Clinical Psychological and Social Practice

in Health Intervention

VOLUME 17 · NUMBER 1 · 2026 WWW.CLINICALSOCIALWORK.EU

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Cover Andrea Spi8áková, *The Chair*, acrylic on canvas

Open access · Peer reviewed · English only
Formerly *Clinical Social Work and Health Intervention*

Published by International Society of Applied Preventive Medicine i-gap, Vienna ISSN 2076-9741 (online) · ISSN 2222-386X (print)

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JOURNAL INFORMATION

Vol. 17, No. 1, 2026
Open Access Journal
Published exclusively in English
Formerly: Clinical Social Work and Health Intervention
ISSN 2076-9741/Online
ISSN 2222-386X/Print
Journal DOI: 10.22359/cswhi
www.clinicalsocialwork.eu

The journal is published on a non-profit basis. It is fully open access and charges no article processing or submission fees. All articles undergo double-blind peer review by two independent reviewers.

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Editorial

Clinical Practice, Prevention and Public Health

Dear Readers, Esteemed Colleagues, Dear Friends,

The issue you are holding opens a new chapter in the life of our journal. From Volume 17, Issue 1 (2026), *Clinical Social Work and Health Intervention* continues under a new title: **Clinical Psychological and Social Practice in Health Intervention**. The change is not cosmetic. Over the past seventeen years, the authors who have entrusted their work to us have shown again and again that health is never only a medical matter. It is shaped by how people think and feel, by the families and communities they live in, by schools, workplaces and institutions, and by the quality of the help they receive. The new title expresses what the journal has, in fact, already become: a meeting place for clinical psychology, social work and health intervention. From this issue on, the journal is published exclusively in English and remains fully open access.

The guiding thread of this issue is *Clinical Practice, Prevention and Public Health*. Several contributions show how much of good care happens long before illness becomes acute. The study by Bálint and Slezáková maps what patients with coronary artery disease actually know about secondary prevention and reminds us that education is a core part of cardiac rehabilitation, not an optional addition. Horová and colleagues review interventions that improve hand hygiene in children, while Deaconu and colleagues document how the COVID-19 pandemic disrupted group dental prophylaxis in kindergartens and how slowly these routines have returned. Klamárová and Andra8číková link the incidence of tooth decay in children to everyday eating habits and family routines, and Horváthová summarises what we know about preventing occupational allergic diseases.

A second group of papers comes directly from clinical practice. Gazdíková and Deglovič present new perspectives on nephropathies and the role of mitochondrial dysfunction; Alhakim and Abusultan describe a rare case of Grisel syndrome after adenoidectomy; Proke8ová and colleagues and Repka and >iaková show what targeted physiotherapy can achieve in carpal tunnel syndrome and non-specific neck pain; and Rottková, Pady8áková and Slezáková analyse nursing interventions that prevent surgical site infection.

The third group turns our attention to the psychological and social side of health – the area our new title deliberately names. Klimová and Repková examine risky sexual behaviour of young adults in relation to emotional intelligence and coping. Gottschalk and Topolska explore the relationship between vegetarian eating, gender and fatigue in students. Finally, Mačkinová, Planka and colleagues study fear of crime through the lens of time perspective – a reminder that the way we relate to our past and future shapes how safe we feel in the present.

From my own work with people recovering from addiction, I know how often the decisive moment of change is not a new medicine but a relationship, a routine, or a sense of meaning that makes care possible. That is why this journal will continue to welcome psychologists, social workers, physicians, nurses, therapists and other helping professionals who study health not as an abstraction but as part of real human lives.

I thank all authors, reviewers and members of the editorial board who have made this transition possible, and Dr. Rivka Rosenberg for her guest editorial. I hope that this issue will be for you not only a source of new findings but also an inspiration for your daily practice.

Prof. PhDr. Michal Oláh, PhD.
Pan-European University, Faculty of Psychology, Bratislava
Guarantor of the issue

Guest Editorial

The contemporary landscape of healthcare demands an integrated understanding of disease, behavior, environment, and social context. In clinical social work, such integration is not optional; it is central to effective intervention. Health outcomes emerge from biological processes together with family systems, institutional structures, educational settings, occupational conditions, economic resources, cultural expectations, and wider social determinants. The articles in this issue of Clinical Psychological and Social Practice in Health Intervention collectively demonstrate this reality: prevention, treatment, and recovery depend on the interaction between clinical expertise and the lived realities of individuals, families, and communities.

This issue brings together contributions on secondary prevention, nephropathies, hand hygiene among children, the COVID-19 pandemic, Grisel syndrome, occupational allergic diseases, tooth decay and eating habits, neck pain, and prevention of surgical site infection. At first glance these topics may seem diverse; yet they share a common concern: how health interventions can be effective, humane, and sustainable in the conditions of actual life. Clinical social work provides a crucial bridge between medical knowledge and lived experience, translating clinical recommendations into practical, context-sensitive intervention that attends to adherence, distress, access, communication, vulnerability, and social support.

A dominant theme here is prevention, particularly secondary prevention in chronic illness. Chronic kidney disease, for example, requires monitoring, medication adherence, lifestyle change, dietary management, and repeated healthcare contact. The burden of illness includes fear, uncertainty, fatigue, financial strain, and the emotional weight of long-term care. Clinical social workers identify barriers to adherence, support families, coordinate care, and advocate for resources, shifting prevention from a technical task to an ongoing relational and organizational process.

Children's health behavior is another focal area. Hand hygiene, nutrition, and oral care are learned within families, schools, and communities. Effective health education depends on adult modeling, institutional supports, and feasible environments. Preventing dental caries demands attention to food access, family routines, and cultural context rather than solely individual instruction. Clinical social work strengthens these linkages by embedding education within relationships and practical supports.

The pandemic's legacy continues to shape mental health, social trust, education, and access to care. Telehealth expanded rapidly, revealing benefits and new equity challenges. Clinical social workers are essential to recovery, addressing grief, isolation, disrupted routines, and systemic inequities while ensuring innovations promote access and dignity.

Occupational allergic diseases and workplace risks show that prevention extends beyond clinical spaces into labor conditions. Work can threaten both health and livelihood; responses require environmental change, medical care, legal support, and psychosocial advocacy. Rare conditions such as Grisel syndrome illustrate how medical complexity produces social complexity: families need clear communication, emotional containment, and coordinated follow-up.

Common problems like neck pain remind us that everyday suffering matters. A biopsychosocial approach links ergonomics, stress, work demands, and coping resources. Surgical site infection prevention highlights the necessity of organizational reliability, patient education, discharge planning, and cross-disciplinary coordination.

Taken together, the papers in this issue argue that modern health intervention cannot operate in silos. Clinical social work connects systems to people, translates recommendations into practice, uncovers hidden barriers, and supports prevention that is feasible in real life. This journal's interdisciplinary mission fosters scholarship that is both rigorous and humane. If healthcare is to meet contemporary needs, it must be coordinated, inclusive, preventive, and attentive to the full human context of illness

and recovery. This issue powerfully affirms that vision.

Rivka Rosenberg, PhD
Bar-Ilan University, Ramat Gan, Israel
July 4th, 2026

ORIGINAL ARTICLE CPSPHI 2026; 17(1): 7–15

Mapping Knowledge of Secondary Prevention in Patients with Coronary Artery Disease

G. Bálint (Gabriel Bálint)[1,2], Z. Slezáková (Zuzana Slezáková)[1]

Summary

Objective: The aim of our study was to map the proportion of completely correct answers and to compare the level of knowledge between two age groups in the studied domains.

Design: Pilot study.

Participants: 180 hospitalised patients with coronary artery disease.

Methods: We used the Slovak version of the Coronary Artery Disease Education Questionnaire (CADE Q-II), which targets five domains: health status, risk factors, exercise, nutrition and psychosocial risk.

Results: We found that patients <60 years of age provided more completely correct answers in all studied domains compared to patients >60 years. Patients <60 years achieved a total mean score of 63.47±12.3 SD out of 93; compared to patients >60 years with 58.84±10.1 SD out of 93 (p=0.014). In the comparison of the two age groups, we found statistically significant differences in the studied domains.

Conclusion: The pilot study shows that both age groups scored an acceptable level of knowledge and have gaps of knowledge in five studied domains.

Keywords Gaps of Knowledge; Secondary Prevention; Assessment Tool; Coronary Artery Disease; Age Groups.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 7–15. https://doi.org/10.22359/cswhi_17_1_01

Cited references: 19
Publisher: International Society of Applied Preventive Medicine i-gap

INTRODUCTION

Up to 60% of patients with cardiovascular disease have limited health literacy, which is associated with low commitment to lifestyle changes, increased number of hospitalizations and a higher risk of mortality [1]. Studies confirm that adequate knowledge about the disease improves the patient's awareness of potential and existing risk factors and supports the maintenance of a healthy lifestyle, which leads to better cardiovascular health [2]. Nurse-managed interventions effectively help change the lifestyle of individuals by promoting knowledge and increasing health literacy [16]. Nurses are in an important position to contribute to the reduction of deficits and uncertainties in the field of health, increase awareness and health literacy, and thus play an important role in the field of prevention [11]. The CADE-Q II questionnaire is a suitable tool for evaluating knowledge, as well as the effectiveness of education in the field of secondary prevention [7]. Assessment tools to assess knowledge and identify patients with low health literacy should be incorporated into standard health care for patients with coronary artery disease [6]. During patient education, it is not enough to just provide information; at the same time, it is necessary to achieve a change in attitude and behaviour in the field of health and integrate it

into comprehensive care [12]. A prerequisite for effective prevention is a comprehensive, multidisciplinary and holistic approach.

Aim

To map the proportion of completely correct answers in studied domains; to compare the level of knowledge between the two age groups in the studied domains.

Materials and methods

In a pilot cross-sectional study, we approached 180 hospitalized patients at The National Institute of Cardiovascular Diseases in the Slovak Republic. Data collection took place between June 2021 and April 2024.

Inclusion criteria

Hospitalized patients with coronary artery disease aged between 35 and 75 years.

Exclusion criteria

Patients with congestive heart failure, chronic liver failure, chronic kidney disease G3-G5, post-cardiac arrest amnesia.

DATA COLLECTION

In the pilot study, we used the Slovak version of the standardized Coronary Artery Disease Education Questionnaire. The CADE-Q II questionnaire was translated from the English original into the Slovak language; the translated questionnaire was repeatedly checked and compared to the original. Patients participating in the study were approached separately by the study investigator. The questionnaire is focused on five domains: health status, risk factors, exercise, nutrition and psychosocial risk; it contains 31 closed items with a choice of one of 4 answers. A score of 3 is for a completely correct answer, a score of 1 is for a partially correct answer, a score of 0 is for two incorrect answers. The maximum achievable score is 93 [5].

Data analysis

The questionnaire return rate was 100%; all items of the CADE-Q II questionnaire were answered. We used a descriptive analysis of the obtained CADE-Q II data. Subsequently, the monitored variables were analysed using the statistical program IBM SPSS. Continuous variables were tested for normality of distribution using the Kolmogorov-Smirnov and Shapiro-Wilk goodness-of-fit tests with normal distribution. We used the parametric Student's T test and the non-parametric Mann-Whitney U test. All tests were carried out at the level of significance $\alpha = 0.05$.

Results

Sample characteristics

The sample consisted of 78 % male; 22 % female; mean age of the sample was 57.83±8.68 SD years; the youngest patient was 35 years and the oldest was 74 years old. 47,2 % of patients were hospitalized as NSTEMI; 52,8 % of patients as STEMI; 18,8 % of patients were indicated for CABG. 66,6 % of patients had arterial hypertension; 21,6 % had diabetes mellitus. 36,7 % of patients were regular smokers. The body mass index of the sample was 28.53±4.46 SD; waist circumference was 102.98±12.0 SD. Other sample characteristics are shown in Table 1.

Table 1 Demographic, clinical and anthropometric characteristics of patients

Demographic characteristics

Sex	*n*	%	Age (means+ SD)
Male	**141**	**78**	**57,56±8,62**
Female	39	22	58,82±8,95
Education level			
University	63	35	58,55±8,97
Secondary	115	64	57,4±8,6
Primary	2	1	59,5±0,7
Age groups			
Patients <60 years	101	56	51,55±5,97
Patients >60 years	79	44	65,86±3,34

Clinical characteristics

	<60 years n=101	*>60 years n=79*	*N=180*
NSTEMI	**35**	**50**	**47,2 %**
STEMI	66	29	52,8 %
Indicated for CABG	16	18	18,8 %
Arterial hypertension	61	59	66,6 %
Diabetes mellitus	17	22	21,6 %

	<60 years n=101	>60 years n=79	N=180
Current smokers	44	22	36,7 %

Anthropometric characteristics (mean + SD)

	<60 years n=101	>60 years n=79	N=180
Body Mass Index	29,2±4,9	27,7±3,7	28,53±4,46
Waist circumference (cm)	104,1±13,2	101,5±10,2	102,98±12,0

1. ***STEMI*** – *ST - Elevation Myocardial Infarction;* ***NSTEMI*** *- Non-ST-Elevation Myocardial Infarction;* ***CABG*** *– Coronary artery bypass graft*

Figure 1 Representation of CADE-Q II answers of patients <60 years; n=101

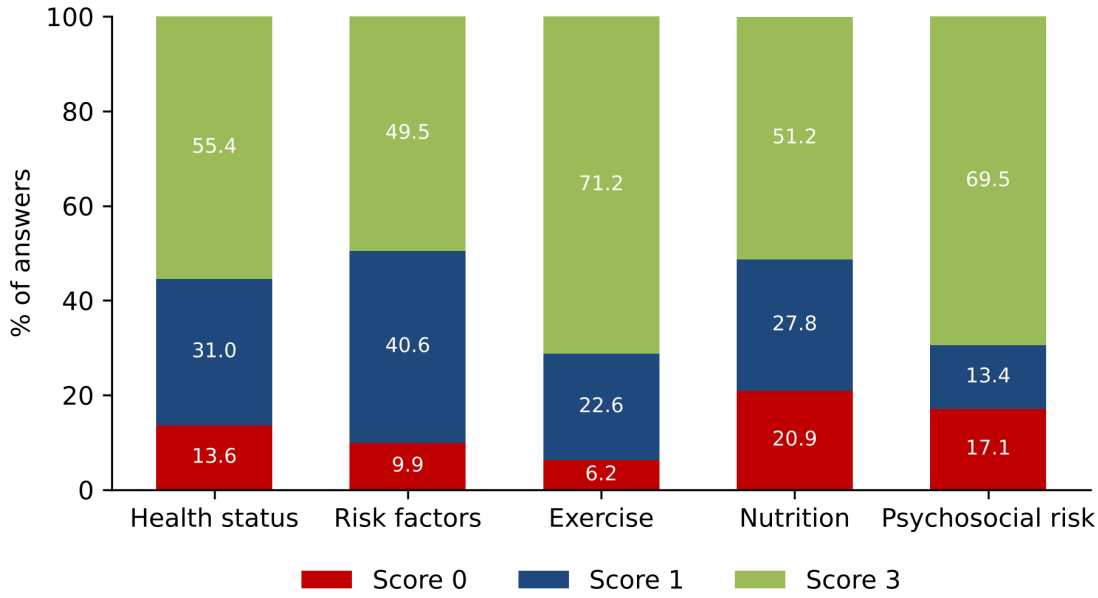


Figure 2 Representation of CADE-Q II answers of patients >60 years; n=79

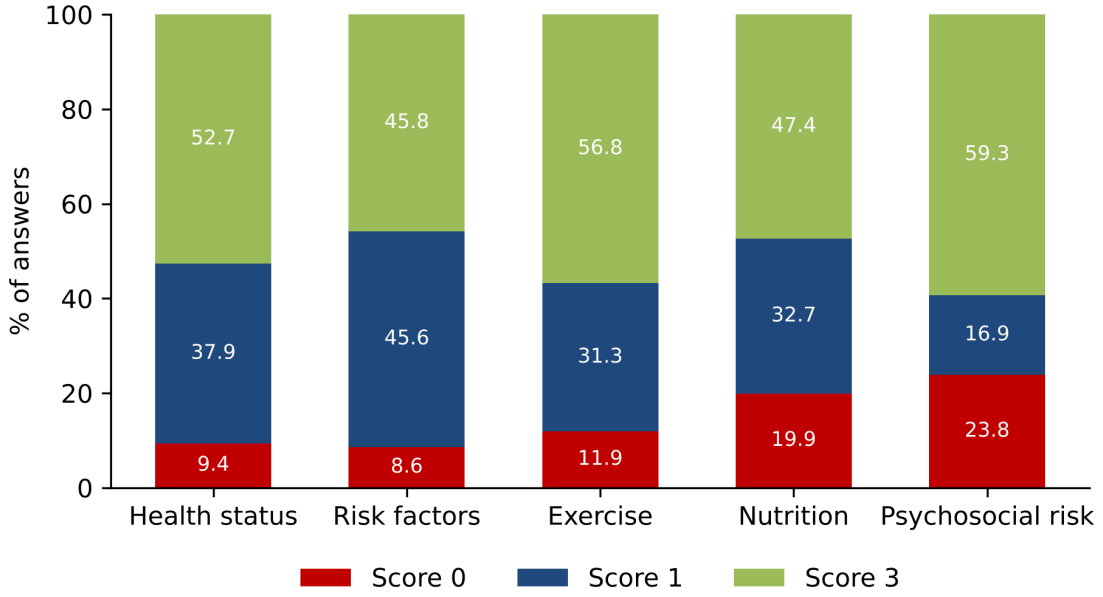


Table 2 Completely correct answers in domains scored 3 by age groups

DOMAIN	<60 years	>60 years
Health status	**55,4 %**	**52,7 %**
Risk factors	49,5 %	45,8 %
Exercise	71,2 %	56,8 %
Nutrition	51,2 %	47,4 %
Psychosocial risk	69,5 %	59,3 %

Figure 3 Mean CADE-Q II score in the studied domains by age group

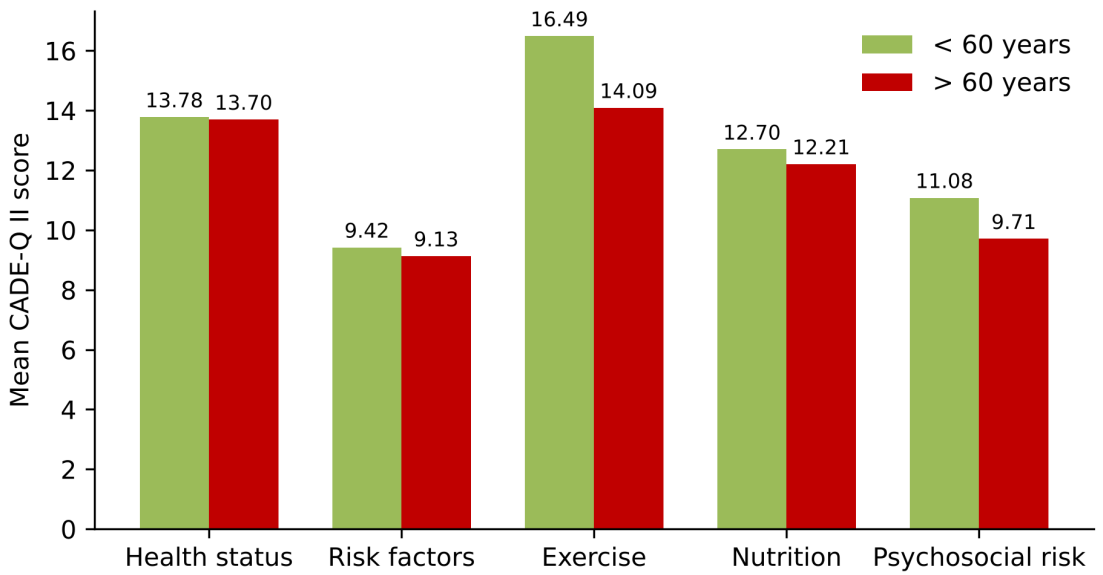


Table 3 Mean score of CADE-Q II items in studied domains; patients <60 years; n=101

DOMAIN	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	SCORE
Health status	**1,92**	**2,57**	**2,45**	**2,32**	**1,86**	**1,59**	**1,07**	**13,78 / 21**
Risk factors	2,24	2,51	2,16	1,25	1,26			**9,42 / 15**
Exercise	2,64	2,18	2,77	1,98	2,42	2,41	2,09	**16,49/ 21**
Nutrition	2,36	0,62	2,6	2,48	2,72	0,96	0,96	**12,7 / 21**
Psychosocial risk	2,47	2,28	2,5	1,86	1,97			**11,08 / 15**
TOTAL MEAN SCORE								**63,47 / 93**

Table 4 Mean score of CADE-Q II items in studied domains; patients >60 years; n=79

DOMAIN	Q 1	Q 2	Q 3	Q 4	Q 5	Q 6	Q 7	SCORE
Health status	**1,7**	**2,68**	**2,55**	**2,15**	**1,81**	**1,41**	**1,4**	**13,7 / 21**
Risk factors	2,2	2,21	2,03	1,53	1,16			**9,13 / 15**
Exercise	2,21	1,72	2,43	1,48	2,03	2,21	2,01	**14,09 / 21**
Nutrition	2,25	0,75	2,46	2,26	2,67	0,96	0,86	**12,21 / 21**
Psychosocial risk	2,11	2,07	2,29	1,74	1,5			**9,71 / 15**
TOTAL MEAN SCORE								**58,84 / 93**

Patients <60 years obtained statistically significantly higher score in exercise 16.49 v.s. 14.09 (p=0.001); psychosocial risk 11.08 v.s. 9.71 (p=0.011) compared to patients >60 years. Patients <60 years obtained statistically significantly higher CADE-Q II total score 63.47 v.s. 58.84 (p=0.014) compared to patients >60 years.

Figure 4 Patient groups based on CADE-Q II score

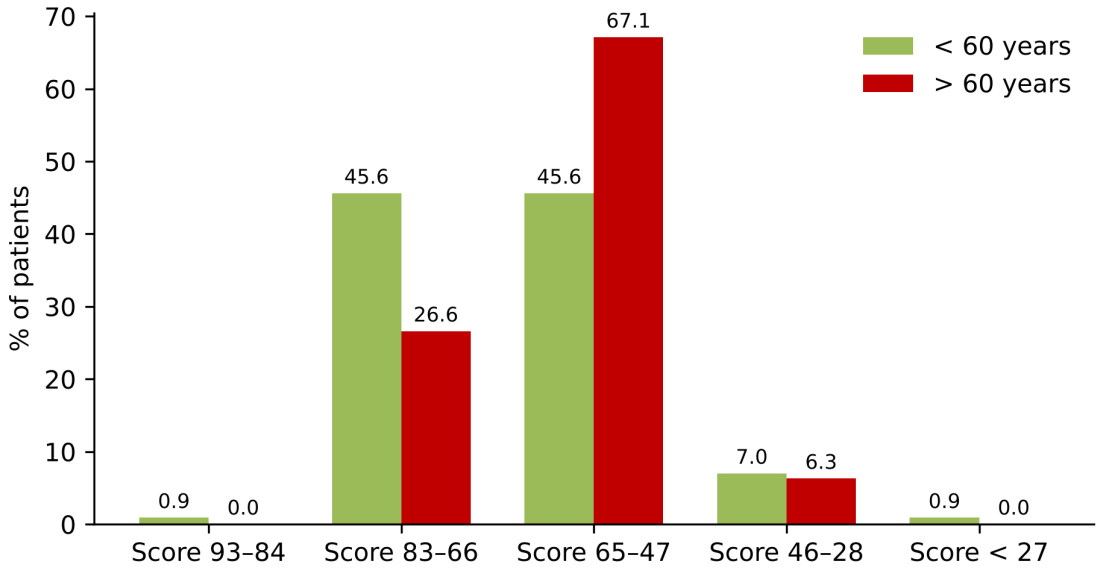


Table 5 Patients' knowledge level based on CADE-Q II score

KNOWLEDGE Level	SCORE	<60 years n=101	%	>60 years n=79	%
Great	**93-84**	**1**	**0,9**	**0**	**0**
Good	83-66	46	45,6	21	26,6
Acceptable	65-47	46	45,6	53	67,1

KNOWLEDGE Level	SCORE	<60 years n=101	%	>60 years n=79	%
Poor	46-28	7	7	5	6,3
Insufficient	<27	1	0,9	0	0

Great knowledge level in group of <60 years was obtained by 0,9 %; good level was obtained by 45,6 %; acceptable level was obtained by 45,6 %; poor level was obtained by 7 %; insufficient level was obtained by 0,9 % patients.

Great knowledge level in group of >60 years was obtained by 0 %; good level was obtained by 26,6 %; acceptable level was obtained by 67,1 %; poor level was obtained by 6,3 %; insufficient level was obtained by 0 % patients.

DISCUSSION

Education is an essential part of cardiovascular rehabilitation and care for patients with coronary artery disease. Education is needed to support understanding of secondary prevention strategies and for treatment compliance [8].

Our research showed that the average value of the total mean score in both age groups corresponds to an acceptable level of knowledge (Tab. 3 and 4). We know that one of the factors that influence the patient's ability to achieve and maintain a favourable health status is the support of knowledge and health literacy [1]. During hospitalization, patients want and need information, including advice about their disease, its causes, course and prognosis, treatment, necessary changes in lifestyle and level of physical activity [10]. Further, our research showed that patients >60 years of age achieved a statistically significant worse overall score compared to patients <60 years of age (Tab. 3 and 4); more than two thirds of patients >60 years of age achieved the acceptable level of knowledge (Fig.4). The aim of elderly patient education is to maintain as independent and self-sufficient a lifestyle as possible. Maintaining the independence of elderly patients with coronary artery disease leads to their higher quality of life [3].

Our research showed that almost half of the patients in both age groups did not provide a completely correct answer in the domain of health status (Tab. 2); which makes patients feel insecure about their health and prognosis. If patients receive contradictory and incomplete information or no information regarding their health status and treatment, this leads to more intense stress and a deterioration in their compliance; the uncertainty or no knowledge about one's own state of health will have a negative impact on the patient's state of health and quality of life [3]. An important aspect of patient education is to be well informed, the patients must be supported to understand the risks and benefits of each treatment alternative, and what would happen if they decide to refuse treatment [11].

Further, our research showed that more than half of both age groups of patients did not give the completely correct answer in the domain of risk factors (Tab. 2); while we know that the decrease in mortality and morbidity from cardiovascular causes is influenced in 44% by influencing risk factors, in 47% by effective pharmacotherapy [17]. The reduction of risk factors in an individual should be adapted to his overall cardiovascular risk [18]. Therefore, we must be sure that the patient understands which specific risk factors increase the likelihood of another cardiac event. The patient must be well aware of the health risks resulting from the presence of risk factors, as well as the benefits of their reduction [3]. The role of nurses in the nursing process is to identify risk factors increasing cardiac risk in the patient and to intervene in this area, to intervene in the event of a lack of knowledge and to support adherence to pharmacological and non-pharmacological treatment [4]. The recognized risk factors must be actively managed to achieve an optimal risk profile for each individual with coronary artery disease.

Our research showed that patients >60 years of age obtained a statistically significant worse score in the domain of exercise compared to patients <60 years of age (Fig. 3), while we know that a low level of prevention knowledge in the area of exercise increases the risk of secondary cardiac events. We know that in elderly patients, regular aerobic exercise is one of the non-pharmacological prevention methods [16;19]. The intensity, type and frequency of exercise for the elderly should be

adapted to their biological age, functional capacity, safety, comorbidities present, lifestyle habits and previous exercise experience [15], identical principles for safe physical activity also apply to younger patients with coronary artery disease. The aim of educating elderly patients in the area of physical exercise is to provide knowledge about the benefits of physical activity, to raise awareness of the possibilities of increasing the level of physical activity, to explain methods for overcoming barriers and negative attitudes towards physical activity [10], because it is known that a sedentary lifestyle and lack of exercise are significant risk factors for morbidity and mortality from cardiovascular causes [17].

Further, our research showed that less than half of the patients >60 years gave the completely correct answer in the domain of nutrition; while almost half of patients <60 years did not provide the completely correct answer in this domain (Tab. 2); while we know that nutrition significantly contributes to the reduction of risk factors in both primary and secondary prevention [3]. It is known that for patients with coronary artery disease the choice of a healthy diet is associated with the improvement of the management of risk factors, and minimization of the pathophysiological mechanisms that contribute to the incidence of secondary cardiac events [14]. Unhealthy eating habits are significant factors that contribute to the progression of coronary artery disease; changes in eating habits result in a reduction of mortality from cardiovascular causes in patients [13]. A cardioprotective diet is the first choice of secondary prevention counselling in connection with specific dietary counselling for the individual and the relevant risk factors of the individual [14].

Our research showed that patients >60 years of age obtained a statistically significant worse score in the domain of psychosocial risk compared to patients <60 years of age (Fig. 3). It is known that excessive stress burden means a real threat to the state of health, psychosocial stress effects are just as dangerous as the biological stress effects [9]. Therefore, the nurse should be interested in the experience and stress of her patients, nurses should also educate patients in the area of stress management [16]. Patients who suffered a cardiac event are more often exposed to psychosocial problems and it is no exception that they show signs of depression and anxiety. Difficulties related to family relationships, such as limited contact with family or bad relationships with children, are a significant burden on the psychological well-being of elderly patients [3]. We know that depression, anxiety or emotional stress are associated with reduced quality of life, progression of arteriosclerotic disease [14], also experience of negative emotions is an obstacle in implementing positive lifestyle changes and worsens the treatment compliance [13], which increases patients' risk of fatal and non-fatal cardiac events.

CONCLUSION

Our pilot study was aimed at mapping completely correct answers and verification the gaps of knowledge of secondary prevention in the studied domains by using an assessment tool. The findings of our research confirmed a percentage higher representation of completely correct answers in all studied domains in the group of patients <60 years; our research also confirmed the higher score obtained in the group of patients <60 years in all studied domains compared to the group of patients >60 years of age. Patients of both age groups gave the least completely correct answers in the domain of risk factors and nutrition; while patients of both age groups gave the most incorrect answers in the domain of nutrition and psychosocial risk. The research results point to the need for more effective promotion of secondary prevention knowledge to minimize secondary cardiac events and increase the quality of life. The sample had a relatively high prevalence of patients with arterial hypertension, diabetes mellitus, also regular smokers, which significantly increases their cardiovascular risk in case of non-optimized treatment and non-observance of cardioprotective lifestyle principles.

The CADE-Q II questionnaire, with its focus on the studied domains, verifies the knowledge of patients and provides a basis for education, effective information and promotion of secondary prevention knowledge.

