \leftrightarrow (\neg(\neg p \wedge \neg q) \wedge \neg(q \wedge \neg p)) \quad (2 \text{ formula})$$

We rearrange the assumptions using formulas 1 and 2. Reorganized assumptions and conclusion.

$P1 = (\neg(\neg S1 \wedge \neg S2) \wedge \neg(S2 \wedge \neg S1))$

$P2 = (\neg(\neg S1 \wedge \neg S3) \wedge \neg(S3 \wedge \neg S1))$

$P3 = \neg S6 \vee (S4 \wedge S2)$

$P4 = \neg S4 \wedge S5$

Conclusion: $\neg(S2 \wedge S3 \wedge S6) \vee (S5)$

For the realization of this task, a Script file logic1 is created in Matlab (see Figure 1).

```

1 - fprintf('We check the validity of the conclusion \n');
2 - fprintf('S1 | S2 | S3 | S4 | S5 | S6 | P1 | P2 | P3 | P4 | Conclusion \n');
3 - for S1=0:1
4 -     for S2=0:1
5 -         for S3=0:1
6 -             for S4=0:1
7 -                 for S5=0:1
8 -                     for S6=0:1
9 -                         P1=not(not(S1)&not(S2))&not(S2&not(S1));
10 -                        P2=not(not(S1)&not(S3))&not(S3&not(S1));
11 -                        P3=or(not(S6),and(S4, S2));
12 -                        P4=or(not(S4), S5);
13 -                        Conclusion=or(not(and(and(S2,S3), S6)),S5);
14 -                        if P1*P2*P3*P4~=0
15 -                            fprintf('%4d | %3d | %3d | %4d | %4d | %4d | %5d | %5d | %5d | %7d \n', S1, S2, S3, S4, S5,S6, P1, P2, P3, P4, Conclusion);
16 -                        end
17 -                    end
18 -                end
19 -            end
20 -        end
21 -    end
22 - end

```

Figure1. Matlab Script file is for solving the task

It contains assumptions and a conclusion. In this file, a clause sentence is created, which brings out to the screen only those sentences in which all the assumptions are true.

```

Command Window
New to MATLAB? Watch this Video, see Demos, or read Getting Started.
>> logic1
We check the validity of the conclusion
S1 | S2 | S3 | S4 | S5 | S6 | P1 | P2 | P3 | P4 | Conclusion
1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1
1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1
1 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1
1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1
1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1

```

Figure 2. The Results of the task using the program Matlab

Analyzing the obtained results, we can say that if all the assumptions are correct, then and the conclusion are correct.

Analyzing the results obtained, we can say that if all the assumptions are correct, then this and the conclusion are correct. Therefore, we can formulate the final conclusion: "If a student improved his knowledge in mathematical logic and learned to programing, then his chances of finding a job would increase."

RESULTS OF THE RESEARCH

We founded out the opinion of 30 students in the information system study program, about the relationship between mathematics logic and programming.

The distribution of survey respondents by study course is shown in Figure 3. The most active participants in the survey were 1st year students (60.0%). 23.3% and 16.7% of the 2nd and 3rd year students who took part in the survey.

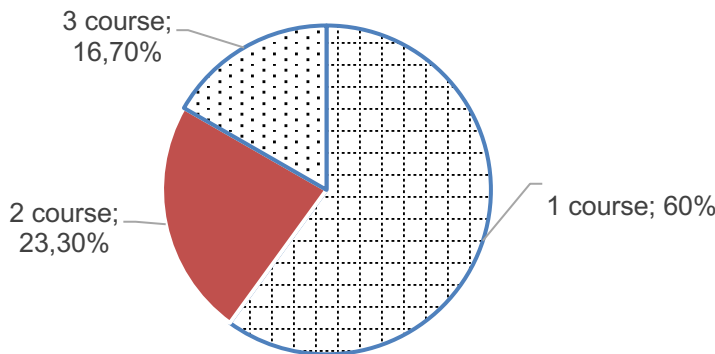


Figure 3. Distribution of respondents by course

Respondents evaluated knowledge of mathematical logic on a scale from 1 to 10. Figure 4 shows the results of the research. Most students rate knowledge of mathematical logic at 6 (26.7%) and 7 (23.30%). Knowledge of mathematical logic was negatively evaluated by 16.7% of students. Excellent and very good knowledge was rated by 10% of the respondents each side.

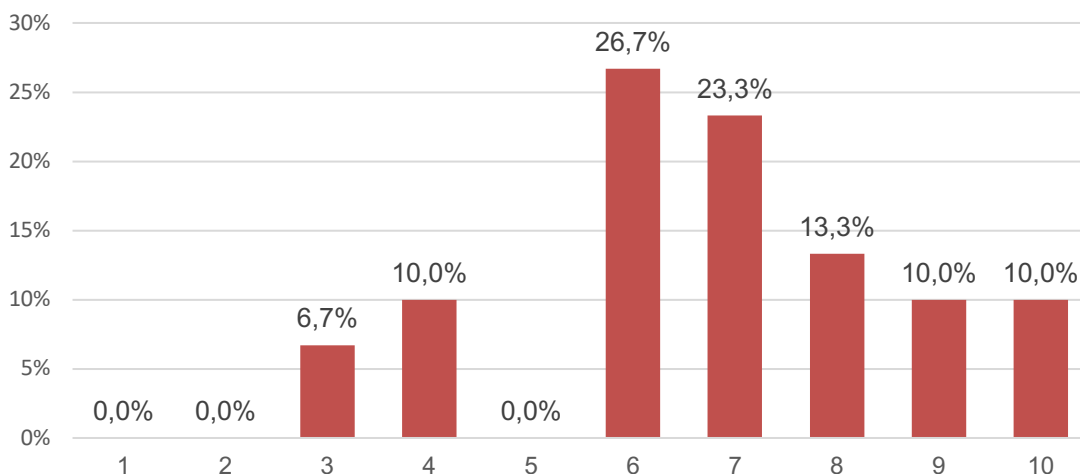


Figure 4. Assessment of the knowledge of mathematical logic of the respondents on a scale from 1 to 10

Respondents evaluated knowledge of programming on a scale from 1 to 10. Figure 5 shows the results of the research. Knowledge of programming is better appreciated by students than by knowledge of mathematical logic. Negatively (1-4 points) is rated only 6.6%. With a score of 5-6, they rate their knowledge at 43.4%. Excellent and very good knowledge was rated by 10% of the respondents each.

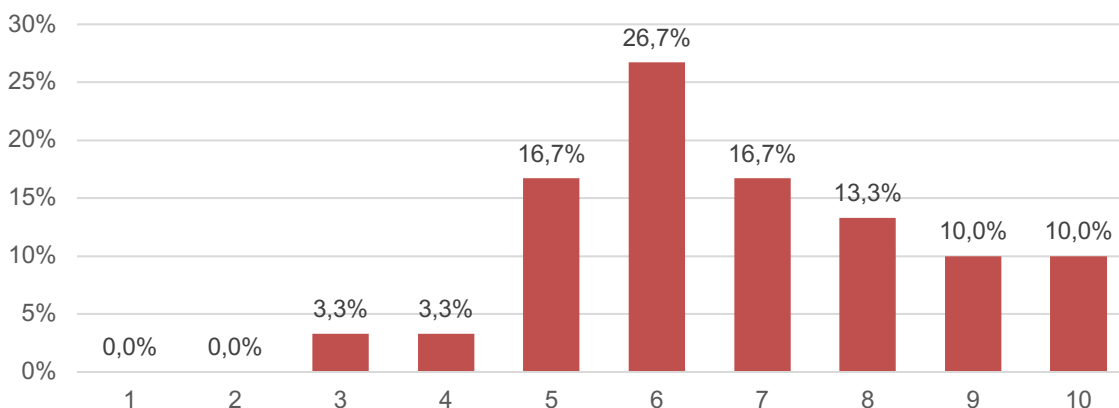


Figure 5. Assessment of the knowledge of programming of the respondents on a scale from 1 to 10

To determine how knowledge of mathematical logic and programming differs, we used the Pivot table. Table 1 presents the data obtained.

Table 1. The difference between mathematical logic and self-assessment of programming knowledge

Course of study	Difference						
	-5	-3	-2	-1	0	1	2
1 course	6%	6%	11%	6%	33%	17%	22%
2 course	0%	0%	0%	29%	57%	0%	14%
3 course	0%	0%	0%	0%	60%	40%	0%

The biggest difference between the self-assessment of mathematical logic and programming knowledge is -5 points. This difference is fixed only in a survey of students of 1 course. In the 3rd course survey, the difference is 0-1 point. In the 2nd course survey, 2 points. We can say that in higher courses, students rate their knowledge of mathematical logic and programming in the same way. 13 students (43%) assess their knowledge of both mathematical logic and programming with the same score.

The survey sought the opinion of student students on whether mathematical logic is needed in programming. The results of the research are presented in Figure 6.

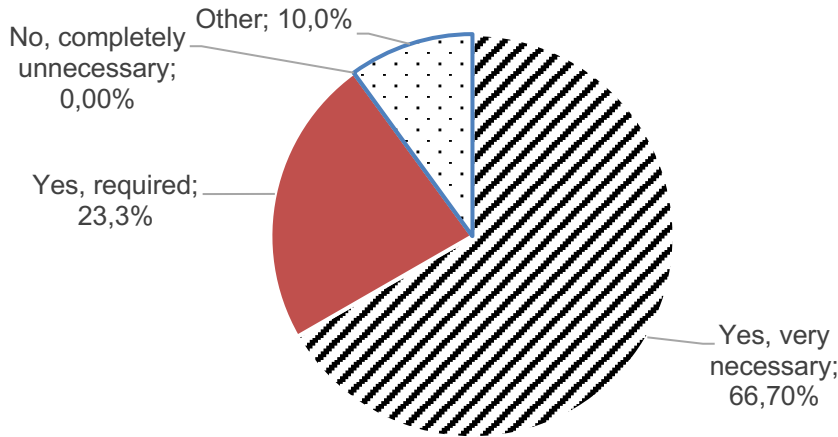


Figure 6. Respondent's opinion about mathematical logic is needed in programming.

It was studied whether the students of the program of the study of information systems were faced with a situation where knowledge of mathematical logic helped to solve the programming task more effectively. They indicated that 90% of respondents indicated that they faced such a situation.

There was a survey with the question, the question was: "Have you ever encountered a situation in programming when knowledge of mathematical logic helped to solve a programming task more effectively? " A large percentage of respondents chose the answer to another (59.3%). In response, they emphasized that mathematical logic is very important in programming, especially when creating complex information systems or computer games. Mathematical logic is considered important or very important in programming by 96.7% of respondents.

Analyzing the opinion of students about whether mathematical logic is applied in the development of software, we can say that 86.7% agree that it is applied. 3.3% indicated that it depends on the situation (Figure 7).

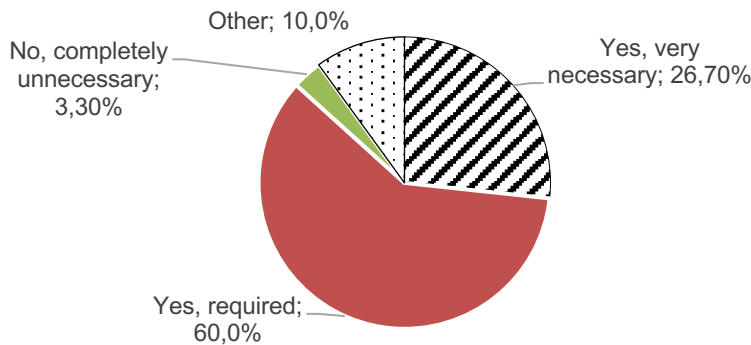


Figure 7. Respondents' views on whether mathematical logic is used in software development.

When analyzing the opinion of students (look at Figure 8), whether mathematical logic is applied to the development of the reliability and security of software. 90% indicated that "Yes, required", or "Yes, very necessary".

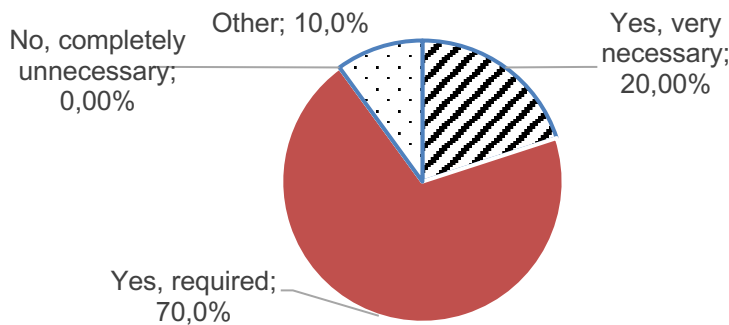


Figure 8. Respondent's views on whether mathematical logic is used in developing software validation and security.

There was a survey with the next question, the question was: "Do you think understanding mathematical logic can help you become a better programmer?" Students gave an opinion on whether an understanding of mathematical logic

can help them become a better programmer. 50% choose the answer "Yes, always", 43.3% choose "Yes, but mathematical logic is needed only for those programmers who seek a deeper understanding of the theory of program development".

CONCLUSIONS

1. After analyzing, the opinion of the students of the Panevėžys College/ State Higher Education Institution, information systems study program about the knowledge of mathematics logic and the ability to programming, it was found that students assess their knowledge of mathematical logic and programming 6-7 points. Students of the program of the study of information systems were faced with a situation where knowledge of mathematical logic helped to solve the programming task more effectively.

2. Assessment the difference in scores between mathematical logic and programming self-assessment is small enough for 2-3 course's students. Emphasized that mathematical logic is very important in programming, especially when creating complex information systems or computer games. Mathematical logic is considered very important in programming.

3. After analyzing how programming can be used to solve the tasks of mathematical logic, it was found that the program Matlab is perfect, which can solve the tasks of logical reasoning by creating a Script file.

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REVENUE POTENTIAL AND FINANCIAL AUTONOMY OF PANEVĖŽYS REGION MUNICIPALITIES

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Abstract. The issue of revenue generation and financial autonomy is one of the greatest challenges in the local governance domain. The revenues at the disposal of the municipalities not only determine the socioeconomic development, implementation of the regional policy goals, but also reveal the situation of financial autonomy. The phenomena of local government revenue measurement and financial autonomy are viewed in the academic literature as multidimensional, as they are characterised by a wide range of indicators. Combining all the revenue indicators into a single index can therefore provide an indication of the level of financial autonomy of local government in terms of revenue.

The TOPSIS multi-criteria approach allows for a comprehensive and integrated assessment of the financial autonomy of municipalities by providing a single summary indicator composed of several revenues ratios.

The empirical research analyses the situation of the revenue potential of Panevėžys region municipalities, assessing the financial autonomy of municipalities in the period 2009-2022. The research shows that all municipalities in the region are very homogeneous in terms of revenue indicators and have a moderately low level of financial autonomy. The empirical results also show that municipalities' financial autonomy is changing slowly compared to the results of previous research. This confirms the dependence of municipalities on centralised financial management, which is governed by the legal acts that have a strong impact on the development of municipalities' financial autonomy and financial capability. Hence, the results in a way also show a lack of capacity on the part of municipalities themselves to seek opportunities to create sustainable, stable perspectives from an economic and social perspective.

Keywords: revenue potential, financial autonomy, TOPSIS method, municipalities

INTRODUCTION

The issue of revenue generation and financial autonomy is one of the greatest challenges in the local governance domain. Solid financial resources in the municipalities are the basis of their social and economic development on the local level. The revenues at the disposal of the municipalities not only determine the socioeconomic development, implementation of the regional policy goals, but also reveal the situation of financial autonomy. Therefore, it is important to have a balanced combination of revenues consisting of own revenues and transfers of a share in the local governance revenue structure, and the ability of municipalities to implement the local social and economic development goals by increasing the revenues.

The implementation of the European Green Deal, the Paris Conference objectives, and the Sustainable Development Strategy goals cannot be achieved without the sustainable development of rural areas. EU documents underline the importance of local government financial autonomy for the development of national regions and the sustainable development of rural areas (A long-term Vision for the EU's Rural Areas - Towards stronger, connected, resilient and prosperous rural areas by 2040, EC, Communication from the Commission to the European Parliament, 2021). At the national level, municipal FA is viewed as a challenge, highlighting the low capacity of municipalities to increase the revenue of their budgets (Sustainable Public Finance Development Programme for 2021-2030 by the Ministry of Finance of the Republic of Lithuania, 2022; Programme of the Government of the Republic of Lithuania, 2020; White Paper on Lithuanian Regional Policy for Sustainable Development 2017-2030, 2017).

Researchers, practitioners, and supranational organizations have been discussing on various LGU revenue assessment issues: revenue classification differences, own revenue sources and their definition, empowerment of revenues as a fiscal policy instrument to increase the financial autonomy, assessment of financial autonomy from the revenue perspective. Identification and assessment of the revenues that could be viewed as a potential for financial autonomy is a serious scientific and practical issue.

This topic has been elaborated from the municipality financial autonomy perspective by the researchers (Miceikienė, Skauronė, Krikštolaitis, 2021; Wichowska, 2021; Skica et. al., 2020; Wichowska, Wierzejski, 2019; Standar & Kozera, 2019; Standar, 2019; Ladner, Keuffer, 2018; Satoła, 2018; Kopanska, 2017; Satoła, Standar, Kozera, 2019; Głowicka-Wołoszyn, Satoła, 2018) who focus on explanation and assessment of the revenue indicators that reflect various aspects of the financial autonomy of municipalities.

Research problem: what is the revenue potential and financial autonomy in the municipalities of Panevėžys region?

Research aim: to assess the revenue potential and the financial autonomy of rural municipalities in 2009-2022 according to the evidence of Panevėžys region of municipalities.

Research methods: scientific literature analysis, TOPSIS method, descriptive statistics methods.

THEORETICAL BASIS FOR BUILDING FINANCIAL AUTONOMY AND REVENUE POTENTIAL OF LOCAL GOVERNMENTS

Since the 1980s, when a detailed analysis of local autonomy was carried out (Clark, 1984; Pratchett, 2004; Sauviat, 2004), the scholars developing the theories of local government autonomy have focused on three dimensions of the autonomy of local government units: the unit's freedom from central government intervention, the unit's territorial freedom to take decisions for the purpose of carrying out defined tasks, and the reflection of local identity. On the basis of an analysis of scientific literature and legal documents, several types of local government autonomy have been identified, with the following main features: local government capacities (Oualli, Boussetta, 2017; Jacob et al., 2008), responsibilities and rights (Turala, 2020; Satola et. al., 2019; Cigu, 2014; Gilles, 2012; Beer-Tóth, 2009), local financial resources (Turala, 2020; Standar, Kozera, 2019; Burbulytės-Tsiskarishvili ir kt., 2018; Psycharis et. al., 2016; Cigu, 2014; Gilles, 2012; Beer-Tóth, 2009) and value-related freedoms (Burbulytės-Tsiskarishvili ir kt., 2018; Psycharis et. al., 2016; Pratchett, 2004; Sauviat, 2004; Europos vietos savivaldos chartija, 1985; Clark, 1984), and the principles of efficiency, fairness, subsidiarity, sustainability and coherence (Turala, 2020; Beer-Tóth, 2009; Hajilou, et. al, 2018; Łuczak et al., 2018; Cigu, 2014; Kozera, Glowicka-Woloszyn, 2016; Psycharis et. al., 2016; Alm et. al., 2014; Jemna, Onofrei, Cigu, 2013). (see Figure 1).

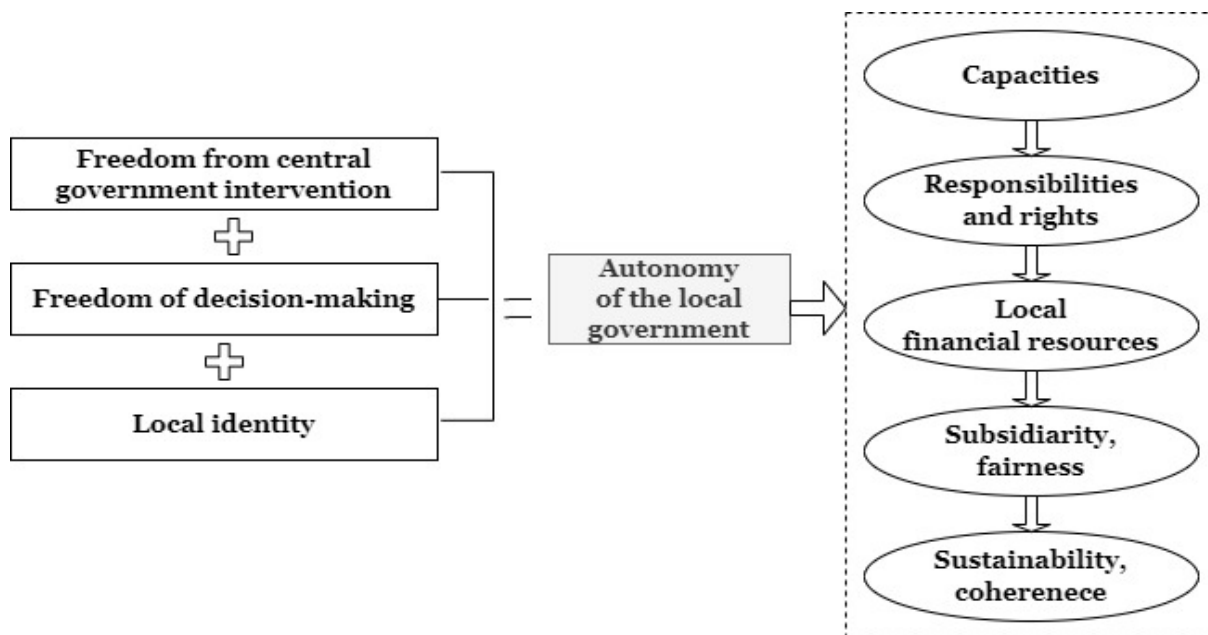


Figure 1. The concept of local government autonomy (Skauronė, 2022)

However, one of the most important types of local government autonomy is financial autonomy, which is the combination of interoperable elements of local government revenue, expenditure, budget, and borrowing that is the subject to the externalities and internalities and reflects the respective legal principles, principles of freedom and capacities exercised by the central government for the purpose of autonomous management of the combination, as well as the capacity of the local government bodies to generate and allocate financial resources, develop local economic and social well-being, and create added value (Skauronė, 2022).

In summary, theories of financial autonomy suggest that regional local governments should finance their needs mainly using own sources of revenue and that the central government should provide the local governments with the control. Own revenue is often treated as an indicator of the well-being of a local government and a key source of information on its financial situation and the level of autonomy (Dziekanski, 2020) and this means that it is highly important to assess the financial autonomy in terms of revenue (Skauronė, 2022; Wichowska, 2021; Satola et. al., 2019; Kapidani, 2018).

In the empirical studies, researchers (Wichowska, 2021; Vavrek, Pukala, 2019; Satola et. al., 2019; Standar, Kozera, 2019; Luczak, Just, Kozera, 2018; Luszak, Kozera; Bacci, 2018; Glowicka-Woloszyn, Satola, 2018; Kozera, Luszak, Wysocki, 2017; Kozera, Glowicka-Woloszyn, 2016) assessed the financial autonomy of region municipalities using diverse revenue indicators (see Figure 2).

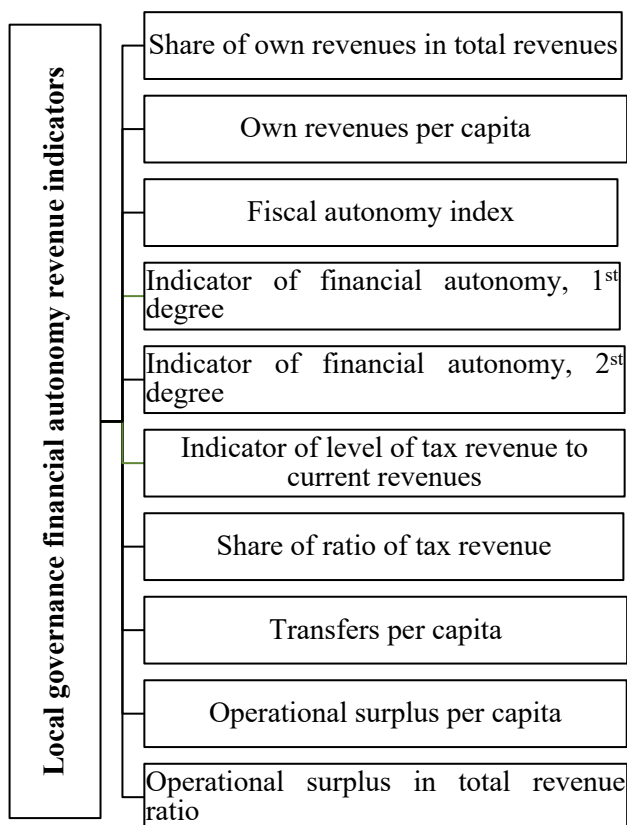


Figure 2. Revenue indicators used to assess the financial autonomy of region local governance

When assessing the potential of region municipalities to increase their financial autonomy, the following should be considered as the factors boosting sustainable development: the principles of financial sustainability and their operation; local revenue and tax base, and the degree of their autonomy and sustainability; fairness and sustainability of the revenue redistribution; factors determining the financial transfers; local prospects for social, economic and regional development, etc.

The scientific literature distinguishes several essential principles of the sustainable development of rural areas: 1. The most recent approach to rural development processes relates to the concepts of sustainable development. 2. Institutional development of communities. One of the essential aspects is institutional development, which includes the creation of community organizations and their active activities. 3. Links between the principles of good governance and sustainable development, strengthening the institutional dimension of sustainable development. An important principle of subsidiarity is that everything that the community (municipality) can solve or manage itself, it must have the rights and opportunities to do so. 4. Evaluation of territorial coherence. Comprehensible, measurable (in numbers, percentages, coefficients) indicators, the data of which are officially published and easily accessible, are necessary for the evaluation of any activity.

In general, in the international research environment, researchers (Miceikienė et. al., 2021; Satola et. al., 2019; Standar, Kozera, 2019; Glowicka-Woloszyn, Satola, 2018) particularly emphasize the lack of country-specific differences in the assessment of the financial self-sufficiency of local governments and they justify the need for and the need for innovation in the development of theories of public finance.

EMPIRICAL RESEARCH METHODOLOGY FOR THE ASSESSMENT OF RELATIVE INDICATORS OF REVENUE AND FINANCIAL AUTONOMY OF PANEVĖŽYS REGION MUNICIPALITIES

Empirical research problem and period of the empirical research. The problem is defined by the question – what is the revenue potential and financial autonomy in the municipalities of Panevėžys region? The importance of assessment municipal revenue performance and financial autonomy lies in the fact that it is possible to evaluate economic and social welfare creation, sustainable allocation, redistribution and growth decisions in the context of the region's municipalities, as well as to identify the need for the development of new scientific insights into these economic phenomena in the fields of economics, fiscal policy and the theories of decentralisation and regional growth.

The aim of the study was to choose the longest possible evaluation period for the assessment of the revenue potential and financial autonomy of municipalities in Panevėžys region, as this leads to more accurate results. Therefore, the empirical study period covered 14 years, i.e. from 2009 to 2022.

Empirical research sample. 6 municipalities of Panevėžys region.

Empirical research data. Municipalities revenue data from the Department of Statistics of the Republic of Lithuania.

Empirical research tool for calculating the results. All calculations were carried out using the software tool Microsoft Office Excel.

The methodology of the empirical research consisted of 2 stages:

1. Selection and calculation of the relative indicators of revenue determining financial autonomy of Panevėžys region municipalities.
2. Formation of the index of financial autonomy of Panevėžys region municipalities on the basis of revenue indicators and assessment of the level of financial autonomy in the period 2009-2022.

Stage 1. The empirical research, based on an analysis of the scientific literature (Wichowska, 2021; Vavrek, Pukala, 2019; Satoła et. al, 2019; Standar, Kozera, 2019; Luczak, Just, Kozera, 2018; Luszak, Kozera; Bacci, 2018; Glowicka-Woloszyn, Satola, 2018; Kozera, Luszak, Wysocki, 2017; Kozera, Glowicka-Woloszyn, 2016) and the subject-related criteria (the calculation of indicators is based on statistical data, which are collected and reported periodically), eight relative revenue indicators of the Panevėžys region municipalities were selected, on the basis of which a set of indicators was constructed: $R = (PIT \text{ per capita, EUR/capita } (r_1); \text{ fiscal wealth index or tax revenue per capita (EUR/capita } (r_2); \text{ PIT as a share in the total municipal revenue, \% } (r_3); \text{ own revenue per capita, EUR/capita } (r_4); \text{ own revenue as a share in the total revenue or first-degree financial autonomy, \% } (r_5); \text{ non-tax revenue per capita, EUR/capita } (r_6); \text{ grants as a share in the total municipal revenue or state intervention indicator, \% } (r_7); \text{ transfers per capita, EUR/capita, } (r_8))$. The study assumes that the two revenue indicators r_7 and r_8 are of a minimising nature and have a dampening effect on financial autonomy, while all other indicators are of a maximising nature and have a driving effect on financial autonomy.

It should be noted that the TOPSIS method for assessment multi-criteria phenomena uses revenue ratios, which are measured in different units, so it is necessary to unify the data across the dimensions of the variables before starting the calculations. For this purpose, the indicators are normalised (Simanavičienė, 2016). The authors' empirical research used vector normalisation of revenue ratios. Various methods have been used to calculate the revenue ratios prior to the development of the financial autonomy index: calculation of the objective significance of the revenue ratios, Entropy, mathematical, descriptive statistics.

Stage 2. A set of revenue benchmarks allowed us to construct an index of municipal financial autonomy using the TOPSIS method. This index is mathematically expressed by the following formula (Hwang, Yoon, 1981; Ginevičius, Podvezko, 2008; Simanavičienė, 2011):

$$K_i = \frac{L_i^-}{L_i^+ + L_i^-}, (i = \overline{1, m}), \quad (1)$$

where $K_i \in [0,1]$

where: K_i – value of the i -th municipality generated by assessment under the TOPSIS method, with the highest K_i value corresponding to the most financial autonomy municipality.

L_i^+ – total closeness of the i -th municipality to the ideally best variant;

L_i^- – total closeness of the i -th municipality to the ideally worst variant.

The formation of financial autonomy index of Panevėžys region municipalities on the basis of revenues indicators and the assessment of the level of financial autonomy in the period under consideration was carried out in the steps of the TOPSIS method, in which various mathematical methods were applied: calculation of the ideal solution of the distance of each municipality from positive A^+ to negative A^- determination of the distance of each municipality L^+ to L^- in n -dimensional Euclidean space, descriptive statistics.

ASSESSMENT OF REVENUE INDICATORS AND FINANCIAL AUTONOMY OF PANEVĖŽYS REGION MUNICIPALITIES

Revenue potential of Lithuanian regions municipalities. Today, regional development in Lithuania is one of the most important policy priorities and poses many challenges. It is therefore essential for municipalities in the regions to have a balanced and sustainable revenue stream, the combination of own revenues (mainly taxes and charges) and transfers (earmarked grants and general-purpose grants) as a share of municipal revenues, which determines the ability of local governments to raise their own revenues (e.g. by increasing tax rates). Financial autonomy in terms of revenue has an impact on the ability of each municipality to develop entrepreneurial initiatives, implement projects, and deliver quality public services, generating and increasing its revenue potential.

In reality, according to the Ministry of Finance of the Republic of Lithuania (2023), the own taxes of Lithuanian municipalities account for only about 3% of their total revenue. It should be noted that only two own taxes are included in the mix of all municipal revenues. They are land and immovable property of legal persons, which account for 1.56% and 1.15% respectively, while other non-tax revenues of municipalities account for 6.25%. And even personal income tax (PIT), as the main source of municipal revenue potential, is also being redistributed. Overall, central government transfers account for the largest share of municipal budgets in Lithuania of any European country making 87.9%.

Increasing the revenue potential of regional municipalities depends mainly on population size. Human capital resources are the decisive factor of sustainable development of a municipality, i.e. the ability to carry out activities, develop businesses, promote entrepreneurship, develop certain sectors of rural businesses and activities and attract investments.

Description of the economic and demographic environment of Panevėžys region. In Panevėžys region there are 6 municipalities, of which rural municipalities (5 of 6) comprised for the major part of the territory. The region's local economies are characterised by agriculture and natural resources, food and beverage production, furniture and textiles and biotechnology. These economic sectors are, in fact, also the revenue-generating potential of municipalities.

The results of the empirical research show that in the recent 14 years, Panevėžys region saw almost 20% decrease of the population, in some municipalities (Biržai district, Kupiškis district and Pasvalys district) it decreased by more than 24%, in Rokiškis district and Panevėžys district the percentage is more than 23 and in Panevėžys city municipality the decrease is 16%. These results show one of the biggest declines in Lithuanian regions (see Figure 3).

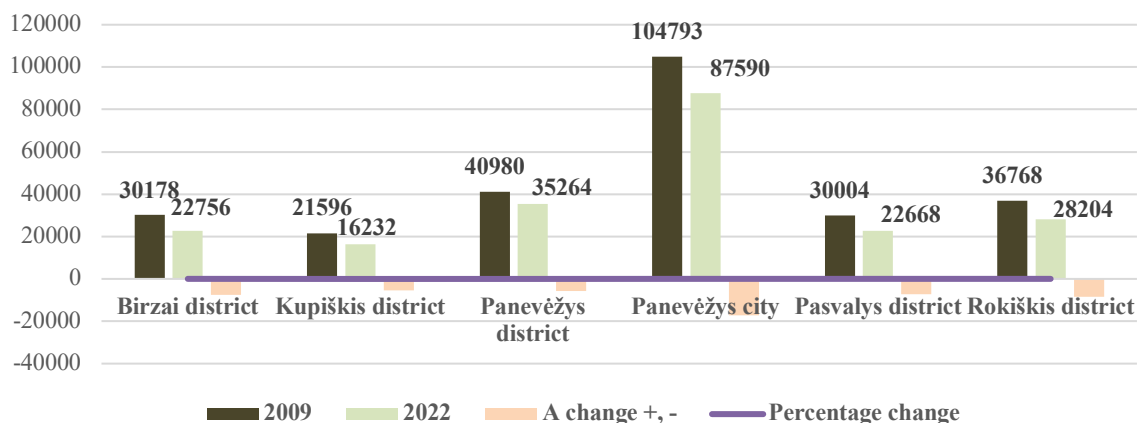


Figure 3. Population change in Panevėžys region municipalities in 2009-2022

Source: compiled according to the empirical research results.

It could be argued that these demographic changes affect the available labor force in the region, pose risk to the region's economic development, make the region less attractive to foreign investments and impair development of the region municipalities in financial terms.

Assessment of revenue indicators and financial autonomy of Panevėžys region municipalities in 2009-2022. The empirical research evaluated the financial situation of Panevėžys region municipalities using 8 income indicators (see Table 1).

Table 1

Level of weight of objective significance of the revenue indicators of the financial autonomy of rural municipalities, 2009–2019

Indicator, unit of measure	Direction of the indicator value	Values of the objective significance of the indicator						Mean
		Biržai district	Kupiškis district	Panevėžys district	Panevėžys city	Pasvalys district	Rokiškis district	
PIT per capita, EUR	Maximizing	0,2122	0,2145	0,1844	0,2523	0,2133	0,2000	0,213
Fiscal wealth index or tax revenues per capita, EUR	Maximizing	0,2015	0,1850	0,1740	0,2390	0,2052	0,1941	0,200
PIT (%) in the total municipality revenue	Maximizing	0,0165	0,0211	0,0197	0,0190	0,0228	0,0163	0,019
Own revenues per capita*, EUR	Maximizing	0,2065	0,1938	0,1832	0,2163	0,2103	0,2054	0,203
Index of financial autonomy, 1 st degree/share of own revenues in total revenues, (%)	Maximizing	0,0146	0,0159	0,0191	0,0165	0,0210	0,0178	0,017
Non-tax revenues per capita	Maximizing	0,2705	0,2984	0,3589	0,0958	0,2626	0,3066	0,265
State intervention ratio (%)	Minimizing	0,0160	0,0124	0,0246	0,0269	0,0206	0,0185	0,020
Transfers per capita, EUR	Minimizing	0,0623	0,0590	0,0360	0,1342	0,0443	0,0411	0,063

Source. Made by the authors own calculations based on Department of Statistics of the Republic of Lithuania.

The research identified the most significant revenue indicators of Panevėžys region municipalities, which have the greatest impact on their financial autonomy. The results showed that in all municipalities the most significant relative revenue indicators during the period were: PIT per capita, EUR (1); tax revenue per capita, EUR (2); own revenue per

capita, EUR (3); non-tax revenue per capita, EUR (4). Although these revenue indicators have been on an upward trend over the period under review, they have not contributed to the rapid increase in the level of municipal financial autonomy. This is because municipalities are highly dependent on central government.

Descriptive characteristics of statistics revealed the tendencies of financial autonomy in municipalities of Panevėžys regions during the analyzed 14-year period from 2009 to 2022 (see Table 2). The relative revenue indicators of Panevėžys region municipalities show that the per capita personal income tax (PIT) has increased by 4.35 times during the period under review (as shown by the minimum and maximum values). However, the standard deviation means that the distribution of the PIT varied from municipality to municipality between 2009 and 2022 and did not encourage municipalities with lower revenues to take measures to increase it, as competition for this tax in Lithuania is a slow-moving instrument. This is because the main source of funding for municipalities' autonomous functions is PIT, which the main source of the municipalities' funding of the general budgets of the Panevėžys region, i.e. on average 42.34% of their total revenue or 83% of their total tax revenue, is considered to be a general-purpose subsidy, as it is redistributed centrally. The share of own revenue per capita of Panevėžys region municipalities revealed that the difference between the less affluent municipalities and affluent municipalities there is a 2.2 fold. As one of the most significant indicators, non-tax revenue per capita has been increasing between 2009 and 2022 (from €13.06 to €138.70), but overall it is very low. In municipalities budgets were dominated by a high share of grants (more than 48% of total revenue).

Table 2

Descriptive statistics of indicators describing the level of financial autonomy in municipalities of Panevėžys region, 2009–2022

Revenue indicator, (r_n)	Mean	Median	Standard Deviation	Min	Max
PIT per capita, Eur	424,12	372,13	194,06	205,22	893,70
Fiscal wealth index or tax revenue per capita, Eur	460,12	404,90	203,81	225,07	950,86
PIT (%) in the municipality revenues	42,34	42,94	6,29	30,33	54,65
Own revenues per capita, Eur	514,01	460,53	230,59	257,35	1079,49
Index of financial autonomy, 1 st degree/share of own revenues in total revenues, (%)	51,39	51,79	6,99	38,30	64,76
Non-tax revenues per capita, Eur	53,89	45,56	29,66	13,06	138,70
Share of grants in the total municipal revenues or State intervention ratio, (%)	48,61	48,21	6,99	35,24	61,70
Transfer per capita, Eur	461,74	416,73	146,13	265,59	852,66

Source. Made by the authors own calculations based on Department of Statistics of the Republic of Lithuania.

In summary, the analysis of revenue indicators of Panevėžys region municipalities shows that all municipalities in the region are very homogeneous (the same). The results confirmed the high dependence of municipalities on central government, which reflects the unfavourable context for joint development initiatives in the region, for multifunctional growth and for the advancement of the local economy and self-regulation.

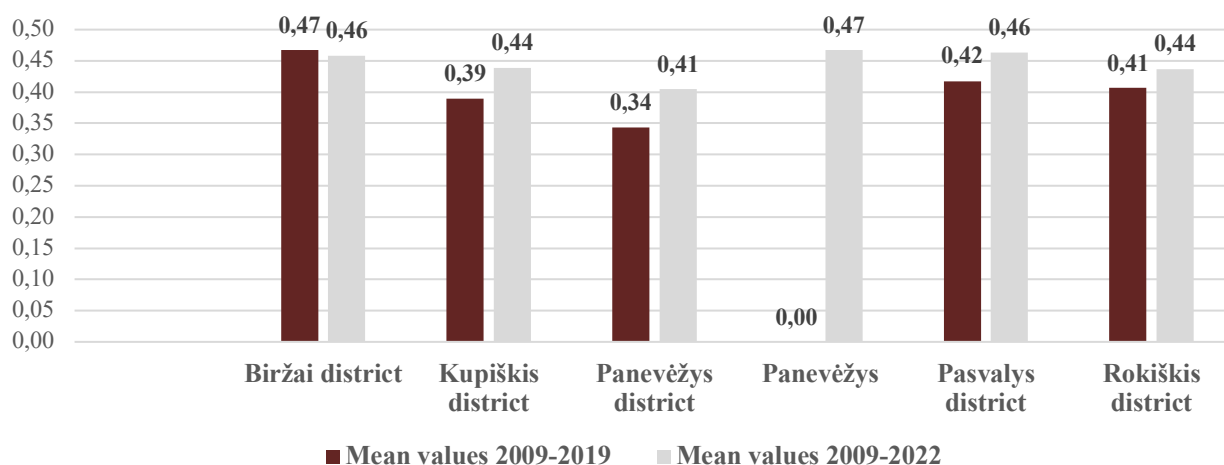


Figure 4. Assessment of the financial autonomy level of municipalities in Panevėžys region 2009 – 2019 and 2009-2022

Source: compiled according to the empirical research results.

It was also found that Panevėžys region municipalities are characterised by moderately low financial autonomy, as the index has not exceeded more than 0.5 points over the analysed period (14 years) (see Figure 4). The figure also

compares the results of the previous empirical research conducted by the author of this paper with co-authors (from 2009 to 2019) with the results of the current follow-up empirical research (from 2009 to 2022). It should be noted that while the previous research assessed the financial autonomy of rural municipalities, the follow-up research included the municipality of Panevėžys and assessed its financial autonomy.

The results of the study are useful for politicians, economists and local government leaders in the region to discuss how to respond to the needs of the region's municipalities, how to foster their local development from an economic and social point of view and how to increase the level of their financial autonomy.

CONCLUSIONS

The empirical study ongoing. The results of the study show that municipalities' revenue potential and financial autonomy are changing very slowly. The results of the empirical study confirm the high dependence of municipalities on centralised financial management, which is governed by legal acts that allow municipalities to be neither financially active nor self-sufficient. In fact, the results also show a lack of capacity on the part of municipalities themselves to seek opportunities to create sustainable, stable perspectives from an economic and social perspective.

Although in the municipalities of the Panevėžys region the transfers from the state budget (grants) to the municipalities' total revenues have been decreasing over the past years, the GPM, which accounted for about 42.6% of the municipalities' total revenues in the period under review, is in fact a grant as this tax is redistributed.

Municipalities of the Panevėžys region were making very little use of the potential to increase the non-tax revenues, which accounted for the smallest share in the total revenue structure. This kind of revenue is the basis for promotion of the entrepreneurship, sustainability, social, economic, and financial prospects for the municipalities.

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EVALUATION OF ECONOMIC DRIVING AS A COST-CUTTING STRATEGY

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Abstract. The development and renewal of the transport sector is a continuous and never-ending process. The technological **revolution** in the automotive industry has been discussed for a while. Vehicles with internal combustion engines, which are considered to be polluting, should be replaced by non-polluting or significantly less polluting ones. Recently, European countries are experiencing a major energy crisis. Both petroleum products and electricity are becoming more expensive, so vehicle consumers are increasingly asking the question, which is better: a vehicle with an internal combustion engine or an electric vehicle? This article examines the possibilities and perspectives of the development of electric vehicles in Lithuania, based on the best practices of other countries.

Keywords: eco-driving, fuel-consumption, costs, instruction

INTRODUCTION

Over past years, road transport enterprises have encountered a growing number of obstacles that have a substantial effect on their expenses. The aforementioned factors encompass a rise in vehicular traffic, a decline in safety, heightened competition, worldwide political and economic instability, rising fuel prices, a decrease in environmental pollution, the European Parliament's closure, the execution of CO₂ emission reduction measures, a scarcity of drivers and their inexperience. The aforementioned challenges incentivize transportation companies to implement cost-cutting measures and comply with EU regulations. The economic driving measure is one of them. According to M. Bagavičius (2021), driving in an economical manner lowers fuel consumption, emissions of carbon dioxide into the atmosphere, and maintains road safety. Even truck manufacturers are spending a lot of money on the devices that are mounted on vehicles to assist guarantee safety and cut down on fuel usage. Enhancing the educational process would enable drivers to become more acquainted with the concept of economical driving. So the aim of the article – applying the economic driving principle to determine areas where transportation businesses might cut costs. The objectives of the research: To reveal the effect of economic driving on fuel consumption from a theoretical point view and use a digital transport management system to record the outcomes of test drives when fuel consumption is compared between economical and standard driving styles, identifying niches for reducing fuel consumption. Methods applied: analysis of scientific literature, experiment, secondary data analysis.