Recommendations for practice

- Using assessment tools within the nursing process to validate knowledge gaps of secondary prevention in patients with coronary artery disease.
- Focus on the education process for patients with coronary artery disease with comorbidities and risk behaviour that increase cardiovascular risk.
- Emphasize knowledge promotion, secondary prevention education in hospitalized patients with coronary artery disease.

Limitations

Generalizability of the pilot study findings is limited. A study on a larger sample of patients should be conducted in the future.

Conflict of interest

The authors have no conflict of interest to declare.

Ethics approval statement

The study was approved by the Ethics Committee of Slovak Medical University in Bratislava. The study was conducted in accordance with the Helsinki Declaration of 1975 as revised in 2000. Participation in the pilot study was voluntary; each patient signed an informed consent before participating in the research.

Funding

The study was funded by the authors.

Author contribution

Concept and design (GB), data collection and data analyses (GB), manuscript draft (GB, ZS), critical revision of the manuscript (ZS), final approval of the manuscript (GB).

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ORIGINAL ARTICLE

CPSPHI 2026; 17(1): 16–21

New Perspectives of Nephropathies

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Summary

Mitochondria are intracellular organelles involved in several key biological processes in the cell, including energy production, redox signaling, homeostasis, inflammation, aging, innate immune response, and mitophagy. Mitochondrial functional defects play an important role in the pathogenesis of diseases of kidneys such as tubular diseases, interstitial nephritis, focal and segmental glomerulosclerosis, and diabetic nephritis. In addition, participation in the pathogenesis of nephrotoxicity and carcinogenesis. Supplementation with CoQ_{10} results in the correction of e.g. neurological symptoms. For kidney diseases, results are so far controversial. Combined with vitamin C and carnitine, as an artefactual electron acceptor and cofactor, they showed a partial positive effect.

Keywords mitochondria, mitochondrial nephropathy, diabetic nephropathy, chronic kidney diseases, acute kidney injury, glomerulonephritis, coenzyme Q 10

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 16–21. https://doi.org/10.22359/cswhi_17_1_02

Cited references: 22
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

Kidneys are vital paired organs that perform three basic functions: excretory - secretory, metabolic and endocrine.

The kidneys undergo processes aimed at the excretion of nitrogenous substances and fluids in order to maintain homeostasis, which require sufficient energy, making the kidneys one of the most metabolically and energetically demanding organs with the need for sufficient numbers (especially in the proximal tubules) as well as for the proper functioning of the mitochondria (MITO) [1,2]. Although the key role of MITO is energy and adenosine triphosphate (ATP) production, in the kidney they also regulate apoptosis, steroid synthesis, calcium (Ca), iron (Fe) homeostasis as well as other processes [3].

Energy supply from renal MITOs is dependent on lipid metabolism with β-oxidation of fatty acids (FAs) and the Krebs cycle. Renal MITOs integrate several metabolic pathways ensuring maintenance of energy homeostasis for both static and dynamic demands [2]. The formation of energy from glucose is accomplished by 2 pathways, namely glycolysis in the cytoplasm and oxidative phosphorylation (OXPHOS) in the MITO. OXPHOS is the most efficient energy producer, generating more than 36 ATP from a single molecule of glucose compared to only 2 ATP molecules generated by glycolysis. In addition, it can utilize all the nutrients available to the cells. Structural damage and dysfunction of MITO are considered to be one of the important factors in the development of acute and chronic kidney diseases [4].

Mitochondrial damage and kidney disease

MITOs contribute to ROS free radical production and the transmission of metabolic and stress signals [5]. A common feature for all forms of acute and

chronic kidney injury is the toxic ROS and RNS present at disease manifestation. This oxidative stress-conditioned damage is caused by ischemia/reperfusion, energy deficiency conditioned by impaired MITO biogenesis or ATP energetics, or defective clearance of damaged MITO by mitophagy. All of these processes cause immune cell activation, accumulation of inflammatory cytokines, apoptosis and tissue damage. The phenotypic manifestations of MITO dysfunction in the kidney are proximal tubule dysfunction, tubulointerstitial disease, cystic kidney disease, podocytopathy and nephrotic syndrome. All renal diseases also increase cardiovascular (CV) morbidity and mortality [6].

MITO dysfunction plays an important role in the pathogenesis of several renal diseases in the early stages, as well as in the progression of kidney disease [7)], including acute kidney injury (AKI) and chronic kidney diseases (CKD) [8, 9].

Acute kidney diseases and mitochondrial damage

MITOs play a dual role in AKI - they are the primary source of energy for each cell and are also a key regulator of cell death. Even minor AKI can progress to fibrosis and subsequently to ESRD. Several studies have shown that it is the fitness of MITOs that is the major determinant in the pathogenesis in restoring function. Impairment of MITO function early in the course of AKI is a key factor leading to tubular damage and persistent renal insufficiency. AKI is accompanied by functional and structural changes in MITO (Figure 1) [10].

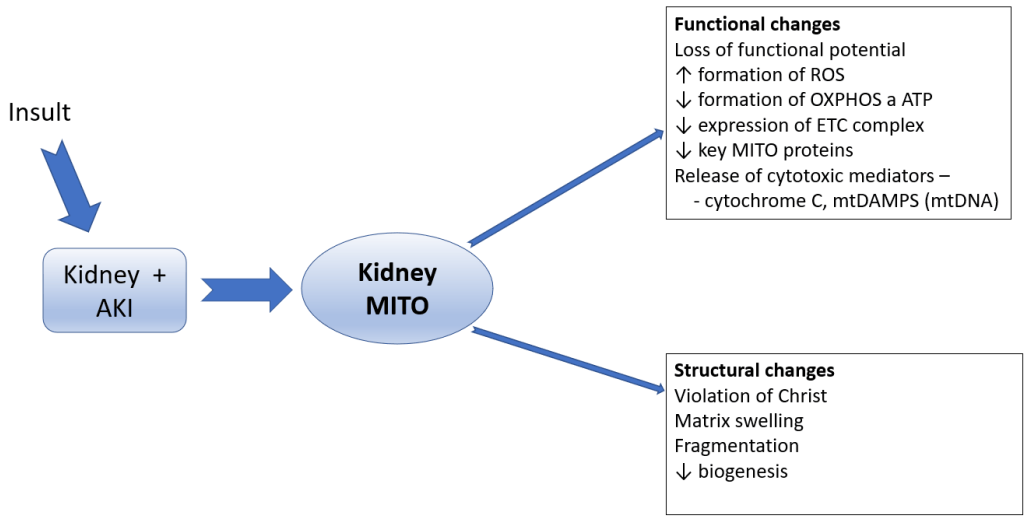


Figure 1 Mitochondrial structural and functional changes during AKI (modified from [10])

Chronic kidney diseases and mitochondrial disease

CKD is structural or functional kidney damage with a tendency to progression or complications due to reduced glomerular filtration, lasting more than 3 months, affecting health status. CKD is not a distinct diagnosis, but is a generic name for heterogeneous disorders of renal structure and function with different clinical manifestations. Renal impairment is now most often secondary to other underlying so-called diseases of civilization, such as diabetes mellitus (DM) and arterial hypertension (AH). AH, DM and obesity play a significant role in the pathogenesis of MITO injury [11)]. In most patients, it is asymptomatic for a long time and is therefore often diagnosed only in

advanced stages [12]. Worldwide, the prevalence of all stages of CKD is reported to be 9-13%, i.e. 850 million people [13, 14].

Both obesity and metabolic syndrome accelerate the progression of CKD and exacerbate CKD-dependent sarcopenia. Both conditions are associated with renal alterations in energy metabolism and lower tissue ATP levels and secondarily lead to MITO dysfunction and reduced MITO numbers [15].

Uremic toxins accumulated in AKI and CKD induce MITO damage and, in turn, MITO damage itself exacerbates renal damage, creating a vicious cycle of CKD progression (Fig. 2) [11]. MITO damage is accompanied by morphological changes leading to ROS accumulation with initiation of inflammation, cyto C release resulting in apoptosis, or deficient ATP production leading to cell damage [11].

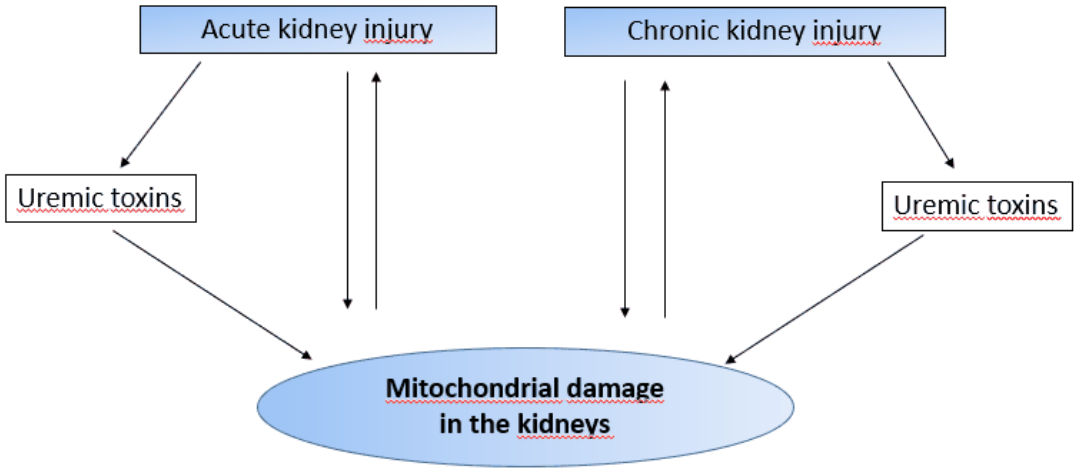


Figure 2 Mitochondrial damage in acute kidney injury and chronic kidney disease (modified from [11])

Dysregulation of MITO homeostasis, changes in bioenergetics as crosstalk with organelle stress contribute to the transition of AKI to CKD [11]. The mechanism of this transition is not yet fully elucidated, but their causal relationship is undoubted (Fig. 3) [16].

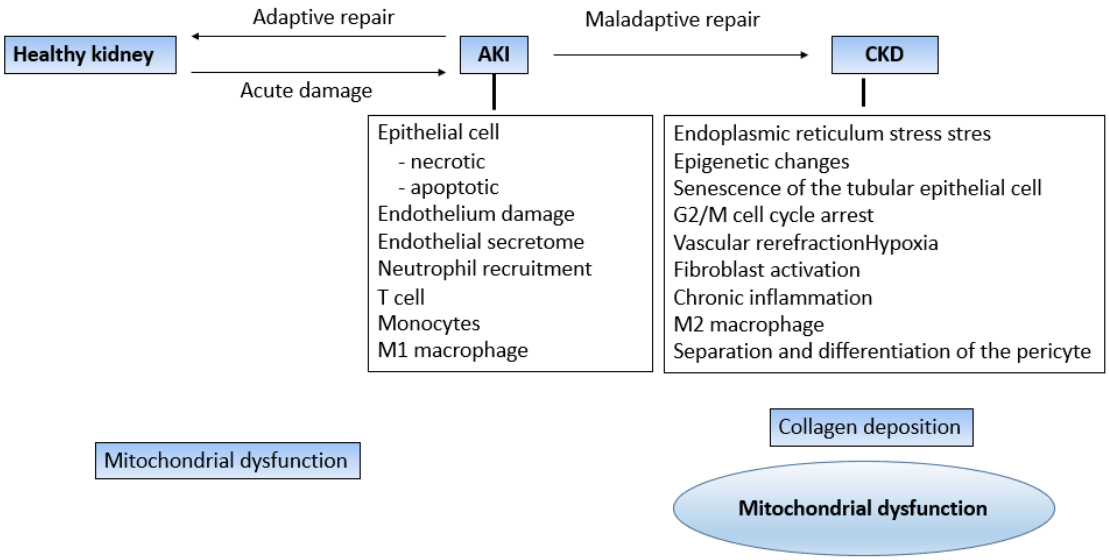


Figure 3 Pathophysiological processes in the continuum of acute kidney injury to chronic kidney disease (modified from [16])

Legend: mtDAMPs - mitochondrial damage-associated molecular patterns

Currently, AKI and CKD are considered to be two poles of the same disease. As mentioned above, MITO aberrations play an important role in both promoting glomerular and tubulointerstitial inflammation and tubulointerstitial fibrosis.

Diabetic nephropathy and mitochondria

In Europe, the USA and most countries in the world, DM is now the most common cause of ESRD with a proportion of around 40%. Moreover, CKD, like DM, is a significant CV risk factor and the combination of both significantly worsens the overall prognosis of the patient [14].

DN is defined as a clinical syndrome arising from long-term specific renal morphological and functional changes in patients with DM of all types. It develops because of diabetic metabolic disorder, mainly chronic hyperglycaemia. It is manifested by proteinuria, renal hypertrophy, renal fibrosis with a progressive decline in renal function. Genetic predisposition is also involved in the manifestation of DN.

The pathogenesis of DN is multifactorial, involving all 4 renal components - glomeruli, tubules, interstitium and vessels. Chronic hyperglycaemia is the initial cause, which, together with the accrual of pathological intrarenal mechanisms, leads to pathological functional and structural changes in all parts of the nephron. There is endothelial dysfunction, thickening of the glomerular basement membrane, disruption of podocyte function with consequent increased albumin permeation into tubular structures and their damage. The intrarenal activity of the renin-angiotensin-aldosterone system (RAAS) is increased with intraglomerular hypertension with hyperfiltration in the glomeruli, potentiating glomerulosclerosis. The production of growth and pro-inflammatory factors is also increased, with proliferation in the mesangium. Polygenetic factors play an important role in the etiology of DN.

There is also evidence of a significant impact of the often-present anaemia (hypoxia, aggravation of interstitial fibrosis), which increases the risk of DN progression and can be slowed by its treatment (erythropoietin) [12]. Aberrant MITO homeostasis also plays a key role in the progression of DN [17].

Hyperglycemia induces overproduction of ROS OS, disrupts MITO-glutathione transport, increases MITO activation of ubiquitous NAD(P)H oxidase 4 (NOX4) in the respiratory chain, decreases the stability of mtDNA against ROS production, apoptosis of podocytes, leading to cell damage with fatal diabetic complications [6].

Good glycaemic control is the best preventive measure against the development of DN. DM-induced MITO dysfunction includes abnormal mitophagy, fission, fusion and biosynthesis. If MITO dysfunction is not restored, renal function may continue to decline as DN progresses [18, 19].

Glomerulonephritis and mitochondria

Chronic glomerulonephritis (GNF) is an immune-mediated inflammation of the glomeruli with subsequent changes in other renal structures leading to haematuria, proteinuria, AH and oedema. They represent approximately 10% of all causes of CKD. Congenital GNFs can be caused by mutations of MITO proteins. The abnormal shape of MITO is already present before disease progression to secondary or acquired focal segmental glomerulosclerosis (FSGS), a severe form of GNF. In an animal mouse model, disruption of MITO autophagy is responsible for FSGS [6].

4. Coenzyme Q 10 and kidneys

CoQ_{10} is an essential fat-soluble substance found in all cell membranes. The main antioxidant (AO) role of CoQ_{10} is direct protection against lipid peroxidation and interaction with α-tocopherol. In humans, its positive effect is manifested in efficient MITO energy metabolism and protection against MITO dysfunction, rather than its direct cellular AO effect. Supplementation with CoQ_{10} results in the correction of e.g. neurological symptoms. For kidney diseases, results are so far controversial. Combined with vitamin C and carnitine, as an artefactual electron acceptor and cofactor, they showed a partial positive effect.

The standard recommendation for MITO nephropathies is the administration of CoQ_{10} in combination with vitamin E and vitamin C, which, in addition to nephrological symptomatology, also affect the overall MITO disability [4].

Increased lipid peroxidation (MDA) and decreased CoQ_{10} levels have been shown to be proportional to the decline in renal function [20, 21] in patients with CKD underlying TIN. Similar results were confirmed in CKD patients in the predialysis phase as well as in dialysis patients. CoQ_{10} supplementation not only led to an effect on OS and inflammation in HD patients, but also reduced the development of CV disease in CKD patients [21].

In our clinical follow-up of the effect of CoQ_{10} at a dose of 240mg/day of CoQ_{10} - Q-GEL™ FORTE, vitamin E and C at 1mg/day, and riboflavin 30mg/day in patients with nephropathies, there was a modification of AO capacity (Table 1) [20, 21]. CoQ_{10} levels were optimized, and lipid peroxidation was reduced (decrease in MDA levels). There were no statistical differences in creatinine clearance, creatinine levels. Tubular renal function did not change statistically significantly during follow-up. However, decreases in fractional excretion of α-amino nitrogen and increases in urinary ammonia excretion were noted in some patients. No changes in lipid parameters were observed, although there was a positive trend in very low-density lipoprotein (VLDL) levels as well as an overall tendency for lipid parameters to correct

TABLE 1 EFFECT OF ANTIOXIDATIVE THERAPY ON LEVELS OF SELECTED ANTIOXIDANTS AND LIPID PEROXIDATION [21]

Month 0 1 2 3
Plasma
CoQ_{10} (μmol/l) 0,15±0,04 * 0,21±0,04 1,39±0,15 1,79± 0,15
α-tocopherol (μmol/l) 32,15±4,73 47,15±6,42 56,43±9,72 44,83±5,82
β-carotene (μmol/l) 0,25±0,07 0,30±0,04 0,34±0,08 0,56±0,02
MDA (μmol/l) 5,26 ±0,2 4,95±0,17 5,23±0,16 5,22 ±0,08
Blood
CoQ_{10} (μmol/l) 0,11±0,03 0,20±0,03 1,44±0,18 1,66± 0,16

Notes: CoQ_{10} – coenzyme k Q_{10}, MDA – malondiladehyde, *average±SEM

Conclusion

MITO plays a crucial role in many kidney pathologies including AKI, CKD, DN, GNF. Recognition, diagnosis and treatment of MITO dysfunctions are in the interest of several scientific teams. Causal treatment of genetic defect-induced MITO dysfunctions is currently mostly limited to laboratory conditions [4, 22].

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REVIEW ARTICLE CPSPHI 2026; 17(1): 22–30

Hand Hygiene Interventions in Children: A Review Study

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Summary

Objective: To map current intervention methods used in the field of improving hand hygiene in preschool and school-age children.

Design: systematic review

Methods: PubMed, EBSCOhost and ProQuest databases were searched. The period 201-2024 was chosen. All forms of interventions aimed at improving hand hygiene in children were included. Subsequently, a critical appraisal of the selected studies was performed.

Results: Our review confirmed the tendency of current research to focus mainly on education in the prevention of poor hand hygiene in children, mainly using multimedia support. Twelve studies confirmed the effectiveness of the intervention, one study did not. Most of the included studies were randomized and controlled, two studies were quasi-experimental.

Conclusion: Various forms of educational interventions are presented as essential interventions in the field of good hand hygiene in children. However, the level of evidence presented must always be evaluated in the context of the conclusions presented.

Keywords Handhygiene. Children. Interventions. Review.

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Cite as
Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 22–30. https://doi.org/10.22359/cswhi_17_1_03
Cited references: 34
Publisher: International Society of Applied Preventive Medicine i-gap

1 INTRODUCTION

The most common causes of death worldwide are infectious diseases, especially respiratory diseases and gastrointestinal diseases. More than 2 million people die each year from these diseases (UNICEF, 2023) and infections account for more than 19% of child deaths (WHO, 2020). These diseases can be effectively prevented or treated if access to simple and affordable interventions is provided. Infectious diseases in childhood lead to increased school absenteeism and consequently poor academic performance (Tsang et al., 2023). The basic recommendation in the prevention of infectious diseases is to observe hygiene measures. Appropriate hand hygiene interventions included with children as early as preschool age lead to a reduction in institutional absenteeism due to illness (Mohamed et al., 2020). Hand hygiene (washing hands with soap and water at key moments) is considered a simple, effective and inexpensive way to directly impact the prevention of many infectious diseases (CDC, 2023). However, in children, only about 42% show good hygiene according to research (Chen et al., 2020). At the beginning of schooling (around the age of seven), the child should be able to gradually assume basic responsibility for self-care and hygiene. Habits that are formed during childhood then tend to persist into adulthood (Movassagh et al., 2017) Therefore, children need to be taught proper hand hygiene at an early age. Children aged 5-14 years are considered the target group for targeting hand hygiene interventions (Kyu

et al., 2018). Among the recommended effective interventions for ensuring good hand hygiene, environmental actions such as ensuring the availability of safe water, sanitation facilities, and especially educational interventions are mentioned (Lange et al., 2021).

The aim of the study is to map current intervention methods used in the field of improving hand hygiene in preschool and school-age children, to present their content and to provide the most up-to-date summary of the topic for use in practice or in further research.

2 Methods

A systematic review design was chosen. Studies were included that were published in the period 2021-2024, in peer-reviewed sources and in English.

To identify the tools, a research question was formulated using a modified PICo tool structure: Participant; Phenomena of Interest and Context (Higgins, 2013). What interventions (I) are used to improve hand hygiene (Co) in children (P)? After the formulation of the research question, keywords were selected (Table 1).

Table 1 Research questions in PICo format and keywords

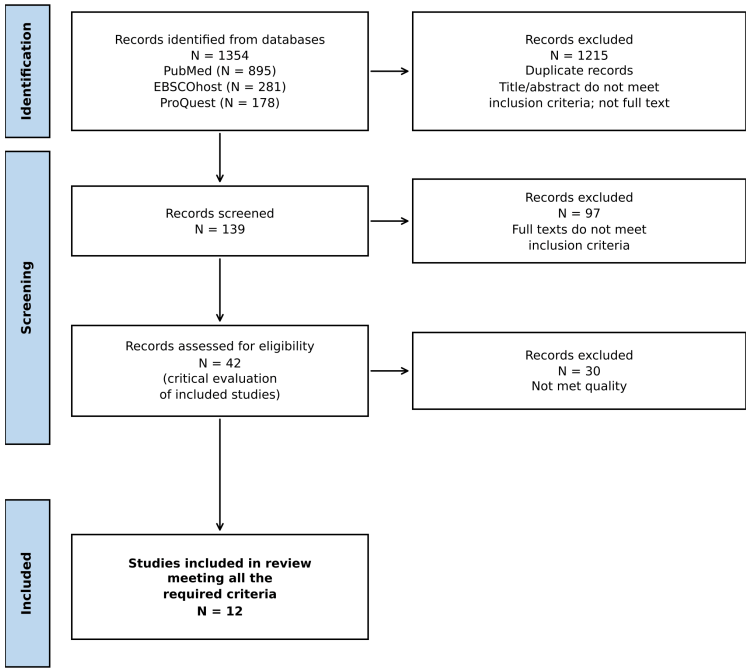
What interventions (I) are used to improve hand hygiene (Co) in children (P)?		
1	**children* OR children* OR youth***	**P**
2	intervention* OR strategie*	I
3	hand hygiene OR handwashing	Co
4	1 AND 2 AND 3	PICo

A systematic search for studies was conducted to identify and locate relevant sources. A search strategy using Boolean operators and truncation was used. PubMed, EBSCOhost and ProQuest databases were searched at all stages of the research. Any form of intervention (educational, behavioural or structural) aimed at improving hand hygiene in children was included. Case report or series, systematic review or meta-analysis studies were excluded.

Subsequently, a critical appraisal of the selected studies was performed. This evaluation was conducted using a modification of the critical appraisal tool of randomized controlled trials, RRAAMBO (acronym Recruitment, Allocation, Maintenance, Blind, Objective), (Glasziou et al., 2009). The RRAAMBO tool was developed by experts at the Centre for Evidence-based Medicine (CEMB) and is suitable for evaluating quantitative studies in primary research (Klugar, 2015). Studies were evaluated in several areas (research design questions). For the final assessment, a summary of the response scores is provided. There is an inverse relationship for this summary score, i.e. the lower the score, the better the scientific evidence of the study (Table 3).

The progression of the overall search strategy is demonstrated in the Prisma flow diagram (Figure 1).

Figure 1 PRISMA flow diagram



3 Results

Twelve studies were included in the final review (Table 2). The studies present interventions aimed at improving hand hygiene in preschool and school-age children.

Table 2 Overview of included studies

Study	Location	Age children	Sample size of children	Intervention period	Aim of the research	Intervention	Results
Hayat (2021)	**Indonesia**	**6th grade primary school**	**60**	**n/a**	**the impact of videoanimation on handwashing knowledge and skills**	**videoanimation**	**increase in knowledge (43.3%; p<0.05) in skills (65%; p<0.05)**
Khan et al. (2021)	Pakistan	6-10 years	93	two weeks	the effect of the intervention on handwashing techniques in school children	education and demonstration of washing protocol	improvement in handwashing practices (p=0.000)
Öncü, Vayısoğlu (2021)	Turkey	8-11 years	151	18 days	the effect of technique-based or duration-based education on children's development of handwashing skills	multi-step teaching	increase in handwashing efficiency (p=0.05)
Kothari et al. (2022)	India	10-12 years	115	five weeks	the impact of education on changing hand hygiene knowledge, attitudes and practices (KAP)	education in the form of a package	improved knowledge of correct technique and duration of effective hand washing (p<0.05); change in attitude

Study	Location	Age children	Sample size of children	Intervention period	Aim of the research	Intervention	Results
							and behaviour (p<0.05)
Fradianto et al. (2022)	Indonesia	primary school level, age not specified	100	three months	the impact of the play-based educational programme on children's knowledge, attitudes and practices in the area of handwashing	education+training in proper hand hygiene	increase knowledge (by 45%), attitudes (from 23% to 88%) and practices (by 64%)
Wu et al. (2022)	China	three to five years	72	four months	impact of interventions on hand hygiene in kindergartens	education + handwashing training	decrease in bacterial colonization of children's hands (p<0.001), improvement in the overall hand hygiene status of children (p<0.01)
Mohamed et al. (2023)	Malaysia	five to six years	36	n/a	development of a hand hygiene teaching module using a learning and play approach	educational sessions	increased knowledge of COVID-19 transmission, prevention and hand hygiene (p<0.001)
Nazirun, Sari (2023)	Indonesia	n/a	25 (with special needs)	n/a	to determine the effectiveness of health education using audiovisual media on the psychomotor ability of hand washing	stimulation by audiovisual media	improving psychomotor handwashing skills in children with special needs (p<0.05)
Watson et al. (2023)	Sudan	five to twelve years	200	16 weeks	the effect of a toy-in-soap intervention and a standard intervention on hand hygiene in an emergency setting	education and hand washing demonstration	no difference in the proportion of all handwashes that used soap; p=0.90)
Graichen et al. (2024)	Germany, Finland	three to six years	162	42 days	the impact of practical and scalable digital intervention on proper handwashing in young children (handwashing time)	digital handwashing tutorial+monitored washing processes	prolonged hand washing (p<0.001); prolonged soaping time (p<0.001) effect appears immediately and persists for the duration of the intervention phase
Parmar et al. (2024)	India	one to five years	800 childre children's day centres	six months	the impact of educational interventions on reducing microbial load, reducing illness and absenteeism in day care centres	education	effectiveness of the education programme (p<0.01), improved hand hygiene compliance (p<0.01) and disease reduction (p<0.01)
Wang et al. (2024)	Taiwan	three to five years	three children with autism spectrum disorder (ASD)	one month	the effect of video self-modelling (VSM) in teaching handwashing to preschool children with ASD	video (head-swapping technology)	demonstrating the effectiveness of an iVSM intervention to three children with ASD

During this period, educational intervention dominated the research conducted. Digital support or multimedia support was used during training in six studies (Hayat, 2021; Kothari et al., 2023; Wu et al., 2022; Nazirun, Sari, 2023; Graichen et al., 2024; Wang et al., 2024). Some of the research focused on specific situations, taking into account the characteristics of the respondents, e.g. children with special needs (Nazirun, Sari, 2023) or children with autism spectrum disorder (Wang et al., 2024) or the research setting, e.g. a refugee settlement in Sudan (Watson et al., 2023) or community setting (Fradianto et al., 2022). A multi-tiered educational intervention included four studies (Öncü, Vayısoğlu, 2021; Kothari et al., 2023; Wu et al., 2022; Mohamed et al., 2023). In three studies UV light has been used to verify or enhance the effect of education (Khan et al., 2021; Öncü, Vayısoğlu 2021; Mohamed et al., 2023). Two studies (Graichen et al., 2024; Wang et al., 2024) used modern digital applications (digital sensors and specially adapted video modelling). A Taiwanese study (Wang et al., 2024) tested the programme on children with autism spectrum disorder (ASD). Ten included studies confirmed the effectiveness of the intervention, while one study (Watson et al., 2023) did not. The Taiwanese study (Wang et al., 2024) included only three participants in a specific situation, and no significance of the findings was noted in the Indonesian study (Fradianto et al., 2022).

3.1 Characteristics of included studies

The Indonesian quasi-experimental study Hayat (2021) focused on the effect of video animation on handwashing knowledge and skills among children. A six-step handwashing video animation (Kementerian Kesehatan Republik Indonesia, 2019) was presented to primary school students. The research was based on the prediction that motion graphic video media are more effective than conventional teaching.

A Pakistani randomized controlled trial Khan et al. (2021) evaluated the effectiveness of a handwashing technique intervention in school children. Ninety-three children were included in the study. The intervention consisted of education and involvement of children in hand washing. The first group was demonstrated only the hand washing protocol and the second group underwent the washing protocol through glow-gel hand washing technique. Verbal and visual (video) means were used. The evaluation used a glow gel and UV light visualization technique and a comparison of pre-intervention and post-intervention questionnaires.

A Turkish study Öncü, Vayısoğlu (2021) compared the effect of technique and duration of education on children's development of handwashing skills. A double-blind randomized controlled trial was conducted at baseline in 151 children. The first group was intervened with a multistep teaching technique (education, practical demonstration of hand washing and provision of pictorial cards for home use). The second group was given a hand-washing demonstration, supported by a song they sang. In the home environment, the children used picture cards by a song. The control group washed their hands as usual. Handwashing efficacy was assessed in all groups by analysis of scatter on fluorescent residues after glo-germ application using digital recordings from the Semmelweis hand in scan device.

The Indian study Kothari et al. (2023) presented research on 115 children. Children attended health talks, interactive sessions using audiovisual aids, videos and materials from the WHO and Centers for disease control and prevention (CDC) websites and live demonstrations of the handwashing steps. The evaluation assessed change in handwashing knowledge, attitude and practice (KAP).

The Indonesian study by Fradianto et al. (2022) aimed to increase school-aged children's knowledge, attitudes and practices of handwashing with a play-based educational program in a community setting where they spend time after school (a religious community). The twelve-week program enrolled 100 children at the primary school level. Structured play with game media was used in the six-step education (the concept of hand washing, the benefits, the right time to wash hands, how to wash hands properly, the impact of not washing hands, and a demonstration hand washing).

A Chinese quasi-experimental study Wu et al. (2022) was conducted over a period of four months. Two kindergartens were the subject of the research. The intervention programme focused on both teachers and children and consisted of a lecture on infectious diseases (teachers), a lecture on hand hygiene (teachers) and hand washing practice

(teachers followed by children). The programme was developed in accordance with handwashing guidelines based on hand hygiene training developed in the Netherlands (Zomer et al., 2013). Children's hand bacterial colonization and hand hygiene environment were assessed.

A Malaysian study Mohamed et al. (2023) presented the development of a hand hygiene module using a learn and play approach. The module was designed based on suggestions from public health experts and focused on the 'learn and play' approach. The comprehensive educational module, which consisted of three educational units, focused on the basics of infectious diseases, transmission and prevention options, the importance of hand hygiene and the importance of soap when washing hands. Fun play elements such as UV light, glitter and toys were used for education.

The Indonesian study Nazirun and Sari (2023) aimed to determine the effectiveness of health education using audiovisual media on the psychomotor ability of hand washing in children (with mental retardation). Twenty-five children with special needs were included in the research. This study analyzed the success rate of washing hands before and after being given audiovisual media. After the application of education with the help of audiovisual media (handwashing videos), the psychomotor skills of handwashing were identified again.

A cluster randomized controlled trial Watson et al. (2023), conducted in a refugee settlement in Sudan, focused on 200 children. The aim was to compare the effect of surprise soap (a glitter game to demonstrate germs spreading, toy soap; education) and a standard intervention involving brief education in the children's home environment and distribution of plain soap. Comparisons and observations were made four times, each at five key moments: after defecating or using the toilet, before eating, before preparing food, before giving food to another person, and after cleaning up another child's feces.

A cluster randomised controlled and blinded trial Graichen et al. (2024) was conducted in four day care centres in Finland (two) and Germany (two), with one control and one experimental group each time. The study included 167 children. The study looked at the impact of digital interventions on correct handwashing in young children. The bathrooms of the participating centers were equipped with the study hardware (automatic faucets and automatic sensors, soap dispensers with digital metering unit and gates). The system was linked to tablets above the sinks (presenting animated instructions), which were triggered by the use of water and soap. Digital sensors measured the flow rate, temperature, time and duration of each water and soap extraction. Data from the sensors was sent via Bluetooth to a gateway installed in the ceiling.

The aim of the Indian cluster randomized six-month study Parmar et al. (2024) was to evaluate the effectiveness of hand hygiene education in reducing disease transmission in children attending day care centers. Interventions included handwashing with soap and water, use of hand sanitizers, and an educational program on hygiene habits. The control group applied routine hand hygiene without further intervention.

The aim of the Taiwanese study Wang et al. (2024) was to examine the effectiveness of Video Self-Modeling (VSM) in teaching handwashing to preschool children with Autism Spectrum Disorder (ASD). The study used an innovative iVSM approach which utilizes the head-swapping technique to generate self-modeling videos. Three children with autism spectrum disorder aged three to five were included. In total, the child performed nine steps in three observations as part of his daily routine. The generic peer-modeling video was generated into self-modeling two-minute videos that were subsequently used during hand hygiene.

3. 2 Critical evaluation of the results

A critical evaluation of the results was carried out with regard to the level of scientific evidence being translated. Most of the included studies were randomised controlled trials according to the level of effectiveness of evidence-based medicine (Khan et al., 2021; Öncü, Vayısoğlu, 2021; Kothari et al., 2022; Mohamed et al., 2023; Watson et al., 2023; Graichen et al., 2024; Parmar et al., 2024); two studies were blinded (Öncü, Vayısoğlu, 2021; Graichen et al., 2024). Other levels of evidence for efficacy included quasi-experimental research designs (Hayat. 2021; Wu et al., 2022) that lacked random assignment of participants to groups. The other included studies were observational-analytic

study designs (Fradianto et al., 2022; Nazirun, Sari, 2023; Wang et al., 2024). A summary of the scores for the evaluated areas of individual research is presented in Table 3. Here, the lower the score, the more scientific evidence the study provides. The table also ranks studies that are not randomised and whose higher final score confirms a lower level of scientific evidence. Thus, the highest quality scientific evidence according to this assessment is provided by the double-blind randomised controlled trial (Öncü, Vayısoğlu, 2021) and the blinded study (Mohamed et al., 2023), which were able to report a positive response to all domains of the RRAAMBO assessment tool. The Taiwanese study (Wang et al., 2024) could not be evaluated with this tool due to the specificity of the research situation.

Table 3 Modified Critical Appraisal Instrument for Outcomes

RRAAMBO Study	R Was the assignment/ assignment of participants random?	R Were IG and CG similar at the beginning of the research?	A Were IG and CG (excluding interventions) treated equally?	A Former participants instructed and analyzed in the groups assigned?	B Was there a blindside in the group?	∑
Hayat (2021)	**2**	**3**	**3**	**1**	**2**	**11**
Khan et al. (2021)	**1**	**1**	**1**	**1**	**2**	**6**
Öncü, Vayısoğlu (2021)	**1**	**1**	**1**	**1**	**1**	**5**
Kothari et al. (2022)	**1**	**3**	**3**	**1**	**2**	**10**
Fradianto et al. (2022)	**2**	**3**	**3**	**1**	**2**	**11**
Wu et al. (2022)	**2**	**3**	**3**	**1**	**2**	**11**
Mohamed et al. (2023)	**1**	**3**	**3**	**1**	**2**	**10**
Nazirun, Sari (2023)	**2**	**3**	**3**	**1**	**2**	**11**
Watson et al. (2023)	**1**	**1**	**1**	**1**	**2**	**6**
Graichen et al. (2024)	**1**	**1**	**1**	**1**	**1**	**5**
Parmar et al. (2024)	**1**	**1**	**1**	**1**	**2**	**6**
Wang et al. (2024)	**3**	**3**	**3**	**3**	**3**	**15**

1-yes; 2-no; 3-unclear; IG-intervention group; CG-control group; ∑-total points

4 Discussion

Hand hygiene is considered an important preventive method in reducing the incidence of infectious diseases (Luangasanatip et al., 2015; Mbakaya et al., 2017). Effective methods that ensure sustainability of outcomes in the longer term include educational interventions using digital technologies (Ofori et al., 2022). Videos are considered to be an effective educational intervention for improving handwashing and the use of detailed video presentations, handwashing leads to better compliance compared to traditional methods (Chen, Chiang, 2007). Our review of studies confirms the current research efforts to focus mainly on education in the prevention of poor hand hygiene in children and confirms that multimedia and digital support appears to be a necessity in the current educational process. Multimedia is a common part of life for today's child population and the educational use of digital technologies seems to be essential. The cost or time of implementation may be a limiting factor for uptake, as suggested by some previous research

(Boudjema et al., 2016) and confirmed by one study (Watson et al., 2023) in our review.

The didactically correct choice of content in accordance with the educational goal (and not only in multimedia) is also important. An educational objective is usually specified as a clear, intended result of an educational activity. However, learning based on didactic transfer alone is not effective (Ginnis, 2002). Early childhood represents a crucial period for children's physical, social, affective, mental and emotional development. Educational interventions should therefore be based on an approach based on the child's experience, activity and play (Nielsen-Rodríguez et al., 2021). The use of activation methods is clearly recommended in the education of preschool and school-age children, which is evident in the included studies.

However, in the context of the conclusions presented, the level of evidence presented also needs to be assessed, as indicated by the result of the critical appraisal (Table 3). In this review, some studies (Khan et al., 2021; Öncü, Vayısoğlu, 2021; Kothari et al.,2023; Mohamed et al., 2023; Watson et al., 2023; Graichen et al., 2024; Parmar et al., 2024) can be considered as the highest level of the evidence pyramid (randomised controlled trials). Only two studies are blinded (Öncü, Vayısoğlu, 2021; Graichen et al., 2024). Randomized controlled trials identify true effects and reduce the potential for research bias (Tina et al., 2021). Randomly assigning participants to either the experimental or control group allows for a comparison of the effect of the independent variable on the dependent variable. In quasi-experiments, which are other included studies, this random assignment is often not possible or ethically permissible, leading to the adoption of alternative strategies. However, the presentation of cohort and observational studies can lead to further inspiration for research endeavours and provides information on research activities in different locations.

5 CONCLUSIONS

Various forms of educational interventions are presented as essential interventions in the field of good hand hygiene in children. However, the level of evidence presented must always be evaluated in the context of the conclusions presented. Replication of effective interventions can inspire follow-up research.

Funding

The study was supported by the Ministry of Health of the Czech Republic (grant number: NW24-09-00302). All rights reserved.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 31–36

Effects of the Corona Pandemic on Group Prophylactic Measures in Kindergartens: Challenges and Perspectives for Public Health Management

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Summary

The coronavirus pandemic has led to considerable challenges in the education and healthcare system. This study analysed the impact of the pandemic on the implementation of group prophylactic measures in German kindergartens. The aim was to quantify the changes caused by the pandemic and identify possible influencing factors. The data was collected through a nationwide survey of 126 kindergartens, which recorded the implementation of defined measures before, during and after the pandemic. The analysis was based on descriptive statistics and the McNemar test to analyse temporal changes as well as correlations to identify structural influencing factors such as staffing ratios. The results show significant losses in the implementation of group prophylactic measures during the pandemic, which to a large extent have not yet returned to pre-pandemic levels. The staffing ratio of the facilities often played a decisive role in internal measures (e.g. joint tooth brushing), while external measures (e.g. visits to the dentist) recovered significantly better, although these even came to a complete standstill. The results highlight the urgency of making prevention programmes more resilient to crisis situations. Investment in human resources, the development of alternative concepts and the introduction of uniform standards could help to strengthen preventive measures in the long term and promote children's dental health in the long term.

Keywords Corona Pandemic. Group Prophylaxis. Dental Health. Public Health Management. Preventive Measures. Children

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 31–36. https://doi.org/10.22359/cswhi_17_1_04

Cited references: 15
Publisher: International Society of Applied Preventive Medicine i-gap

INTRODUCTION

Dental health in childhood has a significant impact on general health and quality of life (Foláyan et al., 2023; Çolak et al., 2013). Caries, the most common chronic disease in children worldwide, can lead to considerable health and social impairments even at an early age (Schmoelke et al., 2021). In Germany, group prophylaxis in kindergartens has established itself as a central component of preventive dentistry. It aims to sustainably improve children's oral health and reduce health inequalities through regular measures such as joint tooth brushing, visits to the dentist and nutritional education (DAJ, 2021; Collet et al., 2020).

The coronavirus pandemic has significantly impaired these established structures. National and international studies show that the restrictions during the pandemic have led to a deterioration in children's health, development and well-being (Kaman et al., 2023; Bantel et al., 2021; Langmeyer et al., 2020). To combat the pandemic, early childhood education and care centres were closed in most countries around the world, including

Germany, from mid-March 2020 (Blum & Dobrotic, 2021), which presumably also has an impact on dental health, as group prophylaxis has a long tradition in these facilities. From the perspective of dentistry, cooperation with parents and kindergartens is crucial for continuous and successful caries prophylaxis (DJA, 2021).

Despite the resumption of many measures after the pandemic, it is reasonable to assume that the return to pre-pandemic standards in group prophylaxis has not yet been fully achieved.

This study aims to provide information and a solid data basis on how the pandemic-related restrictions have influenced the implementation of group prophylactic measures in kindergartens and which measures have now been re-established or continue to show deficits. The aim is to better understand the impact of the pandemic on children's dental health and to identify the structural factors that favour or inhibit the resumption of preventive measures. The findings should help to formulate recommendations for more resilient public health management that stabilises and sustainably strengthens preventive structures even in times of crisis.

METHODOLOGY

Sample

The data basis for this study is formed by responses from **126 kindergartens** that took part in a nationwide online survey. The centres were contacted at random via platforms and networks to ensure that the sample was as representative as possible. The kindergartens surveyed come from different regions of Germany. The aim was to identify regional and structural differences in the implementation of group prophylactic measures.

Survey instruments

A **standardised questionnaire** was developed to collect the data, which specifically targeted the implementation of group prophylactic measures in three time periods: before the pandemic, during the pandemic and today. The questionnaire comprised four key measures, with the former directly targeting dental health and the latter mostly covering this topic peripherally (e.g. low-sugar diet):

1. **Brushing your teeth together**
2. **Visit by a dentist to the centre**
3. **Oral health projects with children**
4. **Information events for parents**

The answers were dichotomous ("yes"/"no", in relation to regular implementation), which made it possible to clearly quantify the changes in the implementation of the measures between the periods. In addition, basic characteristics of the facilities (e.g. number of children in care, staffing ratio or location) were recorded in order to analyse possible influencing factors. For this purpose, the kindergartens were assigned to different comparison groups according to the respective criterion.

Statistical analysis

The statistical analysis aimed to identify changes in the implementation of the four group prophylactic measures over time and to investigate possible correlations with structural factors. The following tests were used for the analysis:

- **McNemar test**: This test was used to analyse significant changes in the implementation of the measures between the time periods ("before vs. during", "during vs. after", "before vs. after"). As a test for paired dichotomous data, it was ideally suited for analysing longitudinal changes.
- **Correlation analysis**: Pearson correlation coefficients were calculated to analyse the relationship between the implementation of measures and structural factors (e.g. staffing ratios, location). These provided information on whether and to what extent certain factors favour the resumption of preventive measures.

The data analysis was carried out using standard statistical software programmes. Significance was tested at a level of $\mathbf{p < 0.05}$.

RESULTS

The nationwide survey of 126 kindergartens provided insights into the implementation of group prophylactic measures before, during and after the coronavirus pandemic. The regular implementation of four measures was analysed: joint tooth brushing, visits to the dentist, oral health projects and information events for parents. The analysis focussed on changes over time and the correlations with criteria such as geographical location and staffing ratios.

Brushing your teeth together

Before the pandemic, joint tooth brushing was established in all 126 facilities surveyed (100%). During the pandemic, implementation fell to 11.11%, which can be attributed to the hygiene and infection prevention measures. After the pandemic, the measure was reintroduced in 51.59% of nurseries. The McNemar test revealed highly significant differences between the periods "before the pandemic" and "during the pandemic" ($p < 0.001$) and between "during the pandemic" and "after the pandemic" ($p < 0.001$). This confirms that the pandemic has caused a significant reduction in this measure and that a partial but incomplete recovery has taken place after the pandemic.

The analysis showed that an optimal or more than optimal staffing ratio significantly increased the probability of readmission ($r = 0.56$). An "optimal staffing ratio" was defined in this study as the presence of at least two trained nursery nurses per 25 children. Centres that met or exceeded this staffing ratio were able to reintroduce the measure significantly more often than centres with a lower staffing ratio. This illustrates that sufficiently qualified staff is a key prerequisite for the successful implementation of time-intensive preventative measures such as joint tooth brushing.

Visits from the dentist

Before the pandemic, 96.03% of nurseries had regular visits to the dentist. During the pandemic, there was a complete collapse in this measure (0%), which can be attributed to the strict hygiene and infection control measures and the general restrictions on access to external visitors. After the pandemic, 92.86% of facilities resumed this measure, although the original frequency before the pandemic was not fully reached. The McNemar test showed significant differences between the periods "before the pandemic" and "during the pandemic" ($p < 0.001$) and between "during the pandemic" and "after the pandemic" ($p = 0.0027$). This shows that the pandemic led to a complete collapse in this measure, but that the situation improved significantly after the pandemic.

A differentiated analysis shows that the pandemic-related restrictions had a massive impact on the number of visits to the dentist in all geographical categories. However, kindergartens in large cities showed the highest probability of consistently implementing this measure again. However, this observation was not significant ($r = -0.07$), although a minimal bias was found in favour of urban facilities. These differences could indicate logistical and infrastructural challenges in less densely populated areas, which could make the organisation of such visits more difficult.

Oral health projects

Regular oral health projects were carried out in 94.44% of nurseries before the pandemic. During the pandemic, this proportion fell to 33.33% and rose to 65.87% after the pandemic. The McNemar test confirmed significant differences between the periods "before the pandemic" and "during the pandemic" ($p < 0.001$) and between "during the pandemic" and "after the pandemic" ($p < 0.001$). The comparison "before the pandemic" and "after the pandemic" also continued to show significant differences ($p < 0.001$), which indicates that the projects could not be fully restored to their previous level after the pandemic.

A weak positive correlation with the staffing ratio ($r = 0.3$) indicates that facilities with better staffing levels resumed projects more frequently. This shows that an optimal or more than optimal staffing ratio had a positive influence on the implementation of projects to promote oral health both during and after the pandemic. By contrast, kindergartens with less than optimal staffing ratios had significantly greater difficulties in continuing these educational measures. This shows that staff resources are not only crucial for general care, but also for specific preventative measures.

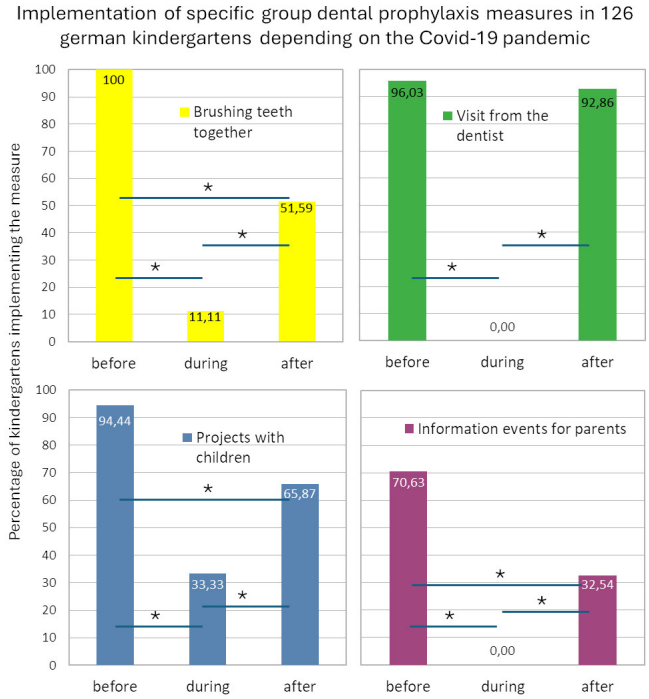
Information events for parents

Before the pandemic, 70.63% of the nurseries surveyed organised regular information events for parents in which important aspects of oral health and oral hygiene were discussed. During the pandemic, these events came to a complete standstill (0%). After the pandemic, the proportion of centres that held such events again rose to just 32.54%. The McNemar test showed significant differences between "before the pandemic" and "during the pandemic" ($p < 0.001$) as well as between "during the pandemic" and "after the pandemic" ($p < 0.001$). The comparison "before the pandemic" and "after the pandemic" also continued

to show significant differences ($p < 0.001$), which indicates a continued reduction in the implementation of these measures.

The data analysis showed that although the staffing ratio played a tendetial role, it did not have a clear influence ($r = 0.21$). This suggests that other organisational or structural factors may have played a greater role, such as the prioritisation of other tasks or the limited availability of resources for such events. However, as expected, institutions with less than optimal staffing ratios had the greatest difficulty in resuming these measures, which could be due to the additional strain caused by the pandemic.

Figure 1 Graphical representations of all changes in the implementation of specific group dental prophylaxis measures in German kindergartens as a temporal response of the Covid-19 pandemic (n=126; statistical differences are marked with an asterisk; McNemar test)



DISCUSSION

This study examines the effects of the coronavirus pandemic on the implementation of group prophylactic measures in German nurseries and highlights key challenges and potential areas of action for public health management. A clearly summarised graphical representation of the results can be found in Figure 1. Furthermore, Table 1 shows the main observations and the most important influencing factors identified.

Table 1 Overview of influencing factors and remarks on the implementation of oral health measures in childcare facilities during and after the COVID-19 pandemic.

Measure	Influencing Factor	Remarks
Brushing Teeth together	**Staffing ratio (strong positive correlation, r = 0.56)**	**Resumption is highly dependent on staffing levels; better staffing increases the likelihood of implementation.**
Oral health projects with kids	Staffing ratio (weak positive correlation, r = 0.30)	Facilities with better staffing levels resumed projects more frequently; positive influence of staffing on implementation.
Visits from the dentist	-	Almost full resumption; logistical differences in rural areas; geographic location plays a minimal role.
Information events for parents	Staffing ratio (no clear influence, r = 0.21)	Organizational factors play a greater role; staffing has little influence on implementation.

Decline in group prophylactic measures due to the pandemic

The results show a significant slump in the implementation of group prophylactic measures during the pandemic in the kindergartens surveyed. This applies in particular to joint tooth brushing and oral health projects, which came to an almost complete standstill. One of the main reasons for this were pandemic-related restrictions such as reduced group sizes, the ban on mixing groups and the minimised use of shared spaces such as washrooms, which created organisational challenges that made it difficult to implement these measures (DAJ, 2021).

In addition, external parties were banned from entering nurseries as an infection control measure, which directly prevented dentist visits and information events for parents from taking place (Blum & Dobrotic, 2021). This ban interrupted direct contact between dentists and children and also made cooperation with educational staff and parents, which is essential for effective prophylaxis, more difficult.

Slow recovery after the pandemic

Most measures were resumed after the pandemic, but many did not reach the original pre-pandemic level. This is particularly noticeable in the case of joint tooth brushing (51.59% after the pandemic vs. 100% before the pandemic) and information events for parents (32.54% after the pandemic vs. 70.63% before the pandemic). This indicates that organisational and personnel challenges still exist. An optimal or above-average staffing ratio proved to be a decisive factor for the resumption of these measures ($r = 0.56$ for joint tooth brushing, $r = 0.30$ for oral health projects). The analysis confirms earlier findings that a shortage of specialist staff in nurseries not only significantly impairs the quality of care, but also the implementation of preventive health programmes (Weimann-Sandig & Kalicki, 2024; DAJ, 2021). In particular, facilities with a "less than optimal" staffing ratio had greater difficulties in resuming preventive measures.

Effects of the entry ban

The lockdown imposed during the pandemic had far-reaching consequences for the implementation of dental visits and other external programmes. Preventive dental check-ups, which took place in 96.03% of nurseries before the pandemic, were completely suspended during the pandemic. After the restrictions were lifted, these programmes were re-established in 92.86% of facilities, which underlines the resilience of professional prevention structures. Nevertheless, rural areas remain slightly disadvantaged, which could indicate logistical challenges (Schmoelke et al., 2021; Blum & Dobrotic, 2021).

CONCLUSIONS AND IMPLICATIONS FOR PUBLIC HEALTH MANAGEMENT

The results of the study emphasise the considerable challenges that the coronavirus pandemic has brought for dental health and prevention structures in nurseries. This results in important recommendations for action for public health management:

1. **Strengthening external support**: External stakeholders such as dentists or dental professionals should be more frequently and intensively involved in preventive structures in order to compensate for internal deficits caused by the shortage of specialists (DAJ, 2021).
2. **Integration of preventive measures into standards**: Anchoring preventive health measures in the standard guidelines of kindergartens would ensure that such measures can also be implemented in times of crisis (Jesberger & Greß, 2021).
3. **Digitalisation of prevention programmes**: The development of digital formats, such as parent webinars or interactive learning platforms for children, could be an important addition to traditional measures and overcome language and access barriers (Bird et al., 2019; El Benny et al., 2021).
4. **Long-term strategy against shortage of skilled staff**: The shortage of skilled staff in nursery schools remains a structural problem. Measures to reduce the workload of teaching staff and targeted investment in the training and recruitment of specialist staff are essential to ensure the implementation of internal prevention measures (Weimann-Sandig & Kalicki, 2024).

The pandemic has shown that preventive health measures for children need to be made more

resilient in order to survive in times of crisis. Public health management can make a significant contribution here by developing both structural and organisational solutions that ensure children's dental health in the long term.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 37–41

The Importance of Physiotherapy in a Conservative Treatment of Carpal Tunnel Syndrome

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Summary

Objective: The main objective of the work is to demonstrate the impact of selected physiotherapy methods in patients with carpal tunnel syndrome in a conservative solution. The assumptions that are examined within the work and serve to verify or refute and are the basis for the research are as follows: We assume that after completing the therapy in patients with carpal tunnel syndrome, pain will be reduced, range of motion of the carpometacarpal joint of the thumb will improve, and hand swelling will decrease.

Methods/ Participants: We conducted the work in a form of an observational study. The group consisted of 8 adult patients aged 39-71 years who met the inclusion criteria, namely that they had been examined and diagnosed with carpal tunnel accompanied by specific symptoms.

Methodology: All patients underwent a physiotherapy examination, which included taking a medical history, measuring upper limb circumferences, goniometric measurement of the upper extremities, and then the patients rated the relevant pain using a numeric rating scale. After the initial examination, we determined a suitable physiotherapy plan, which we implemented over a period of one month with a frequency of visits twice a week and a duration of 50 minutes for each exercise unit. To verify the goals, we analyzed the results using statistical methods of t-test where the alpha significance level for all goals was set at 0.05.

Conclusions: Based on the results of the work, we can confirm a positive effect of physiotherapy in carpal tunnel syndrome. Improvement occurred in all patients, subjectively patients reported a lower level of pain than before the start of the therapy, objectively we managed to achieve a greater range of motion in the carpometacarpal joint of the thumb and swelling also decreased after therapy. Patients were instructed on the importance of regimen measures and we provided them with ergonomic advice.

Keywords Carpal Tunnel Syndrome. Physiotherapy. Nervus Medianus.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 37–41. https://doi.org/10.22359/cswhi_17_1_05

Cited references: 31
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction: Theoretical starting points leading to the implementation of the study

Carpal tunnel syndrome is caused by compression of the nervus medianus, which is located on the volar part of the wrist. It is one of the best-known and most widespread entrapment syndromes. A frequently recorded, dynamic carpal tunnel syndrome in epidemiological conditions is associated with manual work. Idiopathic carpal tunnel syndrome is most common in women (65-80%) and between the ages of 40 and 60, with 50-60% of cases being bilateral. (Chammas et al,

2014) In secondary carpal tunnel syndrome, any condition that modifies the walls of the carpal tunnel can cause compression of the nervus medianus. These include irregularities in the shape or position of the carpal bones. In dynamic carpal tunnel syndrome, the pressure inside the tunnel increases during wrist flexion and extension. This increase is associated with repetitive movements of wrist flexion and extension along with fingers flexion and forearm supination. Acute carpal tunnel syndrome can occur as a result of trauma (displacement of the distal part of the scaphoid or dislocation of the wrist due to fractures), infection, bleeding from anticoagulant overdose or haemophilia, acute thrombosis of the nervus medianus artery, and burns. The diagnosis of carpal tunnel syndrome accounts for up to 90% of the total number of entrapment syndromes. Initially, this syndrome is characterized by:

- Intermittent nocturnal paresthesias and dysesthesias, the frequency of which increases and occur during wakefulness.
- Loss of sensation along with weakness and atrophy of the thenar muscles.
- In severe cases, symptoms may spread proximally to the forearm, upper arm, and sometimes into the shoulder.
- Symptoms on the entire palm surface. (Padua et al, 2016)

Although it is clear that carpal tunnel syndrome is a chronic phenomenon of peripheral nerve compression, in the pathophysiology and specific etiology there is an increase in intracanal pressure. Persistent pressures above 20-30 mmHg can cause damage to the nervus medianus by disrupting blood flow. Several studies confirm that increased pressure in the canal is present in patients with carpal tunnel syndrome and also correlates with clinical symptoms. (Zamborsky et al, 2017) We also focused on diagnostics and treatment procedures in physiotherapy for the selected diagnosis. Given the high frequency of occurrence of this entrapment syndrome, confirmation or rejection of this diagnosis belongs to neurologists. Due to the evaluation of the clinical condition and the use of auxiliary examinations (EMG), establishing or excluding the diagnosis of carpal tunnel syndrome is usually not problematic. Commonly confused conditions include C6 and C7 root lesions and cervicobrachial syndrome with pseudoradicular irritation. Arthralgias and arthropathy of the small joints of the hand or polyneuropathic syndrome can also be included here. Rarely confused conditions include brachial plexus lesions, Dupuytren's contracture, acral vasoneurosis, reflex dystrophic syndrome, and a few others. (Kim et al, 2014) The therapy is expected to improve the primary grip, a strong and precise movement model can be included. Contact with the largest possible surface area of the object is typically achieved with a power grip. This model includes a spherical, hook, and cylindrical grip. Precision grip, which requires dexterity, is used for precise manipulation. This includes the pincer, pinch and key grip. An integral part of the grip is the squeeze. It is necessary that the squeeze is appropriate. Thanks to sensory perceptions and vision, the hand is able to adapt the squeeze to the properties of the object and the given experiences are stored in memory. (Vyskotová et al. 2013) In patients with persistent numbness, neurological deficits, or long-lasting symptoms, surgical decompression is more successful than conservative treatment. For patients with severe carpal tunnel syndrome who do not respond to conservative treatment, it may be the only alternative that provides definitive treatment. (Pourmokhtari et al. 2021)

Objective

The main objective of the work is to demonstrate the effect of selected physiotherapy methods in patients with carpal tunnel syndrome after conservative treatment. The following objectives are to determine the effect of physiotherapy on pain and mobility of the affected hand and wrist and to focus on reducing swelling in the wrist and hand area. Last but not least, the effect of the physiotherapy is to teach the patient proper ergonomics to prevent the recurrence of carpal tunnel symptoms. The assumptions that are examined within the work and serve to verify or refute and are the basis for the research are as follows:

We assume that after completing the therapy in patients with carpal tunnel syndrome, pain will be reduced.

We assume that after completing the therapy in patients with carpal tunnel syndrome, range of

motion of the carpometacarpal joint of the thumb will improve.

We assume that after completing the therapy in patients with carpal tunnel syndrome, hand swelling will decrease.

Methods

We conducted the work in a form of an observational study. The group consisted of 8 adult patients aged 39-71 years who met the inclusion criteria, namely that they had been examined and diagnosed with carpal tunnel accompanied by specific symptoms. All patients underwent a physiotherapy examination, which included taking a medical history, measuring upper limb circumferences, goniometric measurement of the upper extremities using the SFTR method, and then the patients rated the relevant pain using a numeric rating scale. (Janda et al. 1993) (Melzack 1993) After the initial examination, we determined a suitable physiotherapy plan, which we implemented over a period of one month with a frequency of visits twice a week and a duration of 50 minutes for each exercise unit. In physiotherapy, we focused on the use of kinesiotherapy, manual therapy, hand stimulation, application of ultrasound with local action, carrier frequency f=3 MHz, repetition frequency f=50Hz, semi-static application, pulse-pause ratio 1:2, intensity 1.0-1.6 W.cm-2 on the CMC joint of the thumb from the palmar side, and kinesiology taping. (Hagovská, 2016) The results of the work were supported by the method of measuring and comparing input and output values. For the verification of the objectives, we analyzed the results using the t - test methods where the level of significance α for all goals was set at 0.05.