THE IMPACT OF ECONOMIC DRIVING ON THE COSTS OF TRANSPORT ENTERPRISES: THEORETICAL ASPECTS

Eco-driving (efficient driving) is a modern, driving style that allows moving according to the dynamics of traffic flow, but at the same time safely, saving the vehicle and reducing fuel consumption. The Swedish National Driving School coined the phrase for the first time in 1998 in Scandinavia (Caban *et al.* 2019) According to the authors, since 2001, the Netherlands, Germany, Finland, and Switzerland have all undertaken eco-driving initiatives Over the past ten years, this problem has been extensively covered in numerous international publications. If to be precise, in European countries, eco-driving is considered to be as a modern driving style and has been rapidly gaining popularity for more than a decade. The fundamentals of eco-driving apply to every type of vehicle (light, truck), regardless of the fuel type, gearbox, or driving expertise of the driver. Driving with an eco-driving mindset makes driving much safer and lowers the likelihood of getting into an accident. The literature review allows for the assumption of certain elements that might be regarded as the main benefits of eco-driving:

- Safety – lowers the risk of being involved in an automobile accident without impeding traffic and instead adjusts to driving conditions: of eco-driving keeps the driver able to work, is less likely to get into difficult situations, and experiences less stress (Jamson *et al.*, 2015; Nævestad, 2022);

- Economy – depending on the driver's skills, fuel consumption is reduced by about 15%, while at the same time it saves the vehicle, reduces operating costs, does not change much in insurance premiums, and may even be lower (McIroy & Stanton, 2015; Allison *et al.* 2021; Huang *et al.*, 2021 and ect.)

- Ecology – reducing fuel consumption leads to a corresponding reduction in pollution, negative impact on the environment, and ensures a better quality of life in society. Eco-driving is a sign of socially responsible companies (Huang *et al.*, 2018, Huang *et al.*, 2021).

The fundamental guidelines for eco-driving are as follows, according to M. Bagavičius (2021):

- Moderate use of the car's electrical appliances;
- Timely gear shifting;

- Maintaining a constant speed;
- Correct acceleration and braking;
- Assessing the situation;
- Rolling using inertia and avoiding a full stop to an obstacle;
- Avoiding idling and turning off the engine in a timely manner.

According to Lois *et al.* (2019) the concept of eco-driving refers to a set of guidelines that deviate from standard driving practices and include driving at a relaxed pace, avoiding needless stops, being prepared, and getting rid of excessive idling. Other authors go into much more meticulous detail about the fundamentals of eco-driving. Sanguinetti, Kurani & Davies (2017) emphasize that in order to create a thorough and accurate definition and typology of eco-driving behaviors, the current research expands, synthesizes, and defines eco-driving in ways that are clear and explicit. Six mutually exclusive groups of behavior are included in the resulting typology: driving, cabin comfort, trip planning, load management, fueling, and maintenance. Huang, *et al.* (2018) argue that correct acceleration, driving speed, choice of route (assessment of the situation) and avoidance of idle are the basic principles of eco-driving. Therefore, M. Bagavičius's (2021) position essentially sums up the principles of eco-driving. So the authors of the article investigated whether and how economic driving principles may be made mandatory for transportation corporations in order to lower their costs. This goal stems from the widely held belief in the market that eco-driving is the domain of larger transportation corporations and that eco-driving is slow driving that falls short of profitability targets.

The most obvious indicator of a driver's level of eco-driving is the energy/fuel consumption of their vehicle. It is therefore not strange that the impact of eco-driving on fuel consumption to meet sustainable development goals is the topic that is most frequently covered in the academic literature (Caban *et al.* 2019; Lois *et al.* 2019; Xu *et al.* 2021; Li *et al.* 2020; Sarmadi *et al.*, 2022 and etc.). A review of the literature also reveals that in the transportation industry, offering a service to a customer at the lowest feasible cost is crucial. Transportation companies are investing in new vehicles, technology, and personnel training in order to reduce fuel costs, emissions, and maintain road safety. However, economic driving is a strategy for accomplishing these objectives. Therefore, the results of this experiment reveals how the economic driving principles might be applied in transportation firms and is disclosed in the upcoming chapter.

METHODOLOGY

Defining the problem is an important step in organising the study. The issue relates to the statement that the absence of eco-driving in the delivery of transportation services raises the expense of travel and the amount of losses (damage to vehicles, cargo, damages, etc.) and is based on the idea that eco-driving is particularly one element of a cost-cutting strategy. The study's applicability is further reinforced by the fact that most academic publications concentrate more on the effects of fuel consumption reductions from an ecological standpoint. However, we argue, that fuel economy is the area for cost reduction and we describe this phenomenon's expression in detail. Experimentation was the selected research methodology. An experiment is when a researcher sets up a scenario wherein the effects of altering one of the related or independent variables on other components and variables in the system under investigation are noted. An artificially constructed environment is called an experiment, and it serves to both test potential solutions and aid in forecasting results.

On May 18, 2023, a Volvo truck and a Krone curtainsider semitrailer were used for the experiment. To add to the realism and make use of the inertia caused by weight, 20 tonnes of concrete blocks were piled onto the semi-trailer. The vehicle weighed 38 tons in all. The selected route was 71 km, of which 30 km were on motorways and the other distance was made up of towns and regional roads. There were a lot of speed bumps, smart traffic lights, regular and roundabouts, and a level crossing with a stop sign throughout the route and etc. There were about 20 kilometers of mountainous terrain on the trip. The experiment was carried out on the same day in order to preserve the most consistent weather possible. A new driver conducted two runs of the experiment and he was unaware of the application of economical driving principles and did not received instruction during the first run.

Acceleration, perceptiveness (stops, braking, extreme braking, use of vehicle inertia (rolling), use of terrain, obstacle evaluation, and use of support systems (autopilot, engine brake) were among the characteristics that were observed during the experiment as the academic literature suggests (Zhao *et al.*, 2015; Bagavičius, 2021 and etc.). Observations made by the researchers (trip report analysis) and data recorded by the fleet management system are presented in the next chapter.

ANALYSIS AND INTERPRETATION OF THE RESEARCH FINDINGS

The experiment was designed to compare the performance of a driver who has not received any economic driving training. The driver drove the route in his usual manner the first time and with the assistance of an eco-driving instructor (following a quick lecture) the second time. Recorded and tracked trip characteristics are summarized in Table 1. The trips distance was 71.4 km and did not differed in both cases. Travel time on the first ride was 1 hr. 30 min. 26 sec., the second one respectively 1 hr. 36 min. 08 sec. so differed for an objective reason: 2 minutes were spent at the level crossing to lower the train. The duration of the trip prove that economic driving is not a slow ride, as most drivers think. Average engine revs were: the first run 981 and the second – 1011, the between these two was 30 revs. The number of higher revs requires a higher fuel feed, so the main mistake of the driver was lack of experience as well as ignorance of the control of the vehicle.

Several more characteristics monitored were average speed (first run 53 km/h, and the second respectively 49 km/h) and average fuel consumption (40, 6 l/100 km and respectively 30,1 l/km).

Table 1

Trip Characteristics
(authors' own representation, based on the results of the experiment)

Run	Distance, km	Travel time	Engine revs	Average speed, km/h	Average fuel consumption, l/100 km
I	71,4	1 hr. 30 min. 26 sec.	981	53	40,6
II	71,4	1 hr. 36 min. 08 sec	1011	49	30,1

What led to such a result was the duration of rolling using inertia (first run – 8 min.59 sec. and the second respectively 2 min. 02 sec.) and engine shutdown at the traffic lights. It is advised by truck manufacturers to shut down the engine if a standstill lasts more than 30 sec. Truck uses about 2-3 liters of fuel per hour on average when rolling. It implies that the truck uses less fuel the more inertia it employs. In addition to reading a topographic map and choosing the appropriate driving mode based on the terrain, autopilot usage aids in maintaining a steady speed.

Factors like the quantity of stops, the amount of extreme stops, and the number of stops altogether impact the driver's insight. When truck slows down more quickly than 3 m/s, it is considered to be an extreme braking. There were 17 complete stops, 69 stops, extreme braking 3, and 22 brakes during the first run. After the instruction the situation changed: there were observed 11 stops and no one extreme braking at all. When the engine brake is utilized properly, it doesn't use fuel so the instructor's help greatly decreased the amount of times the brake was applied, which also lowered operating costs.

The average position of the accelerator during the first run was 56 percent and the second – 48 percent, the difference was 8 percent. During the first run the driver at least once pressed the accelerator pedal to the maximum so the system recorded a 100 percent click. During the second run the maximum click was 90 percent. Also, the driver also reduced the number of accelerations: acceleration was recorded at 284 during the first run and 212 during the second. Moreover, the driver employed rolling downhill and accelerated on climbs in steep regions. Because fuel consumption is always lower in hilly terrain so it is always vital to take advantage of the acceleration on slopes. Additionally, the higher the gear on an incline, the more torque the engine can produce when maintaining speed.

The findings demonstrated that adequate driver readiness, which includes a breakdown of the most frequent errors that may be avoided, reduces fuel consumption, guards against damage, and lowers operating expenses.

CONCLUSIONS

1. The paper presents eco-driving as a comprehensive solution that tackles safety, economic, and environmental issues. It does this with compelling precision. The adoption of this modern driving style, independent of fuel type or driving experience, can lead to increased road safety, reduced fuel consumption, and support for environmental sustainability, as the authors stress. The eco-driving framework's integration of economy, environment, and safety portrays it as a comprehensive strategy that helps society as a whole in addition to individual drivers.
2. The paper explores the compelling idea of requiring transportation companies to adhere to eco-driving principles, dispelling the myth that these practices are exclusive to larger enterprises. The authors address a major business trouble – fuel usage and operating expenses – by examining how eco-driving might be used to cut costs for transportation companies. While many academic publications focus primarily on the environmental implications of fuel consumption reductions, this study contends that fuel economy plays a pivotal role in overall cost reduction.
3. Experimentation, the selected research methodology, gives the study a useful and practical component. Through the use of a Volvo vehicle and a Krone curtainsider semitrailer loaded with twenty tons of concrete blocks, the researchers were able to simulate real-world conditions and the difficulties encountered in real-world transportation operations. The incorporation of diverse road characteristics, such speed bumps, intelligent traffic signals, circular intersections, and hilly topography, amplified the relevance of the results in actual driving scenarios.
4. Adopting eco-driving techniques in the transportation business was supported by compelling results from an experiment undertaken to assess the effect of eco-driving training on a driver's performance. Significant gains in a number of trip features are demonstrated by comparing two runs: one in which the driver drove normally and the other with the help of an eco-driving instructor.
5. The results are very supportive of the transportation industry implementing eco-driving instruction. The improved maneuverability of the driver is demonstrated by the changed accelerator position, less accelerations, and calculated application of rolling descents and acceleration on ascents. In addition to utilizing autopilot and comprehending the terrain, these modifications highlight how crucial driver preparation and training are to reducing fuel consumption and operating costs.

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INTEGRATION AND PERSPECTIVES OF COLLABORATIVE ROBOTS

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Abstract. The Industry 4.0 industrial revolution is moving at high speed and covers more and more segments. Technologies are constantly improving and help to do work faster, safer, cheaper and simpler. Many industrial robots are implemented in industry, and collaborative robots that can work safely alongside humans, replacing some or all of their actions, are becoming more common. This raises the question of the ethical and moral principles of implementing such systems, which can make a person feel redundant and replaced. This paper examines why the implementation and availability of these systems to users requires a responsible strategy.

Keywords: collaborative robot, integration of robots, cobot, implementation of robots, Industry 4.0

INTRODUCTION

The industry is constantly moving forward, evolving and changing. The aim is to achieve the highest possible standards of efficiency and quality. Currently, the Industry 4.0 strategy is being widely implemented in production, which was first mentioned in 2011 by the German government, and currently the European Commission has announced plans for Industry 5.0 (Xu at al., 2021). As a result, the industry is constantly introducing new lines of automation and robotics to achieve its goals. One branch of robotics is collaborative robots.

Collaborative robots are devices that can work in a shared workplace together with humans. Usually, workers are separated from industrial robots by physical barriers according to valid specific industrial standards, but these barriers become unnecessary for properly implemented collaborative robots (Franklin at al., 2020). The collaborative robot market is expected to grow at a CAGR of 34,3%, which means that even more people will have to share their jobs with these machines, and this raises certain ethical and moral principles. The main risks perceived by current employees are: losing their jobs, working slower than a robot, fear of the future, work safety.

The objective of the research to review the current situation in the market and analyses how the implementation of collaborative robots in workplaces responds to ethical and moral principles, what is the impact on the social environment and what are the best methods to apply the collaborative robot in industry.

Research methods: analysis of scientific literature and data analysis.

COLLABORATIVE ROBOTS MARKET OVERVIEW

Collaborative robots are one of the fastest growing areas of the robotics market. According to different sources, in 2020 the value of the collaborative robot industry was approximately 539,3 million Euros, but in 2022 began to rise due to the impact of COVID and reached the value of 744,3 million Euros by the end of the year, it is assumed that by 2030 market value will reach 1817,65 million Euros on average (see Figure 1), accounting for 30% of the total industrial robot market. This rapid growth can be linked to the pandemic situation and fears of a possible repeat of the restrictions, where social contact has been limited and factories have introduced additional shifts to prevent people from meeting each other, e.g. replacing two workers at one workplace with one worker and a collaborative robot.

The market for these robots is also segmented based on payload, application, and end users (Patil at al., 2023):

- Based on payload, the collaborative robots market is categorized into three categories: up to 5kg, up to 10kg & above 10kg robots. The largest part of this market consists of robots up to 5 kg, this accounted for 44 percent of the collaborative robot market in 2022. They are lightweight, easy to transport, easy to program and safe;
- By end user, the collaborative robot market is segmented into: automotive, electronics, metalworking, and food. The largest part is the car market, where it is used for safety equipment control, quality control, and assembly of components. restate research problem;
- The application segment has been divided into packaging and palletizing, gluing and welding, injection molding, screw driving, quality inspection, pick and place, industrial assembly, lab analysis applications. The distribution of this segment is similar in all the listed areas.

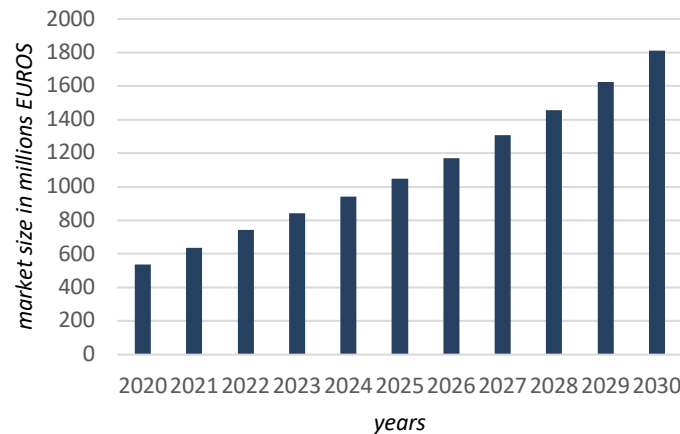


Figure 1 Collaborative robots market growth trends

The first collaborative robots were offered to the market in 2003, they were started to be serially produced by the KUKA robot manufacturer (Hameed at al., 2023). After that, more manufacturers was added to the market, and now almost all major robot manufacturers can make collaborative robots (see Figure 2).



Figure 2 Development of collaborative robotic system (Hameed at al., 2023)

RESPONSIBLE IMPLEMENTATION STRATEGY

Considering the huge and constantly growing market of collaborative robots and the widely covered areas of implementation, it is very important not to forget a friendly and responsible strategy for their implementation, because very often the question is raised about the ethical and moral aspects of implementing such systems.

T. Sorell (2022) emphasize that collaborative robots present at least three kinds of ethical and moral challenges:

1. Collaborative robots are not fenced or otherwise separated from humans, which may affect their physical contact with human personnel. These robots are usually small, light and fixed. However, their safety depends to a large extent on the design solutions chosen and the actions taken.
2. Collecting and reporting data on work performance to management. The robot can be programmed to collect data about the worker's work performance, how quickly he cooperates with the robot, and how quickly he completes tasks assigned to him. This may subject the employee to fines or dismissal.
3. The role of robots in facilitating and eventually replacing the work done by humans. This is especially important if the robot was first introduced as a helper, and then the employee was fired or reassigned.

A similar opinion is also held by J. Wallace (2021), collaborative robots are marketed as uncaged, safe and human friendly as well as being easy to install and program. They are introduced as helpers to workers, but often replace them in workplaces. From this comes the fact that a sustainable strategy is needed to move from human labor to automated systems.

The following steps are suggested to reduce the stress associated with new equipment and to keep staff motivated and confident:

- Good acceptance of new equipment in the company can only be achieved if employees are properly introduced to it, included in its planning, properly trained and motivated.
- Improve the qualifications of production workers, teach programming skills, and delve into existing systems. Unqualified staff members must also be empowered to perform mini-line service or program changes.

- It is very important to involve all relevant employees in the design and planning of the new system. This can take away unnecessary stress from workers in the future if they are familiar with the new robots.

SAFETY OF COLLABORATIVE ROBOTS

Workers often face the fear that collaborative robots will injure them, or just the opposite, people believe that robots are completely safe and forgot about basic self-protection. For this reason, when choosing a working tool for a robot (Franklin at al., 2020), it is very important to take into account all safety requirements:

- the tool must be certified, the tool must be adapted to work with a collaborative robot;
- the tool must have as few moving parts as possible;
- the tool must have as few sharp corners as possible;
- the parameters of the tool must be very accurately guide the robot;
- additional safety measures in robot work zone (safety plane, safety radars, etc.).

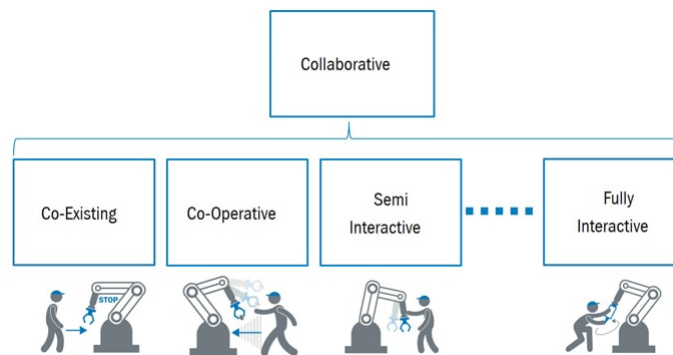


Figure 3 Types of human-robot cooperation (www.sick.com)

M. A. Mariscal (2023) emphasize that the best way to avoid physical human-robot contact is to limit their work areas as much as possible, but this is quite difficult to do when working with collaborative robots. During the last year, due to the particular increase in the market of collaborative robots, certain standards were introduced to regulate the implementation and production of robots.

The main standard for all collaborative robots are ISO/TS 15066, this standard was released at 2016 by The International Standards Organization. It provides basic guidelines for safety requirements for collaborative industrial robot systems and guidelines for the safe operation of this type of robots. A robot built to this standard will have specific safety-enhancing features, such as an integrated safety sensor, speed limits, and force limits (torque). The safety standard ISO 10218 is also applied, which defines the maximum safe robot speed at which a working cobot can move, it is 250mm/s.

Human-robot cooperation can be at different levels (see Figure 3), starting with separate work, so-called co-existing and ending with full cooperation working in one work area, so called fully interactive work. Therefore, security concepts for such a wide range can be very diverse, so each case of collaborative robot implementation needs to be approached differently and separate security assessments must be made.

CONCLUSIONS

Summarizing all the collected and analyzed information, it can be seen that collaborative robots are one of the main sources of work in the industry of the future, requiring responsible and analyzed integration.

These include:

1. All relevant employees must be involved in the implementation process, and their suggestions and opinions must be taken into account.
2. Correct and thoughtful information must be communicated to the employee, avoiding ambiguous phrases.
3. When installing robots in production, it is necessary to choose equipment responsibly and assess all possible security problems.
4. This area requires further analysis, but all authors agree that it has some negative impact on employees.

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PARTICIPATION OF PRESCHOOL TEACHERS IN STRENGTHENING CHILDREN'S ORAL HEALTH

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Abstract. A proper approach to a healthy lifestyle and personal hygiene habits bought in the early years of a child's life has greater lasting value. Preschool teachers' knowledge of children's oral health and care is important to reduce the number of oral health problems now and in the future. It is therefore important to develop good oral hygiene habits in children from an early age. Children of preschool age spend a lot of time in kindergartens, so it is important that not only parents set a good example for their children, but also educators contribute to this. This study aims to evaluate the participation of preschool teachers in strengthening children's oral health and imparting knowledge about individual oral hygiene and prevention of oral diseases. A quantitative research method is applied - a questionnaire survey. The results show that a considerable proportion of pre-school teachers organize oral health activities for children, but children do not brush their teeth in kindergarten. In addition, professionals working with children show that they have sufficient knowledge about oral health but express a need to acquire new knowledge. Conclusions: Children in pre-school educational institutions are motivated to take care of their oral health, it is discussed at least once a year in most institutions, and teachers are interested in this topic and are looking for new knowledge.

Keywords: preschool teachers, educators, oral health, health improvement activities

INTRODUCTION

One of the essential conditions for a harmonious society and personality development is the health of children. In order to have healthier children and their well-being in the future, healthy lifestyle habits must be formed. A healthy lifestyle must be ensured from the moment a child is born, and the main role belongs to the child's family, but the preschool teachers working in children's educational institutions also play an important role. Children spend a third of their time in schools, so for some children, educators or health professionals are the closest persons with whom they can talk about matters of concern, including those related to health (Avelytė, Jociūtė & Astrauskienė, 2021).

Numerous studies can be found in modern literature that analyse the factors that determine the health of preschool children, including oral health (Dinea & Domnariu, 2018; Almutairi, Scambler & Bernabe 2021; Kurnaz & Bayraktar 2021). Personal health care services are well developed and accessible to all residents of the country, but the incidence of dental diseases remains high, and the number of children who need dental prosthetics services is increasing (DANTŲ PROTEZAVIMO PASLAUGOS (Irv.lt)). Preserving healthy teeth for as long as possible is one of the most important goals of health care. Tooth decay is a preventable disease, but it still very often affects preschool children. And this is a public health problem, which is determined by the social and economic situation, eating habits, the attention and attitude of the children's parents to the child's oral hygiene, the parents' ability to visit institutions with the child for oral health care services (Razmienė, 2013). Untreated dental diseases in a child can cause toothache, difficulty in communicating, sleeping, eating. For these reasons, the quality of the child's life deteriorates, it affects them psychologically and socially, children feel discomfort. The knowledge of parents and educators about children's oral hygiene is a very important factor in helping the child to choose a healthy lifestyle (Martinėlytė, Vasiliauskienė & Petrauskienė, 2021). Preschool children spend a lot of time in children's educational institutions, so it is important to analyse how preschool teachers participate in strengthening children's oral health.

The aim of the study is to analyse the participation of preschool teachers in strengthening children's oral health.

Study tasks:

1. To evaluate how educators initiate children's behaviour related to the strengthening of oral health.
2. To disclose oral health strengthening activities that are carried out in pre-school education institutions.
3. To identify the need of information about children's oral health.

RESEARCH MATERIALS AND METHODS

Three methods were chosen to identify the participation of pre-school educators in strengthening children's oral health: a systematic analysis of the scientific literature, a quantitative study – a questionnaire survey and descriptive and graphic analysis of the results of the study. The search for sources of information published in English was carried out in EBSCO, „PubMed“ and other databases. In March–April 2023, a quantitative survey was conducted – a questionnaire survey. Taking into account the principles of scientific research and ethical norms, an original anonymous questionnaire was prepared. The questionnaire was validated by requesting 2 participants and adjusted according to the

comments made. These replies were not included in the follow-up investigation. The questions were designed to help clarify the demographic data of each respondent in the study, the changes in children's mouths and teeth observed by educators, the involvement of children in oral health promotion activities and the cleaning of teeth in an educational institution, and the need for information about children's oral health.

After obtaining the consents of the heads of kindergartens and in accordance with the principles of bioethics, an anonymous survey of two Pasvalys kindergarten teachers and members of the Facebook groups „AUKLĖTOJA AUKLĖTOJAI (ideas, works, lesson plans)“ and „LEADERS OF PRE-SCHOOL AND PRIMARY EDUCATION TEACHERS“ was held. The questionnaire was published on the website www.manoapklausa.lt.

The sample of the study is the target group – pre-school educators. The respondents were between the ages of 21 and 64. 86 questionnaires were correctly filled out, and their results are analysed in this publication. The obtained data were processed using „Microsoft Office Excel“ and „Microsoft Word“ programs.

THE RESULTS

Analysis of demographic data revealed that the majority of participants were 30-45 years old (48,8%). The largest number of respondents were from the towns of Panevėžys county (73,3%) (See Table 1).

Table 1

Demographic Data of the Respondents		
Age of Respondents		
21–30 years	30–45 years	46–64 years
n=16 (18,6 %)	n=42 (48,8%)	n=28 (32,6%)
Towns Where Respondents Live		
Panevėžys county	Other	
n=64 (73,3%)	n=22 (26,7%)	

The majority (37,2%) of respondents who took part in the study are from the town of Pasvalys, slightly less (36,1%) are from the town of Panevėžys. A quarter of respondents (26,7%) marked the answer “Other”, they are from other cities such as Vilnius, Kaunas, Jonava, Ukmergė, Šiauliai, Joniškis, Kėdainiai, Trakai.

It is important that children, while spending time in an educational institution, are accustomed to observe personal hygiene skills. Respondents were asked if children in an educational institution brush their teeth. The analyzed answers show that less than a third (30,2%) of children brush their teeth in kindergarten. The majority of children (57%) do not brush their teeth in an educational institution, and 12,8% do this sometimes. The results show that the possibilities of personal oral hygiene in a children's educational institution could be more widely promoted, since children spend a lot of time in them.

The following question aims to find out whether children have their own toothbrushes in an educational institution. Unfortunately, only a quarter of the children (24,4%) have their own toothbrush in the institution, and the majority (75,6%) do not have their own toothbrush. After reviewing these data, it can be said that most often children do not brush their teeth in an educational institution and do not have a toothbrush.

As shown by a study conducted by Natapov, Dekel, Pikoovsky & Zusman (2021), supervising the brushing of children's teeth achieves very good results in the prevention of tooth decay, especially when toothpaste with fluoride is used for cleaning. In order to reduce the prevalence of dental diseases, it would be appropriate to implement this preventive measure in children's educational institutions in Lithuania.

In order to maintain good oral health, it is important to detect changes in the mouth early, so that they can be eliminated as early as possible and more serious oral diseases could be avoided. Educators spend a lot of time interacting with children, so it is likely that they can notice changes in children's oral health and report them to their parents or guardians. Respondents were given a list of oral changes and asked to indicate which of them they notice (See Table 2).

Table 2

Signs of Oral Health in Children Observed by Educators	
Signs of Oral Health	Respondents observing the signs
Tooth discoloration	66,3%
Healthy teeth	64,0%
Tooth decay	57,0%
Soft plaque	47,7%
Changed mucosa or gums	17,4%
I don't notice anything	17,4%

A summary of the results shows that the most frequently observed changes in the color of the teeth (66,3%) and healthy teeth (64%). As for the most common oral disease among children, tooth decay, it is noticed by more than half (57%) of the respondents. The survey data show that there are also such respondents who do not notice anything in the children's mouth (17,4%). The summarized results show that most educators pay attention to the signs of oral health in children.

Children spend a significant part of the day in an educational institution. For this reason, they can tell their complaints not to parents, but to educators, so it is important that the latter hear complaints. The survey included a question about how often educators hear from children that they have a toothache (see Figure 1).

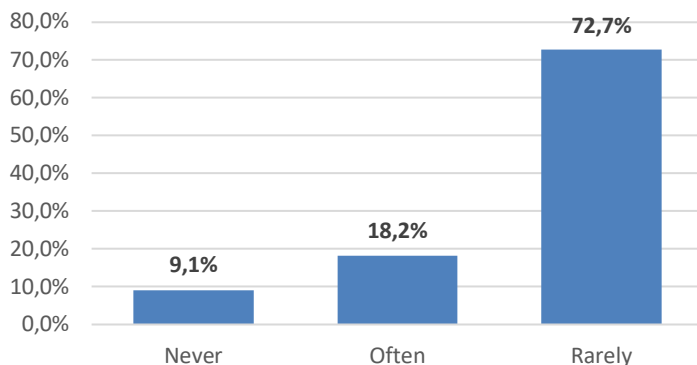


Figure 1. **The frequency of complaints about toothache expressed to educators**

From the data collected, it can be seen that the largest part (72,7%) replied that they rarely hear that a child has a toothache, a relatively small percentage (18,2%) replied that they hear a complaint often, and a very small part replied that they never heard. It can be said that children complain to teachers as well, not only to parents about oral health.

From the results obtained, it can be seen that children tell their complaints to educators, so it is also important whether they report complaints to parents or guardians. The data show that the majority of educators (72,1%) tell parents about children's oral health complaints, but about a quarter of educators (27,9%) do not report it. Summarizing the results, it can be said that the majority of educators behave correctly in informing parents about children's complaints, as this can help reduce the consequences of oral diseases.

It is important that educators encourage children to protect their oral health. Therefore, it was asked whether educators in educational institutions talk to preschool children about the importance of oral health (see Figure 2).

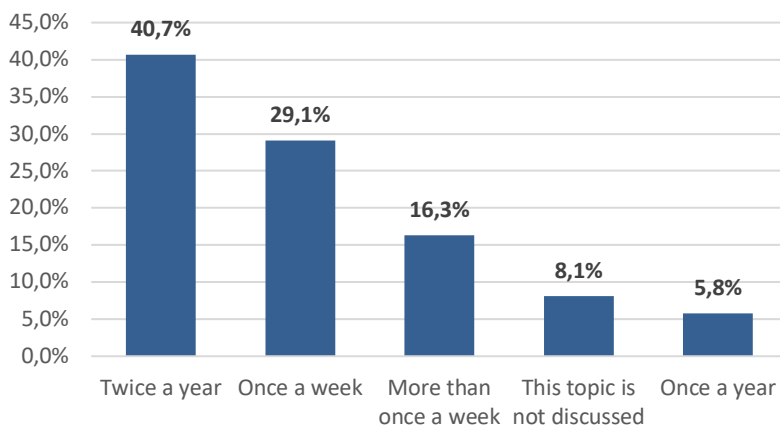


Figure 2. **Frequency of conversations about the importance of oral health**

Almost all respondents (97,7%) answered that they talk to children about the importance of oral health. 40.7% do it twice a year, one third of the respondents do it once a week (29,1%) or more often (16,3%). In summary, it could be said that the topic of oral health is discussed with different frequency in educational institutions.

For the development of children's abilities and skills, active activities are important. The questionnaire asked to share the ways in which educators encourage preschool children to take care of their teeth (see Figure 3).

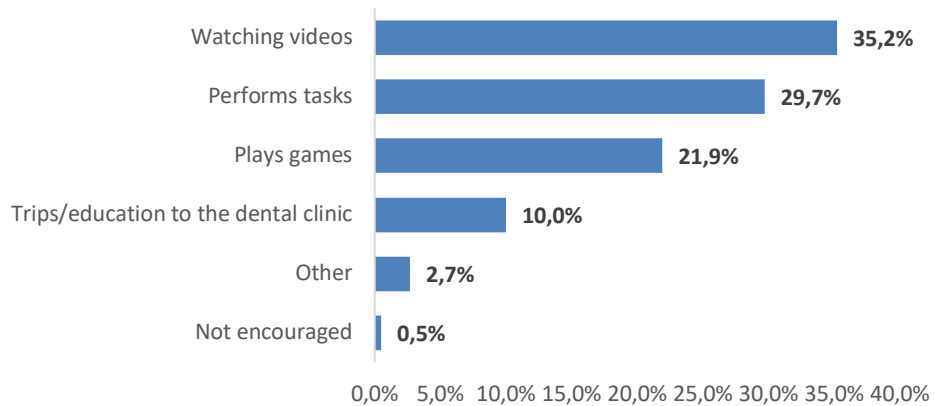


Figure 3. Ways to activate children for dental care

Just over a third (35,2%) of respondents said they encourage children to watch movies on oral health, a similar number (29,7%) said they perform various tasks that are not only interesting for children, but also useful. Others noted that they play various games, go to dental clinics for education, and sing songs. It can be said that educators involve children in oral health promotion activities in an interesting and different way and remind them of the importance of dental care.

In order to find out the need for new knowledge for educators about oral care of children and prevention of dental diseases, the respondents were asked if they have enough knowledge about oral health. An analysis of the responses shows that the majority of educators (75,6%) believe that they have sufficient knowledge about oral health. A very small part of the respondents (5,8%) say that they have a lot of knowledge on this topic, and almost a fifth (18,6%) – that they do not have any knowledge of the topic of oral health at all. In addition, the majority of respondents (81,4%) expressed the need to acquire new knowledge.

It is important that preschool teachers working in an educational institution know about oral health and care, because they determine the behaviour of children. It is important to teach children something new and interesting (Fernando, Kanthi & Johnson, 2013). Therefore, teachers constantly seek knowledge not only in training, but also independently (see Figure 4).

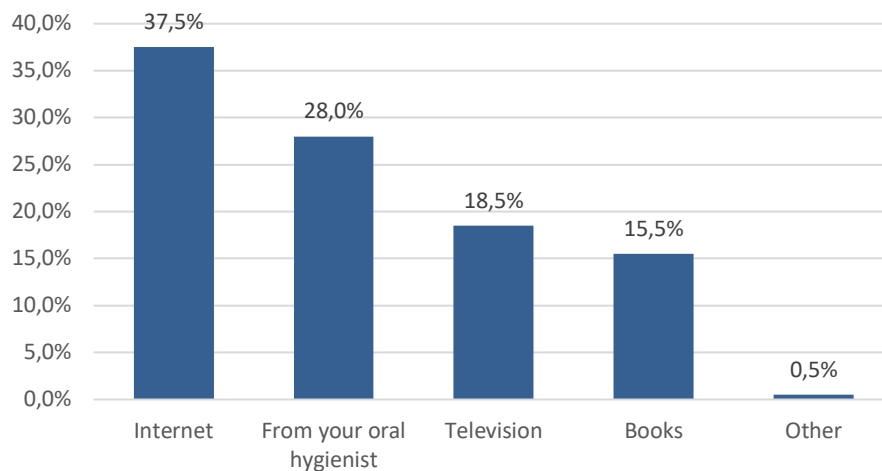


Figure 4 Resources for information on oral health and care

The results of the survey show that one third of teachers (37,5%) look for information on the Internet - it can be social networks, new articles, scientific sources, films, videos. A slightly smaller part (28%) receives information from their oral hygienist, and the fewest respondents answered that the source of information is mostly television (18,5%) and books (15,5%).

It can be said that educators are interested in children's oral care issues, the sources of information are quite diverse, so they receive different and useful information. It is also possible to get new ideas in various groups of social networks on how to broadcast the necessary information about oral care to children in a more interesting way. By the way, their knowledge can also be shared with colleagues.

The summarized results show that educators in the educational institutions where they work, most often notice changes in the colour of the teeth and tooth decay in the mouth of children. Children express complaints about aching teeth to educators infrequently. About the observed changes in children's mouths, mostly specialists of pre-school education institutions inform the children's parents or persons responsible for them.

In almost all educational institutions of respondents where they work, children are told about the importance of oral health. This is usually done twice a year or even once a week. Children in kindergartens are encouraged to take care of their teeth, active activities on this topic are carried out. In the opinion of educators, they have enough knowledge on the topic of oral health, but would like to gain more. When searching for information on their own and interested in oral health and care, educators usually search for new information on the Internet or receive information from their oral hygienist they visit.

DISCUSSION

Improving oral health in children's educational institutions is not a novel approach, although little has been described. In the field of education, researchers have found that two factors can figure out health promotion. Firstly, education (literacy) depends on it because the approach to preserving health and fostering health as a value depends on it. Secondly, educators working in a children's educational institution can supply knowledge, improve attitudes and skills related to health-risky behaviours, and at the same time strengthen health (Cutler & Lleras-Muney, 2006). This is also true when it comes to oral health. This study focused on the activities of preschool teachers, which are important in shaping children's attitudes and behaviours that help preserve oral health. Therefore, the aim was to find how preschool teachers help to fulfil the goals of health promotion programs.

Preschool teachers talk about maintenance of oral health, carry out active activities involving children, and encourage brushing their teeth. Therefore, it is important that they get sufficient knowledge on the subject and be able to apply it properly. In addition, knowledge needs to be updated and supplemented. Cooperation with specialists in other fields, the organization of profession development events would help educators to become even more actively involved in children's oral health promotion activities. The conducted study showed that many educators expressed a desire to get new knowledge about supporting oral health.

Limitation. This study has limitations. Educators were selected regardless of their professional experience, so it is not clear which educators pay more attention to the education of children's personal oral hygiene. In addition, the reasons why children do not brush their teeth in the educational institution were not analysed. It is understood that children's educational institutions are not designed to provide health care, but oral health promotion activities can be carried out with the involvement of preschool teachers in kindergartens.

CONCLUSIONS

- In pre-school educational institutions, children are motivated to take care of their oral health, this is discussed at least once a year.
- Children's behaviour is initiated in separate ways: watching videos, performing various tasks and playing games.
- Most preschool teachers have sufficient knowledge of children's oral health care and express an initiative to gain new knowledge.

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OBESITY AS A CARDIOVASCULAR RISK FACTOR

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Abstract. The escalating global prevalence of obesity presents a significant public health challenge, leading to the development and progression of various cardiovascular disorders and escalating mortality rates. Obesity-induced dysregulation of adipocytes, inflammation, and oxidative stress significantly contributes to atherosclerosis and coronary heart diseases, especially in individuals with visceral obesity. Obesity acts as a catalyst for hypertension, mediated by mechanisms involving sympathetic nervous system overactivity, renin-angiotensin-aldosterone system stimulation, and elevated leptin levels, resulting in sodium reabsorption, water retention, and hypertension. Additionally, obesity induces adverse changes in left ventricular parameters, heightening the risk of heart failure, increases the likelihood of atrial fibrillation through various mechanisms and is directly associated with heightened cardiovascular mortality.

Keywords: obesity, overweight, cardiovascular risk, atherosclerosis, coronary heart disease

According to the World Health Organization (WHO), obesity is defined as excess or abnormal fat accumulation that presents a risk to health (World Health Organization, 2021). A body mass index (BMI) over 25 is considered overweight, and over 30 is obese (World Health Organization, 2021) while central obesity is defined as waist circumference > 102 cm and > 88 cm and waist-to-hip ratio ≥ 0.90 and ≥ 0.85 for men and women respectively (Medina-Inojosa et al., 2022). The rising prevalence of obesity has emerged as a profound public health concern, reaching epidemic proportions globally. The WHO estimated that in 2016 more than 1.9 billion adults were overweight (39 % of the population) and over 650 million (13 % of the population) were people with obesity (Cercato & Fonseca, 2019). This escalating phenomenon is accompanied by a concurrent increase in the incidence of cardiovascular diseases (CVDs), which represent the leading cause of global mortality, accounting for approximately 17.5 million deaths annually and constituting roughly 32 % of all global fatalities (Mirzaei et al., 2020). As an intricate and multifaceted entity, obesity is now unequivocally recognized as a potent risk factor for the development and progression of multiple CV pathological disorders leading to the increased risk of CVDs and mortality (Perone et al., 2023). Obesity is linked to numerous diseases of the cardiovascular system, including stroke, venous thromboembolic disease, and pulmonary hypertension, as highlighted by Powell-Wiley et al. (2021). This link is not only limited to the prevalence of these diseases but also extends to the underlying pathophysiological mechanisms that drive them. With an increasing understanding of these mechanisms, novel insights into therapeutic strategies and preventative measures may be revealed, paving the way for more effective management of obesity-related CVDs and ultimately alleviating the burgeoning burden of cardiovascular morbidity and mortality worldwide. Through this endeavor, we aim to contribute to the evolving field of cardiometabolic research and advance our collective knowledge of this pivotal healthcare issue.

The goal of this research is to determine the impact of obesity on the pathophysiology of CVDs, including atherosclerosis, coronary heart disease (CHD), hypertension, heart failure (HF), atrial fibrillation (AF) and cardiovascular (CVD) mortality.

The objectives of the research are:

1. Determine the mechanisms through which obesity is associated with the atherosclerotic process.
2. Identify the role of obesity in the pathogenesis of heart failure.
3. Investigate whether obesity is linked to an increased risk of atrial fibrillation.
4. Establish the associations between obesity and cardiovascular morbidity and mortality worldwide.

Research methods. To perform a comprehensive search on the correlation between obesity/overweight and cardiovascular risk we searched publications in the PubMed, UpToDate and MEDLINE databases and the inclusion and exclusion criteria were applied. The reports relevant to the topic present within the last 10 years and the papers available in the English language alone were selected. Both animal and human studies were referenced. The documents were also searched manually and obtained from Google Scholar. The following search terms (or combination of terms) were used: 'obesity', 'overweight', 'cardiovascular risk', 'cardiovascular diseases', 'cardiovascular risk factor', 'atherosclerosis', 'coronary heart disease', 'hypertension', 'heart failure', 'atrial fibrillation', 'cardiovascular disease mortality'. Alternative searches for cardiovascular disease, coronary heart disease, heart failure and atrial fibrillation were CVD, CHD, HF and AF respectively. Two investigators (A. L. and K. L.) independently performed the literature research. From all the results garnished, the titles and abstracts were analysed for their relevance to the topic and only those that specifically addressed the topic were included in the final reference list.

OBESITY-INDUCED SYSTEMIC INFLAMMATION, ATHEROSCLEROSIS AND CORONARY HEART DISEASE

The adipocyte dysregulations, present in obese and overweight individuals, appearing as increased levels of pro-inflammatory/atherogenic adipokines and decrease of anti-inflammatory/atheroprotective adipokines, are contributing factors to the imbalance of body homeostasis (Cercato & Fonseca, 2019). Pro-inflammatory adipocytokine expression promotes recruitment and proliferation of pro-inflammatory macrophages and may lead to tissue damage and oxidative stress (Lopez-Jimenez et al., 2022). As a result, the vascular endothelium is left unable to optimally regulate vascular tone, hemostasis, and vascular inflammation, leading to the inception and progression of atherosclerosis (Cercato & Fonseca, 2019; Medina-Inojosa et al., 2022). The objective expression of this process can be observed as increased high carotid intima media thickness (cIMT) - an intermediate outcome in the pathogenesis of atherosclerosis (Turer et al., 2018).

The accumulation of fatty acids gives rise to oxidative stress, which, in turn, precipitates a cascade of consequences, including inflammation, insulin resistance, endothelial cell apoptosis, and the onset of atherosclerosis, (Sobczak et al., 2019). Additionally, the united action of aldosterone, neprilysin, and leptin, in synergy with heightened sympathetic nerve activity, culminates in sodium retention, expansion of plasma volume, hypertension, impaired vascular endothelial function, and ultimately, the development of atherosclerosis. Within the Framingham Health Study, findings reveal that individuals grappling with obesity, particularly those harboring visceral fat accumulation and elevated free fatty acid levels, confront a 50 to 60 percent escalated risk of atherosclerotic cardiovascular disease in comparison to their non-obese counterparts (Henning, 2021).

Both atherosclerotic disease and metabolic dysfunction are specifically associated with upper body and visceral adipose tissues. The accumulation of visceral fat is associated with the excessive storage of triglycerides within the myocardium and the presence of localized fat depots in the epicardium and pericardium, both of which are correlated with the development of coronary stenosis, myocardial infarction, and an increased risk of mortality (Henning, 2021). Data derived from the Copenhagen General Population Study, encompassing more than 70 000 adults with a median follow-up period of 3.6 years, highlights those individuals falling within the overweight or obese BMI categories, but without metabolic syndrome, exhibit a higher risk of myocardial infarction compared to those within the normal BMI range without metabolic syndrome. Specifically, the adjusted hazard ratio (HR) for overweight individuals is 1.26 (95percent CI 1.0-1.61), and it rises to 1.88 (95percent CI 1.3-2.6) for obese individuals (Medina-Inojosa et al., 2022). In a similar vein, a separate study conducted among individuals free of established cardiovascular disease at the study's inception, with consideration for the presence or absence of metabolic abnormalities, has uncovered that obese patients without metabolic abnormalities face an increased risk of coronary heart disease. The multivariate-adjusted hazard ratio (HR) in this context stands at 1.49 (95percent CI 1.45-1.54) when compared to individuals with a normal weight and no metabolic abnormalities (Medina-Inojosa et al., 2022).

So, obesity-induced dysregulation of adipocytes, characterized by inflammation and oxidative stress, significantly contributes to atherosclerosis and coronary heart diseases, particularly in individuals with visceral obesity, highlighting the critical importance of addressing adipocyte dysfunction in preventing obesity related coronary events.

OBESITY AND HYPERTENSION

Obesity is a known causative factor in the development of hypertension (Shariq & McKenzie, 2020). A study by Sabine van Oort et al observed a significantly higher odds ratio of essential hypertension for higher BMI (OR per 1 SD increase, 1.42) (van Oort et al., 2020), while the Swedish Obesity Study observed that at the study's commencement, roughly 50percent of individuals with obesity exhibited hypertension (Medina-Inojosa et al., 2022).

The mechanisms involved include sympathetic nervous system (SNS) overactivity, stimulation of the renin-angiotensin-aldosterone system (RAAS), alterations in adipose-derived cytokines such as leptin, insulin resistance, and structural and functional renal changes. SNS activation in obesity is triggered by abnormal adipokine secretion, RAAS stimulation, insulin resistance, and baroreceptor dysfunction. Furthermore, obesity often coexists with obstructive sleep apnea (OSA), leading to chronic intermittent hypoxia and activation of carotid body chemoreceptors, which reflexively upregulate SNS activity (Shariq & McKenzie, 2020).

Individuals with obesity commonly exhibit higher levels of plasma renin activity, angiotensinogen, angiotensin-converting enzyme (ACE), and aldosterone relative to their lean counterparts. The activation of the Renin-Angiotensin-Aldosterone System (RAAS), coupled with concurrent structural and functional alterations in the renal system, encompassing physical compression of the kidneys, lead to increased renal sodium reabsorption and water retention. These combined effects culminate in intravascular volume expansion, a pivotal precipitating factor in the genesis of hypertension (Shariq & McKenzie, 2020).

Obesity is further linked to elevated blood pressure, a result of elevated leptin levels. Leptin plays a role in regulating nitric oxide production and stimulating the sympathetic system, ultimately leading to sodium retention, systemic vasoconstriction, and an increase in blood pressure (Cercato & Fonseca, 2019).

In conclusion, obesity serves as a well-established catalyst for hypertension, underpinned by mechanisms encompassing sympathetic nervous system overactivity, stimulation of the renin-angiotensin-aldosterone system, and

elevated levels of leptin. These intricate pathways converge to intensify sodium reabsorption, water retention, and ultimately, hypertension in individuals with obesity.

OBESITY AND HEART FAILURE

Being overweight or obese is associated with blood volume overload and higher cardiac output, contributing to adverse structural and functional changes in the left ventricular parameters such as a high end-diastolic volume and increased left ventricular filling pressure. Increased intravascular volume and neuro-humoral mechanisms lead to left ventricular diastolic dysfunction and left ventricular hypertrophy (LVH), which predispose an enhanced incidence of HF (Medina-Inojosa et al., 2022) (Lopez-Jimenez et al., 2022).

Based on the findings of a prospective investigation that examined the association between higher BMI and the occurrence of heart failure, coronary heart disease and stroke, it was revealed that obesity amplifies the risk of developing HF by nearly fourfold (Ndumele et al., 2016). A study conducted as part of the Nord-Trøndelag health examination in Norway yielded similar outcomes. The research indicated that when adjusting for age and sex, the hazard ratio (HR) for heart failure in obese individuals – both metabolically healthy and metabolically unhealthy – was 1.6 and 1.7 for men and women, respectively, when compared to metabolically healthy participants with a normal weight (BMI <25 kg/m²) (Mørkedal et al., 2014).

Moreover, an analysis stemming from the Framingham Heart Study, involving 5,881 participants with no prior history of HF, over a follow-up period averaging 14 years, displayed a twofold increase in the risk of HF in subjects with obesity as opposed to those without obesity (Bastien et al., 2014). Upon adjusting for established risk factors such as hypertension, CHD, diabetes, and left ventricular hypertrophy (LVH), it was observed that for every 1 kg/m² increment in BMI, there is a 5 percent amplification in risk observed among men, and a 7 percent escalation among women (Medina-Inojosa et al., 2022).

To sum up, overweight and obesity induce elevated blood volume and cardiac output, leading to detrimental alterations in left ventricular parameters, including increased end-diastolic volume and filling pressure. These changes, associated with left ventricular diastolic dysfunction and hypertrophy, substantially enhance the risk of heart failure.

OBESITY AND ATRIAL FIBRILLATION

Atrial fibrillation is another condition that has a significantly higher chance of development in obese individuals than those with a normal BMI (Spragg, 2023).

The primary mechanism responsible for this development may be associated with left atrial enlargement, common in obese individuals. This often leads to increased left atrial pressure and volume causing a shortened effective refractory period in the left atrium, proximal and distal pulmonary veins as well as diastolic dysfunction. Pericardial fat and inflammation are thought to contribute as well (Spragg, 2023).

As a result, studies have shown about a 5 percent risk increase of AF for every surplus unit of BMI even after adjustment for inflammatory markers (Spragg, 2023) (US Preventive Services Task Force et al., 2020). After the assessment of dynamic risk, it was concluded that adjusted short-term increase in the risk of AF development can be associated with both overweight (HR 1.22) and obesity (HR 1.65). Compared to normal weight patients, a short-term increase in BMI >25 kg/m² was attributable to a total of 18.3percent of AF cases while becoming obese during the first 60 months showed a 41percent adjusted risk increase of AF development ($p = 0.02$) in contrast to individuals who maintained a BMI below 30 kg/m² (US Preventive Services Task Force et al., 2020).

Recent studies have also unveiled that alterations in one's lifestyle, incorporating weight reduction, can mitigate the recurrence and severity of atrial fibrillation (Lopez-Jimenez et al., 2022). Data from the "REVERSE-AF" trial have demonstrated that a 3percent to 9percent reduction in weight, achieved through guidance from healthcare professionals and lifestyle management, leads to the transformation from persistent AF to paroxysmal AF or no AF in roughly 49percent of the individuals involved. Clinical outcomes become even more notable with substantial weight reduction, as individuals achieving a reduction of 10percent or more in body weight exhibit an 88percent reversal from persistent AF to paroxysmal AF or no AF (Lopez-Jimenez et al., 2022). Moreover, it should be noted that bariatric surgery has been associated with a diminished incidence of new-onset AF as well as the reversal of existing AF (Lopez-Jimenez et al., 2022).

In summary, obesity significantly elevates the risk of atrial fibrillation (AF) through mechanisms such as left atrial enlargement, pressure changes and pericardial fat. A higher BMI is directly associated with AF risk, even after adjusting for additional factors, although lifestyle modifications, including weight loss, offer a promising approach to reducing AF severity and recurrence.

OBESITY AND CARDIOVASCULAR DISEASE MORTALITY

Elevated body weight represents a substantial risk factor not only to morbidity, but also to mortality, contributing to approximately 4.0 million fatalities on a global scale in 2015. Nearly 70 percent of the mortality attributed to elevated BMI is ascribed to cardiovascular disease, and more than 60 percent of these fatalities are concentrated within the obese population (GBD 2015 Obesity Collaborators et al., 2017).

Obesity's impact on life expectancy varies, with class III obesity (BMI ≥ 40 kg/m²) resulting in an average reduction of approximately 10 years, and class I obesity (BMI 30–34.9 kg/m²) decreasing it by about 3 years compared to individuals with a normal weight. A BMI exceeding 25 kg/m² shows a robust positive correlation with a heightened risk of CVD mortality, particularly affecting coronary heart disease and ischemic stroke. Mendelian randomization studies consistently establish a causal link between lifelong higher BMI, especially when accompanied by a high percentage of body fat, and an increased risk of CVD mortality, aortic valve stenosis, and various other cardiovascular diseases (Lopez-Jimenez et al., 2022).

The impact of abdominal obesity on CVD mortality was studied in a cohort of 44,636 women participating in the Nurses' Health Study. The relative risk significantly increased from the lowest to the highest waist circumference quintiles (1.00, 1.04, 1.04, 1.28, and 1.99 respectively), even after accounting for BMI and other confounding variables over 16 years of follow-up. Notably, this association remained significant even among women with a normal weight (BMI 18.5 to < 25 kg/m²) (Medina-Inojosa et al., 2022).

Furthermore, individuals with elevated BMI or central obesity are at an increased likelihood of experiencing prolonged QT intervals, a factor that has been suggested as a potential mechanism for sudden cardiac death (SCD) in individuals with obesity. This risk factor compounds the already elevated risk of CVD mortality (Medina-Inojosa et al., 2022).

In summary, obesity significantly amplifies cardiovascular morbidity and mortality risks globally. Higher body mass index, especially in obesity, reduces life expectancy and is causally linked to increased cardiovascular mortality. Abdominal obesity independently heightens cardiovascular mortality risk, emphasizing the urgent need for targeted interventions to mitigate these adverse outcomes.

CONCLUSIONS

Obesity triggers systemic inflammation and oxidative stress, promoting the atherosclerotic process and escalating the occurrence of coronary heart events in individuals with obesity.

Obesity contributes to elevated total blood volume through diverse mechanisms, resulting in hypertension and eventually causing structural and functional alterations in the left ventricle, manifesting as heart failure.

Higher BMI is independently linked to increased atrial fibrillation risk, even after accounting for other factors, highlighting the significance of lifestyle changes such as weight loss.

Obesity significantly heightens global cardiovascular morbidity and mortality risks, reducing life expectancy, particularly in cases of high body mass index and abdominal obesity, which are causally linked to increased cardiovascular mortality.

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STRESS EXPERIENCED BY ELDERLY PATIENTS IN MEDICAL INSTITUTION AND ITS CONSEQUENCES

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Abstract. Stress is a state of worry or mental tension caused by a difficult situation. Stress is a natural human response that prompts to address challenges and threats. Prolonged stress is harmful to all patients, and especially in the elderly, as it interferes with the faster recovery of patients, debilitates the person's immune system, and as a result, various undesirable symptoms appear. The vast majority of all patients experience anxiety and stress before visits to doctors, various medical procedures and of course operations. Being in a medical institution, seeing various medical equipment and instruments, feelings of uncertainty, fear of death, fear of instability and changes in health status are the main aspects that cause negative psychological reactions in patients. The study was conducted using a quantitative research method. In this study participated 138 elderly people which age was from 55 years. After summarizing and reviewing all answers of the respondents, the fact is noticed that stress is a cumulative phenomenon in our body, and it becomes more and more difficult to survive it with time. It is also possible to see how much influence changes in medical institutions have on the emotional state of patients.

Keywords: elderly patients, stress experienced, medical institution, consequences

INTRODUCTION

All over the world, as well as in Lithuania, the number of elderly people is rapidly increasing. According to world statistics, in the USA, as well as in European countries, elderly and old people make up 15-18 percent of the total population. And the number of elderly and old people is constantly growing.

Often, it is very difficult to recognize patients' psychological problems, since the largest part of patients are very closed and especially reluctant to open up about their internal state and problems are older people. Therefore, employees of medical personnel are not able to recognize the problems of the psychological nature of patients. And often, after recognizing the problems, he does not pay attention to solving these problems (Kriauciūnienė, 2019).

Most often, not a single person in the hospital, or in a medical institution, gets up of their own free will. Most often, patients go to medical institutions with disruption of the normal processes in the body, feeling physical, emotional exhaustion, pain.

Prolonged stress is harmful to all patients, and especially to the elderly, as it interferes with the faster recovery of patients, debilitates the person's immune system, and as a result, various adverse symptoms appear (Balady et al., 2017).

The vast majority of all patients experience anxiety and stress before visits to doctors, various medical procedures and of course operations. Being in a medical institution, seeing various medical equipment and instruments, feeling of uncertainty, fear of death, fear of instability of financial well-being and changes in the state of health are the main aspects that cause negative psychological reactions in patients.

This paper is especially relevant in the last period, when not only our country, but also the whole world and humanity were touched by such global problems as the new and unknown to anyone corona virus, global warming, war. If we look at the statistical data of the Department of Lithuania for the year 2021, we can see that there are as many as 66,779 patients experiencing stress, of which as many as 65,879 adults (18+). When comparing the numbers of Statistics Lithuania with 2018, the number of people experiencing stress increased by as much as 6 times. These statistics only further prove the relevance of the topic of stress experienced by elderly patients during the day and show how the consequences of the corona virus pandemic have affected the emotional state of patients.

The aim of this study was to analyze stress experienced by elderly patients in the medical institution and its consequences.

The objectives were: 1. To identify the causes of stress experienced by elderly patients, in medical institutions; 2. To determine the consequences of the stress caused by patients. 3. To identify ways to overcome the stress experienced by elderly patients, in medical institutions.

Research object: stress experienced by elderly patients in the medical institution and its consequences.

RESEARCH MATERIAL AND METHODS

The search for sources of the information was carried out in EBSCO, PubMed and other databases. The study was conducted using a quantitative research method, the tool of which is a questionnaire survey. The study was conducted in february-march 2023. To systematize the answers, the Likerto measurement scale was chosen. The questionnaire was anonymous, so the data collected is reliable, since respondents could mark the appropriate answer options for them or record their opinion. Elderly patients from all over Lithuania (from the age of 55) who have visited a medical institution at least once in the last year were invited to participate in the study. The survey was carried out using an online tool – website: <http://www.apklausa.lt>.

During the study, the confidentiality of respondents was not violated, and the principle of benevolence was also observed. Before participating in the study, respondents were informed that participation in the study is of their own free will, and they can terminate their participation in the study at any time. Realizing the principle of respect for the dignity of a person, the purpose of the survey was explained to the respondents. Before starting to answer the questionnaire, the participants of the survey were informed that participation in the survey does not affect their job status or quality of life, does not pose any risk, the respondents are not asked individual – personal information, and thus their anonymity is ensured.

DISCUSSION AND RESULTS

According to Gulbinienė et al. (2014), how the patient will be able to cope with the changes of hospitalization depends on his individual character traits and characteristics, temperament, attitude to life and current situation and disease. Important factors that determine a person's adaptation are the frequency of morbidity, frequency of hospitalization, available experience and knowledge, support of relatives, human communication and cooperation with staff.

138 elderly people participated in this study. The results of this study revealed that the largest group of those who participated in the study 60 % were people aged 71 and older. 19 % of all those who participated in the study were between the age of 61 and 65. In the 66 to 70-year-old age group, 15 % participated in the study and 6 % were between the age of 55 and 60 years old. As many as 63 % of respondents said they live on a countryside. 31 % of all respondents to the survey noted that they live in a city and only 6 % said they live in a village. The majority of respondents noted that they have a secondary or higher education and only a small part of respondents had primary education.

Further analysis of the frequency of the respondents' visits to a medical institution was observed that all (100 %) of respondents to the survey have visited a medical institution within a month. According to the survey data, 39 % of respondents spent 2-4 days in the hospital. Meanwhile, 31 % spent 4-6 days in the medical institution, while 17 % noted that they spent 1-2 days there. 13 % of respondents spent 6 or more days in a medical institution. This question asked in the questionnaire, which was aimed at finding out how many times patients have been visited to a medical institution in recent years, is especially relevant, since when analyzing the scientific literature, it was found that persons who visit a medical institution, each time experience stress due to the fact that they see medical equipment, experience a feeling of uncertainty about their health and its condition, due to changed living conditions, etc. However, the more often respondents visit medical institutions, the more often they experience stress and its consequences. As many as 57 % of respondents noted that they had visited the medical facility 1 to 3 times in the last year. 30 % of respondents noted that in the last year they had visited the medical institution 4-6 times, while 10 % had visited the medical institution 7-9 times, 3 % of respondents had visited the medical institution 10 or more times (fig. 1). Most of respondents visited medical institutions due to exacerbations of chronic diseases.

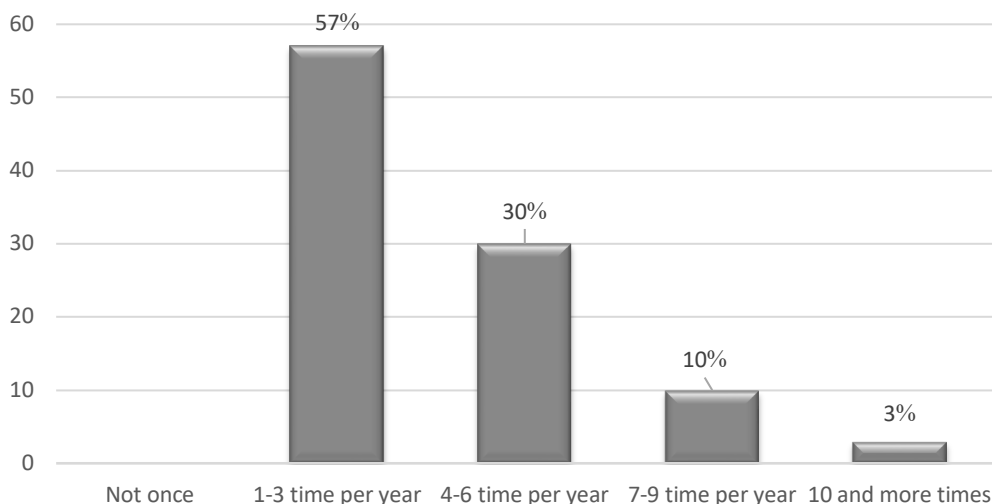


Figure 1. Number of patients visiting a medical institution, per year

The analysis of the survey revealed that the majority of respondents 56% believe that nurses give them too little information about the rules of the medical institution, the procedures performed, the medications prescribed by the doctor, etc. 42% noted that nurses provide sufficient information and 2% of subjects said that nurses partially give them enough information. It can be concluded that patients experience increased stress, since a sufficient amount of information and a close relationship with the patient create a sense of security for the patient. Too little communication between the nurse and the patient is even more stressful for him, since the nurse is the most closely related employee of the medical staff, which forms the connection between the patient and other staff members.

Most of the respondents, visiting a medical institution at least once (and more), felt upset about unexpected events and could not control important events in his life.

Larson et al. (2016) claim that stress is a complex set of physical, behavioral and cognitive, emotional symptoms. First of all, stress affects the thinking, behavior, emotional state and body of an elderly person. According to Taylor (2020), stress particularly affects the elderly and causes mental disorders. Older people then become fussy, distrustful, suspicious and have uncharacteristic mood swings.

The question asked in this questionnaire was to find out if respondents felt signs of stress such as anxiety, decreased enthusiasm, or episodes of excitement while in a medical institution. Each sign of stress leads to certain consequences for the body, which affect the patient's recovery, as well as his general condition of the body. An analysis of the data from the conducted study revealed that the majority of the respondents to the subjects, 49 % of respondents felt symptoms such as tension, anxiety or excitement every time they visited in medical institution in the last month. 37 % noted that they only felt anxiety, excitement or tension when visiting a medical institution in the last month, and 4 % of respondents noted that they never felt symptoms of anxiety, excitement or tension during their visits in the last month (fig. 2).

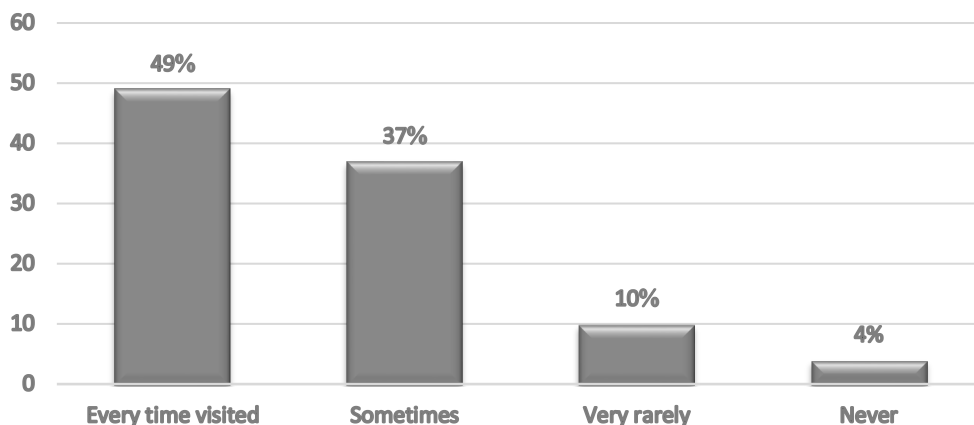


Figure 2. The manifestation of symptoms of anxiety, decreased enthusiasm and excitement of respondents who visited in a medical institution

48 % of the respondents noted that during their visits to the medical institution in the last 6 months, they noticed that respondents were very often unable to cope with the things they had to do; 39 % of individuals said that they only noticed about the inability to cope with the things they had to do, and 4 % of respondents noted that it would be difficult to cope with the things they had to do, - did not notice. When analyzing the control of internal emotions, it was noted that the majority of respondents (51 %) managed to control them.

Next, the aim was to find out what factors caused the most tension in respondents in the last 6 months. Knowing in advance the factors that cause the greatest stress for patients in medical institutions, it is possible to develop preventive measures to alleviate episodes of stress and tension in patients. More than half of the respondents, i.e. 56 %, noted that the biggest factors that caused the most stress in medical institutions in the last 6 months were the change in the order in medical institutions (wearing masks, not wearing them, etc.). 27 % said that the biggest tension in the last 6 months of visiting a medical institution was caused by too little staff communication for respondents; 22 % of the respondents said that the biggest stress for them was caused by long queues with specialist doctors, and only 2 % of respondents said that the most stressful factors in medical institutions were not to contract viral or bacterial diseases from other patients (fig. 3).

To the question of how many times respondents used medications while in a medical institution to improve sleep quality or treat insomnia, noted: 20 % – they always took medications; 24 % used medication very often; 50 % of respondents said they used medications sometimes and only 6 % noted that they never took medication. It shows that, however, people feel stressed and anxious when they are in a medical institution. The survey noted that most respondents noted that stressful situations were easier to survive earlier than they are now. These responses confirm, analyzed in the theoretical part, scientific articles (Fortner, 2018) that stress is a cumulative phenomenon in the body. And every time it becomes more and more difficult to survive stressful situations. According to Fortner (2018), stress is a unique process

due to its cumulative effect. Stress tends to accumulate in the body, and several experienced stressful situations in old age combine into one, and thus begin to slowly destroy a person by causing biological changes in the body.

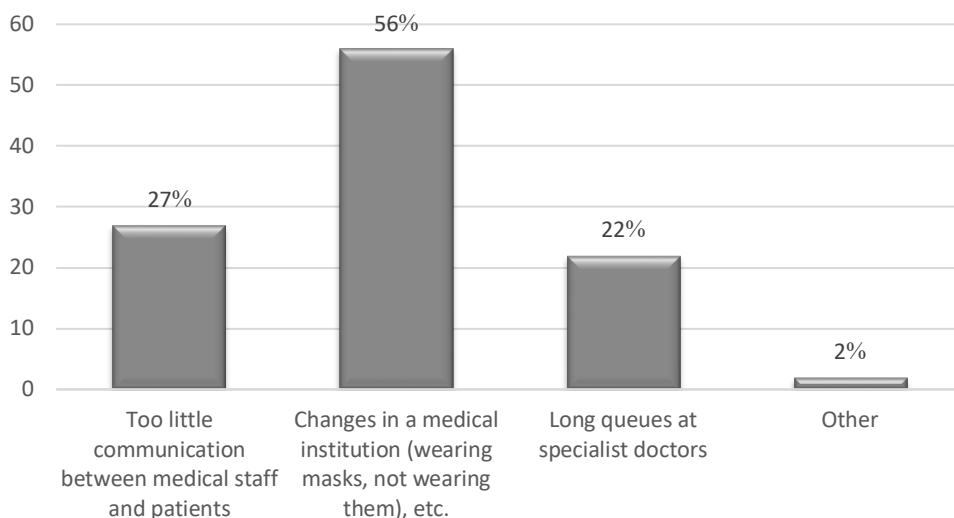


Figure 3. Factors that have caused the most tension in respondents in the last 6 months

Stress that individuals cannot cope with - chronic stress - affects all the most important systems of the body. Stress can makes hard to relax and can come with a range of emotions, including anxiety and irritability. In stressing, it may find it difficult to concentrate, may experience headaches or other body pains, an upset stomach or trouble sleeping. And chronic stress can worsen pre-existing health problems and may increase our use of alcohol, tobacco and other substances (WHO, 2023). Stress may affect of the gastrointestinal tract including gastric secretion, gut motility, mucosal permeability and barrier function, visceral sensitivity and mucosal blood flow (Soderholm & Perdue, 2001; Nakade et al., 2001; Nakade 2007). Hypertension is associated with metabolic changes. The sustained increase in sympathetic activity is related to increased blood pressure and metabolic changes. stress may be related to increased sympathetic activity, blood pressure, and metabolic changes (Shusterman & Lampert, 2013). Cortisol known the body’s stress hormone. It has a variety of effects on different functions throughout the body. It is the main glucocorticoid released from the zona fasciculata layer of the adrenal cortex. Cortisol controlling stress response, blood glucose levels, inflammatory responses and blood pressure (Thau et al., 2022).

This question of the questionnaire was aimed at confirming that stress has a significant impact on memory disorders, and over time, demensive brain disorders become one of the consequences. An analysis of the study's data revealed that the highest proportion of respondents, 37 %, very often feel thinking and memory impairments after experiencing stress. 11 % of respondents said that they always feel thinking and memory disorders after stress, and only 5 % said that they had never felt thinking or memory impairment after the stress they experienced (fig. 4).

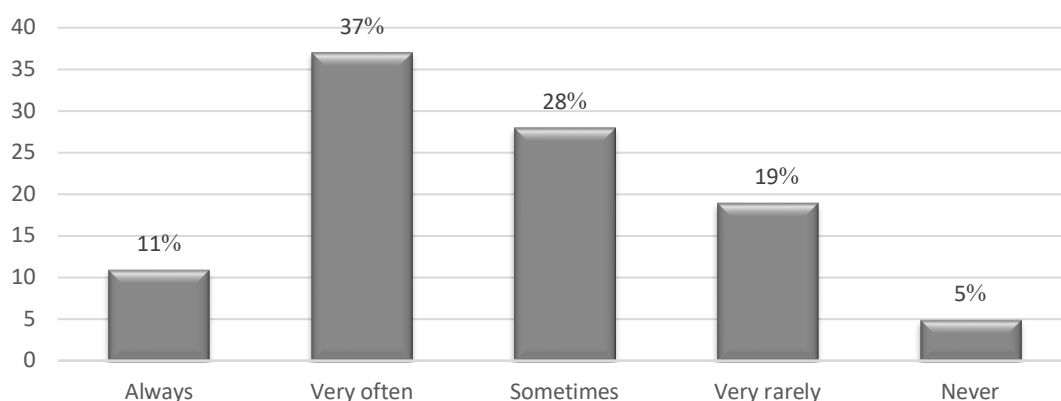


Figure 4. The incidence of impaired thinking / memory of respondents after stressful situations

The survey data showed that after the stress experienced, the largest share of the survey respondents, 28 % of the respondents, felt physically exhausted; 19 % of the respondents experienced physiological changes in the malfunctioning of the heart; 16 % said they had a blood glucose disorder, 12 % of the respondents felt a headache after experiencing stress, 8 % said they were suffering from digestive system disorders after the stress they experienced; 2 % of respondents said they felt joint/muscles pain, while the remaining respondents noted that they felt all the listed symptoms.

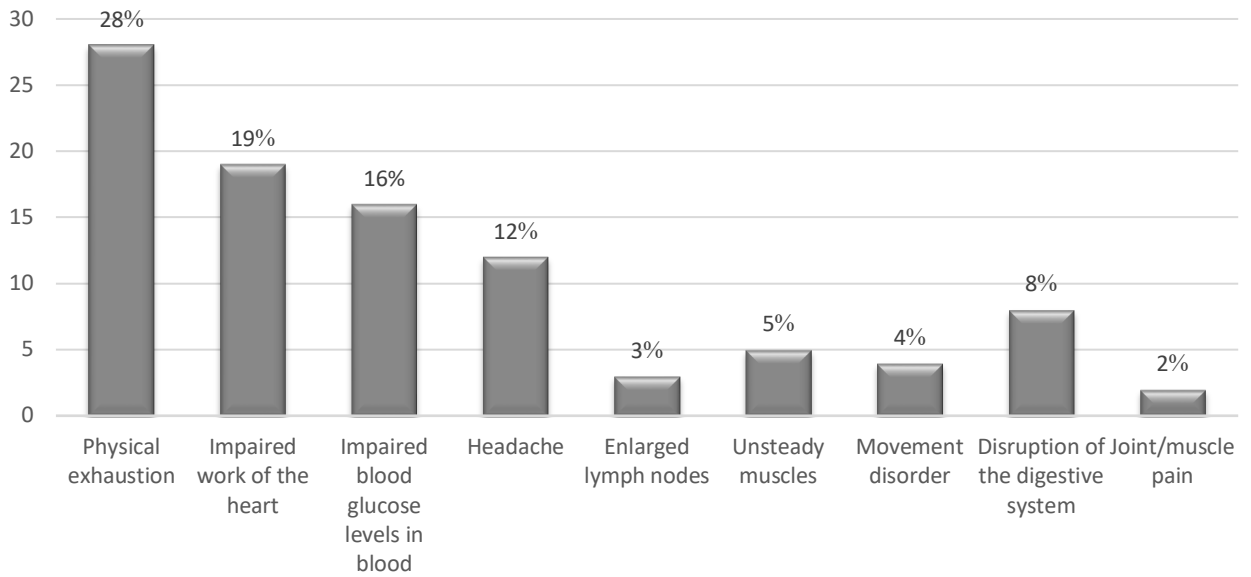


Figure 5. Changes in the body felt by respondents after the stress experienced

These research responses showed that stress causes disorders in the body's systems, which over time can turn into chronic diseases. And already existing chronic diseases can be exacerbated even more.

The effectiveness of coping with stress is directly related to the internal resources available to a person, i.e.; physical resources (health and energy), psychological (cognitive abilities, internal attitudes), and, of course, the goals a person seeks and the desire to achieve them. An analysis of the study's data on ways to cope with stress can show that the most respondents (28 %) noted that the best way to overcome stress were physical activity. Respondents noted that they helped to cope with stress by an objective approach to the situation (12 %), engaging in pleasant activities (14 %), as well as sedatives or antidepressants (12 %) too. 15 % respondents said that the best way to cope with stress for them was through herbal and homeopathic preparations. The remaining 8 % of the respondents, adding their answer option to the opportunity, said hemp oil, smoking hemp and other hemp products help them the most to cope with stress. Also to the answers is another, - respondents noted that one of the best ways to overcome stress for them is yoga engagement, meditation and mindfulness therapy (fig. 6).

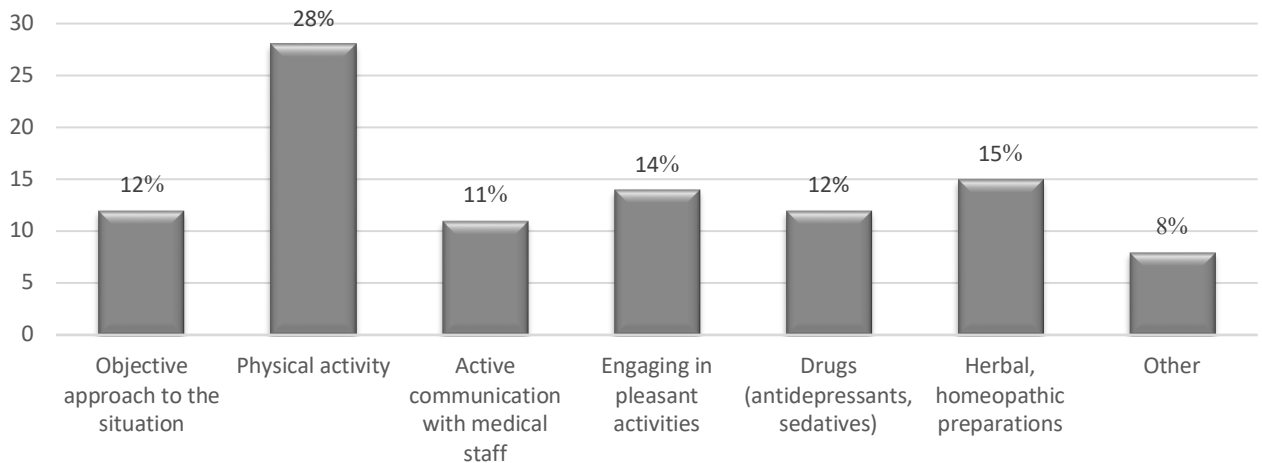


Figure 6. Ways to overcome stress

Analyzing the research data, it can be assumed that more and more patients use medications prescribed by a doctor psychiatrist, such as antidepressants or sedatives, as a way to cope with stress. Also in medical institutions, patients who experience stress, who cannot fall asleep, are prescribed sleeping pills in order to facilitate the patient's rest regime while in a medical institution.

CONCLUSIONS

- Elderly patients named the following causes of stress experienced in a medical institution: changes in medical institutions, especially during quarantine, too little communication of medical personnel with the patient and long queues for specialist doctors.

- The consequences of stress caused by elderly patients, according to the respondents, were: impaired work of the heart, increased arterial blood pressure, impaired blood glucose levels and disorders of the digestive system (reflux, increased acidity of the stomach, lack of appetite).
- During the study, the following ways of coping with stress were identified: physical activity, an objective approach to the situation, an activity with pleasant activities and sedatives or antidepressants, as well as herbal and homeopathic preparations.

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PUBLIC OPINION ABOUT THE BENEFITS AND HARMS OF CHOLESTEROL

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Abstract. The cultural dogma is that cholesterol is an evil villain that needs to be eradicated for true health. Given the unflagging efforts of the medical establishment over the last few decades to lower cholesterol and corresponding media saturation of food and drug promotions boasting cholesterol-lowering effects, it is understandable that most consumers are not concerned about having cholesterol levels that are too low. The reports from aggressive cholesterol-lowering methods suggest that, for many patients, the potential cardiovascular benefits may come with unforeseen risks to physical, mental health and behaviour. The objective of the study was to assess public awareness about the benefits and harms of cholesterol. The tasks were to evaluate public knowledge about cardiovascular disease prevention program, healthy cholesterol levels and potential risks of dyslipidemia with increased or reduced cholesterol levels. The results indicated that the majority of respondents were not aware about the updated cardiovascular disease prevention program and recommended cholesterol levels; more than half of the respondents stated that cholesterol levels must be as low as possible; the majority of respondents were not aware that too low cholesterol levels are linked to depression, dementia, type two diabetes, cancer, aggressive behaviour and shortened life span.

Keywords: low cholesterol level risks; total cholesterol; triglycerides; high density lipoproteins; low density lipoproteins; cardiovascular risk; dyslipidemia

INTRODUCTION

Cardiovascular diseases are the leading cause of death worldwide and in Lithuania. In 2021 the most common causes of death for both genders were diseases of the circulatory system, 53.4 percent for females and 42.7 percent for males. The cardiovascular mortality was 820.3 per 100 000 average population. The largest part of deaths due to circulatory system diseases was caused by ischaemic heart disease (62.1 percent for males and 59.6 percent for females) and cerebrovascular diseases -19.8 percent for males and 24.8 percent for females (Health Information Centre of Institute of Hygiene, 2022). The cardiovascular disease prevention program has been implemented in Lithuania since 2006 (Ministry of Health of the Republic of Lithuania, 2005). Earlier, men aged 40-55 and women aged 50-65 could participate in the cardiovascular disease prevention program. Age limits for target population have been extended since May 1, 2023, and men and women aged between 40 and 60 (inclusive) may participate in the program (Ministry of Health of the Republic of Lithuania, 2023). The lipidogram, electrocardiogram, glucose and creatinine concentration test's results will assess the patient's cardiovascular risk and determine whether it is low, medium, high or very high. The frequency of the patient's participation in the program is updated and will also depend on the risks identified. If the risk of a cardiovascular disease is found to be low or moderate, the person will be invited to take part in the program again after 4 years. If the risk of these diseases is high, the next time the patient will be invited after 2 years, and if the risk is very high, after 1 year. In case of very high risk the cardiologist will further consult and examine the patient. The cultural dogma is that cholesterol is an evil villain that needs to be eradicated for true health. Given the unflagging efforts of the medical establishment over the last few decades to lower cholesterol and corresponding media saturation of food and drug promotions boasting cholesterol-lowering effects, it is understandable that most consumers are not concerned about having cholesterol levels that are too low. The reports from aggressive cholesterol-lowering methods suggest that, for many patients, the potential cardiovascular benefits may come with unforeseen risks to physical, mental health and behaviour. In case of dyslipidemia it is possible for cholesterol to be too low. However, this is much less common than high cholesterol. High cholesterol is strongly associated with heart disease, but low cholesterol may be a factor in other medical conditions, such as cerebral hemorrhage, cancer, suicide, injury, and non-coronary mortality (Nago, Ishikawa, Goto, & Kayaba, 2011). Cholesterol problems are usually associated with high cholesterol for a greater risk of cardiovascular disease. Cholesterol, a fatty substance, can clog the arteries and potentially cause a heart attack or stroke by interfering with blood flow through the affected artery. Serum total cholesterol and LDL-C level is associated with increased CVD mortality, but HDL-C level is inversely associated with CVD mortality (Jung, Kong, Ro, Ryu, & Shin, 2022). It is believed that low cholesterol levels influence depression by altering the metabolism of serotonin. Lower HDL-cholesterol, a known marker of cardiovascular risk, was associated with depression in type 1 diabetes (Melin et al., 2019).

The object of the study: Public opinion about the benefits and harms of cholesterol.

Objective of the study: to investigate public opinion and awareness about the benefits and harms of cholesterol.

Tasks of the study:

1. To reveal respondent’s awareness about cardiovascular disease prevention programme.
2. To assess the opinion about negative cholesterol effects.
3. To evaluate awareness about positive cholesterol effects.
4. To investigate the knowledge about potential too low cholesterol level risks.
5. To evaluate main sources of information about cholesterol positive and negative effects.

THE RESEARCH METHOD

The research was quantitative. The questionnaire was created by the author, after analysing scientific literature and was based on scientific information. It should be noted that the topic, especially about cholesterol benefits and the effects of too low cholesterol levels, have not been investigated in Lithuania, so the questionnaire was mainly based on findings and results of the foreign authors. The survey was conducted in June - September 2023. The survey enrolled randomly selected 86 respondents. The respondents were interviewed using social media and by direct contact. The data were obtained and analysed from 86 questionnaires. The data were evaluated and processed using the Microsoft Office Excel program.

THE RESULTS AND DISCUSSION

The data of the survey were obtained and analysed from 86 questionnaires. 66 respondents were female, 20 were male. The majority of respondents (77%) were females. The majority (72%) were persons between the ages of 18-39 years (see Figure 1).

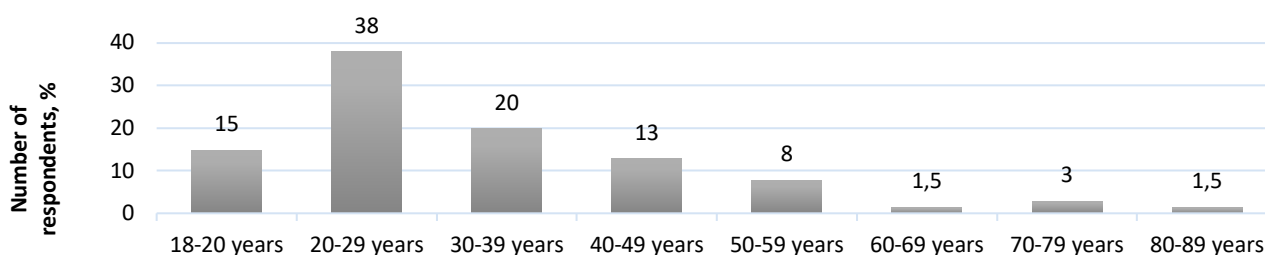


Figure 1. The age

The results of the survey revealed that majority of respondents had obtained secondary, less than one fourth had obtained high (master, doctor, bachelor, vocational bachelor) education (see Figure 2):

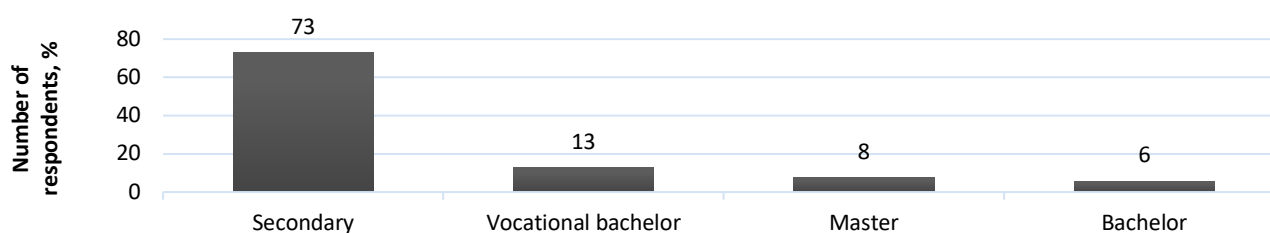


Figure 2. The education

As more than half of the respondents (53%) were young people, one third were students, more than one third were students and employees. More than half of respondents were employees (see Figure 3):

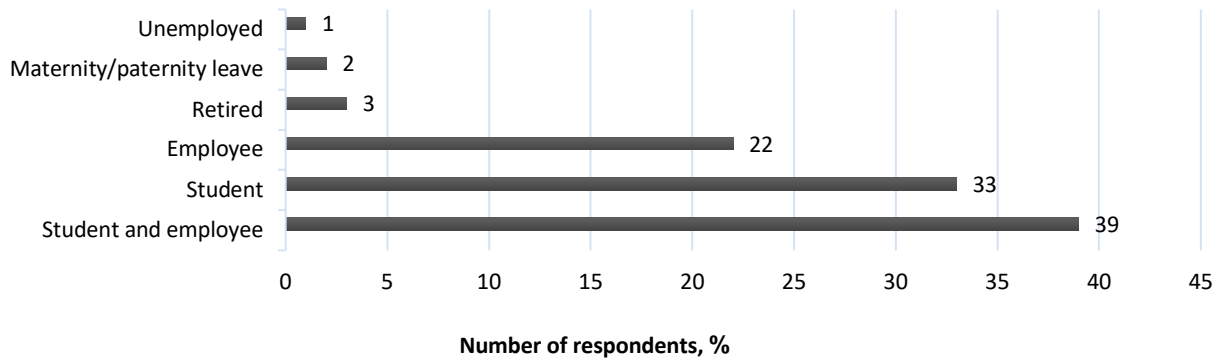


Figure 3. **The occupation**

Recommended cholesterol levels for healthy/low risk persons, according to updated cardiovascular disease prevention program (Ministry of Health of the Republic of Lithuania, 2023) are:

Total cholesterol (TC): < 5.2 mmol/L;

Triglycerides (TG): < 1.7 mmol/L;

LDL: < 2.6 mmol/L; may also depend on a person's cardiovascular risk;

HDL: \geq 1.6 mmol/L.