Results

By processing the input and output data of goniometric examination of passive joint mobility in the SFTR in the carpometacarpal joint of the thumb in the sagittal and frontal plane, we have shown a positive effect of physiotherapy to improve mobility in all patients (Table 1). By measuring the circumference of the areas of forearm, wrist and metacarpal heads, we processed a reduction in swelling after therapy (Table 11). With a visual numerical range of pain, we objectified a pain reduction after therapeutic intervention by physiotherapy (Table 8).

Table 1 Input and output values - goniometric examination of passive joint mobility in SFTR in the carpometacarpal joint of the thumb

			Input values		Output values		
Patient	**Area**	**Plane**	**Right UE**	**Left UE**	**Right UE**	**Left UE**	**Difference in values**
1	CMC joint	S	10 – 0 – 30	5 – 0 – 25	10 – 0 – 30	10 – 0 – 30	5
		F	70 – 0 – 50	55 – 0 – 40	70 – 0 – 50	70 – 0 – 45	20
2	CMC joint	S	10 – 0 – 30	15 – 0 – 45	10 – 0 – 35	15 – 0 – 45	5
		F	60 – 0 – 45	80 – 0 – 50	75 – 0 – 50	80 – 0 – 50	20
3	CMC joint	S	10 – 0 – 25	10 – 0 – 40	10 – 0 – 25	10 – 0 – 40	0
		F	55 – 0 – 35	70 – 0 – 50	65 – 0 – 45	70 – 0 – 50	20
4	CMC joint	S	5 – 0 – 25	10 – 0 – 45	10 – 0 – 35	10 – 0 – 45	15
		F	65 – 0 – 45	75 – 0 – 50	70 – 0 – 50	75 – 0 – 50	10
5	CMC joint	S	10 – 0 – 20	15 – 0 – 45	15 – 0 – 35	15 – 0 – 45	20
		F	45 – 0 – 35	70 – 0 – 50	55 – 0 – 45	70 – 0 – 50	20
6	CMC joint	S	5 – 0 – 20	15 – 0 – 45	10 – 0 – 30	15 – 0 – 45	15
		F	50 – 0 – 35	70 – 0 – 50	60 – 0 – 45	70 – 0 – 50	20
7	CMC joint	S	5 – 0 – 40	5 – 0 – 30	5 – 0 – 40	5 – 0 – 35	5
		F	60 – 0 – 50	50 – 0 – 45	60 – 0 – 50	55 – 0 – 50	10
8	CMC joint	S	10 – 0 – 35	10 – 0 – 25	10 – 0 – 35	10 – 0 – 30	5
		F	65 – 0 – 50	55 – 0 – 45	65 – 0 – 50	60 – 0 – 50	10

Table 2 Input values of statistical data - goniometric examination of passive joint mobility in SFTR in the carpometacarpal joint of the thumb in the sagittal plane

Area	Arithmetic mean	Median	Mode	Maximum	Standard deviation
CMC joint on the right	**36,262**	**27,5**	**20, 25, 30**	**40**	**6,5848**
CMC joint on the left	37,521	42	45	45	8,6603

Table 3 Output values of statistical data - goniometric examination of passive joint mobility in SFTR in the carpometacarpal joint of the thumb in the sagittal plane

Area	Arithmetic mean	Median	Mode	Maximum	Standard deviation
CMC joint on the right	**36,295**	**35**	**35**	**40**	**9,0054**
CMC joint on the left	50,631	52,5	60	60	8,8164

Table 4 Statistical result of paired t - test for the range of carpometacarpal joint movement in the sagittal plane according to SFTR

p-value	**0,00291**	**n=8**
p-value < α		**t=37,19**
p 0,001 < 0,05	α = 0.05	

Table 5 Input values of statistical data - goniometric examination of passive joint mobility in SFTR in the carpometacarpal joint of the thumb in the frontal plane

Area	Arithmetic mean	Median	Mode	Maximum	Standard deviation
CMC joint on the right	**105**	**110**	**110**	**120**	**11,9522**
CMC joint on the left	117,5	130	130	135	17,5113

Table 6 Output values of statistical data - goniometric examination of passive joint mobility in SFTR in the carpometacarpal joint of the thumb in the frontal plane

Area	Arithmetic mean	Median	Mode	Maximum	Standard deviation
CMC joint on the right	**112,5**	**112,5**	**110, 120**	**125**	**9,0157**
CMC joint on the left	118,13	120	120	130	7,4717

Table 7 Statistical result of paired t - test for the range of carpometacarpal joint movement in the frontal plane according to SFTR

p-value	**0,00002326**	**n=8**
p-value < α		**t=6,91**
p 0,001 < 0,05	α = 0.05	

By calculating the p-value, we have confirmed that after undergoing therapy in patients with carpal tunnel syndrome, the ranges of movements in both sagittal and frontal plane in the carpometacarpal joint of the thumb will improve.

Table 8 Numeric pain rating scale (0-10)

		Input values	Output values
Patient	**Sex**	**Pain intensity**	**Pain intensity**
1	female	2	2
2	female	4	4
3	male	2	2
4	female	1	1
5	male	4	4
6	female	1	1
7	male	3	3
8	male	4	4

Table 9 Statistical data of input and output values of pain objectivization

Pain	Input values	Output values
Arithmetic mean	**4**	**2,625**
Median	4	2,5
Mode	4, 3, 5	4
Maximum	6	4

Pain	Input values	Output values
Minimum	2	1
Standard deviation	1,2247	1,2183

Table 10 Statistical result of paired t - test of input and output values for pain objectivization

p-value	0,00006782	n = 8
p-value < α		t = 1,37
p 0,001 < 0,05	α = 0.05	

By calculating the p-value, we have confirmed that after undergoing therapy in patients with carpal tunnel syndrome, pain will be relieved.

Table 11 Anthropometric measurement, upper extremities circumference [cm], evaluation of swelling in the hand area (Janda et al. 1993)

			Input values		Output values		Difference in values	
Patient	Sex	Area	Right UE	Left UE	Right UE	Left UE	right	left
1	female	forearm	22	22	22	22	0	0
		wrist	**14**	**15**	**14**	**14**	**1**	**0**
		metacarpal heads	17	17,5	17	17,5	0	0
2	female	forearm	23,5	23,5	23,5	23,5	0	0
		wrist	16	16	16	16	0	0
		metacarpal heads	18	18	18	18	0	0
3	male	forearm	30	30	30	30	0	0
		wrist	**26**	**24,5**	**25,5**	**24,5**	**0,5**	**0**
		metacarpal heads	**28**	**26,5**	**27**	**26,5**	**1**	**0**
4	female	forearm	30	29	30	29	0	0
		wrist	**22**	**20**	**21**	**20**	**1**	**0**
		metacarpal heads	**25**	**23**	**24**	**23**	**1**	**0**
5	male	forearm	24,5	24,5	24,5	24,5	0	0
		wrist	**19**	**18**	**18,5**	**18**	**0,5**	**0**
		metacarpal heads	20	20	20	20	0	0
6	female	forearm	27,5	27,5	27,5	27,5	0	0
		wrist	20	20	20	20	0	0
		metacarpal heads	22	22	22	22	0	0
7	male	forearm	26	26	26	26	0	0
		wrist	21	21	21	21	0	0
		metacarpal heads	24	24	24	24	0	0
8	male	forearm	29	29	29	29	0	0
		wrist	**23**	**24,5**	**23**	**24**	**0**	**0,5**
		metacarpal heads	**25**	**25,5**	**25**	**25**	**0**	**0,5**

CASE REPORT

CPSPHI 2026; 17(1): 42–48

Grisel Syndrome as a Complication After Adenoidectomy, Case Report

A. Alhakim (Abdullah Alhakim)[1], M. Abusultan (Mohanad Abusultan)[2]

Summary

Torticollis in paediatric patients is relatively common symptom. It can be a result of a rare condition called Grisel's syndrome which is characterised by a non-traumatic atlanto-axial subluxation. This syndrome developed either post nasopharyngeal inflammation or ENT surgeries. According to Fielding and Hawkins classification, Grisel's syndrome can be divided to 4 types based on the degree of subluxation between atlas and axis. stage III-IV may require surgical intervention. Manual repositioning showed a good result in type I-III. As a consequence of joint subluxation there are changes on the myofascial structures of the neck. Decrease ROM in the joint area, Muscular spasm, Trigger points and muscles shorting all these can be noticed on physical examination. Our case study focused on conservative treatment for this syndrome. Using the Goniometer, we were able to monitor improvement in joint ROM, manual muscle length test to control involved muscles stretching. Physical medicine and rehabilitation can be considered as an essential part of the treatment protocol.

Keywords Grisel's syndrome, ROM, physical therapy, Atlanto-axial subluxation, Torticollis, spontaneous or Non-traumatic atlantoaxial subluxation (NAAS). ENT surgical complication.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 42–48. https://doi.org/10.22359/cswhi_17_1_06

Cited references: 16

Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

Grisel's syndrome is a non-traumatic spontaneous subluxation of the atlanto-axial joint consequent to pharyngeal inflammation 1. In 1830, Sir Charles Bell was the first to describe it in a patient with syphilitic pharyngitis 2. The name was derived from the French otorhinolaryngologist Pierre Grisel who reported 2 cases of nasopharyngeal inflammation leading to the development of torticollis. 3

The pathogenesis of this condition is still not clearly understood. The inflammation process may lead to increased flexibility of the ligaments which causes subluxation between axis and atlas. 4

Grisel syndrome has been reported in association with inflammatory processes of the pharynx and following ENT surgical procedures as adenoidectomy and tonsillectomy. 5

In this paper, we report a case of persistent torticollis following adenoidectomy which successfully recovered with conservative treatment using physical medicine and rehabilitation methods.

Case report

An 8-year-old boy underwent adenoidectomy under general anaesthesia. The child was placed in the Rose position, adenoidectomy was done endoscopically with a Thomson's adenotome. The procedure was completed without any complications. On the 4th postoperative day, he presented with painful torticollis. X-ray of the cervical spine as well as Computed Tomography (CT) scan were performed for diagnosis. Cock-robin position was detected on anterior-posterior cervical spine projection. CT scan of the cervical spine showed atlanto-axial rotary subluxation, which was confirmed by three-dimensional (3D) reconstruction and Classified as Fielding typ 1. MRI of the cervical spine was performed and showed no spinal cord pathological changes, there was a clear rotation in C1-C2 segment of 25-degree, face

rotated to the right with a subluxation posture in the left intervertebral ligaments. Accumulation of fluid in the area of Atlanto-axial joint and in the region of left C1-C2 INTERVERTABRAL DISC. The soft tissue of the neck showed no access. Lymphatic nodes enlargement along the main vessels of neck. The patient was given antibiotics, spasmolytics and anti-inflammatory treatment, in addition to bed rest and immobilisation with a cervical collar for one month. In rehabilitation clinic patient presented with neck pain, a clinical picture of left torticollis, left lateral flexion of the head with rotation to the right side. ROM was limited due to fixed torticollis. Lateral flexion to right was impossible, left head rotation limited, palpation of m. sternocleidomastoids painful, shortening of left upper and middle trapezius, left m. sternocleidomastoids left scalene and right levator scapulae, shoulder asymmetry. The rehabilitation protocol was planned for 6 months, starting with 3 session per week of physical and manual therapy including myofascial release technic, manual traction of the Cervical spine. Followed by Post isometric relaxation (PIR) of shortened muscles, mainly upper and middle Trapezius, sternocleidomastoids and scalene. Paraffin administered as a form of thermotherapy 2 sessions per week. Monthly the patient status was re-evaluated with gradually decrease of the symptoms and increase in ROM. After first month BS 1 cm, lateralflexion to right better in 2 cm , rotation of head better 3 cm to left, by end of rehabilitation plan, symptoms disappeared and the range of motion was fully restored.

Figure 1 Patient before and after therapy



Figure 2 Cock-robin position on anterior-posterior cervical spine projection



Figure 3 Three-dimensional reconstruction of CT scan, showing rotatory atlanto-axial subluxation.

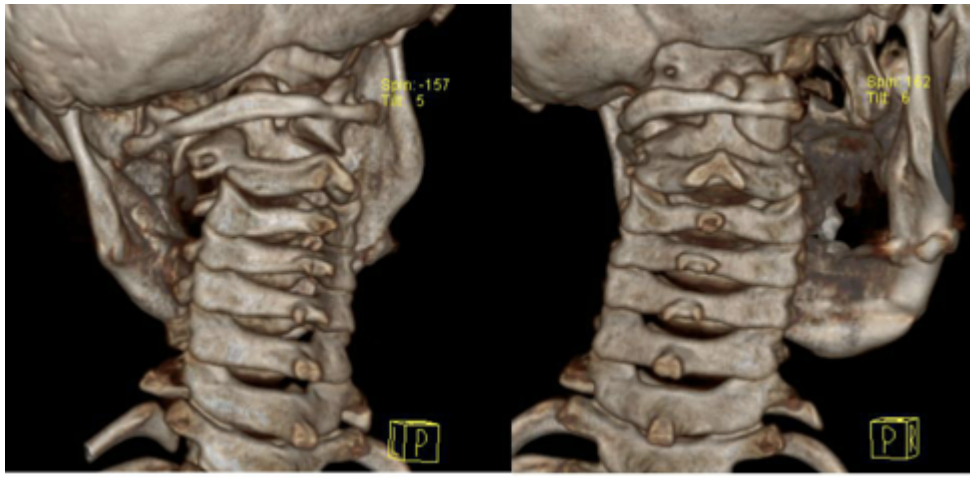


Figure 4 Axial view of CT-scan shows atlanto-axial dislocation (Fielding Hawkin I)

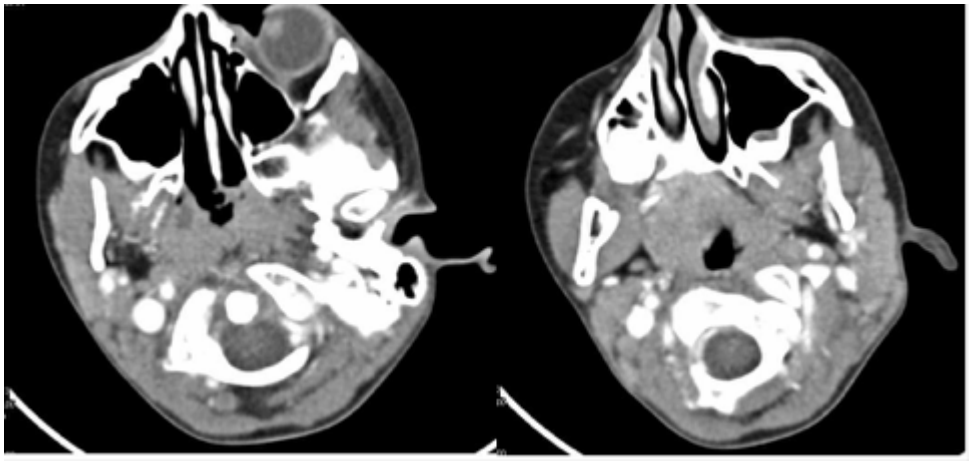


Figure 5 MRI

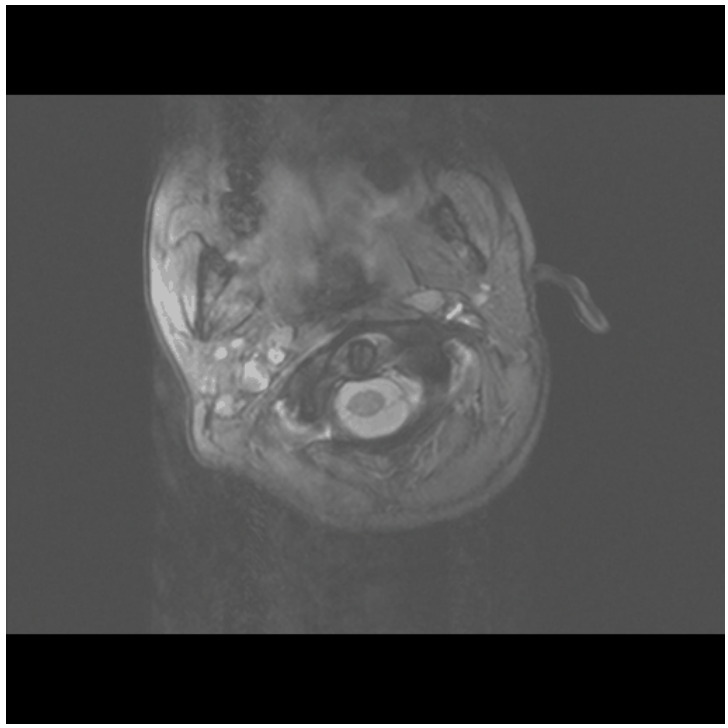
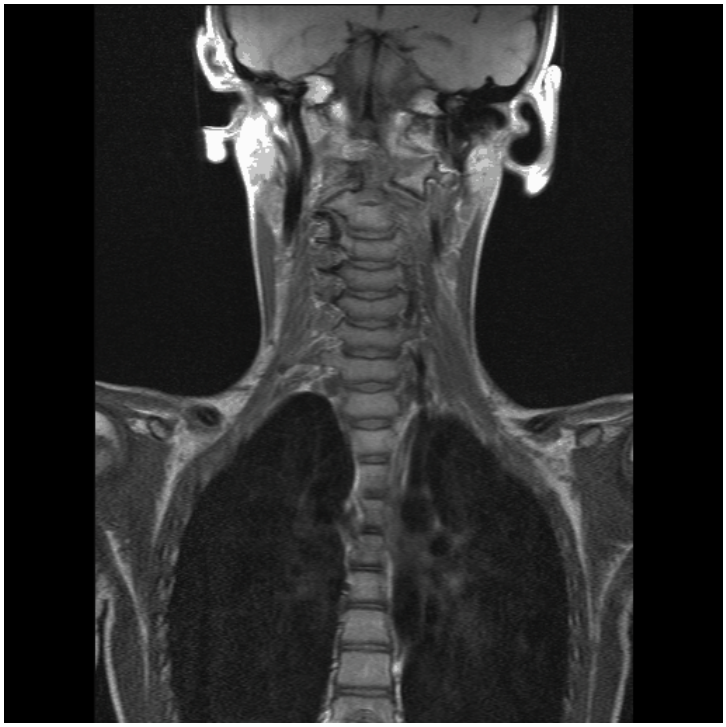


Figure 6 MRI



Department of radiology Uniklinik

(Rotation in the C1/2 segment • 25° (face turned to the right) - with subluxation - in the left intervertebral flexion. Increased fluid in the atlantoaxial joint and in the area of the left C1/2 intervertebral flexion. Slightly increased signal of the C2/3 disc in the T2 sequence. Slightly increased fluid in the C0/C1 joint on the right. No abscess found in the soft tissues of the neck. Bilateral enlargement of the left lymph nodes along the major vessels of the neck and under the m. sternocleidomastoids. Dorsally to the submandibular salivary gland, there is an enlarged lymph node measuring 10x15x35mm with higher signal in T2 compared to other lymph nodes (cannot rule out lymphadenitis/coliculation). Recommend follow-up ultrasound examination.

C4-7: Mild dorsal disc protrusions (up to 1mm) without contact with the spinal cord.)

MRI report after 1 month

MRI of the spinal cord + CC transition

(Rotation in the C1/2 segment by 25° (C1 is rotated compared toC2 counter clockwise when viewed from the front;

subluxated position in the left intervertebral flexion.

Increased fluid in atlantoaxial junction and in the area of the left intervertebral flexion of C1/2.

finding without significant change compared to earlier report one month ago

C4-7: Mild dorsal disc protrusions (up to 1mm) without contact with the spinal cord.)

Discussion

Grisels syndrome is a rare condition with only few number of cases reported in the literature. Generally it occurs in the paediatric population due to infections of the upper aerodigestive system (i.e., pharyngitis, tonsillitis) or as surgical complication of ENT procedures (i.e, adenoidectomy, tonsillectomy, ventilation tube insertion.)6 According to Al-driweesh et al., the most common post-surgical cause was adenotonsillectomy (55%), followed by pharyngoplasty (11%)7. Karkos, P D et al. in his systemic review included 103 cases between 1950-2006. Of which 48% were due to infection and 31% post-adenotonsillectomy. According to his finding most of the cases were treated conservatively; arthrodesis was necessary in a few cases. Al-Hussain, Omair H, and Ghadah Al-Hussain

came with a conclusion that most patients are treated conservatively with antibiotic, NSAID to alleviate clinical symptoms which include neck pain, torticollis and decrease neck ROM. Other cases which were not related to post-surgical GS were reported as a complication of Kawasaki disease or Mycoplasma pneumoniae it was accompanied by increase in inflammatory markers e.g., ESR, neutrophilia. Other viral or bacterial specious which was found to cause GS including Epstein-Barr virus, Kawasaki disease, *Streptococcus pyogenes*, *Staphylococcus aureus*, and other infectious agents. Liu . falsaperla

Etiopathogenesis of this condition is not fully understood. Some authors suggested a two hits hypothesis. One theory proposed the pre-existing higher flexibility of ligaments in children. The second is that the inflammatory process in the cervical muscles leading to spasm which results in the atlantoaxil joint subluxation. 8 Symptoms usually occurs few days after the procedure, where most the patients presented within 5days 9, which was the case in our patient who presented with symptoms on the 4th postoperative day.

Diagnosis of the Grisels syndrome can be made based on clinical examinations, while history of previous ENT surgery or pharyngeal infections should rise suspicion of Grisels syndrome. Early diagnosis can prevent from the devastating neurological complications. 6 this should be followed by immediate start of the treatment Deichmueller

Typical symptoms of GS include cervical pain and fixed rotation to one side with a slight fixation resulting from the limited rotation of the C1-C2 joint. 9 Laboratory investigations are considered to be not very helpful for the diagnosis of GS although inflammatory markers can be noticed in post infectious cases(7). Paolo spinato noticed that the presence of concomitant infection or inflammation in the head and neck region can negatively impact the rate of recovery. Imaging studies play an important role in the diagnosis of GS, this include X-ray, CT scan and MRI of the cervical spine. CT scan is considered to be the most important imaging method for diagnosis of GS (8) 19.

Fielding and Hawkins classification of GS was made to describe the degree of atlantoaxial displacement. The classification is divided into 4 subtypes. 10 Type 1 is the most common subtype. 11 Type 1 is characterised by fixed rotation of C1 - C2 , disluxation less than 3mm without subluxation.

Type 2 presence of subluxation in one side of the atalno-axial joint. Dislocation from 3-5 mm.

Type 3 Bilateral ventral joint subluxation. Dislocation more the than 5mm.

Type 4 posterior C1 subluxation with combination of dnes fructure or dnes aplasia. 12.

The need for surgical treatment is increased with higher stages. Stage I-II generally are treated with non invasive approach. While stage III-IV are treated surgically with C1-C2 fusion especially when it is combined with dens fracture or dens aplasia. Some authors treated stage III with 3 months immobilisation and a halo brace. Pilge came with a new approach of treatment by manual repositioning under general anaesthesia followed by immobilisation of cervical spine with Minerva cast for 2 months.12.

In our case we were able to prove that early diagnosis with appropriate physical therapy can resolve the problem. Even after the normalisation of the Atlanto axial joint on CT scan we noticed that, there can be still changes in the soft tissue which cause persistence of the symptoms. Physiotherapy and rehabilitation can be used for resolving such a functional changes without the need for long term general myorelaxant and NSAID.

Conclusion

In children with a non-traumatic sudden rigid neck fixation and torticollis a close collaboration between paediatrician, physiatrist and surgeon is crucial. early diagnosis and treatment plan can prevent the need of surgical intervention. Physical medicine and rehabilitation treatment should be included always in the treatment for avoiding long term neurological complications. Benefits of rehabilitation was remarkable in our case study.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 49–59

Prevention of Occupational Allergic Diseases

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Summary

Objective: Occupational allergic diseases represent a distinct group of work-related illnesses caused by allergens in the workplace, which do not typically cause clinical symptoms in healthy individuals. The aim of this review was to summarize the occurrence, basic characteristics, risk factors and prevention of most common occupational diseases.

Design: Review article analyzes the available publications about different types of occupational allergies. Statistical data for Slovakia were used from National Centre of Health Information in Slovakia and from Eurostat for Europe.

Results: Occupational allergies are usually chronic conditions that are triggered or aggravated by work activities. They typically manifest within the first few months of starting a job, with worsening symptoms upon continued exposure to the allergen. Depending on the body location, common occupational allergic diseases include allergic contact dermatitis, allergic rhinitis, occupational bronchial asthma, and exogenous allergic alveolitis. Workplace allergens are most found in various industrial sectors (construction, printing, rubber industries, etc.), but also in food processing, healthcare, horticulture, hairdressing, and other fields.

Conclusion: Globally comes to increase in allergic diseases over recent decades. The rapid emergence of new occupational technologies rises the awareness in the category of work-related allergies and implementing effective prevention strategies. Prevention plays a substantial role in the management of professional allergies and includes the use of personal protective equipment, workplace preventive measures, and proper management of at-risk employees. In cases of suspected work-related allergies, early diagnosis, prompt and effective treatment, and allergen avoidance, including reassignment to a different position, are crucial.

Keywords occupational disease, occupational allergies, dermatoses, allergic rhinitis, bronchial asthma, alveolitis, prevention

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 49–59. https://doi.org/10.22359/cswhi_17_1_07

Cited references: 33
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

An occupational disease is defined as a disease that develops in an employee while performing work or service-related tasks. It must be recognized by an appropriate healthcare facility specializing in occupational medicine.

Occupational allergic diseases form a specific subgroup of occupational diseases caused by allergens in the workplace that do not trigger clinical symptoms in healthy individuals. It is typically a chronic condition caused or aggravated by work activities. Occupational allergic diseases generally appear within the first few months of starting a job and worsen with continued exposure to the allergen. Many workplaces' hazards damage various organs also through non-allergic mechanisms (e.g., silicosis, pneumoconiosis, pulmonary asbestosis).

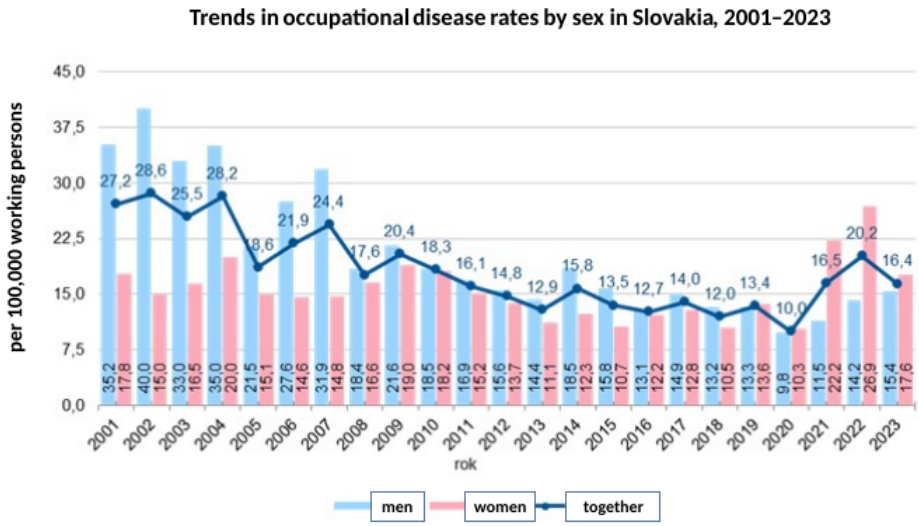
Occupational allergies are not monitored as a separate group; instead, individual diseases are listed in different sections of the occupational diseases register. Recognized occupational allergic diseases are relatively rare. However, given the global increase in allergic diseases over recent decades and the rapid emergence of new occupational technologies, awareness of this category is essential for diagnosing work-related allergies and implementing effective prevention strategies.

In an aging society, the period of professional activity frequently extends well into advanced old age (Sus2b, 2023). Healthcare for older adults, including older employees, sets higher professional requirements (Trnka, 2010), necessitates expanded treatment availability (Furtak-Pobrotyn, 2018), and entails above-average costs (Pobrotyn, 2020). Among other considerations, older individuals with chronic diseases, including allergic respiratory conditions, face an elevated risk of severe COVID-19 (Drobnik, 2021) as well as influenza and related complications (Drobnik, 2023), and awareness of these risks increases the popularity of vaccination in this age group (Sus2b, 2022). A growing challenge for the healthcare system stems from the emergence, in an aging population, of conditions and complications that were previously rare (Sus2b, 2015) or exhibit atypically severe courses (Sus2b, 2015), as well as malignancies (Pajewska, 2023) and mental disorders (Trnka, 2013), all of which affect the fulfillment of social and professional roles (Trnka, 2017). Consequently, particularly meticulous medical recordkeeping is required (Sus2b, 2009). Given widespread staffing shortages, healthcare can only meet these demands through the increasingly extensive use of modern technologies (Sus2b, 2023), including computer systems (Sus2b, 2008) and telemedicine (Grata-Borkowska, 2022), which in turn introduce new, previously unknown risks (Sus2b, 2017).