The evaluation of respondent's knowledge about cardiovascular disease prevention program revealed that the majority of respondents were aware about lipidogram cholesterol fractions, more than half of respondents knew that one of tests performed during the cardiovascular disease prevention program is lipidogram, less than half knew the recommended total cholesterol level for healthy or low risk people, only one fourth of respondents knew the updated male and female age interval for participating in the cardiovascular disease prevention program (see Figure 4):

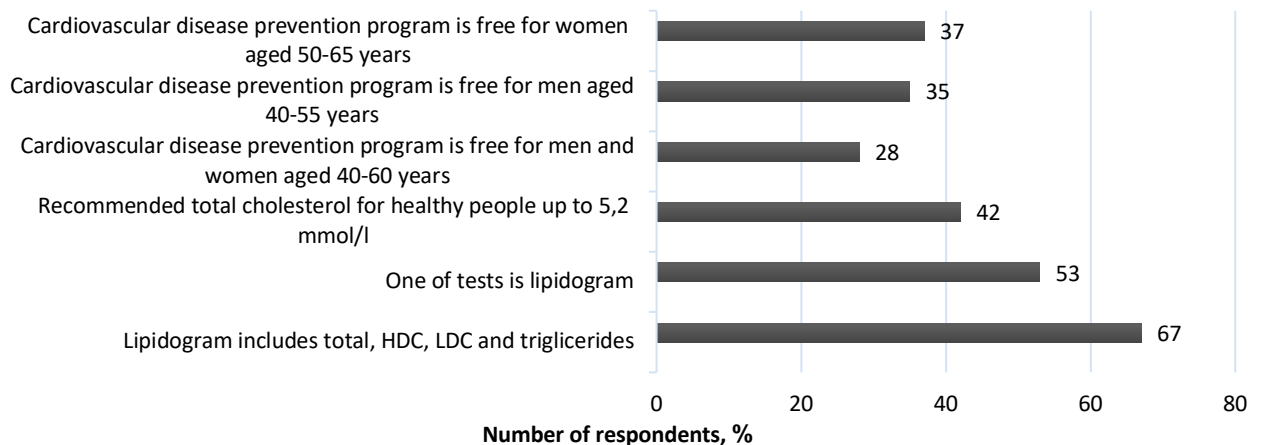


Figure 4. **The awareness about cardiovascular disease prevention program**

High prevalence of dyslipidemia remains a major problem in Lithuania. 9 out of 10 people have dyslipidemia, 1 out of 10 - severe dyslipidemia. Severe dyslipidemia is associated with higher frequency of other cardiovascular risk factors (Kutkienė et al., 2018). As it is shown in the Figure 5, the majority of respondents avoided fats, but not sugar in their diet. It was confirmed that a diet with a greater proportion of sugar increased CVD risk via negative changes in metabolic profiles including body weight, waist circumference and lipid parameters, whereas low sugar diet produced the positive effects. A restriction of sugar intake to lower than 10% energy intake is vital to reduce CVD risk (Ahmad, Isherwood, Umpleby, & Griffin, 2020). Discussing the results of lipidogram and possible treatment or the diet of the respondents revealed that the majority consumed as little fat as possible in their diet, less than half reported that lipidogram test had been performed in one year period, for half of respondents cholesterol levels were normal, less than half stated that their total cholesterol and LDL levels were increased, one third reported that they had increased levels of total cholesterol and triglycerides, the minority (7%) were taking antilipidemic drugs (see Figure 5):

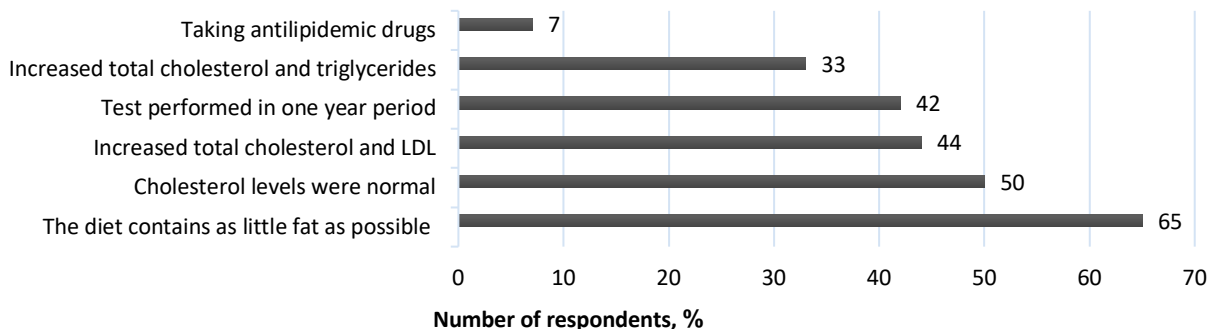


Figure 5. Lipidogram results and treatment

Smoking only about one cigarette per day carries a risk of developing coronary heart disease and stroke much greater than expected: around half that for people who smoke 20 per day. No safe level of smoking exists for cardiovascular disease (Hackshaw, Morris, Boniface, Tang, & Milenković, 2018). It was estimated that women with severe dyslipidemia were smoking nearly four times more than men in Lithuania. What is more, women with severe dyslipidemia in comparison with men had arterial hypertension more often, they were more obese and less physically active. These findings support the theory, that atherosclerosis is a polyetiologic chronic disease, when all factors act synergistically (Kutkienė et al., 2018). The results of the survey indicate that more than half of respondents were aware about high cholesterol cardiovascular risk and smoking and high cholesterol links, less than half stated that „cholesterol the less the better“, that high level of triglycerides can cause harm, one third were aware about negative effects of high level of low density lipoprotein (see Figure 6):

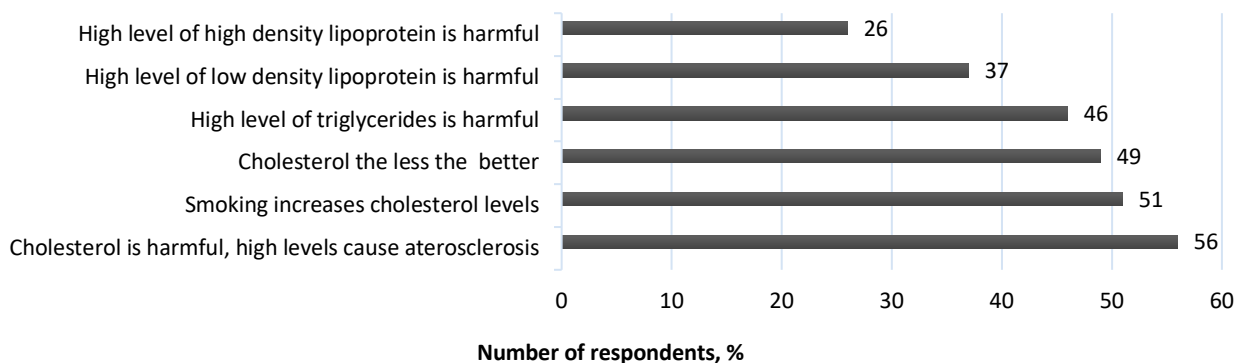


Figure 6. The awareness about cholesterol negative effects

Cholesterol is a major component of plasma membrane in mammalian cells. In addition to its structural requirement, cholesterol is important for other cell functions as bile acid and hormone biosynthesis, embryonic development, and cell proliferation (Fernández, del Val T. Lobo, Gómez-Coronado, & Lasunción, 2004). Cholecalciferol, the form of vitamin D named D3, is synthesized in the skin from 7-dehydrocholesterol upon irradiation with ultraviolet waves in the range of ultraviolet B light. 7-dehydrocholesterol is part of the metabolic pathway that controls the synthesis of cholesterol in human cells. By absorbing ultraviolet radiation, which can be ionizing, 7-dehydrocholesterol turns into pre-vitamin D3, which, in turn, because of its molecular instability, converts to cholecalciferol (Christakos, Dhawan, Verstuyf, Verlinden, & Carmeliet, 2016). The serotonin1A receptor belongs to the superfamily of G protein-coupled receptors (GPCRs) and has been shown to require membrane cholesterol for its organization, dynamics and function (Patra et al., 2015).

The results of the survey show that less than half of the respondents knew that cholesterol is required to build cell membrane and for the synthesis of various hormones, though only one fourth knew the benefits for the immune system, serotonin transporting in the brain and vitamin D synthesis (see Figure 7).

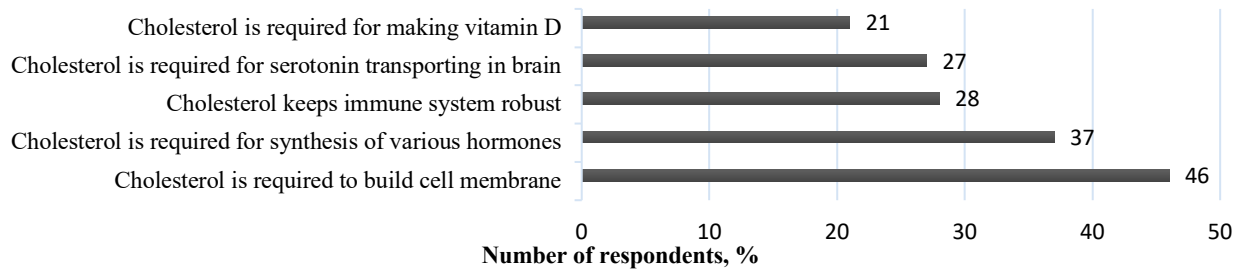


Figure 7. The awareness about the benefits of cholesterol

Dyslipidemia can be associated with too low cholesterol. Low total cholesterol is associated with increased risk of major adverse cardiovascular events (MACE) in older men without ischaemic heart disease (IHD) who are not taking statin therapy but not in those on statins (Gnanenthiran et al., 2020). The total cholesterol level range associated with the lowest mortality was 5.4-7.2 mmol/L, irrespective of concomitant diseases or health status. The association between low total cholesterol levels and a high risk of all-cause mortality was confirmed in a Belgian cohort of adults 80 years and older (Turusheva, Vaes, Degryse, & Frolova, 2020). The significant association was observed between lower LDL-C and higher risk of intracerebral hemorrhage when LDL-C was <70 mg/dL, and the association became nonsignificant when LDL-C \geq 70 mg/dL (Ma et al., 2019). Low cholesterol may be a factor in other medical conditions, such as cerebral hemorrhage, cancer, suicide, injury, and non-coronary mortality. It was confirmed the highest risk of the lowest cholesterol group for hemorrhagic stroke, heart failure (excluding myocardial infarction), and cancer mortality significantly higher than those of the moderate cholesterol group, for each cause of death (Nago et al., 2011). It was estimated that LDL-cholesterol lowering by pharmacotherapy or genetic variation causes increased risk of type 2 diabetes, whereas HDL-cholesterol raising may be protective (Higuchi, Izquierdo, & Haeusler, 2018). The risk of all-cause dementia in the general population and in statin non-users was increased in those with LDL-C level in both the lowest and the highest quintiles, showing an inverted J-shaped relationship. Although there was a seemingly paradoxical association between low LDL-C level and dementia risk in statin non-users (Lee et al., 2022). It is believed that low cholesterol levels influence depression by altering the metabolism of serotonin. The serotonin_{1A} receptor belongs to the superfamily of G protein-coupled receptors (GPCRs) and is a potential drug target in neuropsychiatric disorders (Patra et al., 2015).

Analysing respondent's awareness about too low cholesterol effects, the obtained data revealed that the majority of respondents had no information about low cholesterol risks for type two diabetes, shortening of life span, depression, dementia, cancer and aggressive behaviour (see Figure 8).

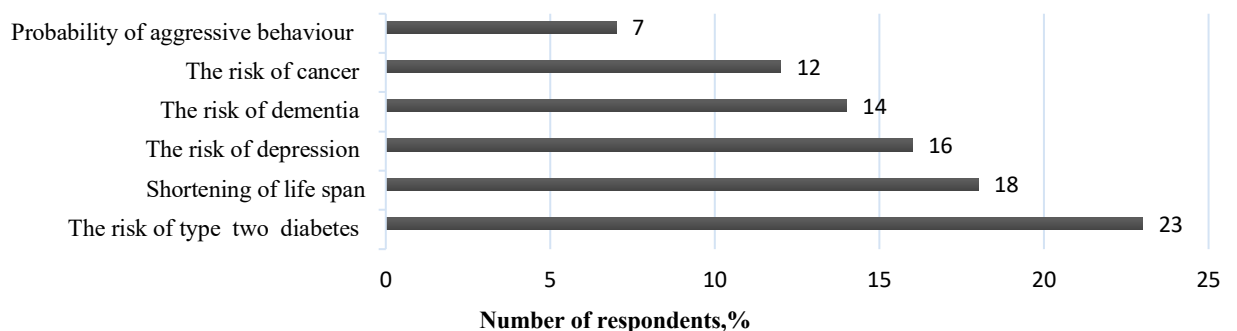


Figure 8. The effects of too low cholesterol level

Since 2006, when the cardiovascular disease program was established in Lithuania, the society was constantly educated about the risks of high cholesterol level and prevention of the cardiovascular disease. The results of the survey revealed that the main respondent's sources of information were internet, family doctor's provided information and the questionnaire they were interviewed (see Figure 9).

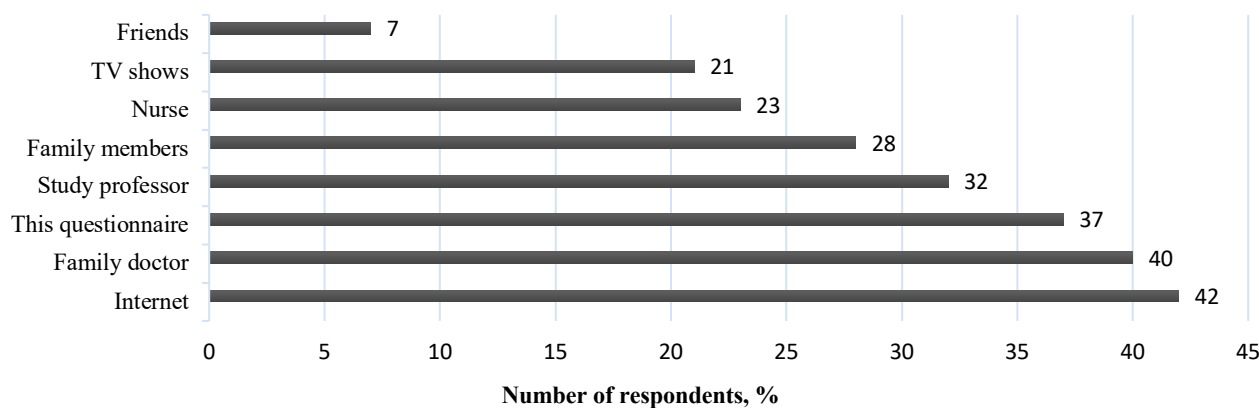


Figure 9. The sources of information

The findings of the study imply that public education about the benefits of cholesterol and dyslipidemia potential risks is insufficient. Being the frontline care providers in close relationships with the patients, primary health care specialists have a unique opportunity to increase patients' awareness and perception of dyslipidemia, both when cholesterol level is too high and too low, health risks and prevention measures. Family doctors and community nurses should educate patients more actively, more informational measures are required to ensure better public awareness especially after the update of cardiovascular disease prevention program.

The study has some limitations. The number of investigated respondents was small, and the majority of enrolled respondents were young people, only one fourth of them in the age interval having been participated or participating in the cardiovascular disease prevention program and possibly being more educated in this field. All these factors limit the generalizability of our study findings. More informational measures are required to ensure better public awareness, especially young people, about the discussed problem in the future.

CONCLUSIONS

1. The results indicated that more than half of respondents were not aware about the updated cardiovascular prevention program and recommended cholesterol levels. Less than half reported about lipidogram performed in one year period and stated that their cholesterol levels were increased.
2. More than half of respondents stated that cholesterol levels must be as low as possible and were aware about high cholesterol cardiovascular risks.
3. Less than half of respondents stated that cholesterol is essential for cell membrane and various hormones synthesis. The majority were not aware about other beneficial cholesterol effects.
4. The majority of respondents were not aware that too low cholesterol levels are linked to depression, dementia, type two diabetes, oncological diseases, aggressive behaviour and shortened life span.
5. The main informational sources were internet, family doctor's provided information and the questionnaire respondents were interviewed.

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STUDY OF AN IMAGE RECOGNITION SYSTEM: IDENTIFICATION OF PART THREAD QUALITY BY CHANGING THE ANGLE OF THE PART WITH THE BASE OR THE ILLUMINATION OF THE PART

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Abstract. Industrial image processing is mostly based on the use of special cameras or imaging systems installed within the production line (SmartRay 2023). Image recognition is a computer vision program that uses machines to identify and classify specific objects, texts, and digital images and videos. Basically, it's the ability of computer software to "see" and interpret things in a visual medium the way a human can (GLOVER et al., 2023). To find out the influence of the lighting and/or viewing angle of the examined part on its quality, the image recognition camera used in the study was the "SICK Inspector PIM60" image recognition camera, the "YONGNUO" LED YN-160S" light source and the camera dome and filters of various colors: red, blue, green, transparent, and variable ND filter. The results obtained show that using isolated lighting and clear, red, blue, green, and ND2 - ND64 filters, the recognition accuracy reaches only 3 recognitions out of 10 attempts, which is still only 30 % accuracy. The recognition of a defects with settings at the angle (10, 20, 30, 40 degrees) using clear filter and the external lighting from one side of the part is high-quality when the surfaces of the parts are completely clean without any mechanical damage (scratches, knocks). Only 3 out of 10 parts threads features were correctly recognized, as the camera captures additional reflections from the part surface because of additional damage on the parts surface (Gasiūnas et al., 2022). The obtained results show that using a green camera filter and external illumination of the part from one side is the best way to identify the thread quality of the part. The results obtained show that using a green filter and external illumination of the test piece, it is possible to obtain ~ 100 % recognition of the part and its holes dimensions quality if the part is always placed in the same place and the same lighting conditions are used (Gasiūnas et al., 2022).

Keywords: angle; image recognition; below; filter; camera; quality; defect

INTRODUCTION

Object recognition is an amazing human feat. An attempt to develop a machine to mimic human capability is the starting point of object recognition. The term "recognition" has been used to refer to many different visual abilities, including identification, categorization, and discrimination (Jain et al, 2022). According to 2012 data, the Image Recognition error rate has been high (about 26 %), By 2018, deep learning models reduced this error rate to 2.2 %, surpassing human performance (average error rate of 5 %) (Xiaohong, et al., 2020, Kruger 2018). Currently, devices are increasingly used to ensure the quality of product parts or other products. To clarify the different capabilities of a standard industrial camera with image recognition software, a study was conducted comparing the quality of detail recognition by changing camera filters, lighting conditions and part angle to surface. The study used 3 different lighting methods (internal - in camera integrated light source, external – led light source from object of interest side, external with outside lighting elimination), 5 different filters (blue, red, clear, ND and green filter) plus camera dome. The obtained results show that ~100 percent part quality and hole dimensions can be recognized using a green filter and external illumination, provided the part is always in the same location and under the same lighting conditions. Quality control is the most important function of manufacturers because the product produced by the company is in demand only if it is of high quality and meets the requirements of accuracy, safety and reliability set by the standards. Quality control can be manual (an employee checks the quality of a product or its part with a special device to detect and identify defects) or automatic (a product defect is determined automatically, without human intervention). Automated inspection can use an image recognition system to compare the physical characteristics (dimensions, surface engraving, holes, etc.) of a quality product. New image processing techniques as well digital image capture equipment provide an opportunity for fast detection and diagnosis of quality problems in manufacturing environments compared with traditional dimensional measurement techniques. The focus of the proposed methodology is on computational efficiency to ensure that the algorithm runs in real time in high volume manufacturing environments. The algorithm is trained with previously classified images. New images are then classified into two groups, quality and defective (Megahed et al., 2012).

THE RESEARCH METHOD

Physical equipment includes YONGNUO LED YN-160S external light source, computer (must have 1 GB RAM or more, CPU Pentium 1GHz or better) with LAN connection, and Inspector PIM60 image recognition sensor manufactured by SICK samples (see Figure 1) (SOPAS 2016). The layout of the physical equipment during the study is

presented in Figures 2 and 4. The free camera software "SOPAS" was used in the study's, which allows you to detect the object based on its size, shape, and identification mark (inscription, scratch, drawing, sticker). etc.) (Gasiūnas et al., 2022, SICK 2018, YONGNUO 2021).

The methodology for determining the flaw in threads of parts using an image recognition camera (sensor) is based on the introduction of comparable parameters (by marking the quality characteristics of the part under the conditions in which the characteristics of other parts will be studied). Various filters (clear, green, red, ND, blue) and lighting configurations (internal or external) are used to capture the most suitable conditions, i.e., the best quality recognition conditions are selected for a specific detail on which the object under study is best focused. After the typical (reference) setting is made, the test details are compared to it (see Figure 1 - 4) (Gasiūnas et al., 2022).

The first study used only the camera's factory built-in (integrated) lighting with clear, red, blue, and green filters, and the subject was from ninety to one hundred millimeters away from the sensor. The layout of the equipment used in the studies and the obtained results are presented in Figures 1 - 2 and table 1 (Gasiūnas et al., 2022).

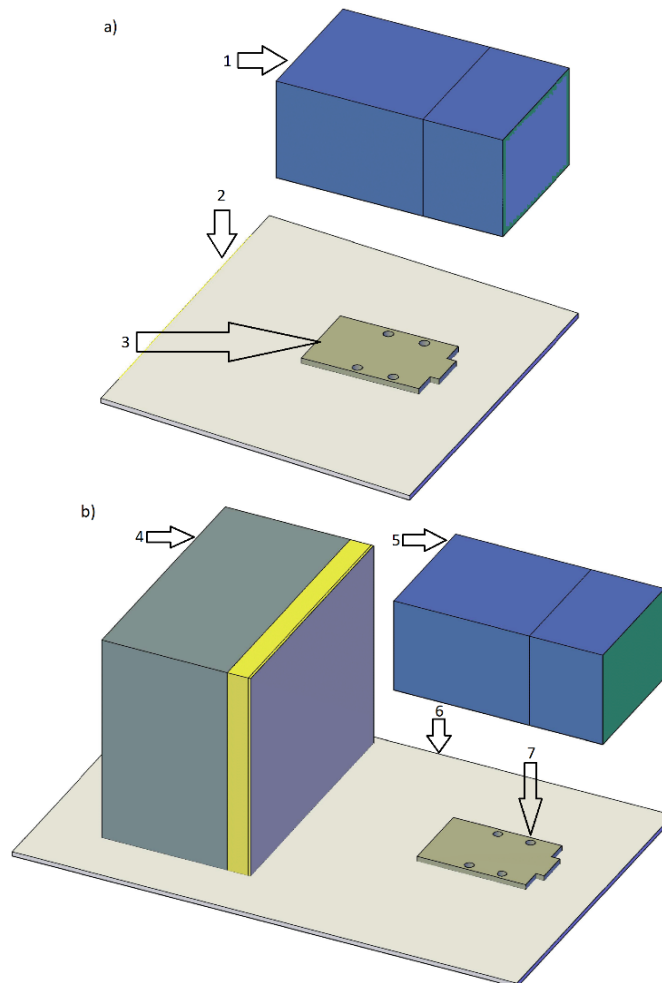


Figure 1. (a) Layout of the physical equipment used in the study without external lighting (1'st study); (b) Layout of the physical equipment used in the study with external lighting (2'nd - 3'rd study) (Gasiūnas et al., 2022).

1, 5 – image recognition camera / sensor (*SICK INSPECTOR PIM 60*); 2, 6 – interchangeable base; 3, 7 – object under investigation; 4 – lighting.

In the following study used additional external side lighting of the subject with blue, clear, red, and green filters, and the subject was 90 - 100 mm away from the camera. The layout of the equipment used in the experiments and the obtained results are presented in Figures 1 and 2.

RESULTS FROM PREVIOUS STUDIES (1'ST - 3'RD STUDY'S)

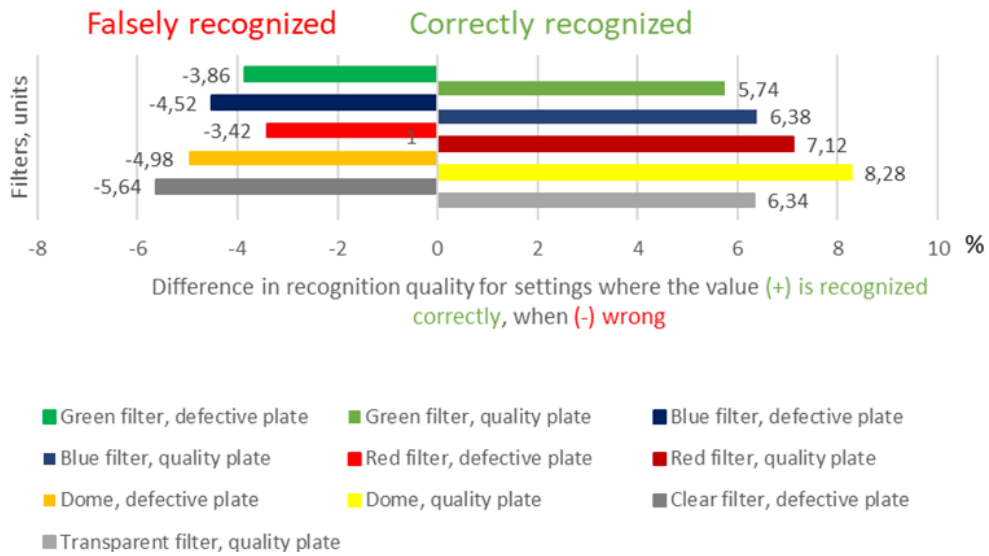


Figure 2. The first study results

In the first study, the recognition of a part's dimensional inconsistency with settings using red, clear, blue, and green filters and the internal (integrated) illumination of the camera is null, i.e., the defect in details is not noticeable and all of them are 100 percent cases are identified as high quality (see Figure 2).

Table 1

The first study				
Study	Average difference with conformance limit (conformance difference must be ≥ 0 %), %			Comment
	Quality	Defect	Results	
Green filter	5,74	-3,86	-	Correctly identified 5/10
Blue filter	6,38	-4,52	-	Correctly identified 5/10
Red filter	7,12	-3,42	-	Correctly identified 5/10
Dome	8,28	-4,98	-	Correctly identified 5/10
Clear filter	6,34	-5,64	-	Correctly identified 5/10

According to the results obtained in the second study, the recognition of the quality parts was 20 % with external lighting and the red filter, 0 % with the blue filter, 20 % with the clear filter and both quality and defective parts with the green filter in all tests were correctly identified, i.e., 100 % accuracy (see Figure 2).

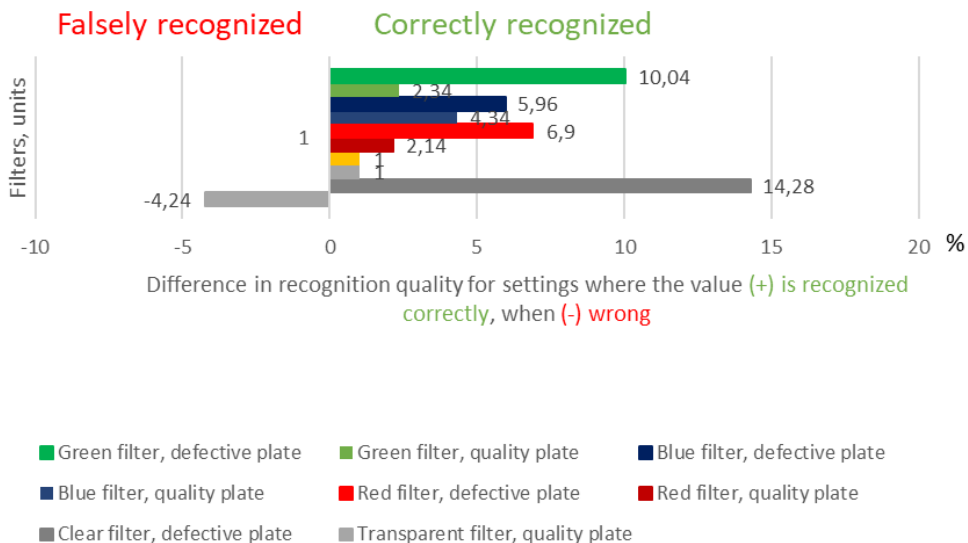


Figure 3. The second study results

When using a green filter and illuminating the part under investigation from the side, the features of the part were correctly identified in all cases, and the recognition of a quality part exceeded 0,94 percent. value ($\geq 90\%$) (see Figure 2) (Gasiūnas et al.,2022).

Table 2

The second study

Study	Average difference with conformance limit (conformance difference must be $\geq 0\%$), %			Comment
	Quality	Defect	Results	
Clear filter	14,28	-4,24	-	Correctly identified 5/10
Blue filter	5,96	4,34	+	Correctly identified 10/10
Green filter	10,04	2,34	+	Correctly identified 10/10
Red filter	6,9	2,14	+	Correctly identified 10/10

The third study used additional external side illumination of the subject with ND filter, and the subject was from ninety to one hundred millimeters away from the camera. The layout of the equipment used in the experiments and the obtained results are presented in Figures 1b), 3 and table 1 (Gasiūnas et al.,2022).

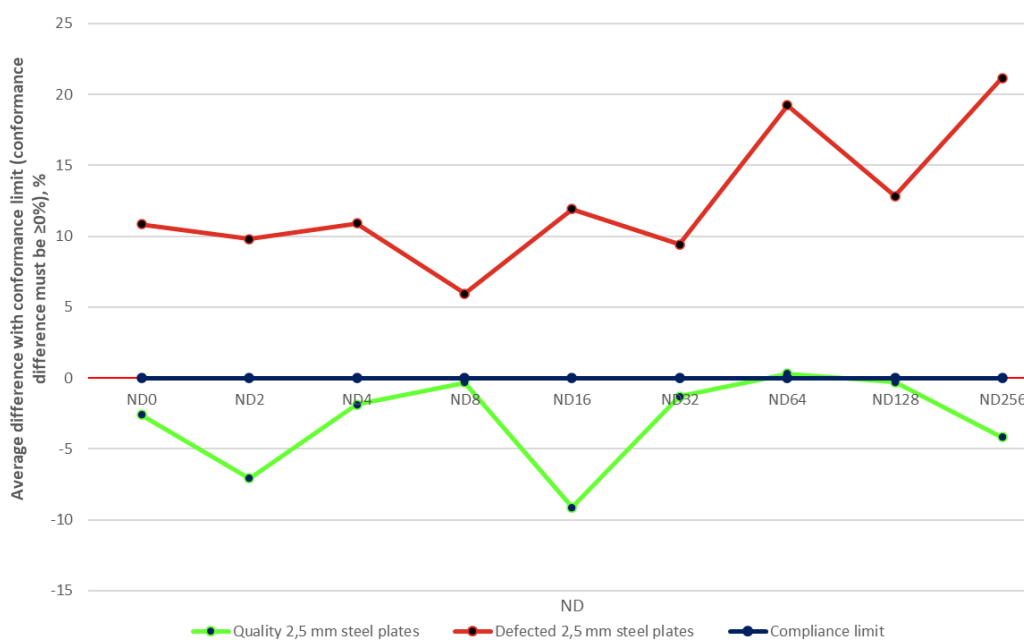


Figure 4. The third study (with ND filter), results (Gasiūnas et al., 2022).

In the third study, the recognition of defects with settings using ND (variable) filter and the external lighting of the PIM60 is close to null, i.e., the quality details are not noticeable and 95,56 percent. cases are identified as defective (see Figure 4).

Table 3

The third study (with ND filter)

Study	Average difference with conformance limit (conformance difference must be $\geq 0\%$), %			Comment
	Quality	Defect	Results	
ND0	-2,6	10,86	-	Correctly identified 5/10
ND2	-7,07	9,81	-	Correctly identified 5/10
ND4	-1,88	10,9	-	Correctly identified 5/10
ND8	-0,31	5,96	-	Correctly identified 5/10
ND16	-9,14	11,93	-	Correctly identified 5/10
ND32	-1,31	9,41	-	Correctly identified 5/10
ND64	0,3	19,24	+	Correctly identified 7/10
ND128	-0,29	12,84	-	Correctly identified 5/10
ND256	-4,19	21,17	-	Correctly identified 5/10

Only when the filter is set to ND64, the sensor detects the features of the parts more accurately, the recognition accuracy reaches only 7 recognitions out of 10 attempts, which is 70 percent accuracy (see Figure 3) (Gasiūnas et al., 2022). According to the results obtained in the third study, the recognition of the quality with ND filter was not noticeable and still the best results are obtained with the green filter, i.e., 100 percent accuracy (see Figure 3).

FOURTH AND FIFTH STUDY'S

The fourth study used only isolated lighting and clear, red, blue, green, and ND2 - ND64 filters, the subject was 90 – 100 mm away from the camera. The layout of the equipment used in the experiments and the obtained results are presented in Figures 5 and table 4.

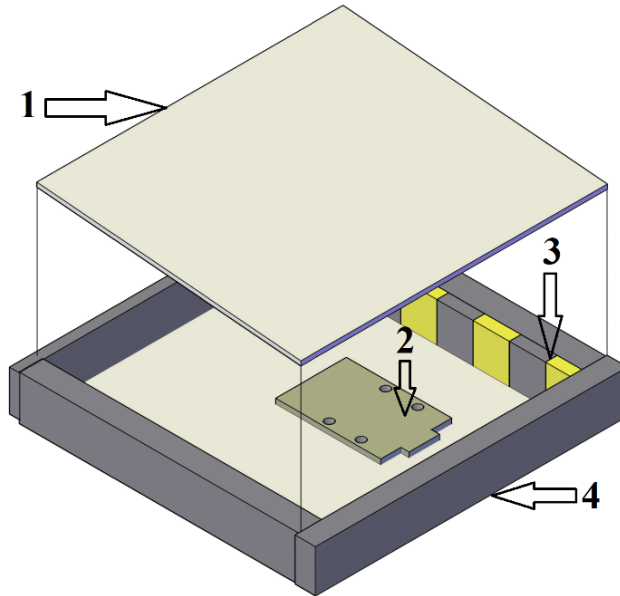


Figure 5. **Layout of the physical equipment used in the study with isolated lighting from 4 sides (4'rt study).**
1 – A box that isolates the part and the camera from external lighting; 2 – Detail under investigation; 3 – The LED strip which illuminates the detail from all 4 sides; 4 – Frame supporting interchangeable base.

Table 4

The fourth study isolated lighting from 4 sides

Part number	Quality	Red filter	Blue filter	Clear filter	Green filter	ND2	ND4	ND8	ND16	ND32	ND64
		<i>Compliance %</i>									
1	-	61,1	51,8	65,0	66,6	73,0	72,7	70,3	66,9	61,3	-
	+	88,2	55,9	85,4	83,4	90,2	90,0	87,9	83,9	79,0	-
2	-	62,8	52,1	66,4	67,2	58,6	59,0	55,7	52,4	52,0	64,3
	+	87,5	45,1	87,6	89,9	87,6	86,9	83,5	80,3	74,4	-
3	-	56,5	45,0	70,0	69,2	69,8	68,8	66,7	61,8	56,7	60,0
	+	87,2	58,7	90,1	91,0	87,2	86,8	84,1	80,5	74,2	56,3
4	-	64,3	41,3	69,1	68,6	71,3	72,6	71,0	66,3	63,2	-
	+	91,1	53,9	87,1	90,5	90,2	88,7	87,1	81,6	72,6	57,7
5	-	64,1	47,4	64,7	66,8	69,9	69,4	66,7	61,3	60,9	-
	+	91,8	56,1	87,3	80,8	90,2	91,1	88,8	84,0	76,5	59,0
6	+	48,6	99,8	83,3	83,6	60,7	62,5	52,5	55,6	52,1	-
	+	58,8	44,8	62,4	61,6	63,2	62,1	57,1	56,7	53,0	37,4
7	+	61,2	59,1	55,6	56,4	64,3	63,5	62,0	60,9	57,8	38,4
	+	80,4	61,8	79,3	76,0	81,6	80,5	78,7	74,9	70,2	23,1
8	+	72,3	58,8	81,4	84,5	65,7	65,4	64,1	61,1	59,2	63,0
	+	61,4	57,5	63,0	65,4	80,0	78,2	76,6	77,8	66,6	35,6
9	+	51,0	51,8	82,5	65,5	25,9	25,5	23,2	21,1	21,1	-
	+	62,7	45,8	63,2	84,0	79,1	74,9	75,2	70,3	67,5	14,3
10	+	59,2	57,9	59,3	66,1	67,9	66,5	65,2	60,7	57,9	62,6
	+	79,4	59,9	57,7	56,6	83,9	83,4	82,0	76,7	70,6	-

The fifth study used additional external side illumination of the subject with clear filter, and the subject was 90 - 100 mm away from the camera at 10 to 40-degree angle to interchangeable base. The layout of the equipment used in the experiments and the obtained results are presented in Figures 1b), 3 and table 5.

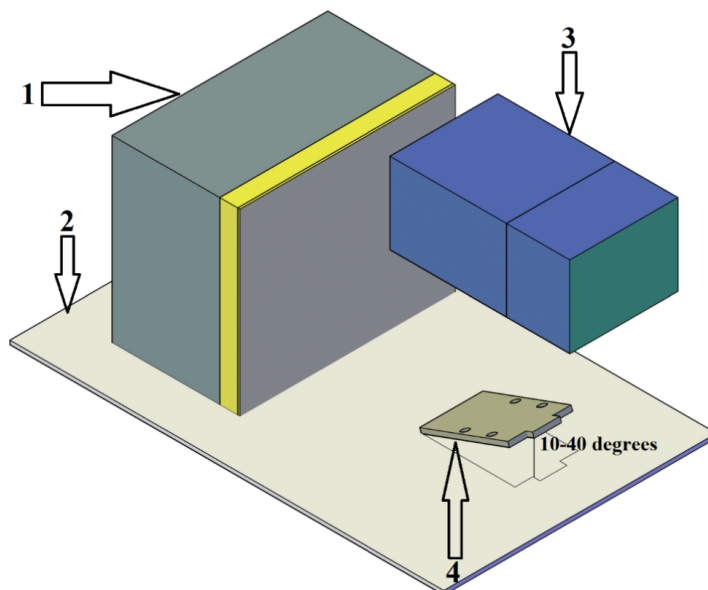


Figure 5. The fifth study used additional external side illumination of the subject with a clear filter, research subject is at 10 - 40 degrees angle to interchangeable base.

1 – External lighting; 2 – interchangeable base; 3 – sensor; 4 - detail at angle from 10 to 40 degrees to an interchangeable base.

Table 5

The fifth study					
Part number	Quality	Examination at an angle of 10 degrees	Examination at an angle of 20 degrees	Examination at an angle of 30 degrees	Examination at an angle of 40 degrees
		Compliance %	Compliance %	Compliance %	Compliance %
1	-	81,90	76,00	73,90	76,00
	+	92,00	90,20	90,70	92,00
2	-	76,20	74,60	73,70	70,00
	+	94,70	90,70	92,30	95,30
3	-	73,10	72,60	68,80	73,70
	+	93,50	90,70	91,80	91,50
4	-	78,30	77,30	71,50	71,30
	+	91,40	91,60	91,00	91,60
5	-	77,10	76,60	71,50	71,60
	+	92,90	91,40	90,40	91,50
6	+	92,80	69,70	90,50	84,60
	+	65,50	84,00	82,60	75,00
7	+	92,00	65,60	90,10	93,80
	+	78,20	73,90	83,10	78,90
8	+	81,60	67,40	80,70	94,60
	+	91,50	84,70	81,60	86,30
9	+	77,70	69,00	91,60	84,40
	+	77,50	81,00	82,90	90,30
10	+	91,50	69,60	89,10	86,00
	+	79,00	84,40	82,70	93,30
Comparative	+	99,30	99,90	98,20	99,80

It can be seen from Table 5 that the investigation of the quality of the threads of the examined parts after turning the part in relation to the base through an angle of 10 - 40 degrees, when the part is illuminated from the side, is unsuccessful. The success rate is only about 30 percent.

RESULTS

In the fourth study, the recognition of defects with settings using red, clear, green, blue and ND (variable) filters and the isolated lighting from 4 sides of the camera is close to null (8 %), i.e., the quality details are not noticeable and 92 % cases are identified as defective (see Table 4). Only when the filter is set to ND2, the sensor detects the features of the parts more accurately, the recognition accuracy reaches only 3 recognitions out of 10 attempts, which is still only 30 % accuracy (Gasiūnas et al.,2022).

In the fifth study, the recognition of a defects with settings at the angle (10, 20, 30, 40 degrees) using clear filter and the external lighting from one side of the part is high-quality when the surfaces of the parts are completely clean without any mechanical damage (scratches, knocks) (see Table 5). These are violations in which the part is still of high quality because they do not affect the use of the part. Only 3 out of 10 parts threads features were correctly recognized, as the camera captures additional reflections from the part surface because of additional damage on the parts surface (Gasiūnas et al.,2022). (Gasiūnas et al.,2022).

CONCLUSIONS

1. After the fourth study, the best quality research results with the isolated lighting from 4 sides were obtained when the filter is set to ND2, accuracy reaches only 3 recognitions out of 10 attempts, which is 30 % accuracy. So, the results from the previous 3 studies were better.
2. After the fifth study, the best quality research results with settings at the angle (10, 20, 30, 40 degrees) using clear filter and the external lighting from one side of the part is high - quality when the surfaces of the parts are completely clean without any mechanical damage (knocks, scratches, or other marks).
3. After conducting research, the best quality research results were obtained by observing the part at 90 - 100 mm, using a green sensor filter and external lighting from one side. It was found that, when observing the part in approximately the same position (± 5 mm and $\pm 5^\circ$), 100 percent can be obtained. recognition accuracy (quality details correspond to settings ≥ 90 , and defective parts correspond to settings < 90).

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RAINWATER HARVESTING SYSTEM: SELECTION OF OPTIMAL VOLUME TANK

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Abstract. The rooftop rainwater harvesting means the collection of water from the rooftop of any structure. The tank is the most expensive and critical component of rainwater harvesting system.

The study was conducted at an individual farm in Degučiai village to find the optimum volume of the storage tank for harvested runoff from the rooftop of the farm building in years of different humidity. The precipitation data of Šilutės region over 10 years was analyzed for the water harvesting potential. In the calculations, water demand for the vegetation period is taken into consideration according to the quantities specified by the farmer.

It is determined that rainwater harvesting potential during the vegetation period is 7.53 m³ in dry years, which can meet around 24 % of the farm water needs when the catchment area is 50 m². Even in the wettest year, the farm's water demand could be satisfied only for two months. When the catchment area is 200 m² over 7 months' period, it would be possible to accumulate 40.16 m³ of water and it would fully satisfy four months' water demand of the farm in dry years. In wet years, all accumulated water during the vegetation period can cover all of the farm's water demands. Optimal volume of the tank is 11 m³ for dry and average humidity years, and up to 14 m³ in wet years, respectively.

As it can be seen from the study, the volume of the tank mainly depends on the amount of precipitation, roof area and the farm's water demand.

Keywords: rainwater harvesting, rooftop, the volume of water storage tank

INTRODUCTION

Water is vital in the agricultural sector. Farmers use water to grow crops, to process agricultural products as well as for other farm purposes. Agriculture is a major provider of food, but also one of the largest users of water resources (Forouzani and Karami, 2011; Damkjaer and Taylor, 2017). Depending on the climate of the region and the level of economic development of the country, agriculture uses about 60-90% of available water resources.

For many decades in Lithuania it was important to remove excess moisture from the soil, however, in the last decade with prolonged dry periods the increase in the number of days when high daily temperatures prevail, as well as with changes in the dynamics of precipitation, it has become more and more important to use all the precipitation water that infiltrates the soil and is collected through the rain systems as efficiently as possible. For a long time, economic entities have been able to use underground and surface water resources without limits. However, due to changes in the legal regulation of surface and underground water use starting in 2024, farmers are increasingly looking for alternative engineering solutions. Thus, collecting rainwater in tanks can be an excellent measure of an alternative water source on a small farm.

The growing number of published scientific articles in the world shows the relevance of installing rainwater harvesting systems. The number of published articles increased from two articles in 1999 up to 57 articles in 2018. It is noteworthy that almost 50 percent of these articles were published between 2014 and 2018 (Velasco-Munoz et al., 2019).

According to the author Qadir et al. (2007), rainwater harvesting is defined as the management and use of rainwater immediately for daily needs, or rainwater stored and used later. Rainwater harvesting encompasses all methods by which rainwater and runoff are effectively managed and used for various purposes. The practice of rainwater harvesting has been known since prehistoric times and is still part of many domestic and agricultural systems around the world, especially in arid and semi-arid regions.

The literature mentions three main methods for selecting the volume of the water storage tank (Santos and Taveira-Pinto, 2013): a) using the falling daily precipitation and the amount of water demand, a water balance equation is created; b) assessing how many days the water from the tank will be used and what is the average water demand per day; c) using the annual amount of collected precipitation or water demand, the runoff coefficient and the catchment area are estimated.

The aim of the study is to determine the theoretical potential of rainwater collection from the roof of the farm building and selection of the optimal volume of the tank in years of different humidity.

METHODS

The private farm chosen for research is located in Degučiai village, Šilutė region. The period of 2012 - 2022 was chosen for the precipitation analysis, the data was collected from the nearest Šilutė meteorological station. The distance from the farm to the weather station is about 20 km.

Precipitation in the farm is collected only from a part of the roof (roof area 50 m², slope of the roof - 30°). The roof of the building is covered with corrugated sheets of fiber cement. Rain drainage system is installed lead the collected rainwater to an above-ground water collection tank with a volume of 3 m³ (Figure 1). In the system water-meters were installed in the inflow and outflow sections, and a water filter was installed in the inflow.



Figure 1. Rainwater harvesting tank in the analyzed farm

The amount of precipitation (runoff) generated from the roof is calculated by an approved methodics (STR 2.04.01:2018):

$$W_f = 10 \cdot H_f \cdot p_s \cdot A, \text{ m}^3/\text{month} \quad (1)$$

here: H_f - amount of precipitation/month, mm; p_s - runoff coefficient, in this case - 0.85 is chosen according to the roof covering (STR 2.07.01:2003); A - area of the runoff basin, m².

The area of the runoff basin is calculated according to the formula (STR 2.04.01:2018):

$$A = A_s + 1/2 \cdot (A_s \cdot \tan\alpha), \text{ m}^2 \quad (2)$$

here: A_s - roof area, m²; α – roof slope.

Calculating the surface runoff from the roof, 10% was subtracted from the generated runoff to account for potential losses (overflow due to heavy rainfall and wind, evaporation from the roof covering). The study assumes that the rainwater tank is impervious to sunlight, so water loss due to evaporation from the tank was not assessed.

The possible rainfall accumulation and storage capacities are evaluated according to the assumptions used by scientists in the literature (Liaw ir Tsai, 2004; Lupia et al., 2017): if the accumulated amount of precipitation was higher than the current volume of the tank, the excess water (overflow) was subtracted from the accumulated runoff; the water demand is subtracted from the accumulated/stored rainfall if there is sufficient water in the tank; in a situation where there is not enough water in the tank, it is assumed that the missing water demand is satisfied using another source of water supply.

RESULTS

A 10-year rainfall analysis was performed to estimate the potential amount of water collected from the roof of a farm building. The average annual rainfall over the analyzed ten-year period was - 778.02 mm, this was by 2.74 percent less than the standard norm in Šilute region - 800 mm (in 1991- 2020). In 2022, the amount of precipitation comprised 572.2 mm. After analyzing the precipitation data, three relevant periods were selected: dry, averagely humid and wet years. The selected years and corresponding annual precipitation values are shown in Table 1.

Table 1

Characteristics of multi-year precipitation in the study area

Statistical characteristics			Rainfall (mm)	Year
Average (mm)	778.02	Dry year (10 perc.)	536.9	2014
Mediana (mm)	717.80	Averagely humid year (50 perc.)	703.9	2020
Standart devation (mm)	54.04	Wet year (90 perc.)	1115.6	2017

In the research period the farm had an above-ground tank installed in the rain collection system. The tank was emptied during the cold period and precipitation was not collected. Rainwater harvesting begins only when the prevailing average daily air temperature is positive. Based on the standard norm (1991-2020) for March the temperature is 0.9 °C and prevails until November (2.6 °C) (meteo.lt).

Since the farm uses stored water for greenhouse irrigation, it is accepted that the farm's water demand is 6-8 l/m², i. e. avg. 6.1 m³/month. The demand was accepted according to the norms specified by the farmer. The remaining water in the tanks is used for other needs of the farm.

In dry years, in 7 months' period it was possible to accumulate 11.97 m³ of rainwater, avg. 1.7 m³/month, but in the vegetation period - only 7.53 m³ (Figure 2).

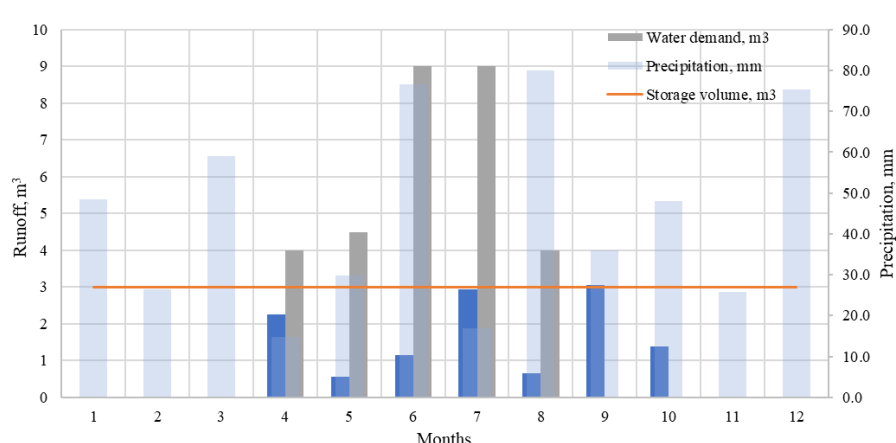


Figure 2. The amount of rainwater collected from the roof of the farm building and the demand in the farm in dry years

During the entire accumulation period the accumulated amount of precipitation does not exceed the volume of the available capacity without estimating the need for farm water use. In dry years the water needs of the farm will be satisfied by about 24% and the demand deficit will have to be covered with water from other sources. It is necessary to note that the limiting factor is the amount of precipitation and the area of the roof.

In the year of average humidity over seven months the amount of rainwater that could be accumulated would comprise 12.40 m³, around 1.77 m³ per month, while in wet years - 20.32 m³ (Figure 3).

As can be seen from the amount of collected precipitation, even in the wettest year, the farm's average water demand could be met for only two months and farm water demand remains by 39% higher than the amount of rainwater that can be stored.

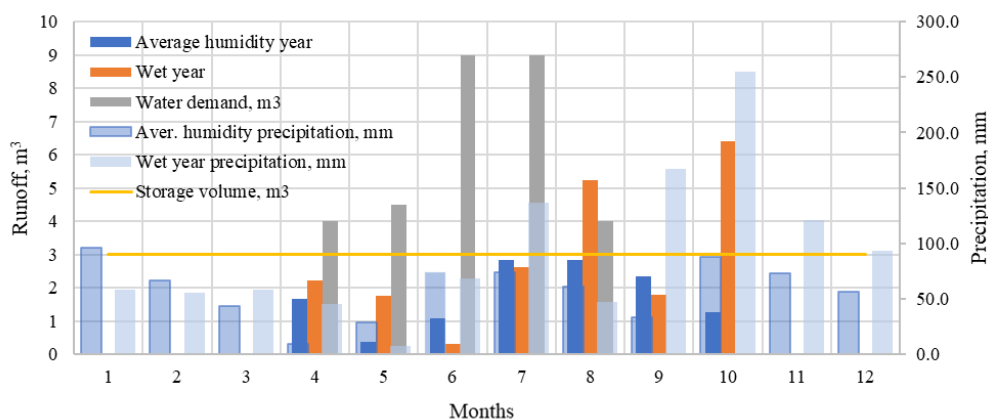


Figure 3. The amount of rainwater collected from the roof of the farm building and the demand on the farm in medium humid and wet years

In order to meet water demand of the farm, it would be necessary to start storing water several months earlier, but this is limited by the climatic conditions of Lithuania and the selected above-ground tank. To increase the volume of the tank is not useful, since the water demand of the farm exceeds the inflow into the tank, thus at the end of each month all the water from the tank would be used up, i.e. $St < 0$.

The scenario when water is collected in a tank from the whole roof of the farm building was analyzed as well (Table 2).

Table 2

Recommended tank size according to the catchment area

	The amount of accumulated water in dry years, m ³	The amount of accumulated water in averagely humid years, m ³	The amount of accumulated water in wet years, m ³
Runoff basin area, 200 m ²	40.16	40.66	62.20
Tank volume, m ³	11	11	14

By increasing the roof area in dry years over 7 months' period it would be possible to accumulate 40.16 m³ of water and this would fully satisfy four months' water demand of the farm. A very similar situation was obtained in years of average humidity. During the entire vegetation period all accumulated water can cover all of the farm's water demand in wet years. After the analysis of different humidity years, optimal volume of the tanks is considered to be 11 m³ for dry and average humidity years, and up to 14 m³ in wet years.

As can be seen from the analysis, the runoff amount from a small roof area is small, and therefore the volume reliability of the tank is low. As the roof area increases, the amount of water entering the tank increases. As a result, the tank becomes more reliable in terms of volume.

The performed calculations show only the theoretical potential of rainwater collection in the farm. To obtain more accurate calculations, the rainwater drainage system should be assessed, i.e. downpipe diameters, filter capacity, as well as prevailing wind directions in the area should be considered. Selecting the optimal volume of the tank it is necessary to take into account the choices of tanks available in the market and the possibilities of the farm to install such tanks.

CONCLUSIONS

1. The tank is the most expensive and critical component of the rainwater harvesting system. The volume of the tank determines the reliability of the system operation and the satisfaction of the farm's water needs. Precipitation varies between years with different humidity levels, so it is difficult to determine the optimal volume of the tank and assess the reliability of system operation. As can be seen from the study, the volume of the tank mainly depends on the amount of precipitation, the area of the roof and the water demand of the farm.
2. In dry years, when water is collected from the surface basin area of 50 m², the water needs of the farm will be satisfied only to a minor extent (24%), even in wet years. The amount of water stored will not be enough to meet the farm's needs and the demand deficit will have to be covered by water from other sources. Since the water needs of the farm exceed the inflow into the tank and at the end of each month all the water from the tank will be used up. The tank volume of 3 m³ is sufficient, because the inflow into the tank will not exceed its volume over a month.
3. By increasing the roof area (up to 200 m²) over 7 months' period it would be possible to accumulate 40.16 m³ of water and this would fully satisfy four months' water demand of the farm in dry years. In wet years during the vegetation period all accumulated water can cover all of the farm's water demands. The optimal volume of the tanks is 11 m³ for dry and average humidity years, and up to 14 m³ in wet years.

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THE EVALUATION OF SPECIFIC PHYSICAL PREPARATION FOR U-14 AGE GROUP TENNIS PLAYERS

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Abstract. During the last quarter of a century, tennis players have become faster and stronger, the way of the game has changed accordingly. Being successful in tennis and achieving high results in national and international competitions, it's requires a high level of specific physical preparation. During the specific physical preparation training process is necessary to increase and evaluate the physical qualities of tennis players in preparation, competition, and transition period. In this article, with the method of literature and document analysis, were selected control exercises and tests, which can be used to evaluate the specific physical preparation dynamics of U14 age group tennis players.

Keywords: tennis; tennis training process; tennis specific physical preparation; evaluation

INTRODUCTION

The training process is a pedagogical process aimed at developing people's physical and mental qualities, tactical and technical skills, acquiring theoretical knowledge to achieve the high result in a sport. The training process is carried out in accordance with specific goals and tasks, the coach develops a training plan based on the groups or players sensitive age period, physical preparation, and training process periodization. The training process of tennis includes general and specific, technical, tactical, and psychological preparation. The general physical training process is aimed of a general, harmonious development of a person and health strengthening, general conditioning as the basic for developing specific physical training. The specific physical preparation training process is aimed to increase the physical qualities for tennis to achieve high results in national and international competitions. Also, each age has its own characteristics, which must be taken into account when implementing the training process. The players of the U14 group go through puberty at this age, when the body undergoes changes. At this age, it's important to improve and evaluate the physical qualities, that are most important to tennis players. The special physical training process involves a gradual increase in training and competitions, solving tasks related to strengthening the health, developing special physical qualities, learning complex technical activities, instilling an interest in competing in tennis.

During the last quarter of a century, tennis players have become faster and stronger, the way of the game has changed accordingly (International Tennis Federation, 2019). Tennis players need a high level of physical preparation to endure a tough and sometimes exhausting game. A tennis player needs physical qualities such as endurance, speed, agility, strength, power, and flexibility. Tennis requires high endurance; the game is unpredictable and can last up to 4 hours. Tennis players need a high level of aerobic conditioning to avoid fatigue, aerobic conditioning can determine their ability to withstand high intensity loads during a match and can influence a player's technical and tactical performance, allowing them to make better decisions when fatigued (Genevois, 2019). Speed is necessary in game situations when the player executes a shot and quickly changes direction or, conversely, reduces speed to create optimal contact with the ball (ITF, Fitness training, 2019). During a tennis game, it's important to navigate in space, execute shots from different positions, move quickly on the court. Also, during the game, tennis players are required to: run, stop, turn, jump, slide, hit in different directions of movement (International Tennis Federation, 2019). Dexterity manifests itself in the ability to quickly reduce running speed, maximally accelerate in the opposite direction and change running direction. A tennis player must make shots at different points of the court, decide in time, and take the necessary starting position before executing the shot (Genevois, 2019). Body strength it's very important for tennis players. Arm strength is important for any sport that involves catching, throwing, or holding an object (Badminton Australia, 2008). A tennis player must perform shots at different heights, sometimes even in a semi-squat, this requires the strength of the leg muscles. Arm strength is needed to execute a strong shot or serve, which requires a firm grip on the racket. Tennis is an asymmetric sport, to prevent possible muscle imbalances and reduce the risk of injuries in time, the specific physical training process should include strength exercises aimed at developing the strength endurance of the muscles of the legs, back, abdomen, chest, and arms (Roetert, 2015). Strength training increases the expression of muscle strength and power, as well as the level of muscle endurance. The game of tennis has evolved into a fast-paced game based on endurance and power (Fernandez-Fernandez, Ulbricht, Ferrauti, 2014). Tennis players must be able to use power effectively, execute fast, powerful shots and serves (International Tennis Federation, 2019). Flexibility is the ability to perform movements with the necessary amplitude, it's lack limits the range of movements in the joint, speed, accuracy, causes muscle tension. Poor flexibility is one of the main causes of injuries not only in tennis. Flexibility exercises should be included in the comprehensive and specific training process for tennis, because with age, flexibility begins to decrease in all people.

The International Tennis Federation emphasizes that well planned specific physical training has become the main success factor in tennis (International Tennis Federation, 2019). In the training process, it's important for the coach to be

able to first determine the suitability of the exercises and recognize the shortcomings, then develop an appropriate training plan for increasing physical conditioning (International Tennis Federation, 2019). The training plan for the year is divided into three periods: preparation, competition, and transition period, so that the coach can make conclusions about what has been done in each period and determine the aims of tennis player specific physical preparation, as well as control exercises and tests should be included in each period. The latest research emphasize that it's important to adapt the type of periodization during the tour according to the needs of each player, as well as to establish physical routines that will allow them to reach their optimal physical, mental and tennis condition (Garcia, 2022).

Tennis coaches must regularly obtain data of the tennis player's specific physical preparation. The regularly obtained information about players specific physical preparation will allow the coach to evaluate the strengths and weaknesses, to adjust the training plan in time, to implement the specific physical training process more effectively, so to achieve higher results in tennis. The International Tennis Federation states that regular control exercises and tests provide feedback on the effectiveness of the training plan and allow the coach to monitor tennis players' progress (International Tennis Federation, 2019). Tennis coach need a simple, clear to understand and easy to perform control exercises and tests to objectively evaluate tennis players specific physical preparation.

The aim: to develop a set of control exercises and tests to evaluate the specific physical preparation dynamic for tennis players of the U14 age group, during the tennis preparation training period.

Research object: tennis specific physical preparation process.

THE RESEARCH METHOD

To develop a set of control exercises and tests to evaluate specific physical preparation dynamics for tennis players of the U14 age group, were applied methods such as the analysis of literature, sources, scientific research, The National Tennis Federation, and other sports documents. Selected control exercises and tests can be performed on the tennis court, in the gym, in the stadium or at home, with the main advantage that they can be performed both face to face and remotely.

CONTROL EXERCISES AND TESTS TO EVALUATE THE SPECIFIC PHYSICAL PREPARATION

1) 20-meter run test (Beep test)

The 20-meter shuttle "Beep test" is a popular fitness test to evaluate an athlete's endurance (Badminton Australia, 2008). The test is especially useful for tennis players because the movements are similar to tennis, such as stopping and changing direction of movement (International Tennis Federation, 2019). Consisting of 20-meter shuttle runs (see Fig. 1) performed at increasing speeds until exhaustion, the test has become a standard test, a regular part of testing by various National Tennis Federations (Fernandez-Fernandez, Ulbricht, Ferrauti, 2014). The test can be performed for the entire training group at the same time, as a result dividing the athletes into many levels of physical preparation, providing the coach with a real, quantitative assessment of individual and team physical preparation (Beep test, 2006). Recommended to perform the test using the "Beep test" mobile application, which can be used to simultaneously determine the distance, time, and participants endurance level. The test involves continuous running between two cones located 20 meters apart until the recorded beeps, the "Beep test" mobile application emits one beep at regular intervals, after the beep the test participants must be at the cone, until the next beep. After each minute, the time interval between the signal decreases, so the test participant must increase his running speed. Test can be performed in tennis court, in stadium and backyard.

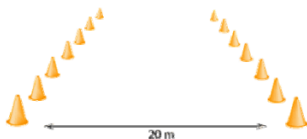


Figure 1. 20 meter run test (Beep test).

2) The spider test

Tennis requires players to repeatedly generate powerful strokes and rapid movements on the court for a long period of time; therefore, to meet and endure these challenging physiological conditions, modern-day players need a mixture of physical qualities such as speed, agility, and power combined with well-developed aerobic fitness (Durmus, Odemis, Sogut, 2022). A shuttle run with balls is called the "Spider test" (Сергиенко, 2013). During the test, it's necessary to accelerate and quickly return to the starting position. During the test, the tennis balls must be moved from point A, B, C, D, E to the middle point of the end line as quickly as possible (United States Tennis Association, 2005). The test participant is allowed three attempts, the best time is recorded in seconds (Amirul Bin Zaini, Pawa Pital, 2017). For test, tennis coach have to draw a rectangle 8.23 metres long and 5.49 metres wide, place the balls on point A, B, C, D, E and draw a rectangle 45 centimetres long and 30 centimetres wide behind the end line (Fig. 2). The test can be performed in tennis court or on the sports field.

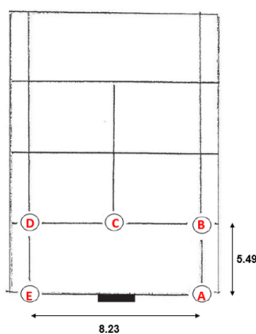


Figure 2. **Spider run test.**

3) *Hexagon test*

The hexagon test is a measure of agility and balance (Beekhuizen, Davis, Kolber, Cheng, 2009). Agility is the ability to quickly change direction, to react quickly, to adapt to the changing conditions of the tennis game. Tennis players demonstrate dexterity when they perform several shots in the shortest possible time or adapt to specific game conditions (International Tennis Federation, 2019). The test participant performs continuous jumps with both legs in a counterclockwise direction outside the hexagon line (Fig. 3). During the test, it is necessary to quickly change direction and stop, as well as maintain balance dynamically and statically. For the test, tennis coach have to draw a hexagon on the floor, all sides are 60.5 centimetres long, each corner must have an angle of 120 degrees. The test taker stands in the middle of the hexagon, looking towards line A. After the command, the timer is started and the test participant performs a jump with both feet over line A and back to the middle of the hexagon, then over line B and back to the middle of the hexagon, then over line C and back to the middle of the hexagon, etc. If the attempt is unsuccessful, the test must be restarted. The test participant must complete three laps, as quickly as possible, after three laps the time is stopped, and the result is recorded after three attempts.

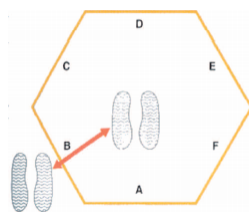


Figure 3. **Hexagon test.**

4) *Forearm grip strength determination test (dynamometry)*

Tennis players who have the strength of hand grip and arm length in servicing in playing tennis will be better prepared and easier to do service accuracy (Mangolo, Makadada, 2020). To evaluate the strength of the muscles of the right and left hand, a hand dynamometer is needed (Fig. 4). The dynamometry method is necessary to measure the strength of tennis players arm muscles. Determination of static hand grip strength with a hand dynamometer is also included in the popular Eurofit fitness test. The dynamometry test can be performed supervision physician or experienced person to make sure test is performed similar with both hands. The non-dominant hand usually scores less than 10% (Badminton Australia, 2008).



Figure 4. **Hand dynamometer.**

5) *Control exercise for bending and straightening the arms (Push-up test)*

Push-up test allows to evaluate the strength of the arm and chest muscles (ITF, Fitness testing, 2019, p. 7). The purpose of the control exercise is to assess upper body muscle strength (Mackienze, 2005). The control exercise develops the power endurance of the shoulder and chest muscles, as a result, increases the speed of the shot during the game. The test participant is given 60 seconds to complete as many repetitions as possible (Fig. 5). It's important to have the correct exercise technique when performing the push-up test. The test can be performed on a tennis court, gym, or sports field.



Figure 5. **Push-up test.**

6) Vertical jump test

Plyometric training has been shown to be an important stimulus for improving explosive actions in junior tennis players (Durmus, Odemis, Sogut, 2022). Including plyometric exercises in the training process is one of the best ways to train power (Crespo, Miley, 1998). Jumps from a place, height, distance allow to evaluate the speed of leg muscles. Power development is determined by horizontal or vertical jumps. Various jumps with maximal effort develop power by strengthening the strength of the leg, back and abdominal muscles. The test involves jumping from a standing position with arm strokes from a half-squat. The test allows to evaluate the power of the lower body (International Tennis Federation, 2019) (Fig. 6).

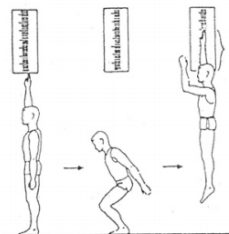


Figure 6. Vertical jump test.

7) Control exercise for determining the power of the upper body with a medicine ball - imitation of a forehand and backhand stroke

Exercises that simulate the real game will help obtain the most appropriate conditions to observe, evaluate, and train hitting stability at impact. This is due to the fact that since each decision on how much power to hit the ball and body position will be unique and differ from shot to shot (Lopez, 2020). Power development is determined by throw control exercises (Ski and snowboard Australia, 2015). Throwing or pushing exercises with balls are used to develop upper body power. Control exercises with medicine ball develop upper body muscle power, when performing a stroke from a standing position, the upper body performs a rotation, this movement is similar to a tennis stroke. Tennis coach can assess the technical execution of exercises, the speed of execution and compare the dominant and non-dominant side of the upper body. The test can be performed with a tennis player on a tennis court, gym, or sports field.

8) Flexibility test – sit and stretch

If the arms and wrists are not strong or flexible, the power produced throughout the lower body and core will not efficiently transition into the ball (Roetert, Kovacs, 2011). Tennis players should place on flexibility development during training, as flexibility enhances muscle strength and movement range (Xiao, Geok, Bai, Bu, Wazir, Talib, Liu, Zhan, 2022). The test is designed to assess the flexibility of the legs and lower back muscles (Ski and snowboard Australia, 2015). It's possible to evaluate the flexibility with classic stretching exercises, one of which is to bend forward or down while sitting or standing (Fig. 7). During the test, the tennis player must reach forward and move the fingers forward as far as possible, hold for two seconds and return to the starting position. The test participant repeats the test three times, the tennis coach records the best result. If the player is unable to reach the toes, the distance is expressed as a negative result. During the tennis game, tennis player has to reach the balls from different positions, it's also possible to reach forward with the racket and execute a shot, for a tennis player whose muscles are flexible, there are practically no unreachable balls.



Figure 7. Flexibility test - sit and stretch.

CONCLUSIONS

It's important for the tennis players of the U14 group to improve and evaluate the physical qualities - endurance, speed, agility, strength, power, and flexibility that are important to tennis players. The aim of the study has been achieved, has been developed a set of control exercises and tests to evaluate the specific physical preparation dynamic for tennis players of the U14 age group, during the tennis preparation training period. Control exercises and tests provide regular feedback on the training process and allow the tennis coach to monitor the tennis player's progress.

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ELABORATING ON THE THEORETICAL UNDERPINNINGS OF THE CONCEPT OF EMOTIONAL INTELLIGENCE

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Abstract. The aim of this research is to shed light on the theoretical aspects of the concept of emotional intelligence. The aim was achieved by setting two objectives: first, the article defines the concept of emotional intelligence, and in the second part, it reveals the structure of emotional intelligence. The analysis of the scientific literature has shown that emotional intelligence enables people to identify, monitor, understand and manage their emotions, as it relates to motivation to work and to build successful relationships.

Keywords: emotional intelligence (EQ), intelligence quotient (IQ), emotions, personality traits

INTRODUCTION

Since the publication of Goleman's best-selling books *Emotional Intelligence* (1995; 2000), there has been a tremendous interest in the topic of emotional intelligence. But what exactly is emotional intelligence? In his book, the author could not have explained the importance of emotional intelligence more precisely than in the words of Aristotle: "Anyone can get angry - that's easy. But getting angry with the right person, within the right limits, at the right time, for the right reason, in the right way, is not easy at all" (*Nicomachean Ethics*).

Academic intelligence has been studied more extensively in science, and IQ (intelligence quotient) is known to be related to various personal achievements, but the ability to understand and manage one's own emotions and those of others is equally important for one's success (Rana, et. al, 2017; Lekavičienė & Antinienė, 2015).

The literature provides various definitions of emotional intelligence, but the most common one is the ability to know and manage one's own and others' feelings and emotions, or the ability to distinguish between emotions and to use the information in order to achieve a single goal or action. High emotional intelligence leads to appropriate human behaviour and more durable relationships, productive work and better performance.

At the most general level, emotional intelligence refers to the ability to recognise and regulate emotions in oneself and others (Poskey, 2006; Stys & Brown, 2004). An approach that dismisses the importance of feelings to human nature is likely to be short-sighted. Understanding emotions is important because understanding emotions determines a person's subsequent thoughts, behaviour and attitudes. Although emotions are often dismissed as irrational and therefore disturbing, research has shown that human emotions play a crucial role in decision-making. The emotional part of the human brain works very closely with the thinking part of the brain to help with decision-making and reasoning, which is why emotions are so important in everyone's life. So is the ability to justify one's actions, to keep dreams alive, to control one's impulses, to not be satisfied with what one has achieved, to control one's moods, to not give in to despair that hinders sober thinking, and to empathise with the situation of others. No one can yet pinpoint the power of emotional intelligence to determine one person's life or another, but a person with a high intelligence quotient may be lacking in a key success factor: emotional maturity. As a result, a person with an excellent education, good analytical skills, sharp logical thinking, etc., may not achieve recognition, become a leader in his/her field, or succeed in his/her personal life (Mayer, Salovey & Caruso, 2000; Nelis, et al., 2009; Lekavičienė & Antinienė, 2015).

In this research, our objective is to delve into the theoretical facets of emotional intelligence. We aim to achieve this by scrutinizing various definitions of emotional intelligence and elucidating its underlying structure.

THEORIES AND CONCEPTS OF EMOTIONAL INTELLIGENCE

The Intelligence Quotient (IQ) was developed and used in the first half of the twentieth century as a measure of intelligence but was soon challenged because it did not take into account situational factors, such as environment or cultural background, to predict achievement.

In terms of the history of the study of emotional intelligence or otherwise known as emotional quotient (hereafter referred to as EQ), when theorists began to hypothesise that several types of intelligence might overlap in a single person, Thorndike (1920), an influential psychologist in the fields of learning, education, and intelligence, revealed that there are not one, but several types of intelligence that people can possess. One of these he called social intelligence, which involves a person's ability to act wisely in the space of human relationships. Later, Gardner raised the concept of multiple intelligences and proposed the theory of multiple intelligences, which dictated that individuals have abilities in several domains, including the verbal, mathematical, musical, spatial, motor and environmental domains. Gardner believed that these intelligences are as important as the type of intelligence typically measured in IQ tests (Gardner 1983, Stys and Brown 2004).

Later, Mayer, Salovey and Caruso (2000) proposed another type of intelligence, which they called emotional intelligence. The authors defined emotional intelligence as a form of intelligence that involves the ability to observe one's

own and others' feelings and emotions, to process them, and to use this information to guide one's thoughts and actions. It is the ability to know and manage one's own and others' feelings and emotions, or the ability to discriminate between emotions and to use the information to achieve a single goal or action (Mayer, et. al, 1999, 2000). Later, these authors refined the definition of emotional intelligence to include the ability to perceive emotions, to integrate emotions by facilitating thought, understanding and regulating emotions to promote personal growth (Mayer, et. al, 1999, 2000).

Whereas it has been argued that neither experience nor education can substitute for cognitive intelligence, as measured by IQ, Goleman (1995; 2000) has argued that basic emotional skills can be developed and refined in childhood with effort. For him, scholarship and a high IQ do not help a person to prepare for life, to learn how to deal with failure and to seize unexpected opportunities. A high IQ does not guarantee prosperity, prestige or happiness in life. Schools and culture, he argued, prioritise knowledge to the neglect of emotional intelligence, in other words, the qualities of character that are crucial to each person's destiny. Like mathematics and reading, emotional life requires skill and knowledge. There is no shortage of evidence that people with a high emotional intelligence - who know how to manage their feelings, who understand and take account of other people's feelings - have an advantage in any area of life (whether romantic or intimate relationships, or in organisational activities that require the ability to understand certain unwritten rules). They are more satisfied with life, more successful, more able to curb their whims and therefore more creative.

The concept of emotional intelligence provides more insight into what constitutes intelligence or intelligent behaviour. In a broader sense, emotional intelligence deals with the emotional, personal, social and experiential aspects of intelligence that are vital to everyday functioning. The less cognitive parts of intelligence are concerned with understanding ourselves and others, relating to people, adapting to and coping with our immediate environment. These factors increase a person's ability to cope successfully with environmental demands. Emotional intelligence is tactical and immediate and therefore reflects a person's intelligence and ability to cope in the world (Bar-On, 2004).

Shmidt (2008) described EQ as the ability to identify and respond to the emotions and feelings of others, and the ability to help others manage their emotions. Other authors have referred to EI as the intelligent use of emotions when they are directed to work in a direction that influences behaviour and thinking in order to achieve specific goals (Weisinger, 1998, Matthews, Zeider & Roberts, 2004). According to Salovey & Grewal (2005), EI is the ability to know, understand, and express oneself; to know, understand, and get along with others; to control strong emotions and impulses; and to adapt to change and to solve personal or social problems. Bar-On, with a slightly different perspective, defined emotional intelligence as caring about one's own and others' understanding of people and adapting to one's immediate environment in order to cope with the demands of the environment. He considered emotional intelligence as all non-cognitive abilities, knowledge and competences that enable a person to cope successfully with various life situations (Lekavičienė & Antinienė, 2015; Vandervoort, 2006).

Salovey & Grewal (2005) took a broader view of intelligence and tried to reassess its impact on people's lives. The aim of their research was to demonstrate how important and how much of a life-changing factor "personal" or emotional intelligence is, manifesting itself in five main areas:

1. Knowing your feelings. Failure to understand one's true feelings makes people dependent on them. People who have a deeper understanding of their feelings are better able to navigate their lives and manage their most important matters, from getting married to choosing a job.

2. Managing emotions. The ability to manage feelings, to steer them in the right direction, depends mostly on self-awareness. People who lack this ability are endlessly confronted with despair, while those who have it in abundance quickly regain their equilibrium when life's troubles strike.

3. The ability to achieve. In order to achieve a goal, it is important to manage our feelings, to stay focused, to be purposeful, to do our work well and to be creative. The ability to fit in with others and to work together ensures the best results in any activity. Those who have developed this ability are very active and creative, and can cope well with any task.

4. The ability to see other people's feelings. Empathy, the ability to empathise with another person's state of mind, is another quality that comes from emotional self-awareness and is essential for communication. Those who can empathise with others' feelings are more aware of others' needs and desires. This quality is not only necessary for those whose work involves care work, but is also important for those working in commerce, management and education.

5. Interpersonal relationships. Communication skills are character traits that help you gain popularity, leadership status and good relationships with other people. People with these qualities do well wherever they have to work, working together with others. They can be called the stars of social life.

To summarise the analysis of the academic literature carried out in this section, emotional intelligence refers to a person's ability to be aware of his or her own and others' emotions, and to build stable relationships by controlling his or her own behaviour and that of others.

STRUCTURE OF EMOTIONAL INTELLIGENCE

Given the different perceptions of EQ, it can be broadly defined as the abilities related to personality traits that enable one to recognise and understand one's own and others' emotions and their meaning, to assimilate and manage them, and to dispose of the information appropriately, for example, by controlling one's own and others' behaviour in the face of the emotions involved (Mayer, Caruso, & Salovey, 1999; Goleman, 1995; Khalili, 2012).

Emotional intelligence essentially enables people to recognise, manage and regulate not only negative but also positive emotions (Garbenis, 2020).

According to Shapiro (1998), the term emotional intelligence has come to be used to describe emotional qualities that are important for human success, such as empathy, expressing and understanding feelings, adaptability, perseverance, friendliness, respect, and control.

Goleman (2006) identifies four domains of emotional intelligence:

- 1) self-knowledge;
- 2) self-control;
- 3) empathy;
- 4) relationship management.

Self-knowledge is the awareness of one's inner states, preferences, resources and hunches. If a person lacks self-awareness, it is difficult for him/her to notice his/her weaknesses. Confidence in knowing one's strengths is not enough (Goleman, 2006; Gómez-Leal, et al., 2022). Self-knowledge was identified by Mayer, Salovey & Caruso (2000) as self-awareness - the ability for a person to be aware of both his or her own mood and his or her thoughts about that mood.

Self-control. People can be categorised according to how they respond to and manage their feelings (Mayer, Salovey & Caruso, 2000; Chin, Anantharaman & Tong, 2011):

- Those who know themselves well. People who understand their moods naturally orient themselves in their emotional lives. Their sober perception of their feelings underpins other qualities of their character: they are independent, well aware of the limits of their abilities, in excellent mental health and optimistic. When their mood breaks down, they do not suffer and are able to repair it. In short, their knowledge helps them manage their feelings.

- The stuck ones. These people are constantly in a quagmire of feelings and cannot get out of it because they are a kind of mood slave. They are unpredictable, unaware of their feelings, unsure of what they are going to do next, and do not even try to mend their mood a little bit. They feel helpless in their own emotional world because emotion is king.

- Reconcilers. These people are usually aware of what they are feeling, but they are completely dependent on their moods and tend to accept them. Reconcilers seem to be of two types: some are generally well-disposed and therefore least concerned about changing anything, while others, although aware of the mood, accept it without resisting it or trying to lighten it. This is the behaviour of sad people who have given up.

According to Goleman (2006), *empathy* can be defined as compassion for other people's feelings, needs and concerns, and is therefore the basis for many moral decisions and actions. Empathy is the basis of morality, as empathy for the suffering or threatened person is a way of sharing their grief and helping them (Rana & et al., 2017; Poskey, 2006).

Relationship management (social skills) is the ability to elicit a desired response from others. Caruso, Bienn & Kornacki (2013) identifies four skills as components:

- Organizational skills;
- The ability to negotiate;
- Ability to establish personal relationships;
- Ability to analyse relationships.

According to Goleman (2000), these communication skills are based on parts of emotional intelligence and must be aligned with the individual's needs and feelings, otherwise they become unnatural communication tools.

Since self-awareness and self-control are linked to personal skills, it could be argued that they constitute personal competence. Empathy and relationship management relate to knowledge, skills and abilities that are related to other people, so these areas of emotional intelligence could be called social competence.

CONCLUSIONS

An analysis of the scientific literature reveals that emotional intelligence can be defined as an individual's capacity to effectively regulate their emotions and feelings, harnessing these emotional states to inspire and drive their work performance, and cultivate prosperous interpersonal relationships.

It can be argued that emotional intelligence can be categorized into two primary domains of competencies: personal and social competence. Within these domains lie specific emotional intelligence competencies, encompassing an individual's capacity to rationalize their actions, exercise emotional restraint, attain predefined objectives while navigating dissatisfaction with results, adeptly handle their own emotional states, and exhibit empathy towards others' circumstances.

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KNOWLEDGE OF HEALTH SCIENCE STUDENTS ABOUT EMERGENCY MEDICAL CARE WHEN CHOKING

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Abstract. The essence of the provision of emergency medical care consists of: prevention of diseases and accidents, readiness to act in the event of an accident or illness, rapid response and treatment. The essence of the provision of all emergency medical care is to reduce the number of deaths and disabilities. The conducted study showed that only a small percentage of students of the faculty of the health sciences can adequately provide emergency medical care in case of the choking. However, students know what to do during partial or complete choking, and also know the main ways to help in case of the choking. The students also identified the consequences of choking caused by the wrong provision of the emergency care.

Keywords: elderly patients, stress experienced, medical institution, consequences

INTRODUCTION

Every day it is possible to face unexpected situations that can claim human life. Dinner can end in death if, after choking on food or drink, emergency medical care is not properly provided. Only with the correct provision of emergency care by choking can further health problems be avoided. There are many unexpected, and often even very unpredictable situations in everyday life, when a person's life is in danger, and only a very short period of time is devoted to preserving it. One of such situations is choking, from which, according to the data of the Public Health Bureau of Šiauliai District Municipality in 2020, about 3,800 people die every year. A study by Igarachi et al. (2022) revealed that choking was the third-highest cause of accidental deaths in the United States in 2018 and the second-highest in Japan in 2019. Japan suffered 8000 deaths due to choking, which was about twice as many as in the United States. What should be done, how to help the choked, when and how to purposefully provide emergency medical care with choking, so that we do not harm by performing actions, but help to save a life and avoid further consequences of a health disorder, not everyone knows, therefore, there are not many people dying from choking.

A study conducted by Igarachi et al. (2022) states that choking quickly leads to cardiac arrest and airway obstruction, it is very important that outsiders effectively remove foreign bodies during choking. The aforementioned author and his colleagues also revealed that the verbal instructions of the dispatchers during the call in communication with the person calling for help improved the vital functions of the person, thanks to which a more rapid emergency medical care was provided until the arrival of a specialized ambulance to the patient. This aspect reveals that the vast majority cannot adequately provide assistance in choking without instructions from the dispatcher.

The object of the study: the knowledge of the health science students about the emergency medical care when choking.

The goal of the study: to determine the knowledge of the health science students about the emergency medical care when choking.

The tasks of the study:

1. To identify the most important actions performed by students in providing emergency medical care during choking.
2. To identify the first action choking on an adult.
3. To identify the consequences of choking caused by the incorrect provision of emergency care.

RESEARCH MATERIAL AND METHODS

The search for sources of the information was carried out in EBSCO, PubMed and other databases. The study was conducted using a quantitative research method, the tool of which is a questionnaire survey. The quantitative study was carried out, which took place in March 2023. The survey took place at the Faculty of Health Sciences of College X, indirectly communicating with students. The survey questionnaire was placed on the apklausa.lt website, and the survey link was sent to all students of health sciences at College X by e-mail. The questionnaire was anonymous, so the data collected is reliable. 162 students participated in the survey.

DISCUSSION AND RESULTS

The survey on the knowledge of emergency medical care in choking involved students from the Faculty of Health Sciences of College X. The study was dominated by women (80 %), while men accounted for 20%. The age of the respondents was distributed as follows: by the age of 25, 48 % had participated, between the ages of 26 and 31 was 26 %, and the lowest proportion was more than 42 years old. When explaining which course students study in, respondents were distributed fairly evenly, i.e. about 30 %. Next, there was interest in which lectures, students learned the most about emergency medical care during choking. The survey data showed that the majority (64 %) of the students learned the most about choking assistance in first aid lectures, only 21 % in emergency medical care, 11 % during anatomy and the smallest part (4 %) of the students during nursing procedures.

Students were also asked what is the choking. The results showed that almost everyone answered (89 %) correctly that it occurs when food or other foreign body enters the mouth not into the digestive tract, but into the respiratory tract, the least respondents (7 %) said that choking occurs when a foreign body gets stuck in the throat and the smallest part (4 %) of the students chose an answer that names choking when a person is unable to inspiration because the foreign body is unscrupulous.

When asked what is most important in providing emergency medical care after choking, respondents were divided as follows: the majority (78 %) chose the answer option that it is very important to call for emergency medical care, and only 2% of those surveyed chose the option that they doubt and do not important, the smallest part (1 %) of the respondents consisted of the answer that it does not at all important. Trying to pull a foreign body out of the respiratory tract is very important for a third part (31 %) of the respondents, 28 % important, 33 % doubt it. And 3 % said it doesn't important and 5 % have chosen the answer option that it doesn't at all important. As soon as hitting the crotch with the palm of their hand, the vast majority (42 %) of the respondents chose to be important, a third (32 %) part believed it is very important, a fifth (21 %) part were doubt that it is important in providing assistance, and the smallest part (2 %) believed that it does not at all important. To promote quality coughing, the largest part, almost half (49 %) chose that it was very important, a third (34 %) part that it is important, less than a quarter (15 %) part doubt it, just 1 % chose the answer option, said that it does not at all important. To give a drink, the majority (40%) of the respondents doubt that it will help the choked, a quarter (25 %) part said that it does not at all important, about a fifth (17 %) part of the respondents thought it is important to give a drink in the form of emergency medical care when choking. About a tenth (12 %) part believed it doesn't important, and the smallest part (7 %) chose the answer that it's very important.

Timely provision of assistance when a person begins to blueing is very important, this answer option was chosen by the majority (84 %) of the respondents, and less than a fifth (14 %) part that it is simply important, the smallest part (1 %) of the respondents believed that it does not at all important, it does not important and doubted the importance of the providing emergency care when a person begins to blueing (see Table 1).

Table 1

The most important actions performed when providing emergency medical care during choking

Assertions	Not at all important	Not important	Doubt	Important	Very important
Timely provide assistance when a person begins to blueing	1%	1%	1%	14%	84%
Give to drink water	25%	12%	40%	17%	7%
Encourage high-quality coughing	1%	1%	15%	34%	49%
Hitting the crotch with your palm as soon as possible	2%	3%	21%	42%	32%
Trying to pull a foreign body out of the respiratory tract	5%	3%	33%	28%	31%
Call for emergency medical care	1%	1%	1%	19%	78%

In the question of whether health science students could properly provide first aid for choking, the answers were distributed fairly evenly. The vast majority (42 %) part of the respondents almost half of those surveyed believed they could provide help, less than a third (27 %) part said they could but would be afraid, 26 % doubted they could provide assistance, and the smallest part (5 %) of the students would not be able to provide first aid to a choked adult.

Dunne et al. (2022) argue that choking is an important cause of preventable mortality. The most common help provided when choking is the Heimlich maneuver, back strokes and thoracic clicks. Recently, however, as an alternative, pump-based devices have been developed and began to be used to remove foreign bodies from the respiratory tract. Therefore, a question was asked to find out do students know what the first act is performed when an adult chokes. Nearly half (47 %) part of those surveyed believed that a Heimlich maneuver should be performed, about a quarter (22 %) should stimulate coughing, a fifth (19 %) part would hit the crotch 5 times with the palm of their hand, and about a tenth (12 %) part would call for emergency medical care (see Figure 1).

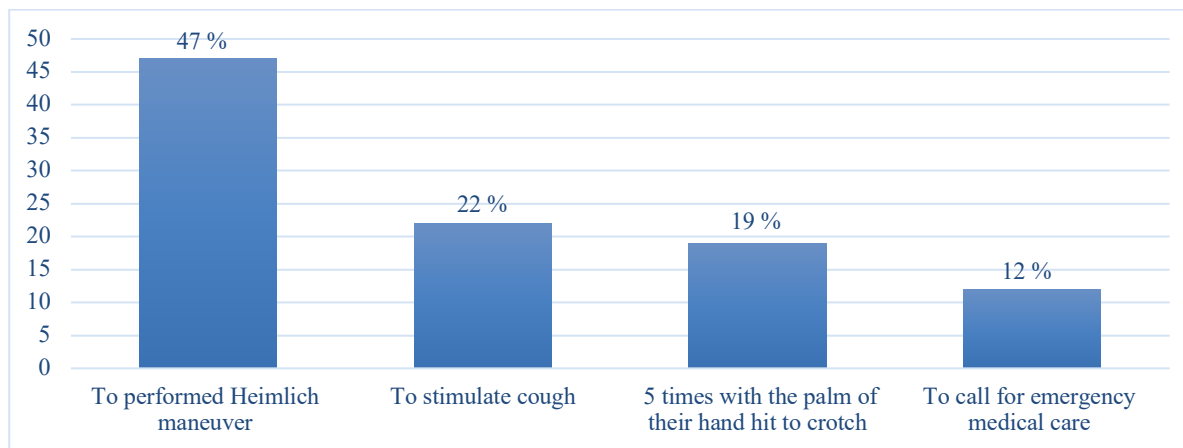


Figure 1. **The first action when choking in an adult**

Rodriguez et al. (2022) emphasized that the Heimlich maneuver is a first aid procedure for the treatment of foreign body obstruction of the upper respiratory tract. This skill is usually taught in basic life support and advanced cardiac life support lectures, but it is never given as much attention as basic of the initial resuscitation. In the visual question, which presented pictures with various performance techniques, it was asked which of the pictures demonstrated the Heimlich maneuver. In this question, we wanted to find out do the students knew what this maneuver looks like. The answers were encourage, as the majority (58 %) of the students chose correctly answer.

Distinguishing partial choking from complete choking is very important because of the further health problems. During partial choking, the foreign body reduces the respiratory tract, but does not completely block them, during complete choking, the upper respiratory tract are fully closed. Most often, the foreign body gets stuck at the vocal folds, leaving a partial entrance to the trachea, or is smaller than the opening limited by the vocal folds and enters the trachea, partially narrowing its lumen. In this case, a person can inspire, cough, and speak, but due to narrowed respiratory tract and coughing, breathing is abnormal, and develops respiratory tract underweight. In this case that the foreign body moves towards the vocal folds, partial choking can become complete (Strazdinienė, 2021).

Therefore, a question was asked about recognizing partial choking. The vast majority (68 %) of the respondents made the right choice, and argued that with partial choking, a person can talk, cough, his face is reddened, 30 % of the students chose that the affected person turns blue, tries to show with gestures that he is choked. The smallest part (2 %) chose the answer option, so that the injured person does not speak, does not cough (see Figure 2).