Epidemiology of Occupational Diseases

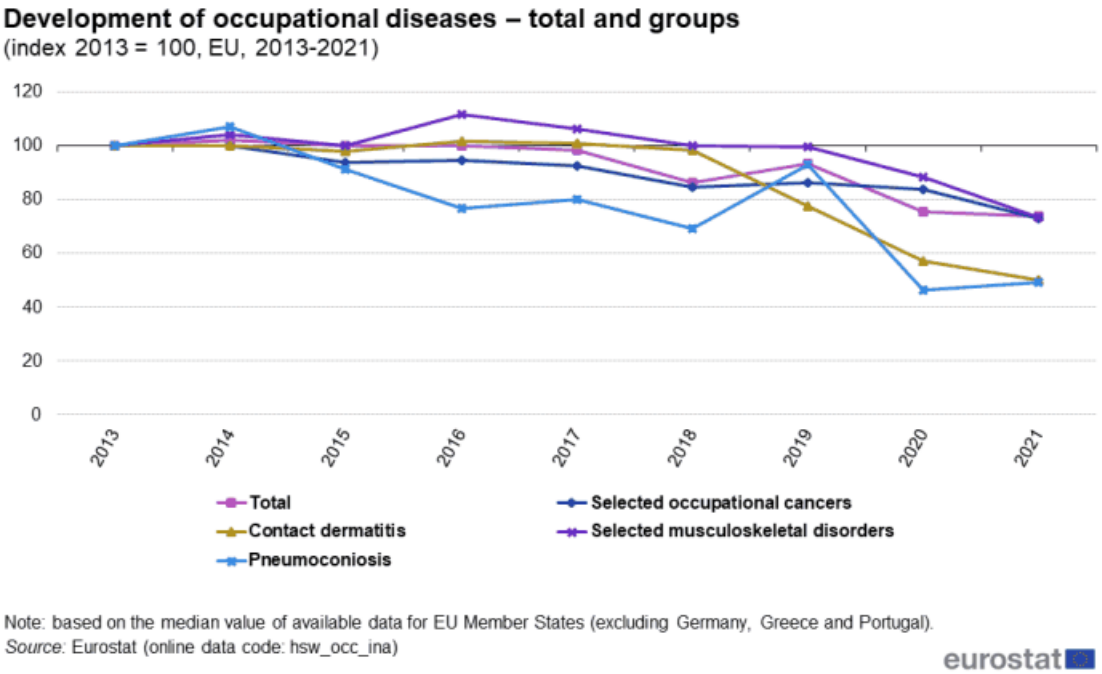
Over the past 20 years, the incidence of occupational diseases has been steadily decreasing globally. In 2023, 429 newly recognized cases of occupational diseases were reported in Slovakia, corresponding to 16.4 cases per 100,000 employed persons - nearly 20% fewer than the previous year (a decrease of 96 cases). The overall trend in occupational diseases in Slovakia has been declining over the past 20 years, too (Figure 1). However, the increase in cases among women in 2021 and 2022 was primarily due to the COVID-19 pandemic, as many female healthcare workers developed occupational diseases because of work-related COVID-19 infections. In 2023, the highest incidence of occupational diseases in Slovakia was recognized in industrial manufacturing (40%), healthcare and social assistance (30%), and mining and quarrying (15%) (NCZI, 2024).

Figure 1 Trends of occupational disease incidence by gender in 2001 – 2023 in Slovakia. Source: adapted from NCZI, 2024



Within the European Union (EU), the EU index value for the number of newly recognized individuals with an occupational disease decreased by 26% from 2013 to 2021 (Figure 2). The time series data is shown in Figure 2 using an index, where the value for 2013 is set at 100. The figure does not display the absolute number of people diagnosed with an occupational disease but focuses on the change in this number over time. Among occupational allergies, contact dermatitis is shown, exhibiting a declining trend (Eurostat, 2024).

Figure 2 Trends in occupational diseases in the EU from 2013 to 2021, overall and by groups of occupational diseases. Source: adapted from ec.europa.eu/eurostat/statistics.



Risk Factors of Occupational Allergies

The risk of developing and progressing occupational allergies is present in various industries with a wide range of allergens (Figure 3). In addition to employees in industry, occupational allergies can also occur in other workplaces (Figure 4). Therefore, a good understanding of potential allergens is necessary, along with interdisciplinary collaboration between occupational medicine specialists and clinical doctors, based on the clinical symptoms and impact on individual organ systems.

Figure 3 Risk industries for occupational allergic diseases



Figure 4 Risk workplaces for occupational allergic diseases outside industrial sectors



Diagnosis of Occupational Allergies

When experiencing any symptoms, the patients visit their general practitioner, who, upon suspicion of an occupational allergy, refers them to the appropriate specialist. The most common examinations are conducted by a clinical immunoallergist, and if necessary, by other specialists such as a dermatologist, pulmonologist, or otolaryngologist. The diagnostic methods differ according to the type of occupational allergy. If there is suspicion that the disease is related to the patient's work, an examination at an occupational medicine clinic is required to confirm or reject an occupational

disease diagnosis. A physician specializing in occupational medicine determines necessary work adjustments and potential compensation for the patient.

Prevention of Occupational Allergies

The risk of occupational allergy depends not only on the concentration of allergens but also on the available protective measures. In some cases, protective options are significantly limited, such as with airborne allergens like wood or flour dust and mold spores. For contact allergens, the lack of protective equipment use may result from negligence, convenience, or business interests. Avoidance of causative exposures through control strategies such as elimination, substitution, engineering controls, and process modification is the preferred primary prevention strategy for preventing development of work-related allergic diseases.

Personal protective equipment

To prevent occupational allergies, various workplace management measures are recommended. Depending on the type of work and potential allergens, protective gloves or respiratory protection equipment should be used. Gloves prevent contact with harmful substances and protect against chemical, mechanical, electrical, or thermal irritation. The type of gloves must be chosen based on the specific hazard. It is also recommended to wear cotton inner gloves under protective gloves, as they absorb sweat and are easy to replace. For respiratory protection can be used respirators, masks, and filtration devices (with or without an oxygen supply) that protect against airborne dust or gaseous substances. Regular filter replacement is necessary. These protective devices are particularly useful in welding, soldering, gluing, painting, and handling solvents or volatile substances.

Management of Occupational Allergy Prevention in Workplaces

There are few opportunities to completely avoid allergens in the workplace. Sometimes it is possible to transfer the worker to a different position, but often the employee must retrain for a different profession. Financial support is typically only available if the disease is recognized as an occupational disease (a process that is often very demanding and lengthy). In some cases, an occupational disease can lead to disability or early retirement.

Certain workplaces pose a particularly high risk for developing allergies, requiring appropriate preventive measures. However, in all industries, it is essential to monitor the allergens that employees are frequently exposed to. Standard protective measures may not be sufficient for allergy sufferers, as even small amounts of allergens can trigger significant reactions. Each workplace must provide employees with detailed information about potential allergens and the necessary protective measures. Occupational exposure limits for harmful substances are regularly updated and must be adhered to, but they may not adequately protect individuals prone to sensitization and allergic reactions, as these can occur independently of allergen concentration. Every employee must be aware that hypersensitivity or allergic reactions can develop at any time, even after years of working in the same profession. For example, hairdressers often develop allergies within the first year of training, while in other professions, significant symptoms may take years to appear, potentially preventing further employment in the field.

Choosing the Right Profession

When choosing a future profession, it is important to consider the risk of allergies, especially for individuals with a higher risk or in environments where these risks are increased. For atopic individuals, i.e., those with a higher predisposition to allergic diseases, as well as patients with developed allergies, it is crucial to assess the allergen exposure in the workplace and inquire about possible allergens. Testing before entering a job remains a subject of discussion, as the presence of sensitization does not necessarily mean that an allergy will develop. On the other hand, testing can lead to a false sense of security, as allergies may develop after years. A typical example is the allergy to chromium in cement among bricklayers, which can develop after the age of forty.

For new employees, it is recommended to consult a doctor if the first symptoms indicating a possible allergy appear, as these symptoms may worsen over time. In the case of a known allergy to substances in the work environment, it is crucial to consider

changing the job position and retraining, especially for younger people. In some countries, financial support is provided to employees who need to retrain. Protection from allergies should be ensured during the preparation for employment, not only for atopic individuals but also for healthy people without any signs of allergic diseases.

Classification of Occupational Allergies

Most of occupational allergic diseases can be categorized based on their localization to:

- Allergic contact eczema
- Allergic rhinitis
- Occupational bronchial asthma
- Extrinsic allergic alveolitis

Certain types of occupational allergic diseases are more common in specific professions, depending on the presence of allergens that typically cause allergic symptoms, most often affecting the skin or respiratory tract (Figure 5).

Figure 5 Classification of occupational allergies and their occurrence by profession



Professional Dermatoses

The occurrence of skin diseases related to work and the environment has been increasing in recent years. They have significant socio-medical, healthcare-political, and economic impacts. Young people at the beginning of their productive age are often affected. Irritative or allergic contact reactions are the most common. Skin diseases typically progress chronically and are often not initially associated with the type of work performed.

Diagnosis requires several years of experience with professional dermatoses. Treatment and retraining involve considerable financial costs, and those affected often struggle to find employment again. Costs increase when an occupational disease is recognized. Prevention and rehabilitation have significantly improved in recent years, thanks to advancements in dermatological procedures and interdisciplinary outpatient and hospital counseling.

Professional dermatoses most commonly present as contact eczema on the hands, where exposure is most significant. Two possible mechanisms apply. Direct skin irritation by a harmful substance can trigger irritant contact eczema. A delayed allergic reaction based on sensitization to an allergen causes allergic contact eczema. Clinically and histologically, they are usually indistinguishable. Irritative manifestations often precede the development of contact eczema as they weaken the skin's barrier function, and initial inflammatory changes in the skin's surface layer make sensitization easier, leading to the development of

contact eczema. Atopic eczema increases the risk of professional dermatoses.

A typical trigger for professional dermatoses in healthcare workers was latex, which spread through powder dust in latex gloves. Its significance has decreased with the use of non-latex gloves. Moisture present for at least 2 hours of work time increases the risk of developing an allergy. The most common allergens that cause professional dermatoses are chromium compounds in cement, epoxy resin (colophony), nickel, rubber components (thiuram, dithiocarbamate), disinfectants (glutaraldehyde, glyoxal, thiuram), preservatives and fragrances.

Due to the financial and time-consuming nature of the treatment, more emphasis is needed on preventing occupational dermatoses. *Primary prevention* includes using substitutes for irritating substances, reducing the content of the most allergenic substances, modernizing manufacturing technologies, regularly determining the highest permissible concentrations, tightening legislation, and thoroughly labeling harmful substances.

Technical measures used in primary prevention include cleaning machines or so-called enclosed machines, which offer better control over potential allergens. Organizational measures are also important, such as conducting a detailed analysis of skin exposure at the workplace, assessing workplace risks, regular changes between wet and dry work, and ensuring longer periods for drying items in production. Employees should participate in regular medical check-ups, use protective work equipment like gloves or protective creams, and engage in proper hand cleaning and hand protection for regeneration after work.

Secondary prevention involves early diagnosis and quick, effective treatment of emerging dermatoses. Advanced eczema has a much worse prognosis. In *tertiary prevention*, appropriate treatment procedures are sought for severe dermatoses, where good skin care is needed in collaboration with experienced dermatologists and coordination between dermatologists and occupational medicine specialists.

Occupational Allergic Rhinitis

Occupational allergic rhinitis is more frequently observed in workers in the food industry, textile industry, healthcare, carpenters, furniture makers, sawmill workers, and agriculture. The allergic rhinitis is a special type of work-related rhinitis that includes also different forms of rhinitis associated with the workplace of non-allergic occupational rhinitis.

The most common allergens include various types of flour, textile fibers, furs (flax, wool, cotton, synthetic fibers), hay, straw, feed mixtures, fungi, animal allergens (epithelium, feathers, insects), dust mites, food, latex, wood, formaldehyde, isocyanates, and more.

Diagnosis is challenging due to the need to distinguish between allergic and non-allergic forms. Clinical symptoms include repeated sneezing with a runny or stuffy nose, coughing, mucus drainage, and nasal swelling. It is often accompanied by itching of the eyes, nose, throat, or ears, dark circles under the eyes due to increased blood flow in the sinus area. To prevent contact with the allergen, personal protective equipment (masks, respirators) should be used at work, along with an appropriate work schedule, timely diagnosis and treatment, and possible early reassignment to another position.

Work-related rhinitis may precede development of work-related bronchial asthma, typically 5-6 months before asthma onset and therefore prevention, the early diagnosis and appropriate treatment can also prevent bronchial asthma.

Occupational Bronchial Asthma

Occupational bronchial asthma is the most common professional respiratory disease, accounting for 15-20% of adult asthma cases. Advances in industry and technology in Europe create new risk exposures for the respiratory tract. Many risk factors, such as nanoparticles, have not been clearly studied for their effects on the respiratory system or asthma development. Asthmatic symptoms often emerge after exposure to cleaning agents, irritants, or toxic substances.

When occupational asthma should be recognized as a work-related disease, the causal connection between asthma development and environmental factors at the workplace is crucial. Clinical manifestations include reversible airway hyperreactivity or bronchial obstruction. In the absence of the causative agent, hyperreactivity may be absent. It may depend not only on the causative agent but also on the activity being performed. Episodic asthma attacks occur primarily at the

workplace initially, but they may later occur outside of work, often accompanied by coughing and chest tightness. Symptoms include wheezing, expiratory dyspnea (difficulty breathing), and inflammation in the lower airways, which persists even after the resolution of asthma attacks. In later stages, especially when untreated, structural changes may occur.

Patients with existing asthma should avoid careers with a high risk of developing asthma, such as bakers, gardeners, animal caretakers, and similar occupations. Positive sensitization on different allergens (prick test, specific IgE antibodies) and bronchial hyperreactivity increase the risk of developing asthma. Workers at risk should undergo more frequent examinations during the first two years of employment. Patients sensitized to or reacting to allergens in the workplace should avoid such occupations. In addition to proper job placement and counseling, it is essential to minimize exposure to sensitizing or irritating substances in the workplace. This includes adhering to air pollution concentration limits, adequate dilution of substances, and the use of personal protective equipment. Technical protective measures include ventilated animal enclosures or the use of less dusty flour and granular substances in baking. For irritant substances, there are maximum permissible concentrations, but no such limits exist for allergenic substances.

Secondary and tertiary prevention of occupational bronchial asthma includes early diagnosis of occupational respiratory diseases of allergic origin, which is crucial for the disease's progression and prognosis. The risk of sensitization and the development of occupational asthma is highest during the initial years of employment. After successful diagnosis, it is essential to avoid exposure to the triggering allergen. The longer the exposure, the higher the risk of persistent bronchial hyperreactivity. A comprehensive patient management plan is necessary, from diagnosis to treatment, in collaboration with the primary care physician, pulmonologist, allergist, and occupational health specialist.

Exogenous allergic alveolitis

Exogenous allergic alveolitis is an immunologically mediated inflammatory reaction in the pulmonary parenchyma and terminal bronchioles with characteristics of interstitial lung disease. It is triggered by repeated inhalation of allergens by individuals who have been sensitized previously. The allergens are usually organic substances (bacteria, molds, mycobacteria, and proteins), and less commonly low-molecular-weight chemicals. Allergic inflammation occurs within hours to days, and in chronic forms, the diagnosis may not be made until pulmonary fibrosis develops.

One form of exogenous allergic alveolitis is *"bird fancier's lung."* It is most caused by budgerigars, cockatiels, or pigeons, with a high cross-reactivity between different bird species. It occurs in bird keepers but also in pet owners. The sources of allergens are protein components of excrement or feathers. Sensitization to molds and thermophilic actinomycetes, which can contaminate bird dust, is often present.

A common form of exogenous allergic alveolitis in Europe is *"farmer's lung."* It is caused by repeated exposure to moist hay and straw and the molds and bacteria (Aspergillus, Alternaria, thermophilic actinomycetes) contained within them. These microorganisms thrive under optimal conditions when hay is stored in barns, influenced by humidity, fermentation processes, and rising temperatures. When handling feed or bedding, fungal spores or bacteria are released into the air and subsequently inhaled by farmers.

A particular form involves lung disease caused by air conditioning systems. It is caused by contaminated humidifiers and air conditioning systems. It commonly occurs in carpenters, bookbinders, and printers, where air conditioning systems have been installed.

The clinical course of exogenous allergic alveolitis depends on the type of allergen, the intensity, duration, and frequency of exposure. From a time perspective, it can be acute, subacute, or chronic. The acute form typically appears 3-12 hours after repeated allergen exposure, with flu-like symptoms, fever, chills, headaches, body aches, respiratory difficulties, non-productive cough, chest tightness, and exhaustion. Crackles are often heard on lung auscultation. Symptoms resolve after the removal of the allergen without specific treatment within 24-48 hours. The subacute form results from recurrent, usually lesser allergen exposure. It is characterized by gradually worsening shortness of

breath, cough, fatigue, or weight loss over weeks to months. The chronic form can develop with prolonged minor exposure to allergens or repeated acute episodes – a chronically recurring form. This can progress to advanced interstitial lung disease, including pulmonary emphysema (farmer's lung). Effort-related dyspnea becomes more frequent. However, other chronic fibrotizing lung diseases must be differentiated.

Prevention of exogenous allergic alveolitis focus on preventing contact with the triggering allergen. *Primary prevention* also includes changes in working conditions, public education about potential sources of allergens, or targeted training for employees to reduce allergen exposure. For farmers, recommendations include switching from hay to silage feeding or from straw bedding to manure farming, as well as using special ventilation and heating systems in barns to reduce the presence of allergens. *Secondary and tertiary prevention* involves protecting the airways with respirators, regular preventive examinations, early diagnosis, treatment, and good management of existing exogenous allergic alveolitis.

Conclusions

Occupational allergies are mostly chronic diseases that are caused or exacerbated during work activities. Due to the overall increase in the prevalence of allergic diseases in recent decades, it is important to consider potential occupational allergies, the diagnosis of which can be more complicated, especially due to the necessity of proving a causal link to the allergen in the patient's work environment. Allergens causing occupational allergies are found in various working conditions. Prevention is crucial, including the use of personal protective equipment, preventive measures in the workplace, and good management of at-risk employees. In cases of suspected work-related allergies is very important early diagnosis, prompt and effective treatment, avoidance of the allergen, and if necessary, reassignment of the employee to another position.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 60–67

Sexual Behaviour of Young Adults from a Public Health Perspective

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Summary

Aim: The aim of the thesis is to examine the forms of risky sexual behaviour of young adults in Slovakia and on the basis of the findings to outline possible intervention procedures, as forms of help or re-education. Psychosocial factors involved in the occurrence of risky behaviour include emotional intelligence and coping strategies.

Methods: Data were collected by administering a questionnaire battery that includes a sociodemographic questionnaire, a questionnaire aimed at tracking risk behaviors, and standardized questionnaires: the TEIQue – SF focused on trait emotional intelligence and the CSI 32 examining coping strategies. The research population consisted of 200 respondents aged between 18 and 26 years, with an equal representation of both genders, with different location of residence and socioeconomic background.

Results: Based on statistical analysis, we confirmed the association between sexual risk behaviors and emotional intelligence and coping strategies. We confirmed that men are significantly more likely to seek sexual encounters outside of a monogamous relationship; sexual risk behaviors are positively associated with maladaptive forms of coping and negatively associated with adaptive forms of coping. Lower levels of emotional intelligence correlate with higher levels of risky sexual behaviour.

Conclusion: The results of the research point to areas suitable for the application of preventive, experiential and educational programmes. We confirmed that men are significantly more likely to seek sexual encounters outside of a monogamous relationship, risky sexual behaviour is positively associated with maladaptive forms of coping and negatively associated with adaptive forms of coping, lower levels of emotional intelligence correlate with higher levels of risky sexual behaviour

Keywords Risky sexual behaviour. Young adults. Emotional intelligence. Coping strategies.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 60–67. https://doi.org/10.22359/cswhi_17_1_08

Cited references: 32
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

Despite their significance, health issues affecting the younger generation are frequently overshadowed by the mounting challenges posed by an aging population (18). This occurs because the latter group exhibits specific vulnerabilities to diseases (2)—including those with atypical (24) or exacerbated courses (23)—often leading to reductions in functional capacity (31). These limitations, in turn, heighten difficulties in delivering appropriate care services (4), contribute to rising associated costs (5), and reflect limited possibilities for prevention (20). Meanwhile, younger patients demonstrate elevated awareness and sensitivity (28), necessitating a different form of interaction with healthcare professionals (27) compared to

older adults (26). They also tend to be more receptive to solutions supported by modern technologies (17), especially teleinformatics (7), and are typically more adept at using them (19). Nonetheless, a particular challenge in this context is the proper documentation of medical procedures (22) as well as the assurance of data confidentiality (21).

Young adulthood - characteristics of the developmental period

It is very difficult to precisely define the age of young adulthood because of the different attitudes of different authors dealing with the issue of ontogenetic psychology. This discrepancy is probably due to the different criteria advocated by individual authors. One relatively clearly defined factor for the onset of young adulthood is the attainment of majority, or legal adulthood (25), the threshold of which in Slovakia is the eighteenth year of life. Defining until when this developmental period lasts is even more complex. The aim of this period is to achieve relative freedom in decision-making and the ability to accept responsibility, to evaluate one's own possibilities and competences, to control one's own emotions and behaviour. Young adults should become independent from their primary family, master couple living, accept authority figures and interact appropriately with them, and become economically independent (25). Therefore, for the purpose of our research, we chose the age range of 18 to 26 years.

A specific feature of today's modern age is the fact that all these psycho-social changes are taking place in a constantly changing and highly dynamic social environment, which represents another significant stress factor for today's young people (8). At the same time, it is important to point out the difficulty of achieving developmental tasks in the context of the current social situation in Slovakia. The Youth Report 2018 (13) considers young people to be the most vulnerable part of the population, precisely because of the impact of changes in the social environment. Independence, which is one of the key developmental tasks of young adulthood, is also strongly influenced by the ability to get a job and secure sufficient financial resources. The difficulty of this process is also reflected in unemployment statistics (13), which show that almost 30 % of all unemployed people are aged under 29. The development of the economy is also playing an important role, increasing the demands on efficiency, the requirements for vocational training and the professional competences of the individual (9).

Risky sexual behaviour

Forms of risky behaviour include frequent change of sexual partners, casual sexual intercourse, unprotected sexual intercourse, and various sexual object choice disorders. Sexual risk behaviours are significantly more risky in young adults than in the general population (16). In recent years, there has been a significant postponement of marital relationships, which has led to an increase in cohabitation and open relationships. There are several reasons for this, ranging from the loosening of moral rules to the economic and social situation of young adults (9).

The reasons for the emergence of risk behaviour in this area can be found in the lack of knowledge about sexually transmitted diseases and inadequate competence in relationships. Sexual risk behaviour is also associated with dissatisfaction in intimate relationships (6). Sexual risk behaviour can be observed in individuals with insecure relationships with their parents, emotionally deprived, who in this inadequate way seek the lack of emotional support and security (9). Awareness, sex education and the attitude of the family and close environment towards sexuality also play an important role. Open communication leads to an awareness of the importance of emotional relationships with partners, a reduction in partner turnover and the choice of appropriate contraceptive methods (11).

The effects of sexual risk behaviour appear in many areas. In terms of STD transmission, these are mainly chlamydial diseases, which are most common in young adults compared to other age groups. The risk of transmission is also significant for gonococcal infections and syphilis (14). Transmission of human papillomavirus, which occurs mainly in the case of frequent sexual partner turnover and unprotected intercourse, is also of serious impact and is one of the causes of cervical cancer (9).

Emotional intelligence

The level of emotional intelligence is a very important factor involved in the emergence of risky

sexual behaviour in young adults. It is important for navigating the social environment, for forming adequate relationships, and also for the individual's self-regulation.

Emotional intelligence can be defined as the ability to register one's emotions and express them in ways that are conducive to personal and intellectual growth (12). Thus, it is clear that sufficient competence in this area is essential for functioning well in social spheres. The approach defining mature and immature emotional intelligence is interesting. Mature emotional intelligence is characterised by the ability to organise and initiate group activity, the ability to empathise, i.e. to empathise with others and their feelings, and to understand other people's feelings, motivations, worries and interests. Credibility is also an important trait that helps to achieve success in life and is essential for innovation and creativity.

Conversely, signs of immature emotional intelligence include egocentrism, inattention to others, uncontrolled emotions such as inadequate response to criticism, explosiveness, mood swings, superficial, impulsive behavior, impatience, calculating, dependence, i.e., self-determination, manipulativeness, and avoidance of responsibility. Emotions are perceived but not expressed, which is insincere and hinders personal growth (30).

Kaliska et al. (10) describe the importance of emotional intelligence specifically during young adulthood. This developmental phase is characterized by detachment from the primary family and the formation of new relationships, for which emotional intelligence is very important. At the same time, achieving emotional equanimity is considered one of the developmental tasks of this period.

The level of emotional intelligence is one of the important factors in the prevalence of risky sexual behaviour, as demonstrated by several scientific studies. Yip et al (32) describe in their study the link between emotional intelligence and risky behaviour. Their findings are consistent with our assumptions; higher levels of emotional intelligence correlate with a tendency to engage in less risky behaviour, while lower levels are associated with riskier behaviour.

Coping strategies

There are many situations in a person's life that require the activation of coping. Folkman and Lazarus (3) discuss two types of coping strategies in their theory: problem-focused coping strategies and emotion-focused coping strategies (3). In problem-focused coping strategies, individuals actively seek to identify the problem, find their own coping resources, and find alternative solutions, including intrapsychic changes. In contrast, in an emotion-focused strategy, the individual attempts to regulate the emotional state caused by the presence of a stressor (15).

Tobin's distribution handles a large number of different ways of coping with stressful situations. He is one of the few authors to report emotion-focused coping behaviours in the domain of attachment, which we consider to be a great advantage, since not every situation can be addressed with a solution aimed at resolving the situation. Tobin points out that it is also possible to see as positive a form of coping that does not actively resolve the situation but allows the individual to accept and cope with it (25). Since these types of situations occur relatively frequently in the lives of young adults, we find this approach appropriate for tracking preferred coping strategies in our research.

Research suggests that risk behaviour is more likely to be linked to emotion-focused strategies. Dariotis and Chen (1), in their work focusing on young adults, describe the link between sexually risky behaviors and coping strategies. Research suggests that increased sexual risk taking and drug use are associated with just the strategies typically associated with problem avoidance. It is clear from these results that deficiencies in coping strategies can have a significant negative impact on the emergence of risk behaviors.

Methods

Research questions and hypotheses

Question1: What is the prevalence of risky sexual behaviour?

Hypothesis 1: We hypothesize that men will experience higher rates of risky sexual behavior than women.

Hypothesis 2: We hypothesize that forms of coping strategies will be correlated with rates of risky sexual behavior.

Hypothesis 3: We hypothesize that measures of emotional intelligence will be negatively correlated with the rate of occurrence of risky sexual behavior.

Research file

The research population consists of 200 respondents who can be characterized as young adults based on their age. The age range is from 18 to 26 years, with a mean age of 21.51 years (SD= 2.536). The sample consisted of 112 females (56 % of N=200) and 88 males (44% of N=200). The female group had a mean age of 20.95 years (SD= 2.249) and the male group had a mean age of 22.22 (SD= 2.710). In the women's group, the lowest age was 18 years and the highest age was 26 years, and in the men's group, the lowest age was 19 years and the highest age was 26 years.

Research procedure

Data collection was done through internet distribution, avalanche sampling method of respondents. Respondents participated in the research on a voluntary basis and the collection was done anonymously. In case of any ambiguity, the authors could be contacted either through social networking or via email. It was also possible to leave feedback from the respondent to the author after completing the questionnaire battery.

The age of the respondent between 18 and 26 years was a prerequisite for completing the questionnaire battery.

Research methods

The research was conducted through a questionnaire battery. Initially, we collected socio-demographic data – gender, age, education, place of residence. At the same time, and in the initial part of the questionnaire, we focused on the frequency and prevalence of risky sexual behavior. Subsequently, validated questionnaires were included The Trait Emotional Intelligence Questionnaire TEIQue-SF, a short form designed for adults and adolescents and tracks measures of emotional intelligence. The second validated questionnaire was the Coping Strategy Inventory 32 - CSI 32 which is a shortened version of Tobin's original inventory that tracks different forms of coping and creates categories at the primary, secondary, and tertiary levels of diversion and attachment (25).

Data processing methods

To process the collected data, we used a specialized statistical computer program Statistical Package for the Social Sciences (SPSS). In this computer program, we subsequently performed the relevant selected statistical tests.

At the outset, we descriptively tracked the questions in the sociodemographic section of the questionnaire battery. We then used SPSS to calculate raw scores for each questionnaire and its parts. In verifying the hypotheses and determining the answers to the research questions, according to the specifics of each variable, we chose the relevant statistical tests, namely Phi coefficient for comparing two groups with dichotomous answers, Correlation coefficient to determine the relationship between the scaled variables, and we used the non-parametric Mann-Whitney U-test to test the differences. Normality of the distribution of the variables was ascertained using the Kolmogorov Smirnov normality test.

Results

Question 1: What is the prevalence of risky sexual behaviour?

When asked about sexual behaviour, 39 respondents said they had not yet had sexual intercourse (19.5% of N = 200). 179 respondents said they prefer to have sexual intercourse only in a partner relationship (89.5 % of N = 200), 4 respondents said they have sex with other partners besides their regular partner (2% of N = 200), 15 respondents said they seek casual sex (7.5% of N = 200), and 2 engage in group sex (1% of N = 200). 94 respondents protect themselves during sex by using a condom (58.4 % of N = 161), 22 use hormonal contraception (13.6% of N = 161), 36 use intermittent intercourse (22.36% of N = 161), and 3 respondents prefer unprotected sex (1.9% of N = 161). The other respondents did not indicate the form of protection they use.

80.5% of the respondents are sexually alive, 89.5% of the respondents prefer monogamous sexual relations, 58.4% of the respondents use condom during sexual intercourse, 22.36% prefer intermittent intercourse, 13.6% use hormonal

contraceptives, 1.9% of the respondents do not use any form of protection.

Hypothesis 1: We hypothesize that men will experience higher rates of risky sexual behavior than women.

We used the non-parametric Mann-Whitney U-test to compare the number of sexual partners between men and women based on normality testing. We compared the total number of lifetime sexual partners.

Table 1 Mann-Whitney U-test – Intersex differences - number of sexual partners (N = 200)

Group	N	Median	Standard deviation	Average ranking	U	Sig.	r
Women	**112**	**2**	**2,91**	**2,55**	**4904**	**0,952**	**-**
Men	88	1	8,05	4,43			

Two-tailed significance test

Based on the results of the Mann-Whitney U-test (U = 4904, p = 0.952), we can conclude that the difference between men and women in the number of sexual partners is not statistically significant.

At the same time, we observed sexual contacts with respect to the relationship in which the respondents make them. We divided these relationships into monogamous and other, under which we included all responses such as casual encounters and multiple sexual partners. Women who sought sex outside of a monogamous relationship were 7 (6.25% of N=112) and men were14 (15.9 % of N=88). The results of the Phi coefficient, which was 0.156 (N=200), indicate statistically significant but very small differences between men and women.

Table 2 Phi coefficient - Intersex differences - sexual contacts (N=200)

Variables	Gender
Sexual contacts	**0,156**

Based on the above results, we can verify hypothesis H1 only in the area of sexual contacts. Men are significantly more likely to seek sexual encounters outside a monogamous relationship.

Hypothesis 2: We hypothesize that forms of coping strategies will correlate with rates of risky sexual behavior.

To examine the effect of coping strategies on sexual behavior, we correlated the number of sexual partners with measures of total attachment and withdrawal.