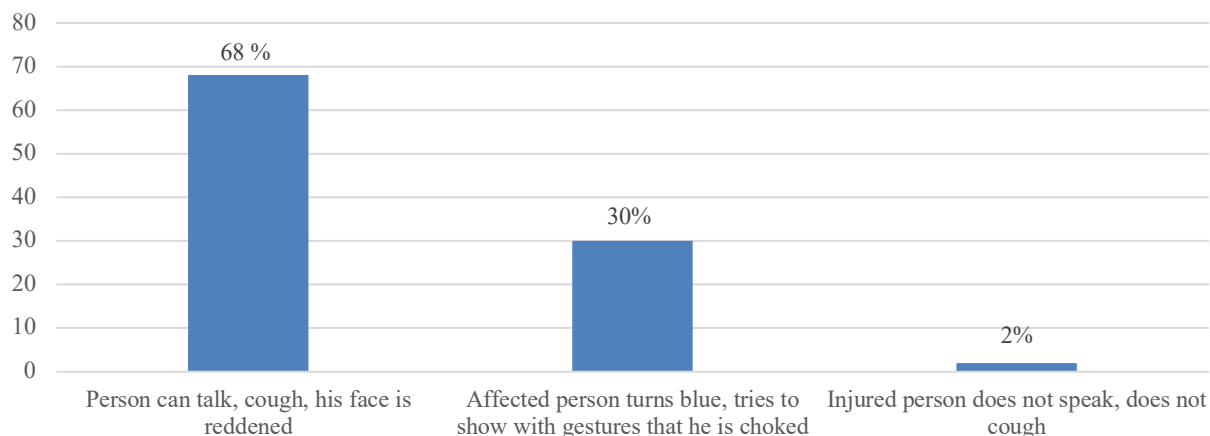


Figure 2. **Partial choking recognition**

Next, health science students were asked what not to do in case of partial choking. Respondents were fairly evenly distributed on the first statement that the Heimlich maneuver cannot be performed in the presence of partial choking. The majority (28 %) of the students believed that it is possible and necessary, a quarter (25 %) doubted that it is important, less than a fifth (16 %) part believed that it is strictly forbidden. The majority (42 %) chose not to start the initial resuscitation, one third (35 %) part doubted it should not be done, about one tenth (11 %) part said it could be done, and the smallest (6 %) part thought it's not important. In case of partial choking, the majority (41 %) of the students believed that it is necessary to stimulate cough, one third (33 %) part said that it is possible, one fifth (20 %) doubted it, 5 % said that it is strictly not possible and the smallest part (2 %) chose the answer option that it does not important. The next statement that you should not try to remove the foreign body with your fingers was distributed as follows: the majority (36%) of the students believed that it is strictly forbidden, 34 % doubted it, about a quarter (23 %) said that it is possible, 3 % that it is necessary and only 2 % thought it doesn't important. The statement that in the case of the partial choking it

is not allowed to drink was distributed as follows: the majority (42 %) of the respondents believed that it is strictly forbidden, 40 % doubted it, about one tenth (13 %) part believed that it is possible to give drink, only 3% considered it necessary, and the smallest part (2 %) said it is not important. The last statement was that you can't hit the crotch with your palm. Almost one third of the students divided themselves evenly into different answer options. 32% doubted this action, 27% believed that it is possible to do this, 24 % said that it is strictly forbidden, about one tenth (12%) part believed that it is necessary, and the smallest part (5%) believed that it does not important.

If a person who has choked is conscious, can cough or try to speak, he is not hit with the palm of his hand to the crotch, which is usually done to a choked person, but is told to cough effectively and often so that the foreign body is removed from the respiratory tract. Cough is also called the most benign way to remove a foreign body. Otherwise, choking will not help, but harm. In case of complete choking, if you see that a person is not breathe, the complexion begins to change, first of all, you should perform 5 hit with the palm of your hand to the crotch (Pranskūnas et al., 2017). Health science students were asked what kind of emergency care is provided in case of complete choking. The majority (76 %) of students chose to perform the Heimlich maneuver, about a tenth (8 %) part said that hit should be made with the palm of the hand to the crotch, 5 % chose to remove a foreign body, 6 % chose to perform initial resuscitation, and the smallest part (5 %) chose to stimulate coughing.

Williams et al. (2014) argues that the effects after choking can be divided into small and large. Minor effects: lack of oxygen in the arteries, bradycardia, laryngospasm, bronchospasm, neurological abnormalities and death. Significant consequences are laryngeal edema, pneumothorax and cardiac arrest. As a result of recurrent irritation of the alveolar epithelium develops edema, which can be supplemented by a secondary bacterial infection. Prolonged inflammation leads to the formation of an abscess, recurrent pneumonia, bronchoectasis and narrowing of the bronchi. The next question was to find out what further health problems are failure to provide timely or not provide emergency medical care in case of choking.

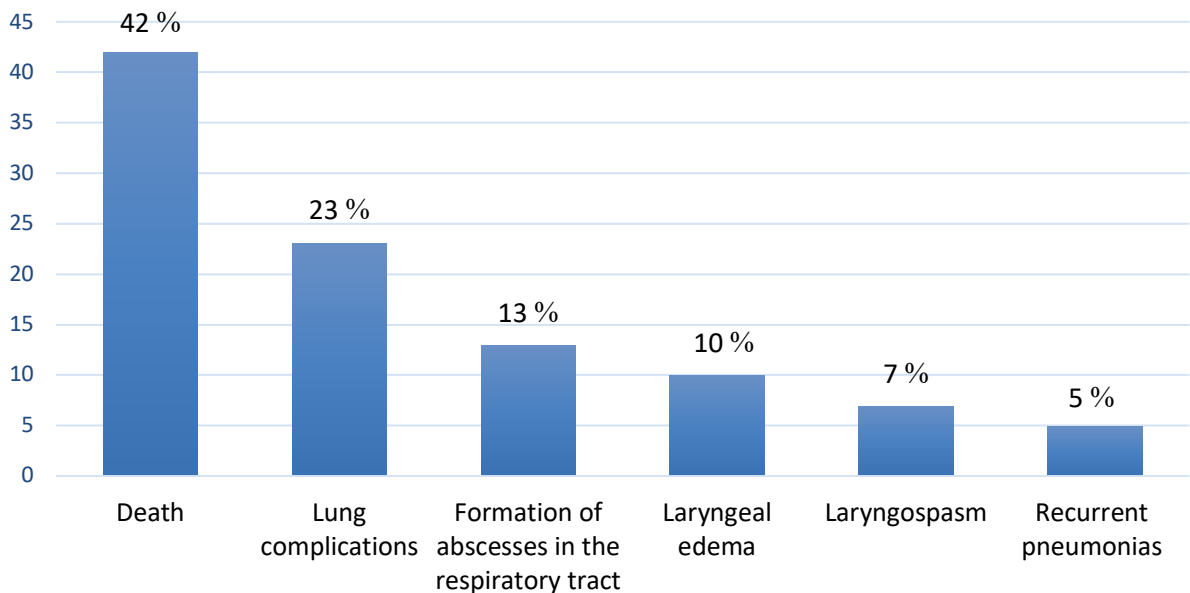


Figure 3. **The most common consequences of not providing timely assistance in case of choking**

The vast majority (42 %) believed it is death, about a quarter (23 %) of the respondents of lung complications. 13 % respondents chose that a common consequence of a health problem is the formation of abscesses in the respiratory tract, 10 % chose an answer that says it is laryngeal edema, 7 % laryngospasm, and the smallest part (5 %) of respondents said that these are recurrent pneumonias (see Figure 3).

CONCLUSIONS

- Elderly patients named the following causes of stress experienced in a medical institution: changes in medical institutions, especially during quarantine, too little communication of medical personnel with the patient and long queues for specialist doctors.
- The consequences of stress caused by elderly patients, according to the respondents, were: impaired work of the heart, increased arterial blood pressure, impaired blood glucose levels and disorders of the digestive system (reflux, increased acidity of the stomach, lack of appetite).
- During the study, the following ways of coping with stress were identified: physical activity, an objective approach to the situation, an activity with pleasant activities and sedatives or antidepressants, as well as herbal and homeopathic preparations.

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FEATURES OF THE INTEGRATION OF BILINGUAL CHILDREN IN NORWEGIAN KINDERGARTENS

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Abstract. The article presents the peculiarities of language development of preschool children in bilingual conditions, the role of kindergarten in the education of bilingual children, the importance of communication between parents and teachers. The paper presents the experience of the Norwegian pre-school education system in integrating bilingual children and the parents' attitudes towards the peculiarities of integration of bilingual children in Norwegian kindergartens.

Keywords: bilingualism, dominant language, emigration, re-emigration, language education, integration

INTRODUCTION

Increasing mobility of people is leading to a growing number of bilingual children. Bilingualism is becoming a necessity for expatriate children, whose parents are trying not only to settle in a new country but also to maintain their children's mother tongue. Children hear two languages from an early age, try to pick up features of both languages and adapt to their environment. This is not always easy and straightforward, especially when they start attending an educational institution such as kindergarten. In today's world, most people know what it is like to live or visit a foreign country. A foreign country is not your own country, where you feel loved, safe and fully prepared to participate in any of the country's social, economic, cultural, etc. activities. When you go to another country, all kinds of problems arise: language barriers, lack of knowledge, the complexity of social services, lack of understanding of how they work, etc. It is therefore not surprising that every immigrant in a foreign country needs both social and psychological support in order to integrate successfully.

The number of Lithuanians living in Norway is very high: local Lithuanian communities are forming and efforts are being made to preserve Lithuanian identity. Children of immigrants attend local educational institutions where the language of the country is Norwegian. Bilingualism is becoming natural as parents want to maintain proficiency in the Lithuanian language, but at the same time want their children to integrate smoothly.

Due to increasing emigration and re-emigration, the topic has received a lot of attention in recent decades, and the number of bilingual children in pre-school education is steadily increasing. As early as 2014, S. Paulauskienė studied the problems and perspectives of bilingual learning, in the same year R. Ivoškuvienė, R. Makauskienė paid much attention to the analysis of the language disorder in bilingual children. I. Hilbig (2020) and I. Televičiūtė, D. Rimavičienė (2015) described bilingualism as part of emigration, one of them investigated the bilingualism of Norwegian families, the other the mother tongue skills of English Lithuanian children. The topic is also relevant in foreign literature. Y. Lo (2018) focuses on bilingualism and children's creativity, while R. Pransiska (2017) also delves into children's active bilingualism. Norwegian language researcher A. Hoigård (2006), in describing the development of children's language itself and its development, mentions the specificities of bilingual children's education, pointing out that in Norway more and more children entering kindergarten are bilingual, and that this topic is of great importance for both parents with bilingual children and educators meeting such children in the educational institution.

In the course of research on the integration of children of immigrant families, it became clear that there is not much research on this topic in Lithuania and abroad. Only a few of them deal with the strategies of involvement of Lithuanian immigrants in Norway, the threats of emigration from Lithuania to family values, etc. However, the problems of integration of children of Lithuanian families are mostly discussed only in social networks and conferences, where personal experiences are shared or insights and advice from psychologists and sociologists are given. Taking into account the findings of scientific articles by foreign and Lithuanian authors, it was relevant to carry out research that could reveal a more detailed situation of the process of integration of children of Lithuanian families in Norway. Lithuanian emigrant families and their children have to adapt and integrate into the social environment of a foreign country, but the problems they encounter require not only the intervention of family members and other relatives, but also of the state. However, assistance measures are not always effective or sufficiently implemented to fully benefit immigrants. On the other hand, it can be assumed that immigrants are not sufficiently interested in the help and services provided to them.

SPECIAL FEATURES OF EDUCATION FOR BILINGUAL CHILDREN

The concept of bilingualism and its impact on child development. In the 20th century, bilingualism was seen as a negative phenomenon that could affect a child's development and slow it down. Bilingualism was believed to cause confusion, uncertainty and lack of self-confidence. It was not an advantage, but rather even a disadvantage

(Krivickaitė, 2015). Bilingualism has been defined by researchers in many different ways. But most often it is understood as a person's ability to communicate in more than one language. This does not mean that the level of both languages will be exactly the same. One relevant criterion for identifying bilingualism is the period of language learning: early childhood or post-puberty. In the case of simultaneous bilingualism, the child acquires two languages from birth. This situation is most common in families where the parents are of different nationalities and speak different languages. Research shows that children who grow up in a bilingual environment from a minority have certain cognitive, neurophysiological and socio-emotional advantages. Bilingualism includes the ability to understand more than one language. But it is most often defined as the constant use of two languages, the possession of a grasp of the languages, the ability to develop a dialogue in both languages. Early bilingualism is usually the focus of research. Research on early bilingualism has been stimulated by the growing number of mixed families (Hilbig, 2020).

Bilingualism is not a new phenomenon in Lithuania, but it is still difficult to define due to the different perceptions of bilingualism. However, there is a general consensus that bilingualism is important and often has positive factors for the bilingual person. Knowing several languages is becoming an advantage and, in recent years, even a natural act. In Lithuania, for some time bilingualism was associated with Polish and Russian as complementary to Lithuanian. In recent years, these languages have been displaced by English. And not only because this language is more often chosen in schools, but also because Lithuania, as a country, is becoming more oriented towards the Western world: Lithuanians go to work in English-speaking countries, English is widely spoken in the world, and families are more often formed where English is used for general communication (Paulauskienė, 2014). The term bilingualism in foreign literature is often associated with the English term "mother tongue" or the Norwegian term "morsmål språk", both literally translated as "mother tongue", meaning that the child's mother tongue, the most important language of the child, is the same as the mother's language.

For many people, bilingualism is not a matter of choice, but simply a necessity of life. This is a common situation in expatriate families when people change their country of residence. For reasons of work, education, integration into a new community, it is inevitable to learn a second language. In these cases, language learning is particularly important for children (Hilbig, 2020). Societal attitudes towards bilingualism are diverse and heterogeneous. On the one hand, it is seen as a great advantage, a sign of greater opportunity and sophistication to be able to speak at least several languages. From another perspective, bilingualism can lead to assimilation and language interference. However, these fears are completely unfounded when it comes to true bilingualism. In the case of bilingualism, especially at an early age, the levels of proficiency in the two languages are very similar. Problems can arise where one language is more dominant, is spoken more frequently and may override the other. The second language is then "weakened" and gradually less spoken, resulting in a loss of language skills, which are less well developed (Televičiūtė, Rimavičienė, 2015). Parents play a significant role in the development of a child's bilingualism. It is people from different cultures and their communication that is the essence of bilingualism.

According to psycholinguistic research, bilingualism is considered to be one of the important factors that have a positive impact on a child's overall development. Bilingualism is still a topic of considerable debate among researchers and is not viewed in a one-sided way. Negative attitudes towards bilingualism prevailed in the mid-1960s, when both bilingualism and multilingualism were considered to have a negative impact on the child's most important cognitive skills. As well as the development of the mother tongue. This view was due to methodological inaccuracies in the research conducted, which were later eliminated and bilingualism was, as it were, rehabilitated (Ivoškuvienė, Makauskienė, 2014).

It has been noted that the influence of bilingualism on child development can be twofold, but more extensive research and observation of bilingual individuals has allowed us to assess the significance of bilingualism on child development.

Researchers have looked at the impact of bilingualism on a child's development from both a positive and a negative perspective. The positive effects of bilingualism are distinguished as follows:

- Bilingualism improves a child's creativity and mental level. Bilingualism can have a positive impact on a child's intellectual abilities, economic growth and overall development;
- Knowledge of more than one language enriches a child's overall knowledge of the environment. Bilingualism widens the circle of communication, so that a bilingual child is likely to be more communicative and to build relationships with other speakers;
- A bilingual child is more interested in different cultures, new customs, and adapts more easily to new environments (Televičiūtė, Rimavičienė, 2015).

However, in addition to the positive effects of bilingualism, there are also negative aspects of the impact of bilingualism on a child's development: If the two languages are not clearly separated, the child may confuse words and speak a mixture of the two languages; learning two languages puts an extra strain on the child's psyche, which can lead to overwork, irritability, and other signs that learning two languages is too difficult; in the absence of a clear structure of bilingual learning, mixed speech may develop in the child's subconscious before the two language systems have been separated, which can lead to errors in speech, lexis and inability to formulate concepts (Televičiūtė, Rimavičienė, 2015).

For a bilingual child, the environment in which he grows up, the educational methods that are selected and applied are very important. Specialists say that a child's language develops when he grows up in a good linguistic environment. The language background is very important, which depends on the social and psychological background. If the child is a foreign language and has to start learning new languages in kindergarten, you can quickly notice changes in the child: he will feel confused, he may become withdrawn, withdrawn. Since the child will barely understand the new

language and will see how the people around him communicate with each other, he may start to feel rejected, not needed by anyone. Therefore, the child's behavior will change. In order to avoid this, the gradual integration of the child into the environment and the provision of assistance are important. Failure to achieve this can have negative consequences not only for the child's speech but also for his emotional state. It is noticed that such difficulties arise for children in emigration, because environmental changes and other aspects also contribute to language differences (Mazolevskienė, Montvilaitė, 2013). The brains of bilingual children work and work much faster, their cognitive development is much broader than that of monolingual children. Their advantage can be called the bilingual advantage. Bilingual children often outperform monolinguals in other scientific results as well, this is due to the fact that parts of their brain work twice as much from the first days of the child's birth, hearing two languages around them (Helland Gujord 2017).

THE EXPERIENCE OF THE NORWEGIAN PRESCHOOL EDUCATION SYSTEM IN THE INTEGRATION OF BILINGUAL CHILDREN

Norway, a country with many immigrants, people from different countries. Therefore, the Norwegian education system has a considerable challenge to help families arriving in the country who want to encourage their children to speak both their mother tongue and Norwegian to adapt.

The Norwegian pre-school education system pays a lot of attention to the holistic education of children and to integrating language teaching and literacy into education. However, Norway receives significantly more people arriving from different countries of the world. Therefore, in addition to the Norwegian language, many people seek to keep their mother tongue and pass it on to their children. In 2018, about 18.3 percent of children of different cultures were recorded in the country. Such percentages show that the number of children whose birth country is not Norway has increased in the country and encourages the country to find flexible solutions so that all children receive appropriate education that matches their capabilities and abilities (Alstad et al., 2020).

The Norwegian education system is adapted to children from different countries and cultures of the world. The local communities, which are included in the education system, are extremely effective, thus giving children the opportunity to feel safe and adapt to the new environment faster. Kindergartens are often staffed by specialists who speak at least several languages fluently. This significantly expands the opportunities for bilingual children to develop both languages in the educational institution, and not just one, the common language. This increases the connection between educational institutions and the community, helps its members to better understand how children are educated in kindergartens, and shows the important role of communities (Engel et al., 2015).

Conducted studies assessing the situation of bilingual children in Norway and Denmark showed that the priority in both countries is first given to the state language. And this affects bilingual children, because in rare cases they can communicate in two languages in kindergartens and later in schools. It is noticeable that there are not so many specialists in Norway who can educate different bilingual children. More often, there are recommendations for parents to help their children learn Norwegian if it is not their native language, but the native or second language is not given additional attention (Jahreie, 2021).

The Norwegian education system recognizes the benefits of languages for children at an early age. And promotes linguistic diversity. However, there seems to be a division, with languages being recognized as useful for human knowledge and broadening horizons for individual development, and the bilingualism of immigration with negative connotations. The research carried out for the Norwegian government as a guideline in terms of bilingualism has shown that it is beneficial for an individual to know at least several languages and that it is appropriate to encourage people to speak several languages. However, the second language is perceived more as a later choice at school, rather than learned at home, like the language of the parents. Since Norway has long been dominated by a monolingual ideology, it is not surprising that the country finds it difficult to accept a large number of immigrants with their languages (Alstad et al., 2020).

Although many studies show that educators with knowledge and experience in working with such children and who are able to speak several languages are important for the education of bilingual children, the number of bilingual assistants in Norway is constantly decreasing. According to research, educators are worried that bilingual children do not receive the necessary help and are not encouraged to maintain and improve both languages. It is also noticeable that many educators lack knowledge and experience on how to educate bilingual children (Romoren et al., 2023).

RESEARCH RESULTS

The aim of the research is to reveal the peculiarities of the integration of bilingual children in Norwegian nursery schools.

A quantitative (questionnaire survey method) study was conducted to achieve the research objective. The questionnaire survey was conducted in 2023. March - April The main condition of the survey is that at least one of the parents should be Lithuanian and speak Lithuanian with the child and live in Norway for at least two years. 180 respondents participated in the survey, of which 89 percent. women. Most of the time, it is women who solve children's education problems and communicate with kindergarten teachers. The majority of families (89.4%) had children after coming from Lithuania and settling in Norway. Only a tenth of the respondents indicated that they had children before

moving to Norway. Arriving in a new country means big changes, especially if there are children in the family. Research reveals that foreign families living in Norway are highly motivated to teach their children the native language. Families where one of the parents is Norwegian usually choose only one language model (Norwegian is spoken in the family).

The purpose of this study was to find out whether parents were interested in the linguistic integration of non-native children in preschools before coming to Norway. It turned out that parents had little interest in the linguistic integration of children in Norwegian preschools. 80.6 percent of all respondents who participated in the study, indicated that, upon arrival in the country, information about the linguistic integration of children taking place in educational institutions was not relevant. 16.7 percent briefly wondered what to expect. Only 2.8 percent stated that Norway's linguistic integration of children in preschools was one of the reasons for choosing this country.

In order to promote children's bilingualism, it is important that it is nurtured at home as well. Research shows that the influence of the family on bilingualism is extremely high. If both languages are also used at home, it is likely that the child will acquire them more smoothly and better, and will experience fewer problems when using them. During the research, it was found that mostly only Lithuanian is spoken in immigrant families, as indicated by more than half of the research participants. Only 25.6 percent stated that they speak both Lithuanian and Norwegian at home and 2.8 percent noted that Lithuanian and English are spoken at home (see Figure 1).

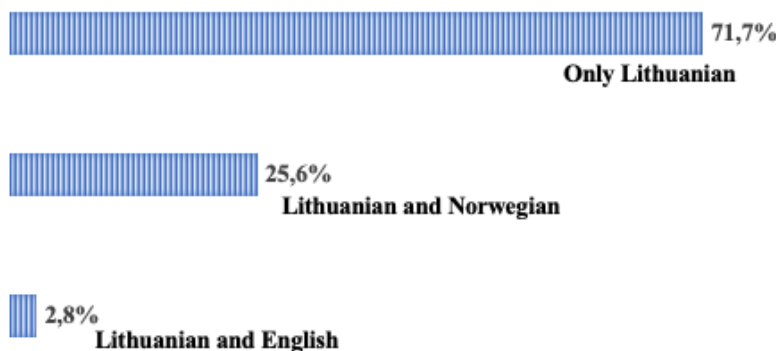


Fig. 1. Languages spoken at home

Based on the obtained results, it can be assumed that parents expect their children to learn Norwegian when they start attending an educational institution. This opinion is expressed by Klizaitė et al. (2020), according to which bilingual children speak one language in a preschool educational institution, while the second language is supported only at home by one of the parents. As a rule, educators working in kindergartens use the national language that all children understand, so a bilingual child has to adapt. Anticipating such a situation, or already having experience, parents tend to speak at home in their native Lithuanian language, which is acceptable to them, because they themselves have not learned Norwegian well, or they think that their children will learn Norwegian naturally from the environment. Not only communication in the family, but also reading books in a certain language, watching TV, listening to the radio can speed up language comprehension.

During the research, it became clear that most books are read and TV is watched in Lithuanian, however, a significant number of parents use both languages when reading and watching TV, as answered by 79 respondents. It can be assumed that receiving and understanding information is still more convenient for Lithuanians who have come to Norway in their native language. Although a fairly significant percentage, almost half, chose the answer that they use both languages. Most often, television is watched in both languages at home when one of the parents is Norwegian. If both parents are Lithuanian, local information, such as local news, is relevant to them in Norwegian, so the habit of watching TV in both Lithuanian (so as not to distance themselves from the home country) and Norwegian is naturally formed (see Figure 2).

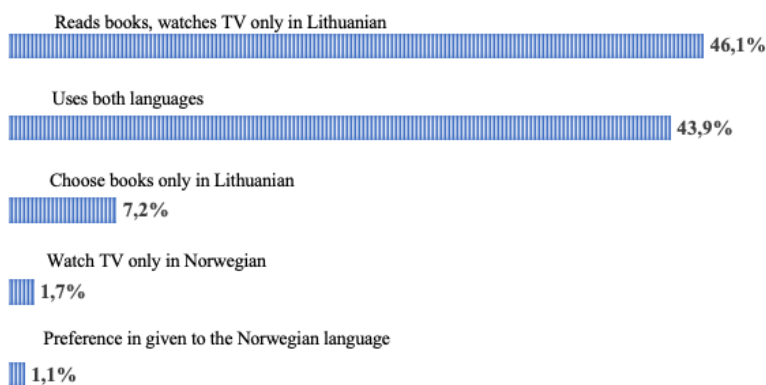


Fig. 2. The language in which books are read and TV is watched

Evaluating the importance of nursery-kindergarten for a child's bilingualism, different perspectives emerge. In one respect, the nursery school, as an educational institution, can clearly contribute to the promotion and support of the child's two languages. On the other hand, a kindergarten can support only one (usually the state) language, so the child's second language will not be developed and will suffer.

For parents whose bilingual children start attending an educational institution, it is important that pedagogues pay enough attention to them. Research participants were asked whether the educational institution was interested in their children's language and culture. It was established that educational institutions are interested in the language used by students and their parents (see Figure 3).

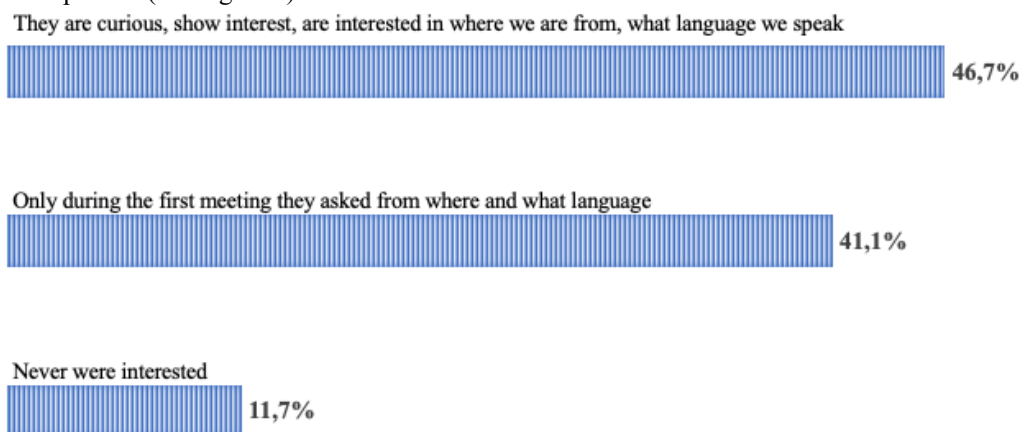


Fig. 3. Educators' interest in the language and culture of the subject

Integration into a new environment can be difficult, especially if greater cultural and historical differences emerge. More than half of parents feel equal. A small part, 16.1 percent, said that Norwegians communicate, but coldness is felt on their part. A tenth of the respondents stated that the community of the educational institution is minimally open. Researchers analyzing the peculiarities of the education of bilingual children say that the contact between parents and teachers can help children feel safer in the educational institution, which would help reduce the tension when they start attending it.

It is important for bilingual children to get more help in the process of language development, because they need to learn the characteristics of two different languages at the same time. According to the insights of Bikelienė and the authors (2022), the place of first and second languages in the family is intertwined. The choice of home language is determined not only by the language of the parents, but also by the language of the educational institution, the peers with whom one communicates, and the efforts and support provided by the specialists of the educational institution. Study participants were asked if they felt that children were getting more help with language development.

More than half of the research participants say that their child is educated together with other children in the same way, that bilingual children are not given special attention or additional education is carried out. Educators are trying to pay more attention to children's Norwegian language education. A tenth of the survey participants believe that their child is often treated more leniently because he is bilingual. It can be assumed that bilingual children in Norwegian pre-schools are not provided with additional support for language development, and therefore the Norwegian language may develop more slowly or not be as fluent (see Figure 4).

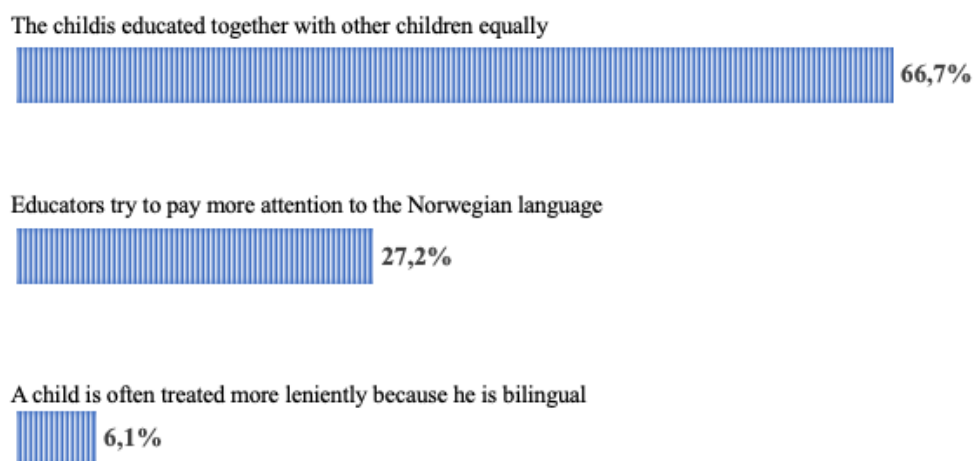


Fig. 4. Children are provided with support in language development

The integration of migrant children in an educational institution can be successful when efforts are made by both children's parents and educators. Daukša (2017) states that Norwegians respond positively to migrant children by accepting them as their own, especially if they are Europeans. The category of foreigner in Norway is perceived more through race than through nationality. During the research, it was found that parents, when sending their children to educational institutions in Norway, do not feel exceptional towards Norwegian children. This was confirmed by 85.6 percent. respondents. Only sixteen parents believe that their child receives more attention and help. Ten research participants stated that less attention is paid to the child. Based on the results of the study, it can be assumed that migrant bilingual children in Norwegian preschools are educated in the same way as Norwegian children and do not receive special attention due to their nationality or bilingualism.

In order for bilingual children to develop their abilities in both languages equally, it is important that they receive similar attention. Bilingual children may learn both languages less well in one of them. This is especially evident at an older age, when learning to write. The aim of the research was to identify whether an additional pedagogue for bilingual children who speaks (and educates) Lithuanian is appointed in Norwegian preschool institutions. The research data showed that bilingual children did not receive additional help, 82.2 percent of parents said it was not offered. An extremely small part (almost a tenth) indicated that the child was helped by a Lithuanian-speaking employee. Only thirteen interviewees stated that they had an assistant who spoke Norwegian. It can be assumed that Norwegian preschools do not provide opportunities for migrant children to receive additional education in their native language. Although a small part of the research participants indicated that the child received help from a Lithuanian-speaking specialist, it can be assumed that it was an employee of Lithuanian origin working in an educational institution.

When a bilingual child integrates in a new environment, it is not only important to support his native language, but it is also important that help is provided in the education of the language that is spoken in the educational institution. Figure 5 provides information on additional support for developing Norwegian language skills.

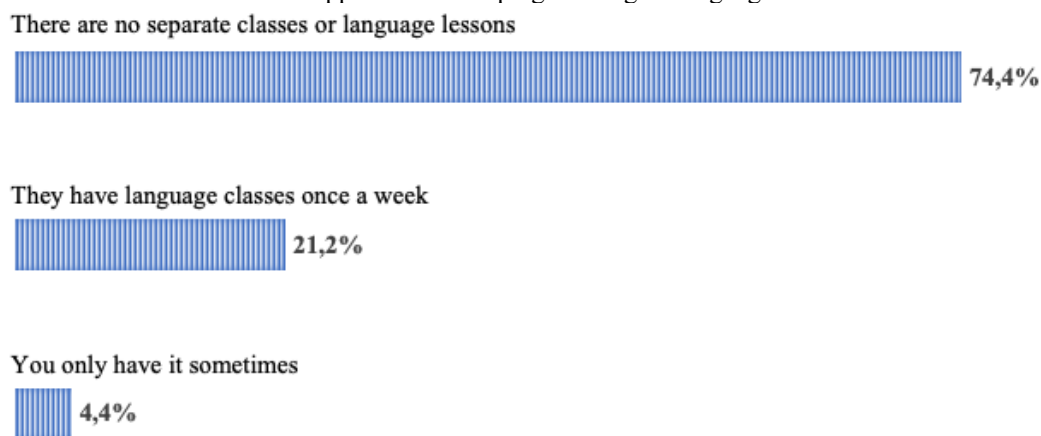


Fig. 5. **Additional Norwegian lessons**

During the research, it was found that the educational institution usually does not initiate separate classes for bilingual children in Norwegian. This is exactly what two thirds of parents indicated. 21.2 percent study participants stated that such language classes are held.. Eight interviewees said that children have additional Norwegian classes only sometimes. Summarizing the research data, it can be assumed that Norwegian educational institutions do not provide additional classes for foreign bilingual children. If such a need exists, parents should look for classes on their own initiative.

In early childhood, parents play an important role in supporting and promoting children's bilingualism. Their contribution to the development of children's languages is great, because it is at home that language development begins, which is then continued in an educational institution. Suleaman et al. (2017) studies revealed that children learn better the language supported by their parents: in which they speak, in which activities and entertainment that are interesting to children take place. It encourages children to get to know and be more interested in the language, it becomes a natural stimulus for learning. During the research, it was found that parents are not inclined to send their children to Lithuanian schools, where children could improve their Lithuanian language skills and support them. A little more than half of the research participants indicated that their children do not attend such schools. As support for Lithuanianness, parents mentioned visiting their birthplace, which also contributes to the education of children's Lithuanian language.

Additional activities in the native language allow bilingual children to better understand it, learn new words and expressions. It is relevant that the language develops in a medium familiar to children by integrating games and activities that are pleasant for them, which would evoke a lot of good emotions. After investigating the fact that parents do not allow their children to attend additional lessons in Lithuanian without seeing the need, they were asked what activities they engage in to develop their child's native language (see Figure 6). The obtained data show that parents tend to spend their free time with their children, during which they communicate in Lithuanian, which enriches children's language skills.

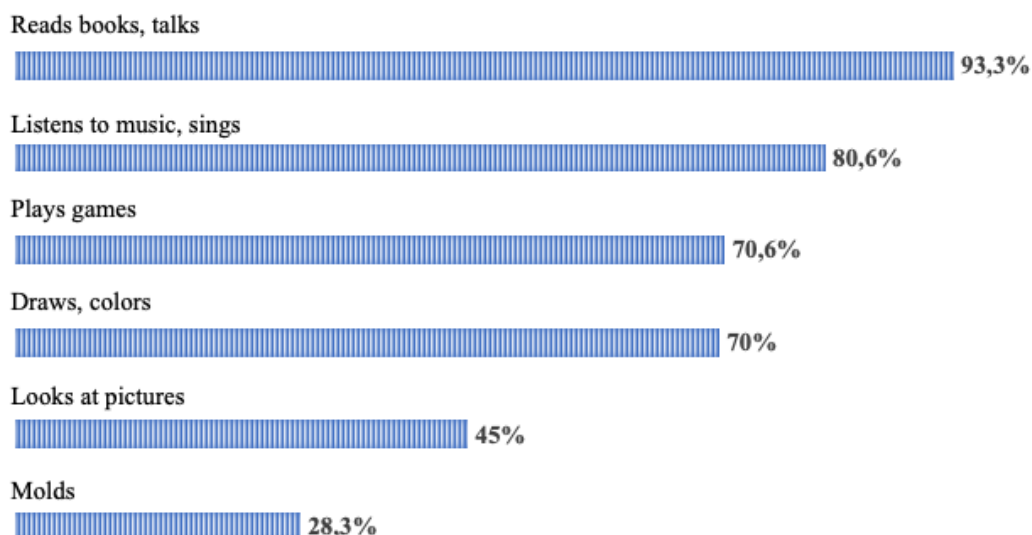


Fig. 6. Additional parent activities with children in their mother tongue

When parents were asked an open-ended question about what kind of help they miss from the educational institution, the majority of parents indicated that they do not miss any additional help, and that their child's education seems adequate. Only a few respondents noticed that they miss a Lithuanian-speaking teacher or more Norwegian language teaching. More than eight tenths of the respondents stated that they are satisfied with the education system and activities in the kindergarten. They say that they understand that this is the education system in Norway and they cannot expect a different approach and education.

Summarizing the research data, it can be said that parents came to Norway in order to construct their lives and create well-being, but this choice was not connected with the possibilities of children's education. The children of the majority of the study participants were born while living in Norway, so it can be assumed that the choice of bilingual education was the decision of the parents themselves, because future plans are associated with living in Norway. The majority of parents speak Lithuanian at home, which gives children the opportunity to naturally get to know the basics of the language and develop it. Most of the respondents indicated that children started attending the educational institution before they could speak, which allows us to say that it is in the educational institution that language development takes place most intensively.

It was established that when the children started attending the educational institution, there was an interest in their native language and culture, but not much attention was paid to it, or additional steps were taken to get to know the peculiarities of the language and culture better. In most cases, all children are educated equally, regardless of bilingualism. Bilingual children usually did not receive the help of a Lithuanian-speaking pedagogue, simply because there are very few such specialists in educational institutions.

CONCLUSIONS

- According to the theoretical analysis of the scientific literature, children's language characteristics may develop differently in the case of bilingualism. This is influenced by the environment surrounding the child, the reasons for bilingualism, the attitude of parents and teachers. Whether a child becomes bilingual or monolingual is determined by the parents. They decide whether the child will speak one or two languages. Bilingual children make more efforts to adapt to a new environment and they succeed in doing so if they feel the support of those around them. Bilingualism can be early, when the child learns to communicate in two languages from infancy or early childhood, or late, when the second language is learned independently. Most often, bilingualism is common in mixed families, where parents communicate in different languages and want to pass on their linguistic experience to their children. When educating bilingual children, educators must assess their progress and provide assistance if needed.
- The study revealed that bilingual children are integrated in the Norwegian preschool education system in the same way as monolinguals. In rare cases, additional conditions are created for them to further improve their Norwegian language. Although educators are interested in the child's native language, country, and nationality, this does not create additional conditions for native language education. There is also no focus on maintaining the child's native language. Migrant children are not excluded from the community.
- The analysis of research data shows that, from the parents' point of view, the integration of bilingual children in Norwegian preschools takes place only in Norwegian. In very rare cases, children also receive Lithuanian language lessons. Parents are confident in the quality of education, but miss additional lessons that would help their children learn Norwegian better. Parents would like a closer connection with the educational institution, so that pedagogues are more

interested in the children's native language, words, customs, this seems to them to be a significant part of children's integration, which can facilitate children's integration.

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ORGANIZATIONAL SUPPORT FOR REMOTE WORKERS IN EXTREME SITUATIONS: THEORETICAL INSIGHTS

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Abstract. Due to extreme situations caused by natural, technical, ecological, or social reasons or acts of war, to ensure the continuity of operations, organizations must adapt to new changes related to changed working conditions, when direct contact with people is avoided and a form of remote work is switched to. This means that at such a time, organizations must reorganize work processes and provide support to employees to ensure the successful implementation of remote work. For organizations seeking to ensure the productive work of employees remotely, technology alone is not enough, they need appropriate employee qualifications, motivation, and organizational support, which plays an important role in shaping employee job satisfaction.

Keywords: organizational support, remote work, extreme situation

INTRODUCTION

The COVID-19 pandemic, which unexpectedly hit the world more than three years ago, changed the nature of work - the form of remote work, which is the most recommended during an emergency, was mandatory, at the request of state authorities, to protect against the spread of the virus. Thus, at an extreme moment, organizations had to reorganize work processes and provide support to employees to ensure the successful implementation of remote work to remain competitive in the market.

Although organizational support is considered one of the success factors in the implementation of remote work (Allen, Golden and Shockley, 2015), it should be noted that the aspects of organizational support for employees in the context of remote work are not particularly widely analyzed by both foreign and Lithuanian researchers. Proponents of organizational support theory treat organizational support as the organization's concern for the well-being of employees (Collins, Hislop & Cartwright, 2016) and note that organizational support determines employee job satisfaction and increases work productivity (Rhoades and Eisenberger, 2002). Therefore, in order to ensure the job satisfaction of telecommuters, according to Bentley et al. (2016), the employee needs all kinds of support from the organization, which will allow him to satisfy security and social-emotional needs, such as recognition, and self-confidence. After analyzing the scientific literature (Bosua, Gloet, Kurnia, Mendoza, & Yong, 2013; Chiaburu & Harrison, 2008; Collins et al., 2016; Cooper & Kurland, 2002; Golden & Viega, 2005; Smith, Patmos, & Pitts, 2015), it was noted that before the COVID-19 pandemic, the studies on employee job satisfaction in the context of remote work were focused on voluntary remote workers, and the forms of support for remote work and their impact on employee job satisfaction were studied fragmentarily. The contribution of Lithuanian scientists to this field is much more modest: Tamašauskaitė (2013) identifies features that are characteristic of remote work regulation according to labor law; Nakrošienė and Butkevičienė (2016) discuss the features, advantages, and challenges of remote work; Nakrošienė, Bučiūnienė and Goštautaitė (2019) identify the features of remote work from home. Thus, there is a lack of scientific works that would analyze the issues of support for remote workers in extreme situations.

The purpose of this article is to reveal the theoretical insights of the organization's support for remote employees in extreme situations.

THE CONCEPT OF ORGANIZATIONAL SUPPORT

The construct of *Perceived Organizational Support* takes an important place in the modern literature of management and organizational psychology. Based on social exchange theory (Blau, 1964) and the norm of reciprocity (Gouldner, 1960), organizational support theory states that by providing resources to employees, it motivates employees to help the organization achieve its goals when both the social and emotional needs of employees are met (Rhoades and Eisenberger, 2002). According to Eisenberger and Stinglhamber (2011), social exchange and self-improvement in the workplace are mutually beneficial for both the organization and the employee. Employees' behavior is determined by the environment, they are not interested in internal cognitive events. Behavior is controlled only by supportive factors that increase the likelihood that the act will be repeated if an immediate outcome is assessed. Support theory ignores the internal state of the individual and focuses on what happens to the person when he takes some action (Dubauskas, 2006).

Proponents of organizational support theory explain organizational support as the organization's concern for the well-being of employees and the evaluation of their work. It is worth noting that perceived organizational support is an individual-level construct that captures individual employees' subjective perceptions of how they are cared for and valued by the organization (Swift and Virick, 2013). Bentley et al. (2016) believe that organizational support has a significant impact on employees' job satisfaction, commitment and loyalty to the organization and the proper maintenance

of the microclimate. This confirms that support theory is guided by a behavioral approach, proving that organizational support determines employee behavior - employees cope better with daily tasks and experience less stress (Thakur & Kumar, 2015), all of which leads to employee job satisfaction and commitment to the organization.

Rhoades and Eisenberger (2002) highlight the following key aspects that increase employees' perceived organizational support:

- *equity*, which refers to the fair distribution of organizational resources to employees. It makes employees feel that the organization cares about their well-being. This justice includes social and structural justice. Structural justice includes the formal rules and policies of the organization and reflects their evaluation - the fairness of working hours, the remuneration received by the employee in comparison with other employees of the organization (social justice);

- *manager's support*, which includes employees' evaluation of their manager's contribution to their well-being. The manager is responsible for organizing the organization's activities and evaluating subordinates. According to Johnson (2019), it is important for a manager to know what their employees are doing, and when working remotely, this becomes more difficult, because the manager does not have the opportunity to meet with employees at their workplace and ask what their situation is, if they are facing any problems. If managers blindly rely on information provided by employees through digital channels such as email and video chat platforms, they can easily be misled. Therefore, managers should make more efforts in communicating with their team members and take the initiative to communicate with them frequently to encourage communication with each other and with the managers themselves (Johnson, 2019). According to Orsini and Rodrigues (2020), managers play an important role in ensuring that employees remain motivated regardless of where people work and whether they work alone and communicate with colleagues only by phone, email, and video chat. Studies conducted by researchers have also shown that managers who foster a needs-supportive approach strengthen employee motivation and achieve better results and stronger job satisfaction. The best way managers can support remote workers is to foster close relationships and open communication, give people autonomy and show trust in them, but at the same time set clear guidelines so that they feel organized and work effectively (Orsini & Rodrigues, 2020). Managers could set clear guidelines for remote work, and it's better to over-communicate rather than under-communicate to keep employees connected. Employees evaluate the manager's actions as "pleasant" and "unpleasant", this is treated as organizational support;

- *working conditions and organizational incentives*. Good human resources practices show that employee recognition, a fair reward system, employee promotion, workplace and safety, and organized training are factors that determine greater perceived organizational support. According to Van der Lippe and Lippényi (2020), working from home can lead to social and professional isolation, which hinders knowledge sharing and undermines job prospects. Such a situation, according to the authors, can be mitigated by effective management strategies. Using the right platforms that facilitate collaboration and knowledge sharing can help optimize the work of teams with many remote workers. Nijp, Beckers van de Voorde, Geurts and Kompier (2016) state that the use of information and communication technologies creates conditions for social communication and establishing connections, helps to avoid psychological isolation and maintain high-quality social functioning and relationships of employees.