Table 3 Coefficient of correlation analysis – Inclination, diversion and number of sexual partners (Pearson; N=200)

Variables	Number of sex. partners
Bow	**-0,246****
Diversion	0,240**

Two-tailed significance test

Based on the above results, we can conclude that the number of sexual partners is strongly associated with total deviance (r=-0.240**) and strongly negatively associated with total deviance (r=-0.246**).

We also compared the rate of total deviance among respondents with respect to preference for practicing safe sex.

Table 4 Mann-Whitney U-test – Overall inclination and preference for safe sex (N = 200)

Group	N	Median	Standard deviation	Average ranking	U	Sig.	r
Safe sex	**133**	**58**	**6,653**	**57,27**	**3480,5**	**0,012**	**0,178**
Risky sex	67	55	8,186	54,17			

Two-tailed significance test

Based on the results of the Mann-Whitney U-test (U = 3480.5, p = 0.012), we can conclude that the difference in the degree of overall inclination with respect to preference for safe sex is statistically significant, but the differences are very small (r = 0.178).

We compared the rate of overall deviance among respondents with respect to preference for practicing safe sex.

Table 5 Mann-Whitney U-test - Overall attrition and preference for safe sex (N = 200)

Group	N	Median	Standard deviation	Average ranking	U	Sig.	r
Safe sex	**133**	**44**	**8,548**	**44,69**	**3723**	**0,058**	**0,134**

Group	N	Median	Standard deviation	Average ranking	U	Sig.	r
Risky sex	67	48	11,398	46,87			

Two-tailed significance test

Based on the results of the Mann-Whitney U-test (U = 3723, p = 0.134), we can conclude that the difference in the rate of overall deviance with respect to preference for safe sex is statistically significant, but the differences are very small (r = 0.134).

Based on the above results, we verify hypothesis H2. We can conclude that risky sexual behavior is positively associated with maladaptive forms of coping and negatively associated with adaptive forms of coping.

Hypothesis 3: We hypothesize that measures of emotional intelligence will be negatively correlated with rates of risky sexual behavior.

To examine the effect of emotional intelligence on sexual behavior, we correlated the number of sexual partners with raw scores on the Emotional Intelligence Questionnaire.

Table 6 Coefficient of correlation analysis – Emotional intelligence and number of sexual partners (Pearson; N=200)

Variables	Number of sex. partners
HS Emotional intelligence	-0,319**

Two-tailed significance test

Based on the above results, we can conclude that the number of sexual partners is strongly negatively related to the emotional intelligence measure (r= -0.319**).

We compared the degree of emotional intelligence in the respondents with respect to their preference for practicing safe sex.

Table 7 Mann-Whitney U-test – HS emotional intelligence and preference for safe sex (N = 200)

Group	N	Median	Standard deviation	Average ranking	U	Sig.	r
Safe sex	133	153	19,576	152,61	3911	0,041	0,143
Risky sex	67	144	18,739	146,87			

Two-tailed significance test

Based on the results of the Mann-Whitney U-test (U = 3911, p = 0.041), we can conclude that the difference in the level of emotional intelligence with respect to the preference for safe sex is statistically significant, but the differences are very small (r = 0.143).

Based on the above results, we can conclude that hypothesis H4 is valid. Lower levels of emotional intelligence correlate with higher levels of risky sexual behavior.

Conclusions

In this study, we examined rates of risky sexual behavior in young adults in the context of coping strategies and emotional intelligence. The results indicate an association between these variables. We found that more than half of the respondents prefer safe sex and the majority carry out sexual encounters in monogamous relationships. Men appeared to have a higher tendency to realize sex outside of a monogamous relationship. The impact of emancipation and the sexual revolution is shown by the absence of gender differences in the number of sexual partners. Preference for coping strategies was also correlated with the number of sexual partners and also with preference for safe sex. Similar results were observed in the context of emotional intelligence.

Much of the coping that young adults use comes from the home environment, but it is possible to modify these strategies in a targeted way. Today, life places a high level of stress on people, and effective forms of coping lead not only to a reduction in risky behaviors, but also to a better ability to manage stress. It would be appropriate to include training in coping forms in school preparation. Emotional intelligence, which includes, among other areas, the ability to understand not only other people's emotions and their expressions, but also to perceive and understand our own emotions, has also emerged as an important factor. Again, these skills are partly acquired in the family environment, but can be improved through training and programmes aimed at this.

In general, it would be necessary and beneficial for society as a whole to work towards a conceptualised system in which findings on risky

sexual behaviour are applied systematically and effectively in prevention. At present, similar activities are carried out on a short-term, ad hoc basis, often in the form of lectures without the possibility of training. Programmes should be delivered in a long-term, practical and safe environment by educators known and trusted by pupils, focusing on preparation for partnership and parenthood, forms of coping and emotions. Reducing risky sexual behaviour among young adults will have a positive impact on public health. Many of the problems that emerge in older age originate in young adulthood and impact the mental and physical health of the entire population.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 68–83

Fear of Crime and Time Perspective

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Summary

The present research study aims to analyse the relationships between different variables such as time perspective in the context of fear of crime. The construct of "fear of crime" was analyzed and divided into four parts, namely, concern about crime, perceived likelihood of personal crime, perceived control over personal crime, and perceived consequences of personal crime.

We used the Zimbardo Time Perspective Inventory (ZTPI) to ascertain past experiences, current stimuli, and expected consequences (related to crime). As the last scale, we used a scale to measure fear of crime and that was the Fear of Crime Scale. Time perspective emerged as a significant factor to predict fear of crime, especially negative past and hedonistic present. Last but not least, we sought to determine the gender difference in experiencing fear of crime. Overall, males had a greater fear of crime than females, specifically in the section focusing on fears and perceived likelihood of personal crime. Women scored higher only on the perceived consequences of personal crime section.

File and methods

The main purpose of this research is to conduct a theoretical and empirical investigation of the relationships between fear of crime and dispositional constructs associated with future expectancy, as well as subjective perceptions of the past, present, and future within the construct of time perspective. A secondary aim is to test the influence of selected demographic variables on fear of crime. A further aim of this thesis is to demonstrate whether these factors do indeed contribute significantly to the prediction of fear of crime.

The research method used in the present study was the Zimbardo Time Perspective Inventory (ZTPI) - respondents were asked to answer statements using a 5-point scale where 1 meant completely false, 2 rather false, 3 neither true nor false, 4 rather true and 5 completely true. A questionnaire was administered to respondents who participated in this research that included demographic data, gender, and age. The questionnaire included a basic scale, the Fear of Crime Scale (Reyes-Sosa, Molina-Coloma 2018).

Keywords Fear of crime. Time perspective. Zimbardo Time Perspective Inventory. Gender. Psychology.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 68–83. https://doi.org/10.22359/cswhi_17_1_09

Cited references: 14
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

Criminologists have long debated the relationship between crime and fear (Jackson, 2009). Given the weak relationship between crime and fear, researchers have looked elsewhere for explanations. Until now, it has been difficult to isolate clear-cut effects of mass media. Instead, perhaps the strongest evidence relates to the importance of public fears regarding neighborhood disruptions, social cohesion, and collective efficacy (Jackson, 2009). The idea is that the incidence and risk of crime is associated in the public mind with issues of social stability, moral consensus, and collective processes of informal control that promote neighborhood order. Everyday problems (young people roaming the streets, the poor, community spirit, low levels of trust and cohesion) produce information about risk and create a sense of unpleasantness, insecurity and mistrust in the environment. „In order to ensure the useful, targeted and effective assistance was created legal area based on the activation of recipients of social services and (with) orientation to their needs." (Mačkinová et al., 2015, p.3)

Many people use words such as fear and crime to express fears of neighbourhood breakdown, loss of moral authority, and breakdown of civility and social capital (Jackson, 2009). Importantly, a complementary perspective thinks that personal vulnerability, defined as differential perceptions of probability, control, and consequences, operates alongside processes of social sensing (Jackson, 2009). The feeling that a crime should have extremely serious consequences and the feeling of little control over the event can disproportionately affect certain groups and thus play a crucial role in the creation and distribution of fear. Hale states that any model that attempts to explain fear includes some notion of vulnerability (Jackson, 2009). At a common sense level, people who feel unable to protect themselves, either because they cannot, for example, run fast or lack the physical fitness to flee an attacker, or because they cannot afford to protect their homes, or because they would take longer to recover from material or physical injuries, can be expected to fear crime more than others.

There are theoretical advances in terms of vulnerability. There are also separate empirical advances in the role of public perceptions of probability and consequences of victimisation. Yet no study has incorporated existing psychological theory on fear of crime to extend the multidimensional conception of vulnerability that to encompass the full range of risk assessment. Killas suggests that there are physical, social and situational aspects of vulnerability that are related to the dimensions of threat that cover exposure to non-negligible risk, loss of control and severity of consequences. For example, more severe consequences are expected for women, older people and people in poor health (physical factors), victims without social support (social factors) and in abandoned areas where no help is available (situational factors). However, as stated by Mačkinová and authors (2019, p. 19), „family and positively fulfilling family relationships form an important role in the occurrence of a variety of negative events that make a person perceptible. When various adverse situations arise, a functional family not only acts as a protection but also as a support, while also facilitating effective stress management."

We are not aware of any study that has identified the mechanisms that promote vulnerability as perceived likelihood, control and consequences. Gender has been tested and age aspects to explain the likelihood of victimization (Likely I am a victim. Are people like me particularly likely to be a victim?), the perceived impact of victimisation (What happens if I become a victim? How do I cope with this?) and the sense of of control over these uncertain events (Can I avoid situations in which I would become a victim? Could I cope with any problems if arise?).

While recent studies have questioned whether this is partly because men suppress the extent of their concerns, compared to women, men may be less willing to express their fears and worries (Jackson, 2009). Debates about fear among women remain relevant. A similar discussion has addressed the relationship between fear and age. Studies have shown that older people tend to report feeling safer running errands in their neighborhood after dark than younger people (Jackson, 2009). While surveys that ask individuals questions about their worries about specific types of crime often find that the relationship between age and fear varies. A

common response to the charge of irrationality is that those groups who express the greatest concern (for example, women and the elderly) actually have a greater perceived vulnerability to victimization and its more serious outcomes. So the argument is not this one, that women (or the elderly) have a false sense of danger and an irrational level of fear. Instead, women/older people are more vulnerable to the consequences of victimization than men/younger people and less able to control their occurrence. Perhaps they may feel less able to physically defend themselves? They may associate one of the crimes with the prospect of another more serious crime. In fact, empirical evidence has supported the idea that women have greater levels of fear heightened in perceptions of personal vulnerability when vulnerability is defined as the perception of a serious crime or sexual assault (Jackson, 2009).

For several years now, our society has struggled to define the concept of fear of crime. Debates have arisen as to how this concept should be defined. Many experts argue that fear of crime should be conceptualised as an emotion. Others think as a measure of risk. Mačkinová (2020, p. 11) say , „however, defimate should be the work of practitioners. They are important their skills, professional qualifications, their passion for the cause and last but not least their ability to cooperate and collaborate with all stakeholders." For many centuries the concept has been defined as risk. In other words, how likely a person is to become a victim of a particular crime. Many researchers think that fear of crime should be defined as an emotional response to potential victimization. While perceived risk should be defined as the likelihood of risk of victimization.

What is the fear of crime? We can also define it as an emotional reaction characterised by feelings of anxiety and danger. This definition is limited to the feeling of danger and anxiety caused by a sense of physical threat. If we want develop the concept of fear of crime, fear must be triggered by perceived changes in the environment concerning some aspect of crime. To link fear and potential physical harm, we must distinguish the reaction triggered by the potential loss of property from the reaction triggered by the potential physical harm. Also, the former reaction is more cerebral and calculating and the latter reaction is emotional and autonomous, we can assume that the internal state of a person who forgets to lock his bike outside his house is different from the internal state of a person who goes alone at night on a dark street with no lights at 3:00 in the morning. This does not mean, however, that the potential fear of loss of property cannot trigger fear. If the property or thing is in a person's possession and threatened or stolen and has monetary value, especially if it also has moral and personal value, then we can speak of a fear of theft or theft. This may sufficiently affect the physical well-being of a person who has been deprived of his property. We can also mention theft of property, which includes physical harm. Here various other other factors, such as groups of people who commit different types of crimes when potential confrontation with the perpetrator. In this sense of the word, we can take the perpetrator can be understood as someone who considers himself to be a stranger whose predatory behaviour is related to with property and leads to the suspicion that there is a potential opportunity to use of violence, should it be necessary. From this we can infer that burglary may trigger a greater fear than simple theft, such as stealing a bicycle from the front of a house.

In general, we can assume that perceptions of risk and restricted behaviour predict our potential fear of crime. From this we can infer that emotion (in this case fear of crime), risk probability (perceived risk) and behaviour (constrained behaviour) work closely together and build on each other. However, a large number of people hold that behaviors, restricted behaviors, are or may be a consequence of fear of crime. We are talking about cases such as when an individual installs a CCTV system before he or she can become a victim of a crime. In this case, the possibility is that such a group of people are thinking more often about the fact that they may become a victim of crime.

Any explanation of the concept of fear, includes the concept of vulnerability. In general terms, it refers to people who are unable to protect themselves, either because they are not physically fit, or lack the strength to repel an attacker's assault, or cannot economically afford to protect their homes. Another reason may be their long-term difficulty in recovering from such an attack, either materially or physically. Thus, as stated by

Mačkinová and authors (2017, p. 64), „bodily harm is an injury to the health of another person, but it must have a certain intensity." For such a reason, we can assume that such people anticipate the fear of crime more than others who do not have the experience of being a victim of crime. Based on this, we can talk about three groups that fall into this category. These are women, the elderly and the poor. Fear depends on three key factors. One of them is exposure to non-negligible risk. The second factor is loss of control (lack of effective defences and protective measures, possibility of escape) and the third is anticipation of serious consequences. These three factors can also work independently of each other. There can also be bidirectional relationships such as the experience of fear of crime, which can itself influence perceptions, we can see more criminal situations and feelings that make a person feel more helpless.

Time perspective

Time perspective Einstein's theory of relativity established the subjective nature of the physical phenomenon of time. The importance of a psychological interpretation of this relative phenomenon has been a source of debate among philosophers, psychologists, and physical scientists. Time tracking may be a fundamental function of human development that is vital in the development of human cognitive function (Zimbardo & Boyd, 2015). Kant, believed that the temporal conception is an innate ability. He argued that it richly colored the way people experience the world (Zimbardo & Boyd, 2015).

William James defended the notion of time as being fundamental to psychology, devoted time perception in the principles of psychology. With the later behaviorist revolution the focus was narrowed, namely on the time-based consequences of behavior and experience. This view, however, was rejected by Kurt Lewin, whose views are more compatible with views of existential philosophers (Stolarski, 2015).

Lewin's model of living space includes the influence of the past and the future on the present behaviour. Lewin defined time perspective as the totality of an individual's views of his psychological future and the psychological past existing at a given time (Zimbardo & Boyd, 2015). Such an integrative view of all time frames in the present is similar to Eastern Zen notions of time, which are more circular and contradict to the traditional Western view in which time passes at a constant, linear pace, never to be reversed.

Joshep Nuttin promoted Levin's time-filled living space, where future and past events influence present behavior to the extent that they are actually present at the cognitive level of functioning and behavior (Zimbardo & Boyd, 2015). Contemporary social-cognitive thinking, as represented in Albert Bandura's self-efficacy theory, supports a tripartite temporal influence on behavioral self-regulation that generated by credible efficacies based on past experiences, current evaluations, and considerations of future possibilities.

Behavioral gerontologist Laura Carstensen and her colleagues have suggested that the perception of time plays a fundamental role in the selection and monitoring of social goals with significant impact on emotion, cognition, and motivation. Yet, the study of psychological of time generally languishes on the shores of mainstream contemporary psychology.

Temporal perspective-taking is often an unconscious process in which there are continuous flows of personal and social experiences. They are assigned to temporal categories or time frames that help give order, coherence, and meaning to events. These cognitive frames may reflect cyclical, recurring temporal patterns or unique non-repetitive linear events in human life (Zimbardo & Boyd, 2015). They are used in encoding, storing, and recalling events, as well as in creating expectations, goals, contingencies, and imaginative scenarios. Between abstract, psychological constructions of the past and anticipated future events lie concrete, experientially centered representations of the present. Temporal perspectives influence many important decisions, beliefs, and actions.

The dominant influence for some comes from the past, from recalling analogous previous situations with the memory of the costs and benefits involved in those decisions. Their recollection may be nostalgic and positive or ruminative, traumatic and negative. They may remember accurately or distort the past. Such a focus on the past can greatly influence the interpretation of and response to the present decision situation, even dominate its intrinsic stimulus. Other influential forces of this hypothetical decision, come from expectations

constructed to include an extension of the present into the future, where the calculated costs of this present action are factored in or rewards are added. The decision process may involve the creation of alternative goal states, means-ends relationships, and probabilistic assessments of both desired components and actual constraints, as well as issues such as weighing anticipated beneficial consequences against longer-term estimated costs. In both cases, the abstract cognitive processes of reconstructing the past and constructing the future function to influence current decision making, enabling the person to overcome compelling incentive forces in immediate life spaces and delay apparent sources of gratification that could lead to undesirable consequences.

When a tendency develops, it usually overemphasizes one of these three time frames in decision making, serving as a cognitive temporal "bias," an orientation to past, future, or present. When chronically present, this bias becomes a dispositional style or individual difference variable that is characteristic and predicts how an individual will respond to a range of everyday life decisions. Individuals, of course, use these temporal orientations to varying degrees and each orientation can lead to optimal decision making in particular situations. Temporal "biases" can include either habitual overuse or incorrect use of one or more of these time frames. Such limiting biases contrast with a balanced temporal orientation, an ideal mental structure, that allows individuals to flexibly switch time frames between the past, future and present depending on situational demands, resource assessments or personal and social evaluations. The behaviour of people with such a temporal orientation would would, on average, be determined by a trade-off or balancing of meta-schematic content representations of past experiences, present desires, and future consequences. Therefore, we can consider time perspective as a situationally determined and relatively stable process of individual differences. Overreliance on specific time frames is multiply determined by many learned factors. Among the most significant include cultural, educational, religious, social class, and family modeling. The operation of time perspective is so extensive in human lives and is multiple determined. People are rarely aware of its subtle operation, influence or predictability. This construct provides the foundation upon which many visible constructs such as goal attainment and setting, risk taking, seeking perception, addiction, survival, guilt, and others.

The time perspective is therefore an important phenomenon. Since it ascribes meaning to events, it is also involved in the anticipation of phenomena and their subsequent processing. Over time, humans have gradually developed a kind of mental shortcuts, otherwise known as heuristics, that facilitate their perception and consequently speed up the processing of information from the environment. Heuristics are based on the previous experience of the person in question or on the experience of a social group that develops a kind of prejudice, or a kind of judgment on a given phenomenon, and when phenomena of a similar nature occur, the individual uses the given behavior that was used and evaluated as correct in the first experience with the phenomenon either by the individual or by the group from the opinion was taken.

Gonzalez and Zimbardo (1985) believed that the way we try to divide time is a stronger characteristic of human experience. Zimbardo et al. define temporal perspective as the way individuals and different cultures divide human experience into different temporal categories such as past, present, and future (Zimbardo et al., 1997). When they sought to examine past, present, and future frames more thoroughly, they developed a scale to measure time perspective. This scale contains past, present, and future frames divided into five subscales. First, there is the negative past frame, which reflects a pessimistic attitude toward the past and the possible experience of traumatic life events. Second, there is the positive past, which is more optimistic and has a positive view of the past. Third is the hedonistic present. Associated with this third subscale is a desire for spontaneous pleasure with a slight regard for risk or concern about future consequences. Fourth, there is the fatalistic present subscale. It is characterized by a lack of hope for the future and a belief that uncontrollable forces determine fate. The final fifth subscale, called the future, is defined as reward dependence that occurs as a result of the achievement of long-term goals.

We can say that fear of crime is an emotional response to danger signals in the environment we are in. Psychological factors include concepts such as alienation and anomie, degree of social change, pessimism about the future, perceived lack of control over life events, and dissatisfaction with one's surroundings. There is potential causal ambiguity in behavioral measures of fear. It is more likely that psychological attributes are a consequence of fear. In general, there is a weak relationship between social psychological factors and fear of crime.

Fear of crime and time perspective

Fear is a natural reaction to physical or psychological danger in every person. The roots of fear go back to the ancient past and is part of human evolution. If humans did not feel fear, they could not protect themselves from threats that were on the border of life and death. Nowadays, people fear situations in which, although the consequences are sometimes much lower, the human being is still set up to consider any threat as lethal due to the generation of a genetic code that is inherited from generation to generation.

Fear of crime, or fear as an emotion, depends on several factors. These factors are involved in the expectation of the development of a given situation. Optimism is one of the factors influencing expectations of future events. Optimism is an attributional style of perception, based on which a person expects a situation to develop positively. People with such expectations are optimistic. The counterpart to optimism is pessimism. Pessimists do not expect the situation to develop favourably or positively; on the contrary, they expect the situation to turn out badly or against them. Which attributional style a person prefers also depends on the situation and also on the person's experience. Mačkinová and Musilová (2017, p. 98) cite socialization as a supportive element. „Person in the process of its development intensifies knowledge, skills, norms, rules, attitudes, habits, etc., which are in force in the present social and cultural environment and which are inculcate to him/her especially by education."

The disposition with which a person enters a situation also influences his or her expectations about crime. An optimistic person will not expect so much to be a victim of any crime. In contrast, a pessimistic person will expect only the worst from a situation. Closely related to optimism is hope. Hope refers to the expectation of a positive turn of events. Like optimism, not all people have it to the same degree. The extent to which a person expects a situation to turn out positively, or the extent to which a person feels hopeful, depends on the situation, the person's experience, and also the people around him or her. A hopeful person, like an optimistic person, expects the situation to develop positively. The last factor or construct influencing fear of crime is time perspective. Time perspective as a construct is perceived as previous experience with crime. One possibility is that people who have had some prior experience with crime will be more sensitive in their perception of fear of crime.

We suggest that hope also plays a role in the concept associated with fear of crime. On the basis of hope, one experiences and anticipates events in one's environment and subordinates one's behaviour on this basis. Hope, as a kind of assessment of coping ability, influences action, even though the subjective assessment of coping ability may not be directly proportional to actual ability. This already depends on the insight of the person concerned, to what extent he or she is aware of his or her abilities and to what extent he or she underestimates, overestimates or accurately assesses them. The aim of this study is to prove whether these factors are indeed significantly involved in the prediction of fear of crime.

Research

The main aim of the study is to empirically investigate the relationship between fear of crime and a dispositional construct related to future expectancy, as well as subjective perceptions of the past, present and future, captured in the construct of time perspective. A secondary aim is to examine the role of selected demographic variables in fear of crime. We present the theoretical underpinnings of our hypotheses under each hypothesis separately.

Hypothesis 1: *We hypothesize that women will have a greater fear of crime than men and across all components.*

Based on the theoretical background of Reyes-Sos and Molina-Coloma (2018), who emphasized that women exhibit higher levels of fear compared to men. This may be due to the fact that they are anxious and aware that they are more likely to be

victims of crime and believe that they have less control over crime and feel that the consequences of crime may affect the group they belong to.

Hypothesis 2a: *We hypothesize that there will be a relationship between the negative past and the components of the fear of crime construct:*

1. a positive relationship in the fears component,

2. a positive relationship in the part focusing on the perceived likelihood of personal crime,

3. a negative relationship in the part focused on perceived control over personal criminality,

4. a positive relationship in the section focusing on perceived consequences of personal criminality.

Hypothesis 2b: *We hypothesize that there is a significant relationship between the positive past history scale and the components of the fear of crime construct will be:*

1. a negative relationship in the fear-focused part,

2. a negative relationship in the focusing on the perceived likelihood of personal criminality,

3. a positive relationship in the part focused on perceived control over personal criminality,

4. a negative relationship in the focusing on perceived consequences of personal criminality.

Hypothesis 2c: *We hypothesize that there will be a relationship between the fatalistic presence scale and the components of the fear of crime construct:*

1. a positive relationship in the fear-focused component,

2. a positive relationship in the part focusing on the perceived likelihood of personal criminality,

3. a negative relationship in the part focused on perceived control over personal criminality,

4. a positive relationship in the section focusing on perceived consequences of personal criminality.

Hypothesis 2d: *We hypothesize that there will be a relationship between the hedonistic presence scale and the components of the fear of crime construct:*

1. a negative relationship in the fear-focused component,

2. a negative relationship in the part focusing on the perceived likelihood of personal crime,

3. a positive relationship in the part focused on perceived control over personal criminality,

4. a negative relationship in the section focusing on perceived consequences of personal criminality.

Hypothesis 2e: *We hypothesize that there will be a relationship between the future scale and the components of the fear of crime construct:*

1. a negative relationship in the fear-focused part,

2. a negative relationship in the part focusing on the perceived likelihood of personal crime,

3. a positive relationship in the part focused on perceived control over personal crime,

4. a negative relationship in the section focusing on perceived consequences of personal criminality.

Sample of respondents and statistical processing

The participants of the conducted empirical research were individuals of both genders, with the mean age of the respondents being around 30 years. Although we did not address age variations in the study, we focused on the differences between men and women. The total number of participating respondents came to 168, with an almost even gender distribution of 79 females and 89 males.

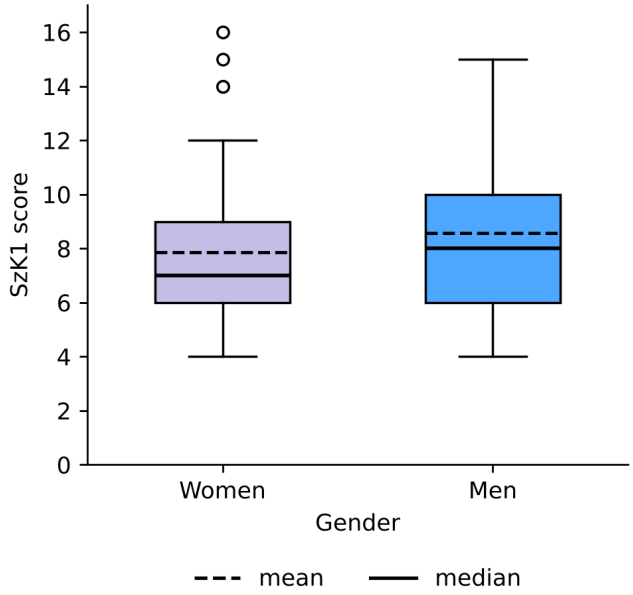
The methods we used in that study were the Zimbardo Time Perspective Inventory (ZTPI) (Kosht'ál, Lukavský, Zimbardo, & Klicperova-Baker 2011), which aims to ascertain how oriented a person is to past experiences, current stimuli, and expected consequences. As a final method, we used the Fear of Crime Scale (Reyes-Sosa, Molina-Coloma 2018).

Results

In the first hypothesis, we predict that women will have a greater fear of crime, across all parts of it. We used the Mann-Whitney U test to process the data. From the results, we found that there is a statistically significant difference between genders only in 3 parts of the fear of crime construct, namely the fear of crime part (U=2808.00 and p= 0.02), the perceived control part (U=2839.00 and p= 0.03), and the perceived consequences of personal crime part (U=2045.50 and p= 0.00). There was no statistically significant difference between genders in the section focusing on perceived likelihood of personal criminality (U=3411.00 and p= 0.74). As can be seen in the graph, males scored higher in the section focusing on worry (Picture 1) and in the section focusing on perceived control over personal criminality (Picture 2). From this we can conclude that men are more worried about crime than women, but they also perceive higher control over

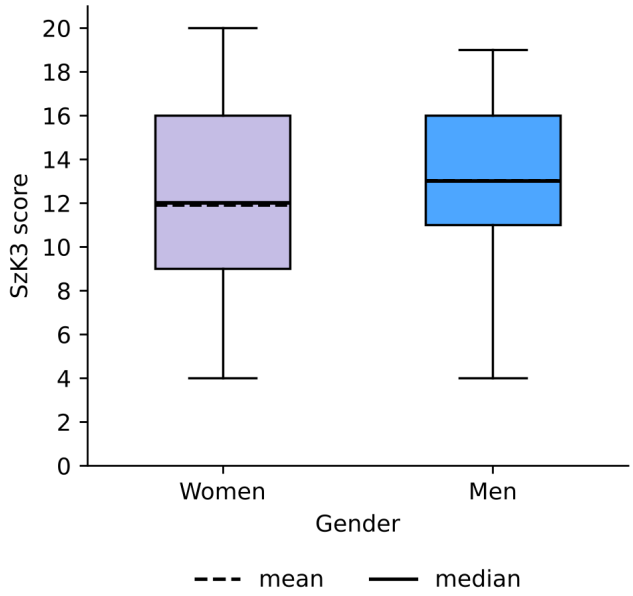
personal crime. As for the section focusing on the perceived consequences of personal criminality, women score higher there (Picture 3). This suggests that women feel that their experience of crime would have a greater impact on their lives than men. Thus, we cannot confirm our first hypothesis, as women score significantly higher on only one part of the fear of crime construct, the consequence-focused part.

Figure 1 Box plot of individual gender scores on the worry (fear of crime) portion of the fear of crime construct (SzK1)



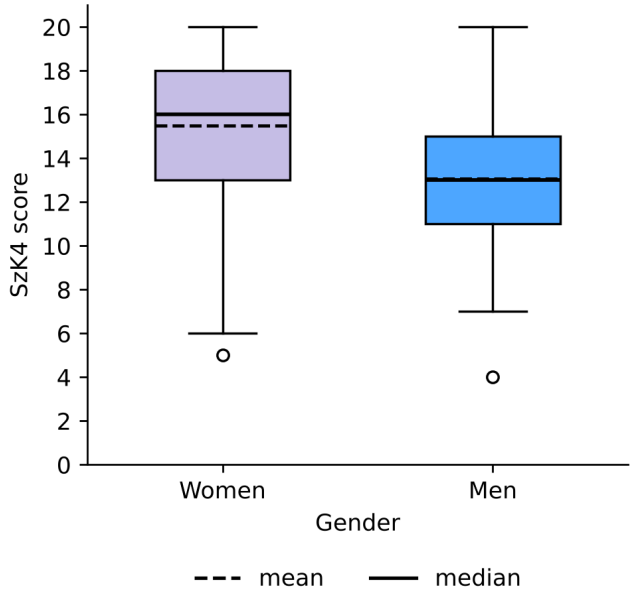
Women: mean = 7.85; median = 7; SD = 2.82. Men: mean = 8.56; median = 8; SD = 2.49.

Figure 2 Box plot of individual gender scores on the perceived control over personal criminality portion of the fear of crime construct (SzK3)



Women: mean = 11.92; median = 12; SD = 4.30.
Men: mean = 13.04; median = 13; SD = 3.38.

Figure 3 Box plot of individual gender scores on the perceived consequences of personal crime portion of the fear of crime construct (SzK4)



Women: mean = 15.49; median = 16; SD = 3.48.
Men: mean = 13.08; median = 13; SD = 3.11.

The second hypothesis focuses on time perspective and its effect on fear of crime. We have also divided the hypothesis into several parts,

namely part A concerning the negative past scale, part B concerning the positive past scale, part C concerning the fatalistic present scale, part D concerning the hedonistic present scale, and part E concerning the future scale.

The following sections focus on part A of the fourth hypothesis, which is the negative past scale. In the first part, we hypothesize a positive relationship between the negative past and the worry-focused part. Rs= -0.16 and p=0.04. The regression values are F(1, 166)= 5.90, p<0.05, R2= 0.06. Based on the alpha error (Table 1), we conclude that there is a negative linear relationship between these variables. Our part of the hypothesis is not consistent with our data. There is a negative linear relationship between the negative past scale of the time perspective construct and the fear of crime portion of the fear of crime construct. That is, the higher respondents score on the negative past, the lower they score on the fear-focused portion. The negative past scale of the time perspective construct predicts 6.5% of the variability of the fear of crime-focused worry construct.

Table 1 Values of the linear regression between the negative past scale of the time perspective construct and the part focusing on fear of crime

Model	B	Standard deviation	t	Sig.
Constatnt	**9,65**	**0,62**	**15,56**	**0,00**
Negative past	-0,16	0,07	-2,43	0,02

In the second part, we hypothesize a positive relationship between the negative past scale and the part focusing on the perceived likelihood of personal criminality. Rs= 0.02 and p=0.84. The regression values are F(1, 166)=0.07, p>0.05, R2= 0.00. The value of the regression coefficient is equal to -0.02. Based on the alpha error (Table 2), we can conclude that although the relationships between the variables are negative, they are not linear. This part of the hypothesis is not consistent with our data. There are negative relationships between the negative past history scale and the part focusing on the perceived likelihood of personal criminality, but they are not linear.

Table 2 Values of the linear regression between the negative past scale of the time perspective construct and the part focusing on the perceived likelihood of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**11,58**	**0,72**	**16,09**	**0,00**
Negative past	-0,2	0,08	-0,26	0,79

In the third section, we hypothesize a negative relationship between the negative past scale and the section focusing on perceived control over personal criminality. Rs= -0.12 and p= 0.13. The regression values are F(1, 166)= 2.14, p > 0.05, R2= 0.01. The value of the regression coefficient is -0.14. According to the alpha error (Table 3), we conclude that the relationships between the variables are not linear. This part of the hypothesis is not consistent with our data. There is a negative relationship between the negative past scale of the time perspective construct and the part focusing on perceived control over personal criminality of the fear of crime construct, but it is not linear.

Table 3 Values of the linear regression between the negative past scale of the time perspective construct and the perceived control over personal criminality construct

Model	B	Standard deviation	t	Sig.
Constatnt	**13,78**	**0,92**	**15,14**	**0,00**
Negative past	-0,14	0,1	-1,46	0,15

In the fourth section, we hypothesize a positive relationship between the negative past scale and the section focusing on the perceived consequences of personal criminality. Rs= -0.11 and p= 0.16. The regression values are F(1, 166)= 4.37, p< 0.05, R2= 0.02. According to the alpha error (Table 4), we can say that the relationships between the variables are positive and linear. This part of the hypothesis is not consistent with our data. The higher the scores of respondents on the negative past scale of the time perspective construct, the lower their scores on the part of the fear of crime construct focusing on the perceived consequences of personal criminality. The negative past scale of the time perspective construct predicts 2.0% of the variability in fear of crime focused on the perceived consequences of personal criminality.

Table 4 Values of the linear regression between the negative past scale of the time perspective construct and the part focusing on the perceived consequences of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**15,83**	**0,82**	**19,38**	**0,00**
Negative past	-0,18	0,09	-2,09	0,04

The following sections focus on part B of the second hypothesis, which is the positive past scale. In the first part, we hypothesize a negative relationship between the positive past and the worry-focused part. The value of Rs= -0.22 and p=0.00. The regression values are F(1, 166)= 6.57, p<0.05, R2= 0.03. The regression coefficient shown in the table (Table 5) has a negative value. Based on the alpha error, we can say that the relationships between the variables have a negative linear relationship. The first part of the hypothesis is consistent with our data. It implies that the higher the scores of respondents on the positive past scale, the lower the scores of respondents on the fear of crime part of the fear of crime construct. The positive past scale of the time perspective construct predicts 3.8% of the variability of the fear of crime-focused worry construct.

Table 5 Linear regression values between the positive past scale of the time perspective construct and the fear of crime part of the fear of crime construct

Model	B	Standard deviation	t	Sig.
Constatnt	**10,21**	**0,80**	**12,76**	**0,00**
Positive past	-0,19	0,07	-2,56	0,01

In the second part, we hypothesize a negative relationship between positive past history and the part focusing on the perceived likelihood of personal criminality. Rs= -0.07 and p= 0.34. The regression values are F(1, 166)= 1.19, p > 0.05, R2= 0.01. The regression coefficient shows a value of -0.09. The alpha error (Table 6) tells us that although the relationships between the variables are negative, they are not linear. Thus, part of the hypothesis is not consistent with our data.

Table 6 Values of the linear regression between the positive past construct time perspective scale and the part focusing on the perceived likelihood of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**12,39**	**0,93**	**13,36**	**0,00**
Positive past	-0,09	0,08	-1,09	0,28

In the third part, we hypothesize a positive relationship between positive past history and the part focusing on perceived control over personal criminality. Rs= -0.29 and p= 0.00. The regression values are F(1, 166)= 16.92, p< 0.05, R2= 0.08. According to the alpha error (Table 7), we can conclude that the relationships between the variables are negative and linear. This part of the hypothesis is inconsistent with our data, and thus the higher the scores respondents achieve on the positive past scale, the higher their scores on the part of the fear of crime construct focused on perceived control over personal criminality. The positive past scale of the time perspective construct predicts 8.7% of the variability of the fear of crime construct focused on perceived control over personal criminality.

Table 7 Values of the linear regression between the positive past scale of the time perspective construct and the part focusing on perceived control over personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**17,01**	**1,13**	**15,08**	**0,00**
Positive past	-0,42	0,10	-4,11	0,00

The fourth part assumes a negative relationship between the positive past and the part focusing on the perceived consequences of personal criminality. Rs= 0.17 and p=0.03. The regression values are F(1, 166)=4.39, p<0.05, R2= 0.02. The value of the regression coefficient is positive and is presented in the table (Table 8). The alpha error tells us that the relationship between these variables is linear and positive. This part of the hypothesis is not consistent with our data. That is, the higher respondents score on the positive past history scale, the higher they score on the fear of crime section, which focuses on the perceived consequences of personal criminality. The positive past scale of the time perspective construct predicts 2.6% of the variability in fear of crime focused on the perceived consequences of personal criminality.

Table 8 Values of the linear regression between the positive past construct time perspective scale and the part focusing on the perceived consequences of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**12,07**	**1,06**	**11,44**	**0,00**
Positive past	0,20	0,10	2,10	0,04

The following sections focus on part C of the second hypothesis, which is the fatalistic presence scale. In the first part, we hypothesize that there will be a positive relationship between the fatalistic presence scale and the part focusing on fear of crime. Rs= 0.02 and p= 0.84. The regression values are F(1, 166)= 0.19, p > 0.05, R2= 0.06. The value of the regression coefficient is 0.03. Based on the

alpha error (Table 9), we can conclude that the relationships between the variables are positive but not linear. Part of the hypothesis is inconsistent with our data Thus, if respondents had high scores on the fatalistic presence scale, they also had high scores on the fear of crime part of the fear of crime construct focusing on fear of crime.

Table 9 Values of the linear regression between the fatalistic presence of time perspective construct scale and the part focusing on fear of crime

Model	B	Standard deviation	t	Sig.
Constatnt	**7,72**	**1,19**	**6,49**	**0,00**
Fatalistic presence	0,33	0,08	0,43	0,67

The second part focuses on the assumption that there will be a positive relationship between the fatalistic presence scale and the part focusing on the perceived likelihood of personal criminality. Rs= 0.14 and p= 0.07. The regression values are F(1, 166)= 2.47, p > 0.05, R2= 0.02. The regression coefficient is 0.14. According to the alpha error (Table 10), we can conclude that the relationship between the variables is not linear and is positive. This means that this part of the hypothesis is not consistent with our data. Thus, if respondents had high scores on the fatalistic presence scale, they also had high scores on the part of the fear of crime construct focusing on the perceived likelihood of personal criminality, but this relationship is not linear.

Table 10 Values of the linear regression between the fatalistic presence construct time perspective scale and the part focusing on the perceived likelihood of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**9,32**	**1,35**	**6,92**	**0,00**
Fatalistic presence	0,14	0,09	1,57	0,12

In the third part, we hypothesize a negative relationship between fatalistic presence and the part focusing on perceived control over personal criminality. Rs= 0.11 and p= 0.16. The regression values are F(1, 166)= 1.12, p > 0.05, R2= 0.01. The regression coefficient is 0.12. Based on the alpha error (Table 11), we conclude that the relationship between fatalistic presence and the fear of crime part of the construct is a positive relationship, but it is not linear. This part of the hypothesis is not consistent with our data.

Table 11 Values of the linear regression between the fatalistic presence construct time perspective scale and the section focusing on perceived control over personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**10,72**	**1,72**	**6,23**	**0,00**
Fatalistic presence	0,12	0,11	1,06	0,29

In the fourth section, we hypothesize a positive relationship between fatalistic presence and the section focusing on the perceived consequences of personal criminality. Rs= -0.07 and p= 0.35. The regression values are F(1, 166)= 0.34, p > 0.05, R2= 0.00. The value of the regression coefficient is -0.06. The alpha error shown in the table (Table 12) tells us that the relationships between the variables are not linear. These relationships are negative that is, this part of our hypothesis is not consistent with our data. Thus, if a respondent scores high on the fatalistic presence scale, he or she also scores high on the part of the fear of crime construct focusing on the perceived consequences of personal crime.

Table 12 Values of the linear regression between the fatalistic presence of time perspective construct scale and the part focusing on the perceived consequences of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**15,11**	**1,56**	**9,70**	**0,00**
Fatalistic presence	-0,06	0,10	-0,58	0,56

The following sections are devoted to part D of the second hypothesis, which is the hedonistic presence scale. The first part hypothesizes a negative relationship between the hedonistic presence scale and the worry-focused part. Rs= -0.08 and p= 0.33. The regression values are F(1,166)= 0.99, p > 0.05, R2= 0.01. The associated regression coefficient value is -0.07. The alpha error shown in the table (Table 13) indicates that although the relationship is negative, it is not linear. This part of the hypothesis is not consistent with our data. If respondents score high on the hedonistic presence scale, they will also score high on the fear of crime part of the fear-focused construct, but this is not a linear relationship.

Table 13 Values of the linear regression between the hedonistic presence construct time perspective scale and the part focusing on fear of crime

Model	B	Standard deviation	t	Sig.
Constatnt	**8,92**	**0,73**	**12,24**	**0,00**

Model	B	Standard deviation	t	Sig.
Hedonistic presence	-0,07	0,07	-0,99	0,32

In the second part, we hypothesize a negative relationship between hedonistic presence and the part focusing on the perceived likelihood of personal criminality. The associated Rs=-0.18 and p=.02. The regression values are F(1, 166)= 5.76, p < 0.05, R2= 0.03. According to the alpha error value (Table 14), we can say that the relationship between these variables is linear and negative. This part of the hypothesis is consistent with our data. Thus, the higher the respondent's score on the hedonistic presence scale, the lower his score on the part of the fear of crime construct focusing on the perceived likelihood of personal crime. The hedonistic presence scale of the time perspective construct predicts 3.4% of the variability of the fear of crime construct focused on the perceived likelihood of personal criminality.

Table 14 Linear regression values between the hedonistic presence construct time perspective scale and the part focusing on perceived likelihood of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**13,29**	**0,82**	**16,21**	**0,00**
Hedonistic presence	-0,20	0,08	-2,40	0,02

In the third part, we hypothesize a positive relationship between hedonistic presence and the part focusing on perceived control over personal criminality. Rs= -0.18 and p= 0.02. The regression values are F(1, 166)= 6.9, p < 0.05, R2= 0.04. According to the alpha error (Table 15), we can say that the relationship between these variables is linear but negative. Our part of the hypothesis is not consistent with our data. Thus, proportionally, as scores on the hedonistic presence scale increase, scores on the part of the fear of crime construct focusing on perceived control over personal criminality decrease. The hedonistic presence scale of the time perspective construct predicts 4.0% of the variability of the fear of crime construct focused on perceived control over personal criminality.

Table 15 Values of the linear regression between the hedonistic presence construct time perspective scale and the section focusing on perceived control over personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**15,14**	**1,04**	**14,56**	**0,00**
Hedonistic presence	-0,28	0,11	-2,63	0,01

In the fourth section, we hypothesize a negative relationship between hedonistic presence and the section focusing on the perceived consequences of personal criminality. The associated Rs= -0.05 and p= 0.56. The regression values are F(1, 166)= 0.65, p > 0.05, R2= 0.00. The value of the regression coefficient is -0.08. Based on the alpha error (Table 16), we conclude that although the relationships between the variables are negative, they are not linear. This part of the hypothesis is not consistent with our data.

Table 16 Values of the linear regression between the hedonistic presence construct time perspective scale and the part focusing on the perceived consequences of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**14,95**	**0,96**	**15,63**	**0,00**
Hedonistic presence	-0,08	0,10	-0,81	0,42

The following sections are devoted to the last part E of the second hypothesis, which is the future scale. Part one hypothesizes a negative relationship between the future and the part focusing on fear of crime. Rs= -0.2 and p= 0.01. The regression values are F(1, 166)=0.65, p < 0.05, R2= 0.03. The value of the regression coefficient is reported in the table (Table 17) and is in the negative. The alpha error tells us that there is a linear and negative relationship between the variables. This part of the hypothesis is consistent with our data. The higher respondents score on the future scale, the lower they score on the fear of crime part of the fear of crime construct. The future scale of the time perspective construct predicts 3.3% of the variability in the fear of crime-focused worry construct.

Table 17 Linear regression values between the future of time perspective construct scale and the fear of crime part of the fear of crime construct

Model	B	Standard deviation	t	Sig.
Constatnt	**10,19**	**0,85**	**11,98**	**0,00**

Model	B	Standard deviation	t	Sig.
Future	-0,19	0,80	-2,38	0,02

In part two, we predict a negative relationship between the future and the part focusing on the perceived likelihood of personal criminality. Rs= -0.05 and p= 0.55. The regression values are F(1, 166)= 1.65, p > 0.05, R2= 0.01. The regression coefficient is equal to -0.12. According to the alpha error (Table 18), the relationship between these variables is not linear and is negative. Our part of the hypothesis is not consistent with our data.

Table 18 Values of the linear regression between the future time perspective construct scale and the part focusing on the perceived likelihood of personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**12,63**	**0,98**	**12,86**	**0,00**
Future	-0,12	0,09	-1,29	0,20

In the third section, we assume a positive relationship between the future and the section focusing on perceived control over personal crime. The value of Rs= -0.19 and p= 0.01. The regression values are F(1, 166)= 5.55, p < 0.05, R2= 0.03. Based on the alpha error (Table 19), we conclude that there is a linear but negative relationship between the variables. This part of the hypothesis is not consistent with our data. The higher individuals scored on the future scale, the lower they scored on the part of the fear of crime construct focused on perceived control over personal crime. The future of time perspective scale of the construct predicted 3.2% of the variability of the fear of crime construct focused on perceived control over personal criminality.

Table 19 Values of the linear regression between the future of time perspective construct scale and the part focusing on perceived control over personal criminality

Model	B	Standard deviation	t	Sig.
Constatnt	**15,34**	**1,24**	**12,42**	**0,00**
Future	-0,27	0,12	-2,36	0,20

In the last section, we hypothesize a negative relationship between the future scale of the time perspective construct and the part of the fear of crime construct focusing on the perceived consequences of personal criminality. Rs= 0.09 and p= 0.25. Regression values are F(1,166)= 0.91, p > 0.05, R2= 0.01. The regression coefficient has a value of 0.10. The alpha error is less than 0.05 (Table 20), indicating that the relationship between the variables is not linear. The relationship that exists between them is positive, so our part of the hypothesis is not consistent with our data. This implies that if respondents had high scores on the future scale of the time perspective construct, they also had high scores on the fear of crime section focusing on the perceived consequences of personal crime.

Table 20 Values of the linear regression between the future scale of the time perspective construct and the part focusing on perceived consequences of personal crime

Model	B	Standard deviation	t	Sig.
Constatnt	**13,17**	**1,13**	**11,64**	**0,00**
Future	0,10	0,11	0,96	0,34

These results show that men generally score higher than women on the fear of crime construct's fear of crime subscales focused on fears and perceived likelihood of personal crime, and women score higher only on the subscale focused on perceived consequences. We divided the time perspective into up to 5 scales. The scales negative past, positive past, hedonistic present, and future all have negative relationships to fear of crime. However, linearly these relationships are only for the negative past, positive past and future scales. The fatalistic present shows a positive relationship to worry however this relationship is not linear. Again, the negative past, positive past, hedonistic present, and future scales all have a negative relationship to the fear of crime portion of the perceived likelihood scale. Only for the hedonistic present scale are these relationships linear. The fatalistic present again shows a positive relationship to this part of the construct as well, but not a linear one. For the part focusing on perceived control over personal criminality, the scales negative past, positive past,

hedonistic present, and future have negative relationships to it. There is linearity only for the positive past, hedonistic present, and future scales. The fatalistic presence has a positive, but not linear, relationship to this section. As for the last part of the fear of crime construct, focusing on perceived consequences, the negative past and hedonistic present scales have a negative relationship to it, with only the negative past having a linear relationship. The other scales have a positive relationship.

Table 21 Correlation matrix for the time perspective scales related to the parts of the fear of crime construct

	Time perspective									
	Negat. past		Pozit. past		Hedon. present		Fatal. present		Future	
	Rs	Sig.	Rs	Sig.	Rs	Sig.	Rs	Sig.	Rs	Sig.
SzK1	**-, 16**	**,04**	**-, 22**	**,00**	**-, 08**	**,33**	**-, 02**	**,84**	**-, 20**	**0,01**
SzK2	, 02	,84	-, 07	,34	-, 18	,02	,14	,07	-, 05	0,55
SzK3	-, 12	,13	-, 29	,00	-, 18	,02	,11	,16	-, 19	0,01
SzK4	-, 11	,16	, 17	,03	-, 05	,56	-, 07	,35	, 09	0,25

Rs = Spearman's correlation coefficient

Sig. = significance of correlation

SzK1 = section focusing on fear of crime

SzK2 = part focusing on perceived likelihood of personal crime

SzK3 = section on perceived control over personal crime

SzK4 = part focusing on perceived consequences of personal criminality

Negat. past = negative past

Posit. past = positive past

Hedon. present = hedonistic present

Fatal. present = fatalistic presence

Conclusion

Our central premise was the relationship between time perspective and fear of crime. We drew on research by Chadee et al. (2016), who did not show a direct relationship between the construct of time perspective and fear of crime in their research. However, our results did demonstrate a relationship. We found that there is a relationship between time perspective and fear of crime. We demonstrated this relationship based on the results we obtained. We found relationships between time perspective and fear of crime in all parts of the fear of crime construct. We found positive relationships in the negative past scale with the fear of crime part of the construct focused on the perceived consequences of personal criminality. We also found positive relationships in the positive past and hedonistic present scales with the part of the construct focusing on perceived control over personal criminality. Negative relationships came out for us in the scales negative past, positive past, fatalistic present, hedonistic present, and future. Specifically, in the sections focusing on perceived control over personal criminality, worry, perceived consequences of personal criminality, and perceived likelihood of personal criminality. We expected these results, as it is reasonable to assume that based on negative past experiences, an individual would feel incompetent to be in control of matters related to crime. Further, it was to be expected that people would be concerned about the future.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 84–95

Correlation Between the Incidence of Tooth Decay in Children and Their Eating Habits

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Summary

Introduction: Oral health is a major indicator of quality of life and level of overall health. The WHO (2022) considers oral diseases to be among the most common non-communicable diseases, affecting almost 3.5 billion people worldwide.

Objectives: The main objective of the study is to identify nutrition-related risk factors for tooth decay in children aged 5-12 years.

Methods: The survey sample consisted of 165 children and their parents. Data collection took place from October 2022 to March 2023. For data collection, a standardized questionnaire Oral Health Questionnaire for Children according to WHO (2013) and a non-standardized questionnaire were used.The condition of the oral cavity of children was determined by clinical examination of KPE and QHI indices, Kariogram, Nutrition Protocol. Statistical analysis of the data was performed using the statistical program SPSS 13.0, Program R and Microsoft Office 365 Excel.

Results: Of the total number of respondents, 44.8% of children are overweight. Sweet snacks are consumed several times a week by 52.1% of children and sweetened drinks by 40.0% of children. An examination of the KPE index points to a high to very high risk of tooth decay in 34.5% of children. The results of the Kariogram show a high risk of tooth decay in 70.3% of respondents.

Conclusion: Maintaining good oral health throughout life is an integral part of prevention. The incidence of tooth decay in children and adolescents in Slovakia is still alarming, despite a slowly decreasing tendency in recent years.

Keywords Risk factors for tooth decay. Cariogenic diet. Cariogram. Index QHI. Nutritional protocol. Prevention.

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Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 84–95. https://doi.org/10.22359/cswhi_17_1_10

Cited references: 15
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

According to the World Health Organization (WHO, 2022), oral health is a key indicator of overall health, well-being, and quality of life. The mouth reflects a person's overall health at every stage of life. The oral cavity is the first point of contact between the digestive tract and the external environment.

The health of the oral cavity in terms of tooth decay is affected by the daily intake of carbohydrate-rich food and drinks. In addition to the development of tooth decay, excessive consumption of carbohydrate diets, a sedentary lifestyle, lack of sleep, stress, but also genetic factors lead to the development of overweight or obesity. A large-scale Chinese study of more than 32,000 children confirmed the existence of an inverse link between tooth decay and BMI compared to a group of children of normal weight. Children who were overweight and obese were more likely to develop primary tooth decay (Liang, Zhang, et al., 2016). However, some studies report a

minimal impact of obesity on the development of tooth decay or tooth decay on obesity, however, studies have been conducted on small samples of respondents. Marshall et al. (2007), based on the findings of the conducted study, confirm a high incidence of tooth decay in obese children. A study conducted in the United Kingdom focused on determining the determinants of tooth decay and obesity, and its results clearly confirm the link between a higher frequency of intake of sugary foods and drinks and overweight/obesity of a child. Sugar intake in food and beverages is one of the main risk factors for tooth decay. Klamárová (2019) states that the taste for sweets has been evoking a feeling of satisfaction and joy in humans since ancient times. Trnková, Balogová (2019) state that already during intrauterine development, the center of taste and important neuroendocrine pathways affecting adipogenesis and the regulation of energy metabolism are formed. Taste cells produce neuropeptide Y, which is responsible for actively seeking sweets, which becomes a big problem in children with a higher BMI when treating tooth decay and the need to change eating habits. The secretion of neuropeptide Y is also increased when consuming artificial sweeteners. Therefore, when identifying the risk of tooth decay, it is a very important part of the examination of the child's eating habits. As part of the nutritional history, it detects the type of sugar ingested, the amount, frequency and consistency of sugary foods and drinks. Furthermore,highly important is the information on the intake of sugars with the main meal and between the main meals, the so-called intermediate meals - snacks (Kovaľová et al., 2010). When assessing nutritional risk, it is advisable to base the assessment on dietary data during the normal working week and especially during the weekend, when eating habits are usually different.Trnková (2022) states that in today's hectic times, children tend to consume semi-finished products and use fast food establishments more often due to lack of time. Follow-up nutritional counseling in a dental hygiene clinic is an important part of the first initial examination, especially if there is a high risk of tooth decay. The primary goal is to educate the patient and parents which foods and drinks are a source of sugars and pose a nutritional risk to tooth decay. It is also important to know about suitable dietary alternatives, sugar substitutes and adjusting the time of sugar intake. Natural sugars contained in fresh fruits and vegetables or dairy products do not play any significant role in the development of tooth decay. Polyphenols, calcium, water and fiber from fruits or vegetables stimulate saliva, cow's milk even protects teeth from tooth decay because it contains calcium and casein. Sugars in the regular diet contain sucrose, glucose, fructose, lactose and maltose, i.e. sugars that are highly cariogenic. According to the WHO, free sugars are added to juices, syrups, fruit juices, honey (Trnková, 2020; Tungare, Paranjpe, 2022).

Compliance with the recommendations is checked at each subsequent visit and the recommendations are amended as necessary. Any changes in the child's eating habits must be gradual, understood by patients and parents. An important part of nutritional interventions is also the motivation for change that promotes oral health (Hellwege, 2018). Health literacy, as stated by Trnková, Kilíková (2021), is one of the options for preventing health problems and protecting health, but also a way to manage newly arisen situations and health-related problems. If a nurse in the role of an educator supplements the text with appropriate images and photographs, memorability increases by up to 30%.

The objective of the research study was: To identify nutrition-related risk factors for tooth decay as well as to define their impact on the incidence of oral and general diseases.

The set of respondents consisted of children aged 5 to 12 and their parents who visited a selected dental practice in Pre8ov DENT-PREV s.r.o., where they focus primarily on child care. Therefore, it is a nest selection of a specific population. The exploratory study involved 165 child respondents, of which 79 (47.9%) boys and 86 (52.1%) girls. The respondents were between the ages of 5 and 12. For the sake of clarity of the evaluated data, the respondents were categorized as follows: children aged 5-6 years, 7-10 years, 11-12 years (Table 1).

Table 1 Age of respondents

	n	%	*Age distribution for work purposes*	n	%
5 years	**12**	**7,3**	**5-6 years**	**27**	**16,4**
6 years	15	9,1			
7 years	17	10,3	**7-10 years**	76	46,0
8 years	14	8,5			
9 years	24	14,5			
10 years	21	12,7			
11 years	33	20,0	**11-12 years**	62	37,6
12 years	29	17,6			
TOGETHER	165	100	TOGETHER	165	100

(Source: Own processing)

The most numerous category of respondents was the category of children aged 7-10 years (76; 46%), followed by the category of children aged 11-12 years (62; 37.6%) and the category of children aged 5-6 years, consisting of 27 respondents (16.4%) (Table 1).

The children aged 5-6 years are at risk for tooth decay. This period of age is characterized by the pruning of the first permanent molars (molars). At the same time, it is statistically the most evaluated category by the WHO in terms of the development of oral diseases in children. It is followed by the age category is children aged 12. The study is primarily focused on the assessment of the age category of children 11-12 years old, in whom the second permanent molars are erupted, the complete replacement of milk teeth with permanent ones is completed. Moreover, it is a critical period for the beginning of the development of periodontal diseases. The age category of 7-10 years is specific for the period of mixed teeth, during which milk teeth are replaced with permanent ones.

In order to assess the risk factors for tooth decay, it is also important to know the health status of the respondents, which we investigated through an anamnestic questionnaire completed before the clinical examination of the respondents, which consisted of an examination of:

1. *Tooth decay index – the kpe/KPE index* (caries/filling/extraction; dmft/DMFT decay/missing/filledteeth) monitors the number of teeth with caries, fillings and extracted teeth. Lowercase letters indicate the index in the deciduous dentition, uppercase letters in the permanent dentition. The resulting value of the kpe/KPE index is obtained by the sum of the examined teeth according to kpe/KPE, multiply by 100 and the resulting value is the kpe/KPE index expressed as a percentage. The values of the risk degree are shown in Table 2.

Table 2 WHO Quantification for the KPE Index

Value (%)	Risk
0,0 – 1,1	**very low**
1,2 – 2,6	low
2,7 – 4,4	Average
4,5 – 6,5	high
6,6 >	very high

(Source: Moreno-Quispe et al., 2018)

1. *the state of oral hygiene of the respondent* was identified through the dental-hygienic index - QHI index, by staining dental plaque. The detection of quantity, coating site and acidity was carried out by a three-component detection device (Triplaque GC). By detecting the biofilm, the degree of the patient's care for oral hygiene can be determined, which the patient (child/mother) sees directly in the mirror. The index also helps in the motivation and instruction of the patient/parent. After applying the detection product to the teeth, three scales of plaque colors are evaluated: pale pink: fresh plaque not older than 12-24 hours, dark pink to purple-blue: plaque older than 48-72 hours, and turquoise: the plaque is acidic and the individual receives a diet rich in sugars. The results are recorded in a diagram and each tooth is evaluated:Grade 0 – no plaque, grade 1 –

isolated colonies, grade 2 – distinct plaque around the edge of the gingiva, grade 3 – plaque covering 1/3 of the cervical surface of the tooth, grade 4 – plaque covering 2/3 of the tooth surface, grade 5 – plaque covering more than 2/3 of the tooth surface. The resulting average value of the index is calculated by summing all numerical values, which are divided by the number of teeth examined (Hellwege 2018; Kovaľová et al. 2010).