Meanwhile, Karanik and Cauchi (2020) analysed organizational support for remote workers, and emphasized that remote work should not be taken for granted, but rather as a work arrangement between employer and employee where mutual benefits are obtained. The authors identify the following strategic directions of organizational support:

- remote work programs must be carefully designed, described and approved by employees, rather than simply assumed to be appropriate; work-from-home agreements must be formalized and adhered to;

- managers must ensure effective communication between those working remotely and those working in offices, including informing those working from home about all the news of the organization;

- the discipline of discussions must be ensured, especially when holding meetings remotely. Appropriate agreements should be drawn up and approved prior to meetings to ensure smooth communication and effective time management;

- managers must inform office workers about remote workers' work schedules and contact information on how to contact them;

- managers must suggest and perhaps somewhat influence decisions on how work will be done at home, as well as provide equipment, recommend a suitable space;

- guidelines are needed to establish regular communication between remote workers and those in the office to ensure that such communication does not become a burden on remote workers;

- organizational administrators must be prepared to implement remote work programs, particularly in terms of expectations, monitoring, supervision, performance measurement and evaluation;

- reserve systems must be prepared in case of technological failures.

However, successful remote work is not possible without the efforts of employees. Fan, Zhao, Bin, Chen, Wang, Song, & Yi, H. (2020) note that managers planning for telecommuting should encourage employees to create an ergonomic workplace at home; follow routines and maintain boundaries between "work" and "home" space; stay social, as socializing with colleagues reduces stress. In addition, the authors draw attention to the fact that managers must also take care of the well-being of their employees because the well-being of employees can reduce the number of absenteeism and increase work engagement and operational efficiency. Investments in technology, such as messaging and video and voice calling platforms, can help keep teams connected, the authors say. It is important to invest in a recognition platform that allows employees to receive feedback.

Organizational support theory allows us to state that the goal of organizational support is to take care of the well-being of employees, ensuring the provision of the necessary equipment and meeting the social and emotional needs of employees, thus achieving the goals of the organization, creating mutual benefits for both the organization and the employee, working both in a physical workplace and in a flexible form of work, i.e. remotely.

FORMS OF ORGANIZATIONAL SUPPORT FOR EMPLOYEES WORKING REMOTELY

Economic, social, and technological changes and today's challenges, such as the disappearance of borders between countries, labour migration, the increasing value of intellectual work, as well as extreme situations, such as a pandemic, quarantine, the presence of war, change working conditions and labor relations. Rapid development of modern technologies allows working remotely from home. However, as pointed out by Collins et al. (2016), in order for an employee to feel job satisfaction while working remotely, organizational support is necessary, which in the scientific literature is understood as the organization's concern for the well-being of employees.

Kowalski and Swanson (2005) identify the following success factors for remote working:

- support from all levels of management, especially the line manager;
- technological assistance and provision of necessary tools and equipment, training on how to use them;
- communication and relationships based on mutual trust between employees.

Although the analysis of research sources (Chiaburu and Harrison, 2008; Collins et al., 2016; Bentley et al., 2016; Kim and Wang, 2018) shows that employee relationships with customers, co-workers, and managers are important for work productivity, it is still necessary to note that there is little research that focuses on social support for those employees who work remotely. Remote work can negatively affect work relationships with supervisors and colleagues, as well as lead to an "us and them" cultural division. According to researchers, as the social support of employees increases, the psychological stress experienced by the employees during remote work decreases. However, as shown by research conducted by researchers, organizational support includes not only helping employees in performing activities but also focusing on providing emotional support to the employee, which increases employee job satisfaction.

Jolly, Kong, and Kim (2021) suggest categorizing social support by form, content (type), and source. First, the form of social support is treated as an employee's behaviour or perception of the provision or use of social support, or the perceived availability or receipt of social support. Research has revealed a gap between employees' actual use of support and their perception of the availability of support. Second, according to the authors, social support differs according to its content (type). House (1981) distinguishes four main types of social support:

- *emotional support* (psychosocial support such as empathy, caring for the employee, providing sympathy, listening to employees' problems, helping them find a solution);
- *instrumental support* (providing the resources necessary to perform the work);
- *informational support* (providing information based on the employee's needs);
- *appraisal support* (providing specific information about the employee's activities, his behaviour, which allows to evaluate his work).

Sias (2009) agrees with the opinion of House (1981) and also distinguishes emotional, informational and instrumental support as the main types of social support for employees.

Social support can come from supervisors, co-workers, family, and community members, but the impact of this support on work productivity may vary depending on the type of source (Tews, Michel, & Stafford, 2020). Remote work becomes a considerable challenge for managers since this form of work is much more complicated compared to the traditional form of work organization. Both more than a decade ago and in recent years, studies conducted by researchers (Gajendran & Harrison, 2007; Marescaux, Rofcanin, Las Heras, Ilies, & Bosch, 2020) have revealed that the positive attitude of the head of the organization, the immediate supervisor towards remote work and the support provided by him to the employee is an essential factor in the implementation of remote work in the organization. It is managers who encourage or limit employees' ability to focus on their work and better manage their personal needs. It is noted in the scientific literature that managers who help their employees find ways and means to balance work and personal life create a positive attitude of employees toward work and promote better work results (Talukder, Vickers and Khan, 2018). On the other hand, employees who perceive that their manager cares about their well-being and personal/family life also feel the need to reciprocate and help the manager achieve the organization's goals by improving its performance (Rofcanin, Las Heras, Escribano, & Stanko, 2020). In the context of remote work, where the boundary between work and personal life is disappearing, according to scientists (de Valdenebro Campo, Avolio, and Carlier, 2021; Straub, Beham and Islam, 2019), family-supportive managerial behaviour helps employees manage work and family responsibilities, thereby increasing employee energy, enthusiasm, and positive mood at work. Recent research carried out by Rofcanin et al. (2020) confirms that there is a positive relationship between family-supportive managerial behaviour and employee job satisfaction.

Although Madsen (2011) expresses the idea that remote work is focused on experienced, disciplined, motivated, and self-confident workers who do not need constant communication with colleagues, work supervision, and coordination, Toscano and Zappala (2020) note that in the remote work environment, both physical and informational isolation harm employee job satisfaction, which can affect the employee's emotional well-being. In this case, according

to the researchers, not only the manager's support but also the co-workers' support is important for remote workers, i.e. trust is expressed, which according to Bulinska-Stangrecka and Bagienska (2021) is an indicator of positive employee attitudes and behavior. Their research results show that mutual trust among employees has a positive effect on organizational performance, strengthens employee cooperation, reduces employee stress, and increases resistance to change. In addition, according to the authors, trust activates the learning process by creating social relationships using different communication channels and increases job satisfaction. This is also confirmed by Raišienė (2012), who claims that communication through electronic means and technological channels is significant when working in virtual groups. The research carried out by the author showed that the role of electronic communication in the efficiency of employees' activities and the success of organizations is ambiguous. Compared to the technological one, direct communication should be prioritized to achieve organizational efficiency. It should be noted that technological channels partially limit some communication possibilities, for example, electronic communication is not suitable for developing informal employee contacts, strengthening employee commitment, and making significant decisions in groups. It is important to understand that the electronic medium does not in itself improve communication. Whether electronic communication will be of high quality or not depends mostly on the personal motivation of the contacts and the real need to use technology. Therefore, to achieve organizational efficiency, according to Raišienė (2012), it is necessary to use the widest possible range of communication channels, as well as to promote direct informal communication of employees, which, according to Fay (2011), reduces the feeling of isolation of remote employees.

Moynihan and Pandey (2008) argue that employees are part of an organization's internal social networks in which each of them influences the other's attitudes and behaviors. Therefore, when examining the experience of remote workers in the context of social support, it is important to consider the interaction of all workers involved in these networks – how individual remote workers interact with other remote workers, managers, and office colleagues. Collins et al. (2016) (2016) conducted a qualitative study in a public sector organization and found that remote work allowed people to distance themselves from negative or irrelevant work relationships while developing positive relationships, mostly with other remote coworkers. Remote work thus allowed people to avoid groups with which they did not identify and strengthen relationships with those they valued and closely identified with. Thus, it can be assumed that greater social support from managers and co-workers in a remote work environment allows for a better emotional state of employees and greater job satisfaction.

Employee support, performance evaluation, and recognition are other important forms of organizational support in the context of both remote and traditional work, which can influence employee job satisfaction and commitment to the organization (Landis, Vick, Novo, 2015). According to Šorytė and Pajarskienė (2014), to ensure that employees feel satisfied with their work, it is necessary to ensure such conditions as a safe working environment, opportunities to combine work and family needs, good relations with colleagues and managers, recognition and involvement of employees in solving the most important issues of the organization. Allen et al. (2015) assert that in order to facilitate the organization of remote work, it is necessary to ensure a supportive work environment that "normalizes" remote work and allows to use of the benefits provided by such a work mode. Wheatley (2017) says that remote workers need to be carefully controlled to avoid the anger of people working in offices: they may feel burdened with additional duties or tasks because their colleagues are not "visible" in the office. However, this idea is contradicted by Mautz (2019) who states that instead of trying to control and track every move and time of employees, managers could trust them more and focus on the results they achieve. For this reason, it is very important to define each person's roles, work tasks, rewards, and responsibilities and to communicate results-oriented performance evaluation clearly and objectively. Bernardino, Déa Roglio, and Corso (2012) note that employee performance evaluation and recognition are critical in teleworking, as face-to-face communication is limited. Performance appraisal provides feedback to the employee about his performance. According to MacDuffie (2007), in virtual teams, where there is a lack of "face-to-face" communication, feedback should be provided periodically, because the lack of feedback can harm employee motivation, work productivity, and final work results. To ensure feedback when creating a productive culture of communication and cooperation in the organization, according to Mautz (2019), it is necessary to combine various information technology tools (e-mails, virtual meetings, SMS, etc.), because virtual relations with employees and mutual trust are the basis employee job satisfaction.

Anand (2020) analyzed remote work and its related issues during the Covid-19 pandemic. The author emphasizes that during a health crisis, organizations must pay attention to the stress experienced by employees and be open by offering employees appropriate communication channels (e.g. messaging platforms, video conferences, e-mails) through which important work issues can be discussed and resolved, organize virtual seminars, new skills development sessions, virtual counseling and training sessions to help employees stay safe and healthy at home, remind colleagues to take extra precautions for potential data breaches and other cybersecurity issues and encourage employees to share work experiences and tips. In this difficult period, according to the scientist, evaluation, recognition, and encouragement of employees is necessary. Meanwhile, Metts (2020) notes that to maintain a high level of organizational morale, it is necessary to develop an employee engagement and communication plan for employees to communicate and maintain relationships while working remotely. Employee engagement should not be a one-off implementation but should be integrated into the company's culture. According to Patro (2013), employee engagement, enthusiasm, and job satisfaction are stimulated by factors such as career development prospects, promotion, communication, recognition, flexibility of employee working hours, fair salary structure, transparent and open work environment, and participation in decision-making.

A person feels motivated to work more when his work is appreciated by managers. The researchers found that although remote workers had more flexibility and autonomy compared to workers performing work activities in a traditional workspace, they had fewer opportunities to engage in work, as a result of which they experienced greater professional isolation - fewer opportunities for promotion, salary increases, personal development, career (Morganson, Major, Oborn, Verive, & Heelan, 2010). Bernardino et al. (2012) assert that (2012) emphasize that special attention must be paid to employee training in the remote work process. Knowledge and application of information technology, and remote work programs is one of the factors to successfully organize remote work. The authors note that training for managers should focus on the ability to manage virtual teams and include aspects such as improving communication, defining goals, and evaluating employees based on their performance. Investing in employee training and development can increase employer trust when the telecommuter recognizes that the organization is investing in his or her professional development. A study by Oubibi, Fute, Xiao, Sun, and Zhou (2022) on the effect of educational organizational support on the job satisfaction of Chinese teachers found that employees who perceive higher levels of organizational support are more satisfied with their careers, and therefore more creative, more engaged, and at work feel more satisfied.

Another type of organizational support that is discussed in the works of researchers is *technical support*. According to Bosua et al. (2013), the main purpose of this type of support is to ensure effective coordination of employees with the organization and co-workers. The more employees in an organization work remotely, the more relevant this support for employees is in terms of technology and training. According to Bayrak (2012), the more there is individual remote work, the higher the need for technology and training related to the application of technology in remote work. Therefore, according to Bosua et al. (2013), in this context the role of technical support becomes important, the task of which is to ensure effective coordination of workers with the main workplace and co-workers. Bentley et al., (2016) assert that as a result, remote work is expected to increase organizational social and technological support, leading to higher employee satisfaction with telecommuting, as support for telecommuting technology and communication reduces employee stress and strain.

Thus, the success of remote work becomes the guarantee of empathy and care-based interaction between managers and employees, which creates a positive work environment; providing the employee with relevant information on personal life and work issues; provision of necessary work resources and tools, and support for the professional and personal development of the employee.

CONCLUSIONS

1. The analysis of the scientific literature allows us to define organizational support as caring for the well-being of employees and evaluating their work. The main factors determining the level of support perceived by the employee, which influences the employee's job satisfaction, are the recognition of employees, the support of the manager, the workplace and safety, the opportunity to learn and advance in the career ladder, and the fair reward system.

2. The analysis of scientific literature revealed that in the context of remote work, the emotional support of the manager and colleagues, informational support, which is related to the provision of relevant information to the employee on personal life and work issues, and support for the professional and personal development of the employee play a special role. However, a prerequisite for successful remote work is instrumental support, which is not possible without the organization's investment in technology (internet access, smartphone, computer) and other resources necessary to perform remote work.

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THE PUBLIC PROCUREMENT: THE IN-HOUSE PROCUREMENT IN LITHUANIAN LAW

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Abstract. Although the in-house procurement, as an exception to public procurement process, have existed in Lithuanian law for more than a decade and the European Union has expressed a clear positive position on the issue by legalize it in international level with Directive 2014/24/EU, but this legal institute still is not analysed enough in scientific level in order to evaluate its situation and problems in Lithuanian public procurement law. Especially, when in order to find the most optimal legislative regulation of the in-house procurement, the Lithuanian legislator has changed this legal institute many times and in many ways without its clear decision as to how the issue should be regulated in statutory regulation. Therefore, the object of the research is the legal institute of the in-house procurement in Lithuanian public procurement law and the aim of the research is to analyse the peculiarities and problems of this legal regulation and its application in legal practice. The article uses basic research methods such as document analysis, systematic analysis, comparative analysis, the deduction analysis and generalization methods. The analysis of this article shows main problems of this legal institute of Lithuanian public procurement law seen clearly in legal regulation and practice require as well as provide the certain solutions for necessary substantial adjustment of existing legal regulation on this question.

Keywords: in-house transactions, public procurement, Lithuanian law, administrative law

INTRODUCTION

There is constant debate in the media about how in-house procurement should be regulated as it is an exception to the application of formal public procurement procedures, therefore, a significant part of the public sees more dangers in it than positive features of this institute, i.e. lack of transparency, risk of possible decision-making in favour of personal interests, etc. (Balčiūnaitė, 2019; Lithuanian Free Market Institute, 2019). While others are in favour of liberalizing the in-house procurement institute, giving institutions as much power as possible in the area of in-house procurement (Soloveičik, 2019; 09.10.2019 Letter of the Association of Lithuanian Municipalities). In search of the optimal and most suitable legal regulation, the Lithuanian legislator changed the regulation of in-house procurements many times, i.e. either by narrowing or expanding the scope of such transactions, by including, or by abolishing provisions related to the control of in-house procurements, and even attempts have been made to ban in-house procurements. And this shows that Lithuania does not have a clear direction as to how in-house procurements should be regulated in the national legal system, especially because the constantly changing political processes and political directions have a strong impact on this. Although the in-house procurements, as an exception to public procurement processes, have existed in Lithuanian national law for a little over a decade, and the European Union in Directive 2014/24/EU clearly stated the position by which it approved this legal practice and legitimized this legal institute at the cross-border level, however, this issue still does not receive more serious scientific research, which would provide a more detailed overview of the situation and problems of this law institute in public procurement. The last research on this topic was carried out more than a decade ago by D. Soloveičikas (2009), and in general, public procurement law is not a common phenomenon in Lithuanian legal doctrine as an object of scientific research, therefore, such research significantly contributes to the development of this narrow but at the same time very important public procurement law in Lithuanian national law. All this shows and justifies the importance and relevance of this study, especially since it can be a weighty basis for discussions on the regulation of in-house procurements in the Lithuanian public procurement law amendment law.

The object of the research – the legal institute of the in-house procurements in Lithuanian public procurement law.

The aim of the research – to analyse the peculiarities and problems of legal regulation of the in-house procurements in Lithuanian public procurement law.

The tasks of the research:

- 1) to reveal the concept, establishment process and peculiarities of the in-house procurements in Lithuanian public procurement law;
- 2) to examine the main issues of legal regulation of the in-house procurements in Lithuanian public procurement law and its application in legal practice;
- 3) to provide solutions in order to solve specific issues of this legal institute in Lithuanian public procurement law.

Methodology of the research: depending on the topic, goals and objectives of the scientific article, the following research methods are used: the systematic analysis and comparative analysis methods are used when comparing legal provisions and case law as well as Lithuanian law and EU law; the deduction analysis method made it possible to define specific problems arising in legal practice from the general requirements, while the generalization method helps to systematize the entire analysis and to provide structured conclusions.

Abbreviations in the research:

1. the LPP – the Law on Public Procurement of the Republic of Lithuania.
2. the LC – the Law on Competition of the Republic of Lithuania.
3. the CJEU – the Court of Justice of the European Union.
4. the EU – the European Union.
5. the CCRL- the Competition Council of the Republic of Lithuania.

1. THE CONCEPT AND EMERGENCE OF IN-HOUSE PROCUREMENTS IN LITHUANIAN LAW AND EU

The conclusion of an in-house procurements is understood as a procedure where the procuring organization can purchase resources from an entity whose activities it can have a decisive influence on and can effectively control, and the main feature of an in-house procurement is that no public procurement is announced, i.e. mandatory public procurement rules do not apply, and such a contract is not considered a public procurement contract (Soloveičikas, 2009). An in-house procurement in the narrow sense is to be considered when a transaction is concluded with one of its divisions (departments), which does not have legal subjectivity, and an in-house procurement in the broadest sense is to be considered when the transaction is concluded with persons controlled by the procuring organization, who have independent legal subjectivity (Janssen, 2014). Public procurement legal norms do not affect internal procurement in the narrow sense, because then the contracting organization and its employees have labour legal relations, however, when it comes to internal procurements in a broad sense, these are indeed problematic, which will be the main focus.

In the absence of consolidated regulation of in-house procurements, CJEU in the 12.11.1999 decision No. C-107/98 (hereinafter - the *Teckal* case) laid the foundation for the institution of in-house procurements and formed two main criteria in which cases an in-house procurement can be concluded: 1) the procuring entity must exercise control over the other counterparty in a manner similar to its own departments, structural parts, units or divisions; 2) the other party to the transaction carries out most of its activities together with or for the benefit of this procuring organization. Although the in-house procurement criteria established in the *Teckal* case became the basis for the in-house procurement institute, however, this was just the beginning and due to the abstractness of the criteria, the CJEU repeatedly provided clarifications on various aspects of in-house procurements until the publication of EU Directive 2014/24/EU in 2014, Article 12 of which established the exception of in-house procurements and the conditions for their conclusion. It is noteworthy that this directive sets out a third condition, which complements the criteria of the *Teckal* case, i.e. condition for direct participation of private capital. However, this condition was not new, but only derived from the doctrine of the CJEU, e.g. CJEU 11.01.2005 decision No. C-26/03, 22.05.2003 decision No. C-18/01 and others. Although the conditions for the conclusion of in-house procurements established in this directive are not sufficiently detailed and clear by themselves, it is necessary to refer to the practice of the CJEU, however, it cannot be said that such consolidation of in-house procurements and their conclusion criteria in EU positive law was insignificant, on the contrary, it gave this institution of law more clarity and definition than it had before (Janssen, 2014).

Meanwhile, analysing the situation in Lithuanian law, it should be noted that the LPP, in 02.03.2010 established the exception of in-house procurements for the first time. The text of the exception was then drafted slightly differently than the current version, i.e. it provided that the requirements of the law do not apply to procurements if the contracting organization enters into a contract with an entity that has a separate legal entity status that it controls, as its own service or structural division and in which it is the only participant (or exercises the rights and duties of the state or municipality as the only participant), and if the controlled entity derives at least 90 percent of its sales revenue from activities designed to meet the needs of the procuring organization or to perform the functions of the procuring organization (LPP wording valid from 02.03.2010 to 26.11.2010). It is noticeable that the norm already distinguished a specific part of 90 percent of the income from the activity, i.e. a specific essential part of the activity, when there was no EU regulation providing for the essential part of the activity. It should also be mentioned that the requirement of the state or municipality as the only participant was established in the LPP, which was later established in Directive 2014/24/EU with a similar wording (with an exception) as the third criterion for in-house procurements. It should be noted that from the protocol of the 22.12.2010 meeting of the Economic Committee of the Seimas of the Republic of Lithuania No. 108-P-49 can be seen, that in the same year, it was proposed to abolish the exception for in-house procurements, based on the fact that the assessment carried out by the Special Investigations Service stated that in-house procurements in municipalities take place in a non-transparent manner, and the regulation at that time does not ensure the control of in-house procurements, especially the exception of in-house procurements threatens competition between services. However, the in-house procurement exception has not been removed from the LPP, but its wording has changed slightly, i.e. the previously valid version of the law was supplemented with categories of income during the last financial year and established the provision that in order to ensure internal procurement control, when the procuring organization approves the public procurement plans planned for the current budget year, information about the planned in-house procurements must also be provided, and within 30 days from the end of the reporting calendar year, submit to the Public Procurement Office reports of all in-house procurements carried out during the calendar year (12-23.12.2010 Law No. XI-1255).

In response to the criteria for in-house procurements established in Directive 2014/24/EU, new amendments to the regulation of in-house procurements in Lithuanian law came into force in 2014, i.e. in the new version of the LPP, the

criterion of at least 80 percent of sales income from operations was established (22.10.2013 Law No. XII-569). The legislator motivated this change by the fact that the second condition for the conclusion of an in-house procurement provided for in the previous version of the LPP before the changes, compared to the one specified in the *Teckal* case, unreasonably narrows the application, although in fact the *Teckal* case referred to “an essential part of the activity of a legal person“, however, this part is not expressed as a percentage. And the legislator also took into account the latest changes made in Directive 2006/97/EC59 at that time, where the essential part of the activity of 80 percent of income is also established. However, from the 12.06.2013 conclusion of the Education, Science and Culture Committee of the Seimas of the Republic of Lithuania No. 106-P-25 can be seen, that the CCRL did not agree to the change and stated that the extension of the limits of the application of in-house procurement criteria increases the possibilities of procuring organizations - state or municipal institutions - to avoid the application of public procurement rules when purchasing goods that they could buy from entities operating in the market, in this way, institutions find themselves in a privileged position, which could create different conditions of competition between private and state- or municipal-run entities.

Judicial practice undoubtedly had further influence on legal regulation, since from the middle of 2015 in the practice of the court of cassation, such as in civil case No. e3K-3-120-469/2018, the legality of in-house procurements begins to be associated not only with the conditions established by the *Teckal* case, but also with additional value bases arising from the provisions of the LC, i.e. continuity of service provision, good quality and availability, opportunities to compete and impact on the equality of other economic entities.

In the penultimate change in the regulation of in-house procurements in 2017, the legislator changed the wording of the in-house procurement exception, prohibiting such transactions in state-controlled companies, as it is precisely such transactions that raise the most questions about abuse and non-transparent tenders. Also, in the new wording of the LPP, there was no longer a requirement to obtain the consent of the Public Procurement Office for the conclusion of an in-house procurement. The President of the Republic of Lithuania did not approve of this amendment to the law, and in the 18.04.2017 decree No. 1K-940 stated, that such an amendment privileges municipalities and does not comply with the constitutional principle of equality, since according to this amendment in-house procurements can only be concluded by municipalities and companies managed by them, especially the number of such transactions is growing and this shows that in the practice of some procurement organizations this exception has become the rule. Such a position was followed by the CCRL in the 30.04.2015 resolution No. 1S-45/2015, where it is noted, that without violating the constitutional imperative of fair competition, the municipality could enter into a transaction with the company it manages in only one case, when, after creating public, transparent and non-discriminatory conditions for all entities operating in the market to compete for the supply of a service or product, the municipality would not receive any bids or would receive bids that do not meet the purchase conditions established by it, however, in such a case, the in-house procurement exception is not required, as unannounced negotiations can then be conducted. Despite this clear disapproval, the relevant amendments to the LPP were adopted.

In 31.12.2019, the last changes to the LPP were made, i.e. Section 2 of Article 10 of this law has been amended, stipulating Point 2, that in-house procurements may be concluded when public services are purchased, administered in accordance with Section 2 of Article 9 of the Law on Local Self-Government of the Republic of Lithuania. Thus, the amendments to the law created wider opportunities for municipalities to carry out in-house procurements. According to the changed procedure, public procurements may not be announced in a fairly wide range of public services and in cases where immovable property owned by municipalities would be required to provide the services. According to the amendment, the aforementioned services for municipalities can be purchased either from existing companies or new ones can be established. Such an amendment to the law should be considered as expanding the discretion of municipalities to choose how public services should be provided. However, it should not be forgotten that the discretion of municipalities is limited to certain services enshrined in the law, which are considered extremely significant for local self-government, without which our society cannot function normally. Undoubtedly, the legislator, when making such a change, relied on the tendencies of other countries to return certain services to the public sector, i.e. based on materials of the 18.10.2019 VII session of the Seimas of the Republic of Lithuania No. 333, the trend of returning the water supply sector to the public sector is clearly visible in France - as many as 106 cases, 61 cases in the United Kingdom, 27 cases in Spain, 17 cases in Germany and in the waste management sector: in Germany – 13 cases, in the United Kingdom – 7 cases, etc.

Thus, during the entire period of the LPP on the regulation of in-house procurements, in order to find the most optimal regulatory option and to reduce threats due to distortion of competition or corruption, the legal provisions of the LPP were repeatedly changed, however, at the same time, it is difficult to see the position of the legislator in which direction the regulation of in-house procurements should go.

2. PROBLEMS OF REGULATION OF IN-HOUSE PROCUREMENTS IN LITHUANIAN LAW

2.1. THE LPP PROBLEM OF REGULATING SOME IN-HOUSE PROCUREMENT CONDITIONS

The condition enshrined Section 1 of Article 10 of the LPP that in-house procurements can only be concluded with the purchasing organization leads to the fact that, in most cases, the conclusion of an in-house procurement alone is not enough to achieve the ultimate goal of the purchasing organization, but at the same time, public procurement has to

be carried out, since it is not always possible to purchase the various instruments required for the execution of an in-house procurement from a controlled procurement organization. In addition, the condition that in-house procurements can only be concluded with the purchasing organization rather restricts the possibilities of non-transparent use of funds. As a result, smaller in-house procurements should generally be made, which would be seen as a positive step.

The most critical of the requirements established in Article 10 of the LPP for concluding an in-house procurement is the provision of Section 2 of this article, that when purchasing by public procurement, it would be impossible to ensure the continuity, good quality and availability of the service, which means that, above all, the procuring organization must announce a public procurement tender and only in the event that no single supplier's offer meets the requirements of the procuring organization or if none supplier would not submit a bid, the procuring organization could enter into an in-house procurement. In this way, entities owned or controlled by the state are directly or indirectly eliminated from the possibility of entering into an in-house procurement altogether (Soloveičik, 2019). It can also be assumed that in such a case, when the procuring organization is still obliged to check when announcing a public procurement, the institution of in-house procurements essentially loses its meaning, since in such a case the institution of unannounced negotiations can be used, according to Article 71 of the LPP, in-house procurements should be characterized by the speed of their conclusion, this can be considered one of the main advantages of this institute, but it is problematic that the conclusion of an in-house procurement in this case may take longer than the acquisition by organizing a competitive procedure.

In addition, a linguistic analysis of the conditions for concluding in-house procurements provided for in Article 12 of Directive 2014/24/EU and the conditions for concluding in-house procurements provided for in Article 10 of the LPP shows, that there are more requirements established in Lithuanian law than at the level of the European Union. As a result, the Supreme Court of Lithuania in civil case No. e3K-3-120-469/2018 applied to the CJEU to find out whether states have the discretion to enshrine additional restrictions on in-house procurements in their national law. Meanwhile, the CJEU in the 03.10.2019 decision No. C-285/18 explained that the Section 1 of Article 12 of Directive 2014/24/EU must be interpreted in such a way that according to it, a provision of national law is not prohibited in which a member state associates the conclusion of an in-house procurement with the condition that the conclusion of a public procurement contract would not allow ensuring the quality of the services provided, their availability or continuity, if at the stage before the conclusion of the public procurement contract, the principles of equal treatment, non-discrimination, mutual recognition, proportionality and transparency are observed when choosing a specific method of service provision. Thus, as it can be seen that the additional condition enshrined in Section 2 of Article 10 of the LPP, that in-house procurements can only be concluded if the continuity, good quality and availability of the relevant service cannot be ensured when organizing public procurement, does not contradict the regulation of Directive 2014/24/EU, however, the aforementioned essential principles must be observed, which makes the process of concluding an in-house procurement even more difficult in Lithuanian law, additionally requiring the following criteria to be assessed.

However, after the adoption of this CJEU decision, the Supreme Court of Lithuania in case e3K-3-494-469/2019 stated that all material and procedural requirements for the conclusion of in-house procurements, which the legislator seeks to apply, regardless of whether they are established in the performance of obligations arising from EU law or using the right of internal legal regulation, must be clearly, accurately, unambiguously and comprehensibly established in one legal act - LPP. This causes a considerable problem, since the CJEU clearly stated that competition cannot be distorted in relation to private economic entities, which means that there must be a certain control mechanism to ensure that competition is not distorted, and such a mechanism is not provided for in Article 10 of the LPP. In addition, the conclusion of in-house procurements is not controlled by the Public Procurement Service, based on point 9.12 of the regulations of the Public Procurement Service of the Republic of Lithuania, from which it can be seen that it only supervises the execution of in-house procurements, but not the conclusion process. Meanwhile, no one controls even such cases when it is not even clear for which object purchase the in-house procurement is concluded, e.g. according to the data of the Lithuanian Free Market Institute (2019), in 2018 the object of the in-house procurement concluded with “UAB Grinda” specified by Vilnius City Municipality is “Purchase of mandatory services and works”, the objects specified in the in-house procurements of Švenčionių district municipality and “UAB Pabradės komunalinio ūkio” and “UAB Švenčionių švara” are “Service provision agreement” and others. The lack of control also results in the fact that all the risk regarding the legality of the conclusion of an in-house procurement rest with the procuring organization, and ultimately there is a risk that such an in-house procurement will be contested, and the time and funds allocated to the in-house procurement will be wasted.

2.2. THE PROBLEM OF THE EXCLUSIVITY OF IN-HOUSE PROCUREMENTS FOR MUNICIPAL ENTITIES

In addition, another visible threat due to the conditions for concluding an in-house procurement provided for in the norm of Article 10 of the LPP, according to which the purchased public services are administered in accordance with Section 2 of Article 9 of the Law on Local Self-Government of the Republic of Lithuania, is that this condition makes the exception of in-house procurements no longer of such an exclusive nature. It is doubtful whether it was really necessary to include such a large number of cases where the conclusion of in-house procurements is allowed, since one could hardly agree with the statement that in absolutely all of these areas, i.e. waste management, passenger transport,

maintenance and management of territories and streets, catering, education, social care services, etc., there are not enough economic entities that can compete for the provision of services, especially if some of such public services can also be provided by private entities. Even more doubts arise as to whether this condition is not just an attempt to save inefficient municipal companies. As a result, it is positive that in at least one case of in-house procurements, a certain control is introduced - obtaining the consent to enter into an in-house procurement from the CCRL.

In addition, the situation that state-owned companies are prohibited from entering into in-house procurements, while municipal companies have expanded opportunities to enter into these transactions, raises questions as to why public entities are treated so differently. The ban on in-house procurements for state-owned enterprises means that not only state-owned joint-stock companies cannot enter into transactions with subsidiaries, but also, for example, ministries or other institutions cannot enter into internal procurement contracts. Thus, it is difficult to find objective criteria that lead to such a different determination of the rules for the conclusion of in-house procurements between state-owned and municipality-owned companies, after all, such a different treatment of subjects in itself leads to a violation of the principle of equality.

Another problematic aspect of the regulation of in-house procurements is that they can be concluded for a very long time, i.e. according to the data provided by the Lithuanian Free Market Institute (2019), some in-house procurements are concluded for a period of 10, 15 or even 20 years. For municipal companies, this ensures constant income and makes it easier to plan the company's future flows - which can facilitate not only the company's daily operation, but also provide various guarantees, such as facilitating the obtaining of loans, while other market participants cannot apply for such facilitations. The conclusion of such long-lasting transactions indicates to market participants that there will be no need for a certain service or product in the market for a long time, and as a result, private entities wishing to engage in such activities may not appear. This closes the market to potential suppliers of goods or services. As a result, even after the end of the in-house procurement period, there are no other alternatives than to buy services from the municipal company again, and an in-house procurement has to be concluded again.

However, it is doubtful whether the abolition of the in-house procurement institute would solve these problems, as the public sector would find other ways to subsidize subordinated companies. Especially after the elimination of in-house procurements, efficient and non-competitive public entities in the market would have to participate in public procurement tenders, in which they would be the only participants, which would waste a lot of time and funds.

2.3. THE RELATIONSHIP BETWEEN THE REGULATION OF IN-HOUSE PROCUREMENTS AND COMPETITION LAW

Meanwhile, when assessing the relationship between the regulation of in-house procurements and competition law, it should be noted that, as already mentioned, in the 03.10.2019 decision No. C-285/18 CJEU stated, that the conclusion of an in-house procurement that meets the conditions provided for in Point a-c of Section 1 of Article 12 of Directive 2014/24 does not in itself comply with EU law, since in-house procurements can only be concluded when it is ensured that competition will not be distorted in relation to private economic entities. In the absence of in-house procurement control established by the LPP, which can ensure that competition against private entities will not be distorted, Article 4 of the LC has been used for a long time, which prohibits public administration entities from privileging individual economic entities. Despite the fact that the LPP provided for the possibility of concluding in-house procurements, the CCRL recognized such decisions (to enter into an in-house procurement) as contrary to Article 4 of the LC and even when the provision that in-house procurements could only be concluded in exceptional cases was not established in the LPP. The CCRL and the administrative courts have shaped the narrowing application of internal procurement and the practice providing for the exclusivity of this institute (e.g. Decision of the Supreme Administrative Court of Lithuania on 29.03.2016 in case No. A-347-552/2016 and others). Thus, a situation arose that the institution, which should enforce the laws, actually changed them, deciding to apply the norms established by the LC to in-house procurements, although in the case of a conflict between the *lex generalis* (Article 4 of the LC) and the *lex specialis* (Article 10 of the LPP), the conflict must be decided in favour of the *lex specialis*.

Only after the aforementioned CJEU decision No. C-285/18, it was understood that administrative authorities cannot create rules themselves, and thus distort the regulation established by law. And the Supreme Administrative Court of Lithuania formed a new direction in the practice of administrative courts and in case No. eA-893-556/2020 stated that there is no reason to conclude that the Lithuanian legislator did not fully implement his constitutional competence in the legal regulation and did not determine all the necessary aspects of in-house procurement regulation, nor is there any basis for such an interpretation of the law, according to which, ignoring the will of the legislator, the application of the in-house procurements institute remains permanently exclusive, regardless of the regulatory change in Article 10 of the LPP. This position was confirmed by the Supreme Court of Lithuania in civil case No. e3K-3-494-469/2019, in which it was noted that that all material and procedural requirements for the conclusion of in-house procurements sought to be applied by the legislator, regardless of whether they are established in the performance of duties arising from EU law or using the right of internal legal regulation, must be clearly, accurately, unambiguously and comprehensibly established in one legal act – LPP. Thus, the practice according to which Article 4 of the LC was additionally invoked should be considered flawed and should not be applied, therefore, the conclusion of in-house procurements according to the LPP cannot be considered as a conflicting LC. However, this does not change the fact that it is necessary to ensure that competition

against private entities is not distorted, therefore the control mechanism ensuring competition should be clearly, accurately and unambiguously established in the LPP.

CONCLUSIONS

1. During the entire period of the LPP for the regulation of in-house procurements, the threat of removing this institute from the legal regulation of Lithuania has repeatedly arisen, precisely because of its insufficiently optimal regulation and the threat posed by distortion of competition or corruption. It is also difficult to see the position of the legislator in which direction the regulation of in-house procurements should go, because at one time the scope of using the institute of in-house procurements is narrowed, and at another time such an opportunity is being expanded, although the institutions responsible for this area had categorically negative positions regarding the existence of this institute.

2. The performed analysis substantiated that there are a number of problem areas in the regulation of in-house procurements established by the LPP:

2.1. the procuring organization must in all cases announce a public tender in order to make sure that it is impossible to ensure the continuity, good quality and availability of the service, as a result of which the in-house procurement institute, which should be characterized by operational efficiency, basically loses its meaning;

2.2. there is no general real control mechanism that ensures undistorted competition and the compliance of the conclusion of an in-house procurement with all the conditions imposed on it, which leads to the fact that all the risk regarding the legality of the conclusion of such transaction rests with the procuring organization;

2.3. extended opportunities for municipal companies to enter into in-house procurements leads to an obvious violation of the principle of equality, and the possibility to enter into an in-house procurement for an extremely long time leads to the absence of new alternatives for the services or goods provided, after the end of such a transaction period;

2.4. the legal practice of additionally formally applying the provisions of competition law to in-house procurements by strengthening their exclusivity is flawed, but the stricter regulation of in-house procurements provided for in Lithuania does not contradict EU law as long as it does not violate other fundamental principles of EU law.

3. The performed analysis substantiated that after establishing a proper mechanism of real institutional control of in-house procurements in the LPP, assigning these functions to the Public Procurement Service, narrowing the range of cases according to which municipalities can enter into in-house procurements, abolishing the ban on state companies entering into such transactions and determining the maximum possible duration of such transactions in the legislative regulation, the institute of in-house procurements would not only be preserved, but would also function much more efficiently.

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LAWYER'S ROLE WITHIN AML LEGISLATIVE FRAMEWORK. LAWYER AS A GATEKEEPER

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Abstract. Advocate's professional identity is irrevocably linked with the ability to perform Advocate's duty, and the latter, in its turn, is subordinated to the requirements of legislative normative framework, including strict and sometimes contradictory requirements of anti-money laundering (further in the text – AML) regulation in force. By attributing advocates (further in the text – advocates) the AML “gatekeeper” role, these legal professionals are indirectly considered as facilitators of money laundering by the global institutional regulatory regime. The origins of advocate as a “gatekeeper” can be traced back to Financial action task force (further in the text – FATF) introduction of this connotation by indicating towards the link between the legal services and the money laundering trends, due to the complicated legal and financial character of money laundering operations. By attributing the advocate gatekeepers role and thus subjecting the legal professional to contradictory requirements of AML regulation (duty to disclose information entrusted to the advocate by his client to competent authorities in case suspicions about money laundering arouse, criminalization of advocate's intervention in money laundering activities, establishment of Authority for Anti-Money Laundering and Countering the Financing of Terrorism), the advocat has to conflict his professional duty requirements about duty of secrecy towards his client, thus endangering the client's democratic rights to fair trial and effective defense. The consequences of this conflict lead to endangering the advocats independence which is closely linked with its performance abilities. Article provides an insight about the development of advocate's new role as a gatekeeper throughout the formation of the anti - money laundering normative legislation, analyzing the origins where the concept of advocat as a gatekeeper was developed. The purpose of the article is to question the adequacy of the advocate's gatekeeper role and to understand whether the recent reform proposals simply address regulators' perceptions that advocates' own understanding and implementation of these functions has not been adequate in recent times. Nonobstant the overall and dominating need for maximum transparency in the anti-money laundering sector, it can not and must not be reached at all costs, ignoring the fundamental role of an Advocat to act as an instrument securing rights to defence and fair trial inthe democratic society. There is a need from Legislator's side to balance advocates' multiple roles with the AML normative requirements not overstepping the red lines of the legal profession.

Keywords: Advocat; gatekeeper; rights to defence; rights to fair trial

INTRODUCTION

According to the definition provided in Wikipedia a gatekeeper is a person who controls access to something, for example via a city gate or bouncer, or more abstractly, controls who is granted access to a category or status. Gatekeepers assess who is "in or out". Various figures in the religions and mythologies of the world serve as gatekeepers of paradisaal or infernal realms, granting or denying access to these realms, depending on the credentials of those seeking entry. Figures acting in this capacity may also undertake the status of watchman, interrogator or judge.

Article provides an insight about the development of advocate's new role as a gatekeeper throughout the formation of the anti- money laundering (further in the text – AML) normative legislation, analyzing the origins where the concept of advocat as a gatekeeper was developed.

The purpose of the article is to question the adequacy of the advocate's gatekeeper role and to understand whether the recent AML reform proposals simply address regulators' perceptions that advocates' own understanding and implementation of these functions has not been adequate in recent times.

In order to analyze the adequacy of “gatekeepers” role attributed to advocats by the recent AML regulation, the author will take a brief overview of the formation of AML regulation which has led to the adoption of the so called 6th AML package, setting the recent AML standards member states have to follow.

It all started with establishment of Financial Action Task Force (further in the text – FATF) in 1989 by a Group of Seven (G7) Summit held in Paris. G7 (now G20) is a mechanism to work through intense policy disputes, for leaders to meet and agree on coordinated policies and to provide leadership on difficult global challenges. By the late 1990s, however, a series of financial crises centred largely in Latin America and Asia had convinced the G7 finance ministers that key emerging economies were insufficiently included in global economic management efforts. Finance ministers had been meeting together with their central bank governor counterparts in parallel to the G7 summits since 1986. Their mandate had been to focus on fairly technical matters related to economic and financial growth and stability, inflation and currency developments. FATF's aim was to develop and promote national and international policies, globally in order to eliminate these threats.

Throughout the years the FATF has grown from a “soft-law” instrument into a powerful and authoritative standard setter in the domain. The transition is reflected by the scope and the tone it's Ministerial mandates contains. In order to better illustrate the major shift in the FATF mandate of action the author will make a reference to the initial Economic

Declaration of FATF of July 16, 1989, then to FATF Mandate of April 12, 2019 and finally to FATF Ministerial Mandate of April 21, 2022. In July 16, 1989 at the G7 summit in Paris FATF announced Economic Declaration stating that the respective year's world economic situation presents three main challenges, namely the choice and the implementation of measures needed to maintain balanced and sustained growth, counter inflation, create jobs and promote social justice, (b) the development and the further integration of developing countries into the world economy and (c) the urgent need to safeguard the environment for future generations.

In accordance with the Ministerial Economic Declaration from the G7 Summit Paris July 16, 1989 world's economic situation presented 3 main challenges:

- the choice and the implementation of measures needed to maintain balanced and sustained growth, counter inflation, create jobs and promote social justice
- the development and further integration of developing countries into the world economy
- the urgent need to safeguard the environment for further generations.

In 1990 FATF established its key documentary package - a series of money laundering recommendations (further in the text – 40 Recommendations). In 2001, a series of special recommendations on the prominent threat of terrorist financing were established, collectively known as the 40 + 9 Recommendations whose aim was to unite anti-money laundering and terrorist financing efforts into one universal instrument. FATF examines techniques and counter-measures and reviews whether existing national and international policies are sufficient to combat the developing threat. The FATF monitors compliance with the 40 + 9 recommendations through a two – pronged strategy. Member countries complete annual self assessment style questionnaire and secondly, the FATF conducts regularly on-site Mutual Evaluation Report examinations on individual jurisdictions, assessing the effectiveness of their national policies in dealing with money laundering and terrorist financing. In the Final Communiqué of their meeting in Moscow on 19-20 July, 2013 (further in the text – Communiqué) G20 Finance Ministers and Central Bank Governors once again reinforced FATF's work in combating money laundering and terrorist financing.

The Communiqué encourages all countries to meet the FATF's standards: the FATF Recommendations. The FATF strengthened corruption-related measures in its response to a call by G20 leaders. This has resulted in tighter requirements on customer due diligence, beneficial ownership, politically exposed persons, and the transparency of cross-border wire transfers, and the requirement for countries to take immediate steps to become party to and implement fully the **United Nations Convention Against Corruption**.

In accordance with the Ministerial Mandate of April 12, 2019 (further in the text – Mandate), FATF was given responsibility to examine money laundering techniques and trends, review the action already taken at a national or international level, and to set out measures needed to combat money laundering, reaffirming the role of the FATF as the global standard setter for combating money laundering, terrorist financing and the financing of proliferation of weapons of mass destruction.

The revised Mandate was intended to serve as the framework for the activities of FATF and included changes to its governance processes.

The following tasks were identified:

- identification analysis of money laundering, terrorist financing and other threats to the integrity of financial system;
- development of international standards;
- assessment and monitoring the members of FATF through peer-reviews, follow up processes;
- promotion of full and effective implementation of FATF Recommendations by all countries;

In June 19, 2019 FATF issues risk-based guidance for legal professionals and development of good practice. (further in the text – Guidance)

The guidance is based on the reference to the FATF report of July, 2010 on Global Money Laundering and Terrorist Financing Threat Assessment according to which the advocates are classified as gatekeepers according to the following typological characteristics:

- gatekeepers are individuals that “protect” the gates of the financial system through which potential users of the system, including launderers, must pass in order to be successful. As a result of their status, they have the ability to furnish access to the various functions that might help criminals to move on to conceal their funds (Point 214.p. 45)
- gatekeepers will undertake either self-laundering or third party laundering. Of the various categories, professionals tend to launder for third parties, either knowingly or unwittingly (point 218., p. 45)
- lawyers offering financial advice are a common element seen in complex money laundering schemes (point 222., p.45)
- insiders are generally known members of a group of limited number who have access to private, secret, privileged or restricted information (point 224, p. 45)
- the main tool insiders have is their first-hand knowledge. They are source of direct and useful guidance to an outsider. Therefore, potential launderers may recruit or coerce an insider into providing such services (point 225, p. 45)

In 2001, the FATF expanded its mandate to also combat terrorist financing. In accordance with the Ministerial Mandate of April 21, 2022, FATF reaffirmed that it is at the centre of the international effort to take decisive, co-ordinated and effective action against these threats of crime, terrorism, corruption and the destruction of environment and called upon all jurisdictions to remain vigilant of the threats to the integrity, safety and security of the international financial system

arising from the actions of the Russian Federation, commitment to effectively implement the United Nations Convention Against Corruption by designing FATF Recommendations and pursue work on the misuse of citizenship by investment schemes and complicit financial and non-financial professional services providers by the corrupt to implement FATF standards, recovery of criminal proceeds remains insufficient. Meaningful and effective asset recovery helps remove incentives for criminal activity, including corruption and tax crimes.

When analyzing the characteristics of a gatekeeper, FATF has attributed to this notion, it has to be concluded, that on EU supra - governmental level an advocat is no longer regarded as an instrument to secure the rule of law within the democratic society. Nor the advocat is being perceived as highly educated professional acting in accordance with the core ethical values the legal profession is based upon – trust and personal fairness, confidentiality and independence and as the representative of the judicial state power.. These ethical values are directly related to the provision of qualitative legal advice which lead to the special status and role of an advocat in the society. The responsible action of an advocat towards its client create the basis for further trust from the individual to the rule of law. It is a fundament to secure the fundamental rights of an individual and its protection by providing professional defence. The notions of justice and fairness being the prism through which the advocates professional activity is being valued and assessed ir closely connected with consideration of ethics.

It is clear that a person being convicted of the predicative offence can not defend itself as well as can do the advocat who has the necessary expertise, knowledge and qualification. Therefore it is important to look upon the activity of an advocat integrally, advocats legal professions can not be assessed by analogy with any other profession according to the NACE classificatory. This profession is integrally binded by three duties, established by the Code of Ethics of Advocats – independence, confidentiality and personal fairness. These duties can not be limited on the contrary case we have to speak about the limited legal certainty that itself is an absurd notion as it directly contradicts with human rights to fair trial and defense. Legal certainty either exists or does not. By limiting any of the principles supporting advocates legal profession the fundamental rights to defense, justice and presumption of innocence are limited, and that is not acceptable.

DEVELOPMENT OF ANTI-MONEY LAUNDERING REGULATIVE FRAMEWORK

In Europe, anti-money laundering (further in the text – AML) rules are issued by the EU Parliament in the form of EU anti-money laundering directive (further in the text - AMLD). AMLD contains a set of provisions and rules directed to respond to the challenge of of money laundering and terrorist financing threats. The EU legislative acts are based closely on FATF Recommendations, guidances and interpretations. Each EU member state then implements this into their legal system, by making amendments to the already existing legislation in force or by issuing new laws in the domaine.

The EU AMLD is intended to prevent money laundering and terrorist financing. It establishes a regulatory environment for this that is consistent across all EU member countries.

June 10, 1991 - the first AMLD was Council Directive 91/308/EEC on the prevention of the use of the financial system for the purpose of money laundering. (Further in the text – 1 AMLD). The initial concern of the 1 AMLD was that credit and financial institutions could and would be used to launder the proceeds of criminal activities, jeopardizing the whole financial system. 1 AMLD established key preventative measures such as customer/client identification, record-keeping and central methods of reporting suspicious transactions. 1 AMLD was designated for financial sector stability.

December 4, 2001 - The second Council Directive 2001/97/EC of the European Parliament and of the Council of the European Union amending Council Directive 91/308/EEC on prevention of the use of the financial system for the purpose of money laundering. (further in the text – 2 AMLD)The 2 AMLD amended and updated the 1 AMLD on the prevention of the use of the financial system for the purpose of money laundering. The aim of the 2 AMLD was to refine the existing provisions created by the 1 AMLD and to plug the gaps in the legislation highlighted by the 40 Recommendations suggested by FATF.

The European Council felt this was necessary step to take as the 1 AMLD did not adequately establish which Member States authorities should receive details of suspicious transactions where the credit or financial institution had branches in various jurisdictions.

The 2 AMLD adopted a broader definition of money laundering, taking into account underlying offences such as corruption and thus expanding the predicate offences. It also clarified that currency exchange offices money transmitters and investment firms were included within the scope of the directive as they were susceptible to money laundering transactions. In addition 2 AMLD directive added the authority to identify, trace, freeze, seize and confiscate any property and proceeds linked to criminal activities. Moving on from the 1 AMLD to the 2 AMLD touched upon the possibility of the Directive becoming applicable to lawyers participating in financial or corporate transactions. The proposition to extend the provisions of the Directive to the legal profession was met with fierce opposition by the European Parliament. It was due to fears that it would encroach on client confidentiality rules and could potentially violate the integrity of court proceedings. A compromise was reached and the scope of the 2 AMLD was not extended to cover professionals such as lawyers. Thus lawyers were exempt from reporting information received in the course of defending or representing a client. August 1, 2006 - Commission Directive 2006/70/EC of 1 August 2006 laying down implementing measures for Directive 2005/60/EC of the European Parliament and of the Council as regards the definition of politically exposed person and the technical criteria for simplified customer due diligence procedures and for exemption on grounds of a financial activity conducted on an occasional or very limited basis (further in the text - 3 AMLD).

The 3AMLD took into account the FATF's revised anti-money laundering and counter terrorist financing standards of 2003. Its introduction can be seen as a culmination of the sudden realization of the susceptibility of designated non-financial businesses and professions such as lawyers to the furtherance of money laundering transactions and the changing political and economic circumstances following the September 11th and the Madrid bombing terrorist acts. Professionals such as lawyers were finally included within the scope of the 3 AMLD. In fact, 3 AMLD makes the regime applicable to lawyers, notaries, accountants, real estate agents, casinos and encompassing trust and company services, exceeding EUR 15 000. It also included measures against the financing of terrorism. The 3 AMLD implements enhanced customer due diligence measures for politically exposed persons (further in text – PEP), simplified customer due diligence procedures for low-risk transactions (Member state assessed), transparent and certain and on-going monitoring of such transactions. Directive (EU) 2015/849 of the European Parliament and of the Council of 20 May 2015 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, amending Regulation (EU) No 648/2012 of the European Parliament and of the Council, and repealing Directive 2005/60/EC of the European Parliament and of the Council and Commission Directive 2006/70/EC (further in the text - 4 AMLD) introduces Risk assessments prepared and drawn by member states and shared amongst them in order to manage the risks. Risk-based due diligence setting requirements for documented results. Obligated entities must also engage in adequate monitoring to enable the detection of suspicious transactions. Establishment of central registers on ultimate beneficial owners of corporate and other legal entities. Introduction of the definition of a politically important person (further in the text – PEP) requiring enhanced due diligence measures to be applied towards PEPs. Setting requirements about record – keeping for 5-10 years. Increased range of sanctions for breaches of AML obligations. The increase of Financial Investigation Unit's (further in the text – FIU) role for sake of improvement of cross border cooperation. Directive (EU) 2018/843 of the European Parliament and of the Council of 30 May 2018 amending Directive (EU) 2015/849 on the prevention of the use of the financial system for the purposes of money laundering or terrorist financing, and amending Directives 2009/138/EC and 2013/36/EU (further in the text – 5 AMLD) imposes greater transparency on the financial sector regarding beneficial ownership with a focus on beneficial ownership of trusts. A firms data on beneficial owners will be made accessible to competent authorities and professional sector service providers, such as banks and others who can demonstrate a legitimate interest. The same information can be accessed by any member of the public without the need to demonstrate a legitimate interest. 5AMLD extends AML/CFT obligations to new assets being managed such as: increasing scrutiny over virtual currencies to prevent anonymity. Anonymous safe deposit boxes will also no longer be allowed. This includes Cryptoasset Exchange Providers; Cryptoasset Automated Teller Machines (ATM); Custodian Wallet Providers; Peer to Peer Providers - businesses that provide an online marketplace to allow the exchange of cryptoassets and fiat currencies; Issuers of New cryptoassets, – businesses that sell a new cryptoasset in exchange for fiat currency; Custodian Wallet Providers and Art Traders: When dealing with high-value artwork that results in a transaction of €10,000 or more, art traders will have to report suspicious activity and perform checks on customers when necessary. It clarified notion of PEP and identified them for monitoring. Enhanced Due Diligence for High-Risk Third Countries. One of the new updates that the 5AMLD brings, is that any client that is based in a High-Risk country is now subject to compulsory enhanced due diligence measures, of which the 'relevant person' must undertake. These include obtaining information on the source of funds, background checks and beneficial ownership to name just a few. Member States may also prevent firms from opening branches or subsidiaries in high-risk third countries and prevent the opening of a branch or subsidiary of a firm based in a high-risk third country.

On July, 20, 2021, the European Commission presented package of legislation to strengthen the EU's AML rules (further in the text -AML Package).AML package comprises 4 legislative acts:

1. The EU “single rulebook” regulation provides guidelines for completing customer due diligence, disclosing the identities of beneficial owners, using anonymous instruments like crypto-assets, and introducing new entities such as crowdfunding platforms. It also includes clauses on "golden" passports and visas.
2. The 6th Anti-Money Laundering directive (further in the text – 6th AMLD) includes national provisions on oversight, FIU, and information sharing requirements which will provide competent authorities with access to reliable information, such as beneficial ownership registrations and assets kept in free zones.
3. The regulation establishing the European Anti-Money Laundering Authority (further in the text - AMLA) invested with supervisory and investigative powers, to ensure compliance with AML/CFT requirements.
4. Amendment of the EU Transfer of Funds regulation on the information accompanying the transfers of funds and certain crypto-assets, in order to make it possible to trace respective transfers.
5. For the purposes of this article, author will focus attention towards two legislation documents it comprises - The 6th AMLD” aimed at improving processes for detecting suspicious transactions & suspicious activity and the European Commission's proposal for a regulation establishing the Authority for Anti-Money Laundering and Countering the Financing of Terrorism (further in the text – AMLA) (“Regulation regarding AMLA”).
6. These two documents are particularly important when analysing the advocats independence and it's duty of confidentiality issues that emerge within the establishment of the connotation of advocat's as “ gatekeepers” new role.
7. The term “gatekeeper” attributed on the grounds as laid down in guidance based on the reference to the FATF report of July, 2010 on Global Money Laundering and Terrorist Financing Threat Assessment in principle fundamentally contradicts the idea of advocats professional obligations. The Article 2.2. of the Charter of Core Principles of the European Legal Profession says “relationships of trust can only exist if a lawyers personal

honour, honesty and integrity are beyond doubt. For the lawyer these traditional virtues are professional obligations”. Therefore, the author concludes that the responsibilities of a gatekeeper conflict with the traditional obligations of advocates towards their clients. (see point 214., 218., 224., 225 of the FATF Guidance for a Risk-Based Approach for Legal Professionals and development of Good Practice)

8. According to the Charter of Core Principles of the European Legal Profession the many duties to which a lawyer is subject require the lawyer’s absolute independence, free from all other influence, especially such as may arise from his or her personal interests or external pressure [...] A lawyer must therefore avoid any impairment of his or her independence and be careful not to compromise his or her professional standards in order to please the client, the court or third parties. [...] Advice given by a lawyer to the client has no value if the lawyer gives it only to ingratiate him or herself, to serve his or her personal interests or in response to outside pressure.

Furthermore this independence is strengthened by the surveillance of the independent bar associations on a national level who elaborate further advocates activity in line with the principles, traditions, ethics and law. By investing unlimited powers of investigation and decision making of the possible breach of Union law to AMLA, the EU governor considers the competence of national supervisory authority as insufficient although there are no facts that could prove the assumption. According to the opinion of the Council of Bars and Law Societies of Europe (further in the text –CCBE) “a necessary and essential corollary to the independence of lawyers is an independent Bar. And no AML measure should interfere with the independence of the legal profession. The independence of lawyers is an integral component of the right to a fair trial as enshrined in of the Article 6 of the European Convention on Human Rights and Article 47 of the Charter of Fundamental Rights of European Union. As the Charter of core principles of the European legal profession sets out, “a lawyer needs to be free – politically, economically and intellectually – in pursuing his or her activities of advising and representing the client. This means that the lawyer must be independent of the state and other powerful interests [...]. The lawyer’s membership of liberal profession and the authority deriving from that membership helps to maintain independence, and bar associations must play an important role in helping to guarantee lawyer’s independence. Self regulation of the profession is seen as vital in buttressing the independence of the individual lawyer.”

By attributing the connotation of a gatekeeper to advocates, EU governor creates concerns for public image and self regulation of the legal profession. Advocats role as the guardian of justice is being transposed to that of a mere subject of law and equalled with a list of other professions which do not belong to the third state power – system of justice. Moreover, the “ gatekeeper” characteristics provided in the guidance based on the reference to the FATF report of July, 2010 on Global Money Laundering and Terrorist Financing Threat Assessment could be true if they were based in empirical data. Unfortunately, there is no empirical evidence on the AML/CFT vulnerability of lawyers that could justify the need for such AML regulation. “ The fact is, according to lawyers, that there is no empirical evidence seriously or systematically implicating legal professionals in financial crimes.” Moreover the fact about lack of empirical evidence has been stressed by the Council of CCBE in its positions paper on the European Commission’s 2021 AML package in saying that “ in the absence of a full ex-post evaluation of the current AML legislation the assumption [of advocates as gatekeepers] is not based on factual data and it does not acknowledge at all the efforts of the CCBE member Bars and Law Societies in detecting and preventing money laundering”.

According to the author’s view the above said substantiates the answer to the question of whether an advocat can be a good gatekeeper. Advocat can not be a gatekeeper because the gatekeeper’s functions and obligations are in clear contradiction with his duty of independence thus undermining the rule of law. When looking upon the the nature of relationships between the lawyers and the clients, from the angle “ lawyer as client’s agent” - lawyer’s traditional role is to help clients pursue lawful goals through available lawful means, but this is quite different from saying that lawyers should do whatever clients want, or assist clients in achieving illegal pursuits. In accordance with the Charter of Core Principles of the European Legal Profession “subject to due observance of all rules of law and professional conduct, a lawyer must always act in best interests of the client and must put those interests before the lawyer’s own interests or those of fellow members of the legal profession.”

PROS AND CONS FOR LAWYER AS A GATEKEEPER

In attempt to define the positive sides for complying with AML requirements in terms of clients due diligence procedures, here are the main reasons why it is a good thing for lawyers to screen clients misconduct. It keeps lawyers themselves honest. It serves societal interests in preventing harm and thus enhances sound judicial administration. Alongside it raises lawyer’s awareness and makes them think about the morality and legality of client’s conduct as well as their own.

Although the author identified several pros for lawyer regarding the AML requirements about the due diligence duty in assessment of its client before the start of transaction, below are the arguments against them.

All of the above mentioned due diligence measures that an advocat must do in order to ascertain if the client’s conduct is compatible with AML rationale, are already valid and existing functions of his or hers daily work.

These functions have been stipulated in the normative acts binding for lawyer sector and surveilled by local independent surveillance regulatory body (further in the text – SRB) on a national level. The These regulatory bodies serve as glossary for advocates for relevant knowledge and understanding of the rationale of the functions.

On the other hand when speaking about the cons for lawyer as a gatekeeper, the considerations are much more fundamental and serious than the pros. By implementing AML regulation the measures of which contradict with the advocates independence, the fundamental rights to fair trial, justice and defense are endangered and so is the democracy in that it exists in sound division of state powers. Therefore the author concludes, that the by attributing the connotation “gatekeepers” the EU legislator and policy maker – FATF – has not considered these fundamental obstacles. As well as the author thinks that attribution of gatekeepers towards legal professionals without empirical data of committed crimes or offenses, not responding to the written concerns of the international organisations created for the defence of the lawyers throughout the world like CCBE, International Bar Association (further in the text – IBA) etc. Is not an example of good governance. Gatekeepers role conflicts with the traditional responsibilities of loyalty that the lawyer has towards his clients. Second important aspect that concerns the application of AML regulation towards advocats as gatekeepers is that it distorts the relationship between advocat and his client. And this aspect would manifest themselves in the limited or no effectiveness in of counseling and defence. The legitimate expectation that all the information disclosed to the advocat will remain confidential is the core elemnet that forms the trust and loyalty relationships between the advocat and the client. This trust and loyalty is mutually created and these two elemenets are dependant on each other. Without lawyers loyalty towards his duties as a professional towards client, trust from clients side can not be absolute. However without these elemenets, advocats can not exercise the effective defence of the client.

The sanctions and punitive measures by regulators enforced by the AML regulation towards advocats for their clients cases will trigger more tension in those relationships from advocates side as well by making enhanced inquiries in order to not commit a mistake, or refuse from the client’s case in order to not damage the reputation, or to report STR under the smallest suspicions of client’s misconduct arise.

CONCLUSIONS

FATF as the EU AML standard setter has introduced the connotation “lawyers as gatekeepers” regarding the representatives of the legal profession as facilitators of AML explaining the link between the legal services and the money laundering trends, due to the complicated legal and financial character of money laundering operations.

The terminology of a “gatekeeper” is to say the least unfortunate. Gatekeepers close the gate, gatekeepers need to form judgements on those they exclude. This inevitably leads to the conflict with the basic principle of lawyer’s duty to represent the interests of their clients. “Whilst admitting the principal duty of lawyers to prevent crime and to convince clients to act legally, it is unacceptable to be forced to turn from the defendant into the accuser of the client.”

The recent reform proposals simply address EU regulators’ perceptions that lawyers’ and SRBs’ supervisory activities about understanding and implementation of professional functions has not been adequate in recent times. It is important to note that these perceptions are not grounded by empirical data. There is no statistics that could serve as a proof to the above mentioned. The CCBE in its position paper on the European Commissions 2021 AML package, dated December 10, 2021, have said that “the fact that the new AML package aiming at strengthening AML rules and overcoming existing loopholes is not based on a full ex-post evaluation of the current AML regime is problematic.”

Gatekeeping is only one part, and a relatively small part, of the lawyer’s role. If lawyers are to put the role of gatekeeper into effect—maybe at the cost of their economic benefits—regulation must balance lawyers’ mutiple roles. In fact this is professionally done by national SRBs’, the competent and self-regulatory body acting as a surveillance and monitoring mechanism on a daily basis for advocats. The advocat not only has a duty to provide professional services to the client it also must respect the law and act lawfully. These are values enshrined in the national legislation binding for the legal profession, arouses from the old traditions. Therefore no AML measure should interfere with the independence of the lawyers. In fact, the importance of independent lawyers and an independent SRB has been recognised by the European Commission in its Rule of Law report: legal professions play a fundamental role in ensuring the protection of fundamental rights and the strengthening of the rule of law. An effective justice system requires that lawyers be free to pursue their activities of advising and representing their clients, and bar associations play an important role in helping to guarantee lawyer’s independence and professional integrity.” However, nonobstant the above mentioned the Commission has not had evaluated the already established regulatory enactments set by the SRB’s in member states.

It goes without saying that lawyers should take reasonable measures and provide their input to combat money laundering, but these measures must be in line with state bar standards and ethical rules and democratic values and fundamental freedoms.

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NEED FOR SOCIAL SERVICES AND DEVELOPMENT OPPORTUNITIES IN RURAL COMMUNITIES

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Annotation. Three parts appeared in this concept: aid in money, aid in goods, aid in services. *The main goal of social services* is to create conditions for a single person or family to develop, strengthen abilities, opportunities to solve their problems, teach them to function independently in society, thus overcoming social isolation. Social assistance is provided when the aim is to prevent the emergence of social problems of clients, when it is necessary to ensure the safety of the society or community. Groups of recipients of social services – elderly persons and their families; persons with disabilities, their families; children left without parental care; children experiencing social risk, their families, families at social risk; families fostering and/or looking after children; etc.

Keywords: social services, rural community, social exclusion, poverty

INTRODUCTION

As social exclusion increases, poverty problems worsen, and the population ages, the need for social services grows. The need for social services is increasing every year and it is increasing in all client groups. The five-year data published on the official website of the Lithuanian Statistics Department (<https://www.stat.gov.lt>) only confirms that the need for such services is only increasing. For example, in 2015 2.5 thousand persons of working age and children with disabilities in day care centers received social services, and in 2020 there were 16.2 thousand of such recipients already. In the children's day centers operating in Lithuania, 8396 children from families experiencing social risk received services in 2016, and in 2020 there were 8132 children. This number has decreased, possibly due to a decrease in the number of families experiencing social difficulties. Services provided to children with disabilities in day care centers - 2016 – there were 2582 children, in 2020 – 4032 children. This number has increased significantly over the past five years. The website of the Department of Statistics of Lithuania publishes relevant statistics on the care of elderly and disabled persons, which is becoming more and more relevant in our society. These are nursing home institutions. This need is also increasing. According to official statistics, 117 such persons were accommodated in state (county) care homes in 2016, and in 2020 – 333. In municipal care institutions in 2016 2564 people lived there, and in 2020 2,921 residents have already been settled. In public organizations, parishes and private care homes 2041 people lived there in 2016, and in 2020 - 3033 persons. Accommodation and care are a very relevant problem for this age group. Therefore, there is a need and opportunity for communities to create nursing homes and provide the necessary services. From the official statistics, we can see that social services are needed by people in their homes (elderly, disabled), as well as the payment of aid money to buy these services: in 2016 there were 18,741 such persons, and in 2020 – 22100. This could also be provided by rural communities. The topical problem of transport is also not left aside. In 2016, municipalities provided transportation services to 12,000 people. persons, and in 2020 13.2 thousand received such services. persons. Rural communities can also develop this service. life house etc. Paragraph 8 of Article 13 of the Law on Social Services of the Republic of Lithuania (2006) stipulates that every municipality must have an institution or institution that plans, administers and organizes social services. Supervision and control of these services must also be carried out in municipalities.

The network of social services is being expanded, therefore it is relevant to analyze which organizations provide social services and it is relevant, after conducting research, to assess the need and development opportunities for social services for residents of rural communities.

Problematic questions - What are the possibilities for the development of social services in rural communities? How could rural communities contribute to the development of social services?

Research object - The need for social services and development opportunities in terms of the opinion of the members of the rural community.

The purpose of the research is to analyze the need for social services and development opportunities in rural communities.

Research tasks:

1. Based on the analysis of scientific literature, analyze the need for social services and their possible development in Lithuania and Latvia.

2. Using a qualitative research method (semi-structured interview), reveal the need and availability of social services in rural communities.

3. Based on the results of the qualitative research, present opportunities for the development of social services in rural communities.

Research methods: Analysis of scientific literature and documents. Semi-structured interview. Qualitative content analysis.

NEED FOR SOCIAL SERVICES AND ANALYSIS OF DEVELOPMENT OPPORTUNITIES RESEARCH METHODOLOGY

In order to analyze the need for social services and development opportunities in rural communities, a semi-structured interview method was chosen. Qualitative research data (semi-structured interview texts) were processed using the qualitative content analysis method.

Some researchers also call this interview semi-structured. The main advantage: interviews provide more detailed, structured data (Rupšienė, 2007). Based on this provision, the semi-structured interview method was chosen for the study, which allows collecting a variety of data, there is no need to "frame" the informant in a strict order, questions can be presented out of order. This study was chosen due to the fact that the chairmen of rural communities know best what the community members need and are best able to identify existing problems.

The semi-structured interview consisted of demographic data on the informants (gender, place of residence, education, age). Another block of questions is dedicated to the analysis of social services provided in communities. The third block of questions is dedicated to assessing what services the communities lack and what hinders their organization. The fourth block of questions is dedicated to community suggestions on how to improve the situation in the field of social services. In this case, the demographic block is not so important.

Members of the rural communities of the Tauragė district participated in the study (6 informants). The research took place in October - November 2022. The research was organized in accordance with the principles of ethics, confidentiality, and anonymity, so the exact location of the participants is not disclosed, only the district is mentioned. The names of the informants are coded with a number.

DISCUSSION OF RESEARCH RESULTS

In order to analyze the need for social services and development opportunities in rural communities, it is appropriate to examine diagnostic areas that can reveal the purpose of this research. Just to say that the villagers receive social services is enough to say nothing. There are institutions providing social services in rural communities, but are they sufficient to meet all the needs of community members? What do the informants themselves think about the services provided, their need, development possibilities? What can communities offer to their residents to adapt to changing situations and meet needs? Therefore, it is appropriate to listen to the needs, wishes and vision of the community members. This study will help analyze this.

Table 1 presents the situation of what services are currently organized in the communities, who are the providers of those services. Which population groups are these services intended for, and what are the funding sources. Also, the variety of services, what kind of help residents currently receive.

Table 1

The range of social services provided in rural communities

Category	Examples of statements	No. of statements
Activities of organizations.	"<...> services are more administrative <...> home assistance for elderly, disabled persons"(1). "<...> is organized and provided by soc. services". (2). "Organized activities, lesson preparation, educational trips"(3). "<...> provides stationary social services. Integral assistance to the home <...>". "Respite services <...>". "<...> reorganization towards the independence of the disabled"(4). "<...> administration functions." "<...> helps residents manage various benefits, allowances, and supports." "<...> distributes food packages from the European Aid Fund". "<...> trips, holidays, cooking, sports <...>"(5). "<...> to provide social care, social care <...>". "Satisfy the psychological, social, cultural and spiritual needs of every nursing home resident <...>". "<...> to ensure their self-expression, motivation, encourage and help them integrate into the community, ensure quality medical rehabilitation services for individuals"(6).	27
Diversity of social services.	"<...> on various social issues <...> "<...> receiving allowances, other benefits, organizing help at home <...> accommodation services <...> "<...> employment services for children (preparation of lessons, organization of educational programs)." "<...> daily skills (housekeeping, cooking, hygiene)"(1). "<...> soc. services <...>". "Other services <...> consulting, information, mediation, representation <...>". "<...> children's employment (preparation of lessons, organization of free time, drawing, sculpting, excursions)"(2). "<...> meetings with psychologists are organized. Community, tolerance, citizenship are cultivated"(3). "<...> it is possible to bring a disabled relative to stay in the institution for 10 days"(4). "<...> accommodation, care services". "<...> general	19

	services, administrative. Consults, informs <...>(5). "<...> care, day care, comprehensive assistance, respite services"(6).	
Recipients of residential services.	"<...> for all population groups <...>". "<...> with all population groups". "<...> elderly, elderly or persons with disabilities". "<...> for children <...>(1). "<...> for all residents of our community". "<...> for the children of the community"(2). "For children, teenagers, parents"(3). "<...> for those with disabilities and/or special needs or complex disability, for elderly persons"(4). "<...> for elderly and single persons, persons with disabilities". "... for all population groups"(5). "<...> for persons with mental, mental disabilities". "<...> for the elderly <...>(6).	19
Funding sources.	"<...> is financed from the state and municipal budget". "<...> from the municipal budget and part of it is paid by the residents themselves from their income". "<...> projects are written, submitted to the municipality and the municipality allocates funding"(1). "Maintained from the municipal budget." "<...> is supported from the municipal budget, according to the submitted <...> projects"(2). "<...> municipality and ministry". "<...> we write projects to receive these financings"(3). "<...> Nursing homes financed by the Ministry of Social Security and Labor <...>(4). "<...> municipality <...>(5). "<...> budgetary institution <...>(6)	12
Social service institutions, organizations.	"<...> seniority <...> care home for the elderly", children's day care centers".(1) "Eldership, children's day centre".(2) "<...> children's day centre".(3) "<...> social services home <...>".(4) "Elderly care home, seniority".(5) "Social services home".(6)	10

In Table 1, we can see what social services community members currently receive, what organizations and institutions operate, what their activities are, what population groups the services are provided to, and who finances them. From the statements presented in the table, we can see that there are few social service institutions in rural communities. After surveying the members of 5 communities in the district, we get almost identical answers about the following institutions: "<...> eldership <...> care home for the elderly", children's day care centers, social services houses". From the received answers, we can see that the main institution that contributes and organizes or provides social services to residents is the municipality. The communities are located in different areas of the district, but they operate within the boundaries of the elderships. Therefore, the main helper and provider of assistance to the communities becomes precisely the eldership. Children's day care centers are also classified as this type of service, although they are not available in all communities. They are just getting started. Day centers are established by the communities themselves, receiving funding from the municipality. The municipality also allocates premises for the centers and pays utility bills. It remains for the communities to find volunteers and employees who work for remuneration (part of the employees are paid their earnings from project funds) and to organize the activities of children's day care centers. There are also not many nursing homes or Social Services homes. They operate in several communities and provide services to residents of the entire district, not just their own. Such a situation is limited by funding. The municipality pays for the services of residents of care homes and has the right of priority to accommodate persons who receive their turn in such institutions. The community alone would not be able to sustain the care home, and the residents are not solvent enough to cover the full amount required to live in a care facility. The services of these institutions are non-stationary and stationary.

According to the Social Services Catalog (2019), social services can be divided into general and special. General social services include such services as "<...> receiving allowances, other benefits <...> consulting, informing, mediation, representation <...>""<...> general services, administrative. The main provider of these services is the eldership. This institution is a structural unit of the municipality and carries out administrative work with partially integrated special social services. Such services as "<...> employment services for children (preparation of lessons, organization of educational programs)." "<...> daily skills (housekeeping, cooking, hygiene), <...> meetings with psychologists are organized. Community, tolerance, citizenship are fostered by day care centers operating in the community. In this area, the rural communities themselves do an excellent job. They know the children of their community best, they know their needs and wishes, they know how families live and in which direction the child can be directed, how to educate him. A more complex population group is the elderly or disabled adults. Specialized accommodation and health care services are provided here "<...> accommodation, care services" are provided by nursing homes for the elderly. These are institutions where life is bubbling, but it is already stationary and the recipients need special care and assistance. The range of services of the "Social Services House" has expanded. If earlier only accommodation and health care services were provided, now inpatient <...> care, day center <...>, integral assistance in individual homes, respite services "<...> disabled relatives can be brought for 10 days" leave in the institution".

It can be said that the services are being improved and their range is expanding. The activities of both day and inpatient institutions cover various areas "<...> home help for elderly, disabled persons", "Organized classes, lesson preparation, familiarization trips, education", "<...> Integral home help <...>". "Respite services <...>". "<...> distributes food packages from the European Aid Fund", " To meet the psychological, social, cultural and spiritual needs of every resident of the nursing home <...>", "<...> to ensure their self-expression, motivation, encouragement and support

integrate into the community". These community-based institutions create a variety of services and try to bring them closer to people. A few years ago, services such as respite and integral help at home did not even exist. Since 2005, food support from the European Aid Fund (EPF) has been distributed in the elderships. It is provided on a voluntary basis, the eldership employees do not receive remuneration for it, and they have a lot of work to do - they need to collect applications, check whether they meet the requirements for receiving support, process them, enter data into the Social Support and Information System (SPIS), distribute products and submit data municipality. Not all services are provided on a voluntary basis. Since these institutions are state-owned, they are financed "<...> from the municipality's budget and part of it is paid by the residents themselves from their income", "<...> projects are written, submitted to the municipality and the municipality allocates funding", "<...> Nursing homes financed by the Ministry of Social Security and Labor <...>". Thus, the sources of funding for these services are state and municipal budgets, and only persons living in care homes pay part of the amount themselves from their own income. 20 percent of the received income remains for residents to satisfy their own needs and desires. As a result of state policy, nursing home residents are usually fully supported. In their residential areas, all population groups can receive services "<...> elderly, elderly or persons with disabilities". "<...> for children <...>", "<...> for all residents of our community", "For children, teenagers, parents", "<...> with disabilities and/or special needs or complex disability". The spectrum of social services is expanding, more diverse services are offered, adapted to all population groups. In this case, state institutions try to meet the needs of the population. But are these services enough, are they efficient and appropriate? Table 2 provides an overview of the possibilities for the development of services provided in communities. In order to analyze the need for social services and development opportunities, it is necessary to analyze which population groups such services would be aimed at, what the need for those services would be, and what factors might hinder the development of services.

Table 2

Opportunities for the development of social services provided in the community

Category	Examples of statements	No. of statements
Factors hindering the development of social services.	"<...> far from the city <...> communication problem". "<...> unwillingness of state institutions to help, advise <...>" "<...> are not able to provide all services". "There is no NGO <...>".(1) "There is a lack of qualified workers <...>". "<...> we lack properly educated community members <...>".(2) "Lack of team". "<...> leaves for work in other areas." "<...>can no longer due to health condition".(3) "<...> people are afraid to leave the house during the pandemic <...>". "There is a lack of enterprising people." "<...> does not want action for "thank you". (4) "Small population, the village is far from the city center, poor communication, lack of motivation".(5) "<...> lack or employment of social workers, excessive workloads".(6)	19
The need for social services in rural communities.	"<...> transport services". "<...> in the help home <...>". "<...> help raising children, <...> parenting training".(1) "<...> come, sit, chat, drink a cup of tea." "<...>buy and bring food <...> make food".(3) "<...> Silver Line <...> "<...> telephone conversations <...>". "<...>conversations, emotional, informational support <...>".(4). "<...> children's day care centers, leisure spaces".(5)	14
The population of the rural community.	"For the elderly <...>". "For families <...>".(1) "<...> children and seniors". "<...> for seniors".(3) "<...> many elderly people <...>". "<...> for the elderly".(4) "<...>for families raising children <...>".(5)	8

The research revealed which part of the population of the rural community would most need such services. These are - "For elderly people <...>", "<...> for older people", Pareigienė, Kuliešis (2013) after conducting a study revealed that there is a rapid aging of the population in rural regions. The rapid aging of the population, the departure of young people from the countryside to the cities or emigration to foreign countries, creates a need for the provision of services to the elderly. Often, such persons can no longer take care of themselves, and they have no relatives who can help them. There is a need to provide such services in residents' homes. This is a good practice because elderly people do not want to leave their homes, they feel good and comfortable in them. They need daily help (buying food, cooking, taking them to the doctor, etc.), but they can live independently in their own home. Another group of service recipients is "<...> children", "<...>for families raising children <...>". It's employment for families with children who also need services. This is a smaller proportion of the population than the elderly. If the municipality and state institutions provide more and more diverse services to the elderly, children and families lack them. This should not affect the fact that the recipient group is smaller. In order to keep young people and families in rural areas, it is necessary to make more efforts and provide quality services. Unable to meet the needs of themselves and their children, young people leave rural areas and go to live where "life boils", in the cities. Therefore, the potential for the development of services is high, and state institutions should contribute to it by offering families various services and preferential conditions, e.g. to purchase housing.

The conducted research informatively showed what services would be needed in the communities. "<...> transport services". "<...> help at home <...>", "<...> come, sit, chat, drink a cup of tea." "<...> buy and bring food <...>" "<...> Silver line <...>". The results of the study showed that the spectrum of services focuses on elderly people. Therefore, it is not possible to move away from the demographic situation in rural areas. After all, the main services and service recipients are seniors. Very often, seniors feel lonely, no one needs them, so there is a need not only for such help as buying, bringing or cooking food, but also for much-needed emotional support and communication. With limited opportunities to visit the elderly, the "Silver Line" and its telephone support would be very necessary and useful for the elderly. Parents also need services and help <...> parenting training', and children need employment "<...> day care centers, leisure spaces". However, good wishes alone are not enough, we need funding, proactive community members, and volunteers. When planning and organizing activities, factors hindering the development of services appear, such as "<...> communication problem", Small population, the village is far from the city center <...>. Remote areas, small population influence poverty and minimal services. Due to such factors, the development of services is stalled. The message often "comes" from the authorities that the population is small and investments will not be useful, it is better to do nothing. The village is often given less attention, no organization is created "<...> unwillingness of state institutions to help, advise <...>", "<...> we lack properly educated community members <...>", "Lack of team" . These statements prove that young, able-bodied residents of the community are leaving for work in other areas, and as a result, there is a lack of enterprising, skilled workers in the community. And when it is not possible to form a good community active team, the idea of creating attractive, dignified conditions for the remaining members of the community is stuck. Specialists and social workers are needed to provide social services, and there is also a great shortage of them in communities. Communities want help from state institutions, but even these do not always help and contribute to helping communities. The covid-19 pandemic, which is now in its second year, has also had a negative impact on people "<...> people are afraid to leave their homes during the pandemic <...>". Restricted people's freedom, fear of getting sick exacerbated existing problems and helped to create new ones. One of them is that people are afraid to leave the house, they are afraid of contracting a viral infection. And staying at home causes many problems, not only social, but also medical and psychological. The most sensitive group for this problem is also the elderly. Often these are lonely, disabled persons. Young people work, study, have other activities, so the impact of the pandemic is less for them than for seniors who spend a lot of time at home. Rural communities are proactive and active enough, with no shortage of ideas. Table 3 presents community members' suggestions, reflections on what services the residents would need, what groups of residents lack services, and what community members' own resources are for contributing to the creation of services.

Table 3

Possible initiatives of community members to enrich community services

Category	Examples of statements	No. of statements
Supply of social services.	"<...> organize transport services, help at home, laundry service". "<...> organized meetings <...>". "<...> specialists from various fields can come and conduct lectures and trainings". "<...> wash the clothes <...>". "<...> can come to bathe <...>". "<...> shuttle services". "<...> to help clean the rooms, prepare food, buy food, bring in firewood".(1) "<...> ride, daily occupation". "<...> to provide employment services - education, organization of interviews <...>".(3) "<...> establishment of social workshops <...> we would organize employment services <...>". "<...> buy food products or medicine <...> before the doctor's office".(4) "Organize <...> camps <...>". "<...> volunteer at a children's camp".(5) "<...> communicate <...>". "<...> a useful children's day center." "<...> it's great to have a group of volunteers <...> help <...>".(6)	25
Plans of community members, organizing social services.	"More active cooperation with social service providers, greater communication between social service institutions". "More active involvement of community members <...>".(2) "We plan to write a project about the ride <...>". "Provide voluntary assistance by offering ideas <...> contribute to the organization of <...> assistance".(3) "Members of the community could volunteer <...> for a ride <...>".(4) "Involve young people <...> to the process of helping the community <...>". "<...> of more proactive people, volunteers".(5) "<...> could benevolently help <...>". "<...> to provide their ideas, suggestions, observations, help <...> to get involved in activities".(6)	14
Community members, recipients of social services.	"<...> for elderly people <...>".(1) "Seniors <...>". "<...> for seniors <...>".(3) "<...> persons with mental or mental disabilities, seniors".(4) "<...> families of <...> children" . "<...> for elderly neighbors <...>".(5) "<...> for single people". "<...> for the elderly".(6)	10
Community resources.	"We have premises <...>". "<...> automatic washing machine <...>". "<...> shower <...>". "We are planning to buy a car <...>".(1) "<...> to buy a car". "We have premises <...>".(3)	6

The activities of rural communities are focused on the organization of cultural and sports events, the organization of leisure activities for youth and seniors, environmental management, and various healthy lifestyle programs (Pareigienė, Kuliešis, 2013). Members of rural communities are sufficiently active and active. Informants named where community members could "stretch", what services and help to offer. "We plan to write a project about the ride <...>", "Provide voluntary help, <...>" "Involve young people <...> in the process of helping the community <...>", "<...> provide their ideas, suggestions, observations, help <...> to get involved in activities". Informants mentioned activities such as writing projects, getting involved more actively in the aid process by helping other community members. The idea of volunteering is most evident in the informants' answers. The activities of the communities are based on the foundations of volunteerism. Members work for their community for free. Achieving beautiful goals does not require large financial resources. Voluntary activities bring communities together and enable them to achieve their goals. When planning the provision of services, rural communities have wishes that could help achieve results "More active cooperation with social service providers, greater communication between social service institutions". "More active involvement of community members <...>". it is encouraging that communities are self-oriented, ready to invest their time in creating better well-being. Population groups that need services do not change "<...> for elderly people <...>", "Seniors <...>". "...for persons with mental or mental disabilities", "for families of <...> children". "<...> for elderly neighbors <...>", "<...> for lonely people". Elderly persons dominate again, and a new group also appears, namely persons with mental or intellectual disabilities. However, all population groups require similar services (home help, communication, organization of health care, organization of leisure time, etc.). Communities are proactive and full of ideas. The informants expressed what services they could organize and provide to their residents themselves "<...> organize transport services, help at home, laundry service", "<...> can come to bathe <...>", "<...> to help clean the rooms, prepare food, buy food, bring in firewood". From the answers given, we can see that communities could provide everyday services that do not require special training, education or financial resources. These are simple but much needed services. Educational, employment organization services "<...> daily employment". "<...> educations, organization of interviews <...>", "<...> establishment of social workshops <...>" Organize <...> camps <...>", "<...> a useful children's day center", "<...> it's great to have a group of volunteers <...>" "<...> specialists from various fields can come and conduct lectures, trainings" "<...> meetings are organized <...>". The ideas presented by informants are important and useful, involving community members in various activities. The greatest desire of communities is to attract volunteers. Many activities can be carried out on a voluntary basis, but not all. Other activities require funds or use of available material base "We have premises <...>", "<...> automatic washing machine <...>", "<...> shower <...>". "We are planning to buy a car <...>". Rural communities actively participate in the field of social services, provide proposals and projects. Communities do not have their own funds, do not earn, and the idea of social business is not developed.

According to Ramaškienė, Šumskienė (2020), the mission of social business is not only profit, but it is necessary to create social value that promotes social impact and solves poverty problems. The mission and vision of social business is the future. The financial benefits will have to wait, because few such businesses are created and there is no significant deposit yet. Currently, the main supporter of communities is the municipality. The municipality allocates premises to the communities and pays utility taxes according to the use contract. Community members can use the facilities. Some communities are starting to develop social business ideas. Writes projects, plans to buy cars, provide transportation services.

CONCLUSIONS

1. The theoretical analysis of the literature revealed new trends in the field of social services. In the past, the social services system was limited to the minimally provided social services. Now the situation has fundamentally changed. After looking at the network of institutions, it is observed that social services are provided by state institutions, non-governmental organizations and new participants in the system - communities. The most widely developed network of state institutions. NGOs are chasing him. Communities are just trying to start providing such services. One can find the beginnings in the development of volunteering, when human resources are used for help - relatives, neighbors.

2. The research results showed that social services are provided in rural communities, but they are still lacking. The main service providers are state institutions, there are no NGOs, and the communities are still trying to find out the need for such services, study their environment, and consider what kind of help they could offer.

3. Rural communities are active, proactive and have potential. Therefore, based on the results of the qualitative research, the possibilities for the development of social services in rural communities have great potential and opportunities for creating and developing a network of these services. The members of the communities themselves identified how the services could be expanded, how the communities themselves could contribute to this: by writing projects to receive services or funding. Authorities can contribute to the development of services by showing greater attention to communities, helping and contributing to the improvement of infrastructure in rural communities (maintenance of roads, organization of public transport, arrangement of public spaces).

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**TAIKOMIEJI TYRIMAI STUDIJOSE IR PRAKTIKOJE
APPLIED RESEARCH IN STUDIES AND PRACTICE**

SCIENTIFIC JOURNAL

2023 No. 19

ISSN 2029-1280
eISSN 2669-0071

Edition of 70 copies
Publisher
PANEVĖŽIO KOLEGIJA

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