2. *the Nutrition Protocol* (Hellwege 2018) was used to analyze eating habits, focusing on information on food and drink intake over a 24-hour period. The data were compared with the data completed in the questionnaire. In the case of a pediatric patient, the parent protocol was filled out. The scheme records the intake of food and drinks during a normal day. Subsequently, the so-called Stephan's curve was created, which reflects the number of times the pH has dropped in the oral cavity. The demineralization and remineralization time over a 24-hour period is calculated, where the green bars represent physiological neutral pH levels (6.75-7.25) in the mouth and the red ones represent a drop in pH below 5.5. The time of intake of food and drinks is counted in the time of demineralization, plus 30 minutes to balance the pH of saliva in the mouth. After the Stephan curve is created, the demineralization time in minutes (hours) is added up in the red column and the resulting value is written to the protocol. The time of brushing your teeth is also recorded in the protocol. Based on the results of the nutrition protocol, the consistency of the meals, the time of intake with the time of brushing your teeth, the type of drinks consumed and the amount of meals between main meals are further evaluated. Subsequently, it is necessary to recommend suitable dietary alternatives, sugar substitutes to the patient and adjust the time of their intake (the adjustment is recorded with a red pen directly in the protocol diagram).
3. *for caries risk assessment, the interactive computer program Cariogram* (Cariogram/Caries Risk Assessment/CAR)was used, which graphically illustrates the biological, etiological risks of tooth decay and provides guidance on the solution strategy for the individual. It finds out information about the number of bacteria, carigenicity of the diet and other related factors of tooth decay. It provides the so-called *Risk profile of tooth decay*. In the program, bacteria are shown in red on the graph, carigenicity of the diet in dark blue, susceptibility to caries in light blue Other associated risks are shown in yellow or orange. The green color means a chance to avoid tooth decay. Values of 0-3 are assigned to ten factors: *caries experience, associated diseases, diet/composition, diet/ frequency, plaque, amount of Streptoccocusmutans, fluoridation, amount of saliva, saliva buffer capacity (pH).* When you enter the seven factors, a karyogram is already displayed, where individual items by color will be evaluated as a percentage (%).
4. *In children, anthropometric data* (weight, height/BMI) were investigated as a risk factor for obesity that affects the development of tooth decay in relation to the child's eating habits. Standard values of the BMI index in children are given in the professional guideline of the Ministry of Health of the Slovak Republic. Percentile values and z-scores of BMI are defined separately for girls and separately for boys. A result of the 5th percentile and below represents malnutrition, a result between the 5th and 85th percentile means a normal healthy body weight, more than the 85th percentile represents overweight and the 95th percentile or more represents the state of obesity (Bulletin of the Ministry of Health of the Slovak Republic, 2012).

All of the above-mentioned data collection steps were preceded by the signing of an informed consent of the children's legal guardians, who were given consent to include the children in the research study. Parents then filled out a questionnaire that consisted of two parts: a standardized according to WHO (2013) Oral Health Questionnaire for Adults and a non-standardized one, through which we obtained additional information in relation to risk factors for the development of oral diseases.

The data collection was carried out from October 2022 to March 2023. We addressed 200 respondents, while 165 respondents (82.5%) expressed their consent to the exploratory studyand clinical examination in writing. The most

common reason for the refusal of legal guardians to participate in the study was their unwillingness to cooperate.

Data obtained from the clinical examination and questionnaire were encoded and subsequently statistically evaluated We considered statistically significant results to be those in which *the p*- value was p< 0.05.

The anthropometric data of the children such as height and weight were obtained and thenthe BMI weight and height index was calculated.

(Source: Own processing)

Table 3 Results of BMI assessment in child respondents

Evaluation of the result of body weight	*Girls*		*Boys*	
	n	%	n	%
Malnutrition (5 percentile and below)	7	8,1	7	8,9
Normal body weight (between the 5th and 85th percentiles)	55	64,0	47	59,5
Overweight (more than the 85th percentile and less than the 95th percentile)	19	22,1	18	22,7
Obesity (95th percentile and above)	5	5,8	7	8,9
TOGETHER	86	100	79	100

The results indicate that 19 (22.1%) girls were overweight, 5 (5.8%) were obese and 7 (8.1%) girls were malnourished. In boys, the results were similar, 7 (8.9%) were malnourished, the same number were obese, and 18 (22.7%) boys were overweight. The highest incidence of overweight in 10 (52.6%) girls was aged 11-12 years and in 8 (42.1%) girls aged 7-10 years. Girls aged 7-10 and 11-12 years also had obesity.

The questionnaire also included an item mapping the incidence of general diseases in respondents, the results of which we compared with the data in the anamnestic questionnaire, which is part of the patient's dental card.

(Source: Own processing)

Table 4 Overview of respondents' overall illnesses

General diseases	*Girls*		*Boys*	
	n	%	n	%
No general diseases	77	89,5	69	87,3
Asthma	5	5,8	3	3,8
Heart disease	0	0	0	0
Diabetes	1	1,2	0	0
Autoimmune diseases	0	0	0	0
Oncological disease	0	0	0	0
Epilepsy	0	0	0	0
Rheumatism	0	0	0	0
Other	3	3,5	7	8,9
TOGETHER	86	100,00	79	100

There were 77 (89.5%) girls and 69 (87.3%) boys. 5 (5.8%) girls and 3 (3.8%) boys had asthma. One girl (1.2%) had diabetes. In the Other three (3.5%) option, girls reported allergies to pollen, eggs and bananas. Heart murmurs, allergies to pollen, grass, plants, or the occurrence of atopic eczema were reported by 7 (8.9%) boys (Table 4).

Moreover, the eating habits of the respondents were investigated.

Fresh fruit is consumed every day by 60 (36.4%) respondents, several times a week by 68 (41.2%). *Biscuits, biscuits, croissants* every day is 47 (28.5%) children and several times a week 86 (52.1%). Various sweetened *sodas, coca-colas* and other sugary drinks are consumed by 60 (36.4%) respondents, 38 (23%) at least once a week and 28 (17%) respondents. Only 36 (21.8%) children had never drunk sugary sodas and cola. Tea with sugar/ fruit tea was a daily part of the diet for 15.2% of children. *Jam/honey* is part of the diet every day for 10 (6.1%) children, once a week for 50 (30.3) and several times a month for 63 (38.2%) respondents. *65* (39.4%) of the respondents drink chewing gum containing sugar a few times a month and 19 (11.5%) children several times a week. *Sweets or candies* are a daily part of the diet of 38 (23%) children, 80 (48.5%) several times a week and 25 (15.2%) several times a month. Only 4 children (2.4%) consume sweets several times a day. An interesting figure is the occasional or no drinking *of energy drinks* in 144 (87.3%) children and several times a month in 14 (8.5%) children. *Ionic drinks are* occasionally or never consumed by 145 (87.9%) and 15 (9.1%) children several times a month. Energy drinks contain methylxanthin, caffeine, taurine, acai, B vitamins, maltodextrin, inosite, carnitine, creatine. Ionic drinks contain high amounts of simple sugars (glucose, fructose), as well as carnitine, taurine, glutamine. *72* (43.6%) child respondents indulge in smoothies and similar drinks several times a month. Ketchup and mustard are among the snacks with a high content of hidden sugars, while as many as 43

(26.1%) children consume them every day, 48 (29.1%) several times a week and at least once a week 52 (31.5%) respondents (Table 5).

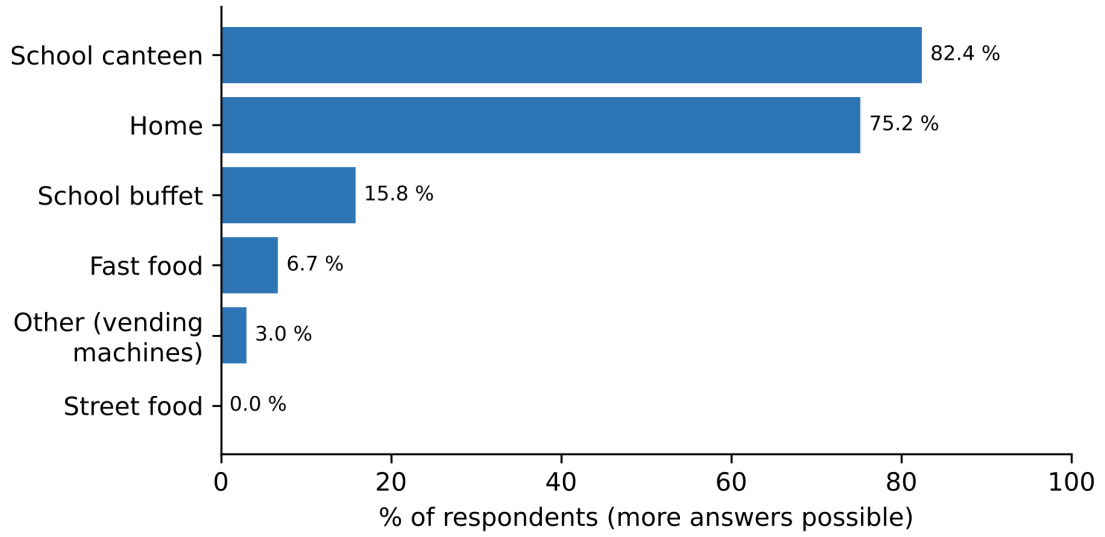
Table 5 Frequency of intake of beverages and food

	Several times a day		*Every day*		*Several times a week*		*Once a week*		*Several times a month*		*Sometimes/ Never*	
Food, drinks	n	%	n	%	n	%	n	%	n	%	n	%
Fresh fruit	22	13,3	60	36,4	68	41,2	13	7,9	2	1,2	0	0
Biscuits, biscuits, cakes, croissants, ..	2	1,2	47	28,5	86	52,1	21	12,7	9	5,5	0	0
Limonády, Cocacola,..	0	0	3	1,8	28	17,0	38	23,0	60	36,4	36	21,8
Jam/honey	0	0	10	6,1	17	10,3	50	30,3	63	38,2	25	15,2
Chewing gum containing sugar	0	0	2	1,2	19	11,5	19	11,5	65	39,4	60	36,4
Sweets/candies	4	2,4	38	23,0	80	48,5	15	9,1	25	15,2	3	1,8
Milk with sugar and grank	0	0	7	4,2	31	18,8	34	20,6	41	24,8	52	31,5
Tea with sugar, fruit tea	3	1,8	25	15,2	31	18,8	35	21,2	38	23,0	33	20,0
Energy drinks	1	0,6	1	0,6	0	0,0	5	3,0	14	8,5	144	87,3
Ion supply drinks	1	0,6	1	0,6	0	0,0	3	1,8	15	9,1	145	87,9
Smoothies and other similar foods	0	0	0	0	6	3,6	12	7,3	72	43,6	75	45,5
Ketchup/mustard	5	3,0	43	26,1	48	29,1	52	31,5	17	10,3	0	0

(Source: Own processing)

Of all respondents, 136 (82.4%) most often use the school canteen and 124 (75.2%) use home cooking for meals. As for other options, 26 (15.8%) children buy food in the school cafeteria. With the possibility of a free answer, 5 (3.0%) respondents mentioned break machines or vending machines for sweets and drinks (Fig. 1). Vending machines for fruit, various drinks and sweets, or sweetened milk, the so-called break machines, are slowly getting into schools. There is a possibility of risk in vending machines for sweetened drinks, sweetened milk and sweets.

Figure 1 Graphic representation of children's preferred eating places (Source: Own processing)



Clinical trial evaluation results

The results of the clinical examination of the KPE index in the monitored group showed *a very high risk* in 24 (14.5%) respondents, *a high risk* in 33 (20.0%) and *an average (medium) risk* in 48 (29.1%) respondents (Table 6).

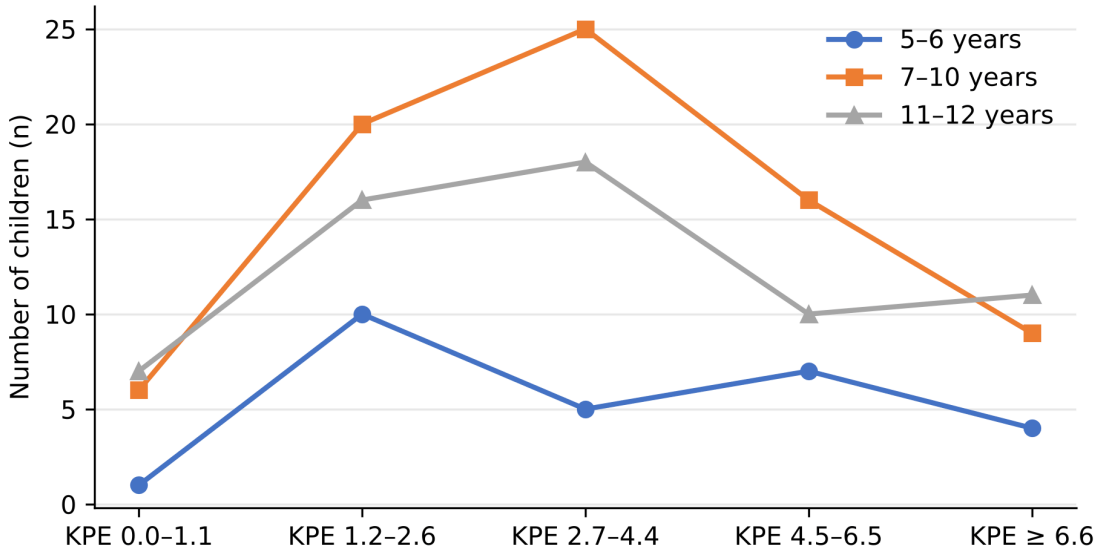
Table 6 Results of the KPE index assessment in children aged 5-12 years

KPE index	n	%	diameter	SD	Risk
KPE 0,0-1,1	**14**	**8,5**	**1,1**	**0**	**very low**
KPE 1,2-2,6	46	27,9	1,9	0,4	low
KPE 2,7-4,4	48	29,1	3,5	0,5	Average (Medium)
KPE 4,5-6,5	33	20,0	5,5	0,6	high
KPE 6.6 and above	24	14,5	7,9	1,3	very high
	165	100	3,98	2,8	

(Source: Own processing)

High average values of the KPE index were shown by children aged 7-10 years (5.53; SD 2.2) and children 11-12 years old (5.73; SD 2.42) at the level of medium to very high risk of tooth decay (Fig. 2).

Figure 2 Graphical representation of the KPE index's rating by age (Source: Own processing)



Evaluation of the results of the QHI index examination

The dental microbial plaque, its quantity, locations, acidity (cariogenicity) and the degree of oral hygiene care, was detected by a three-component detection dye. The available literature indicates that values of 3.0 to 5.0 indicate a high risk of developing oral diseases. 82 (49.7%) children had average oral hygiene and 61 (36.9%) respondents had poor oral hygiene (Table 7).

Table 7 QHI Index Assessment Results in Children 5-12 Years of Age

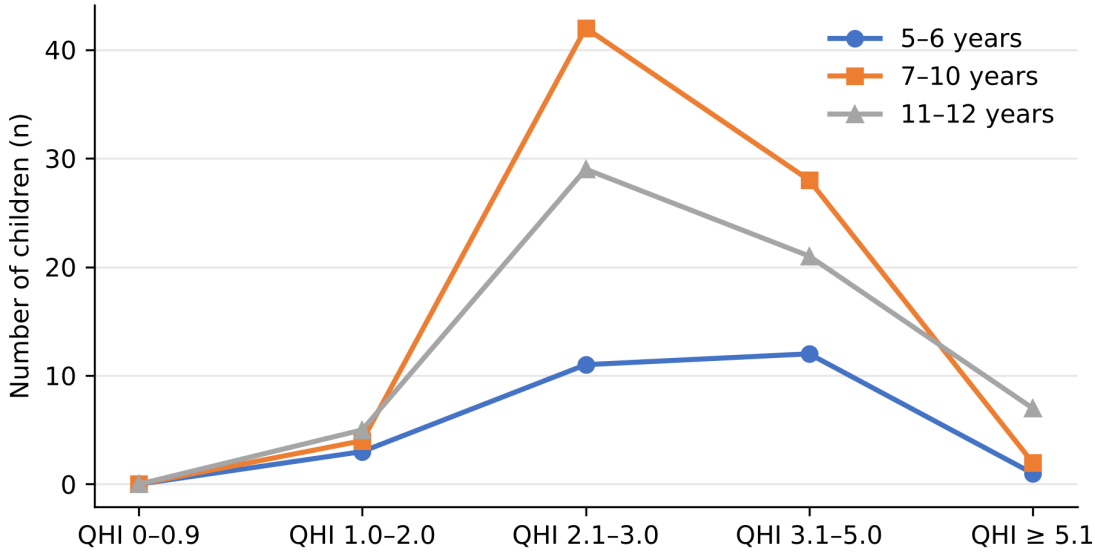
QHI index	n	%	diameter	SD	Oral hygiene status
QHI 0-0,9	**0**	**0,0**	**0,0**	**0,0**	**Very good (satisfactory)**
QHI 1,0-2,0	12	7,3	1,8	0,3	Okay
QHI 2,1-3,0	82	49,7	2,5	0,3	Average

QHI index	n	%	diameter	SD	Oral hygiene status
QHI 3,1 -5,0	61	36,9	3,6	0,5	Bad
QHI 5.1 and above	10	6,1	5,7	0,4	Very poor (unsatisfactory)
	165	100	2,7	0,3	

(Source: Own processing)

Even when assessing the state of oral hygiene using the QHI index, respondents aged 7-10 years and 11-12 years showed the worst results (Fig. 3). The average value of the QHI index for a high risk of tooth decay and poor to unsatisfactory oral hygiene was 4.55 (SD 1.34) for the age group of respondents 7-10 years and 4.7 (SD 1.56) for the age group of 11-12 years.

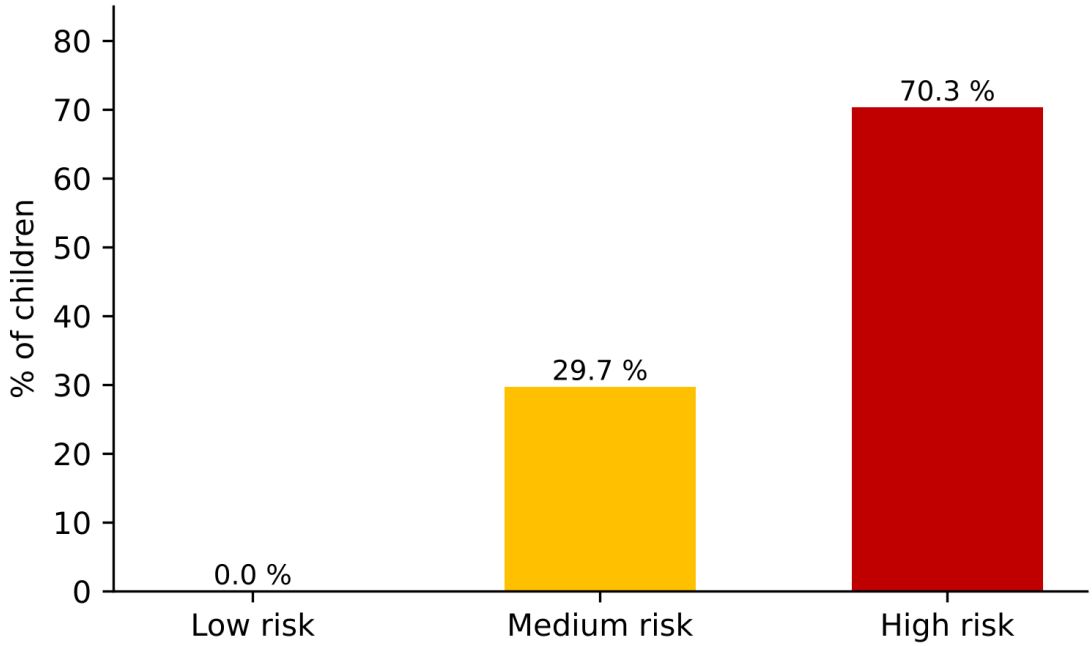
Figure 3 Graphical representation of the QHI index by age



(Source: Own processing)

By evaluating the results of the PC program Cariogram, it can be concluded that up to 70.3% (n = 116) of respondents have a high risk of tooth decay (Fig. 4).

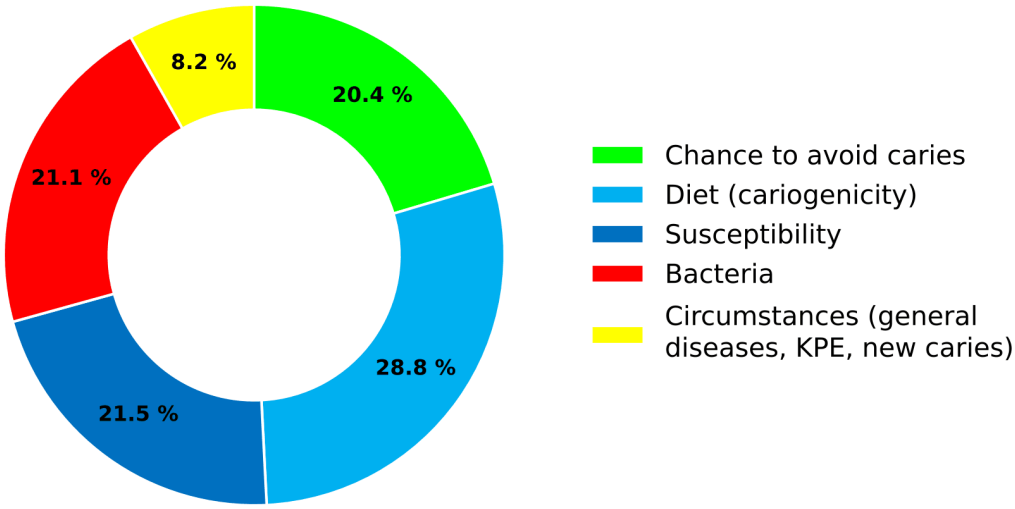
Figure 4 Graphical representation of the degree of risk of tooth decay in children 5-12 years old



(Source: Own processing)

The average risk of tooth decay based on the evaluation according to the model in the Kariogram of all respondents to the study is shown in Figure 5. The most alarming sector appeares to be the area of carigenicity of the diet (28.8%) and the related susceptibility to the development of new tooth decay.

Figure 5 Graphical representation of the average risk of tooth decay of respondents according to the Karyogram model

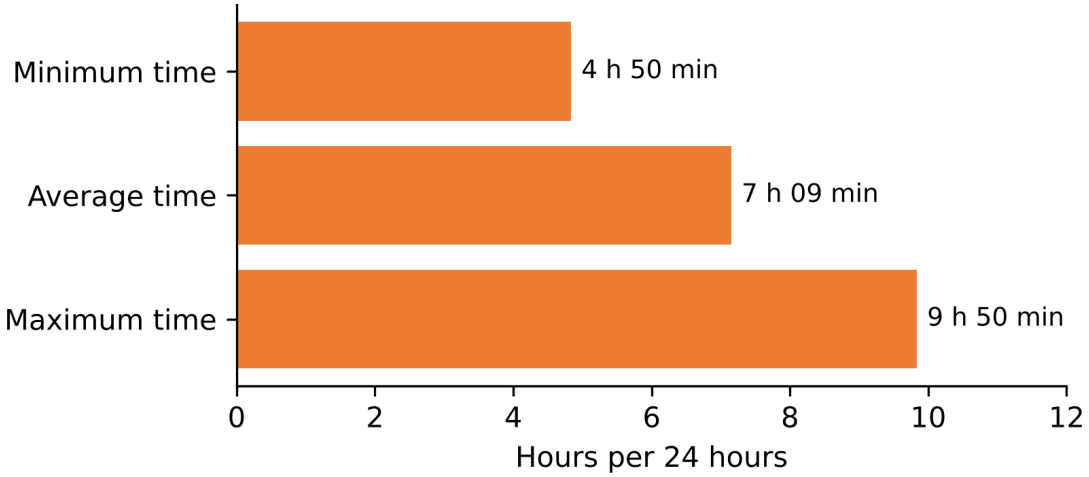


(Source: Own processing)

Evaluation of the results of the examination of eating habits - Nutrition protocol

The frequency of intake of basic cariogenic foods and drinks is also of importance. Therefore, the consistency of the diet intake, the amount and frequency of sugar intake and their duration of exposure to tooth enamel were monitored. The interval of pH decrease in the mouth until the return to neutral values was mostly observed. A drop in saliva pH below 5.5 is risky as the tooth enamel is demineralized. In connection with the drop in pH below neutral values, Klamárová (2019) states that the alternation of the phases of demineralization and remineralization, which results from frequent dietary intake, is critical. The author also states that it takes about 30 minutes for the pH to drop below 5.5 after eating a non-cariogenic food. A low pH can persist for several hours in an unremoved microbial coating. After the evaluation of the Respondents' Nutritional Protocols, it was found that the average time to drop pH below 5.5 in one day was 7 hours and 9 minutes (SD 1.05) (Fig. 6).

Figure 6 Graphical representation of the average time spent consuming a cariogenic diet over a 24-hour period



(Source: Own processing)

The aim was to identify nutrition-related risk factors for tooth decay in children aged 5-12 years, assuming that the value of the KPE and QHI index may be influenced by influenceable factors, e.g. BMI index, consumption of certain foods and beverages.

By statistical analysis, it was found that the value of the KPE and QHI index is statistically significantly influenced by BMI (P=2.2x10-16), chewing gum containing sugar (P=0.02), tea with sugar or fruit tea (P=0.02). The KPE and QHI indices in relation to the chance of avoiding tooth decay, cariogenicity of the diet, susceptibility to tooth decay, bacteria and general diseases appear to be statistically significant, since the P< value was 0.001 for all risk factors.

Conclusion

According to the WHO Global State of Oral Health Report (2022), Slovakia is one of the countries with the highest incidence of tooth decay in milk dentition in children aged 1-9 years (for 2019: 45.8% - 53.2%), in permanent dentition in children over 5 years of age, the prevalence is at the level of 40.6% - 55.7%. The development of tooth decay is significantly influenced by the intake of a carbohydrate diet, as well as the development of overweight and obesity, diabetes, metabolic disorders, or immunity. Karki et al. (2019) found in their clinical study that overweight/obesity and tooth decay clearly have common risk factors, consisting in diet.

Based on the results above, it can be concluded that the state of oral health in children is very alarming, especially between the ages of 7 and 12 with mixed dentition. The cariogenicity of diet also presents one of the most risk factors for tooth decay in children. With the results of their study, Naki, Mori-Suzuki (2023) confirm that excessive consumption of sugars in the diet has a direct impact on the development of tooth decay and increasing kpe/KPE (dmft/DMFT) values from childhood, creating a predisposition to the development of tooth decay in adulthood.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 96–101

The Relationship Between Vegetarian Eating, Gender and Fatigue in Students

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Summary

This study examines the relationship between vegetarian eating, gender and fatigue. It is known that women and vegetarians are a risk group for iron deficiency and that a deficiency in blood iron levels can lead to fatigue. Based on the literature, vegetarians and women are expected to be more fatigued in daily life than non-vegetarians and men. Using online questionnaires, fatigue and eating habits of 95 students are measured. The hypothesis that women are more fatigued than men is confirmed. However, nonvegetarians were more fatigued than vegetarians. A possible explanation for the inverse relationship found could be the healthier lifestyle of vegetarians. Nevertheless, there was a disparity within vegetarians. Vegetarian women were more tired than non-vegetarian men. This may be explained by the dual risk for iron deficiency, namely gender (female) and vegetarian eating. Follow-up research is needed to further investigate this relationship.

Keywords Gender. Eating. Vegetarian. Students. mental health. Fatigue.

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Cite as
Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 96–101. https://doi.org/10.22359/cswhi_17_1_11
Cited references: 18
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

From an evolutionary perspective, one of sleep's core functions is its role as an adaptive state of inactivity, sleep likely evolved to help organisms conserve energy and reduce exposure to predators during vulnerable periods (Borbély et al., 2016). According to the National Sleep Foundation, healthy adults aged 18 to 64 should aim for seven to nine hours of sleep per night, while older adults (65+) typically require seven to eight hours (Hirshkowitz et al., 2015; National Sleep Foundation, 2020). Sleep needs also vary across the lifespan and are influenced by factors such as genetics, health status, and lifestyle (Hirshkowitz et al., 2015).

Sleep deprivation frequently leads to fatigue, manifesting in declines in cognitive performance, attention, reaction time, and mood stability—even after partial or total deprivation (Ren et al., 2025).

Fatigue can manifest as both mental and physical exhaustion (Van Cutsem et al., 2022). Mental fatigue refers to cognitive weariness, while physical fatigue involves bodily tiredness. Generally, fatigue is understood as the difficulty in initiating or sustaining voluntary activities (Van Cutsem et al., 2022). Consequently, sleep plays a crucial role in reducing fatigue, though other factors, such as stress, lifestyle, and health conditions, also significantly influence fatigue levels.

One factor that can have a positive effect on fatigue is a varied diet. Within the scientific literature, it is known that vegetarian eating can have a strong positive effect on health (Xu et al., 2023). In the study of Wang et al. (2023), a vegetarian diet was found to be associated with a lower incidence of all cancer-related diseases.

Although vegetarian eating can have a wide range of positive health effects, there can also be negative aspects associated with it. As a specific example, the importance of the trace element iron can be mentioned. Iron is an essential trace element for humans that is responsible for transporting and

storing oxygen. A lack of iron can cause the transport of oxygen in the cells to be impaired. If the cells do not receive enough oxygen, fatigue can be a consequence. Meat and fish products is the most effective way to absorb iron ((Fletcher & French, 2024). One reason for this is that iron from vegetables and fruits cannot be properly broken down and processed by the body. In short, a deficiency of meat and fish products can lead to fatigue (Fletcher & French, 2024).

A risk group regarding iron deficiency is especially vegetarians. This group of people refuses to eat meat and fish products or need to supplement it. Therefore, they lack the essential trace element from meat and fish products that the body processes best, namely iron (Neufingerl & Eilander, 2022). In addition to vegetarians, a second risk group is known. These are women, especially during menstruation and childbirth. On average, they have lower blood iron levels than men, by virtue of higher blood loss (Ekroos et al, 2024).

On the one hand, it is scientifically relevant to gather knowledge about the relationship between vegetarian eating and fatigue, because both eating and preventing fatigue have an essential value for survival. Moreover, this research contributes to people's awareness to monitor their own eating habits regularly. A recent systematic review and meta-analysis by Knoop et al. (2021) demonstrated that fatigue is a significant predictor of negative health outcomes, including functional decline, falls, hospitalizations, and even mortality, particularly among older adults. These findings highlight the importance of identifying and reducing fatigue as a preventative health measure. The relevance to current

research lies in the clear association between decreased fatigue and improved safety, cognitive function, and overall well-being, supporting the need for effective fatigue management strategies in both clinical and occupational contexts.

On the other hand, it is of social importance to gather knowledge about the relationship between vegetarian eating, gender and fatigue because the vegetarian lifestyle is becoming increasingly popular among young people. Women decide to adopt a healthy lifestyle more often than men, in part because of the current beauty ideal of looking slim. One component of a self-chosen healthy lifestyle is vegetarian eating (World Economic Forum, 2022). From the literature reviewed earlier, it appears that women are particularly at risk for iron deficiency. Iron deficiency is again a risk factor for fatigue. From this it can be inferred that women are more fatigued than men in everyday life due to their self-selected diet. Especially in students, studying learning materials requires a high level of concentration. This proves difficult if the self-chosen eating pattern (vegetarian food) has a negative effect on fatigue.

From these data, the question of this study follows: Is there a relationship between vegetarian eating, gender and fatigue in college students? The question is investigated based on questionnaires that measure fatigue in both vegetarians and non-vegetarians. Based on the literature consulted, the following hypotheses are formulated. First, vegetarians are more fatigued in daily life than non-vegetarians. Second, women are more fatigued in daily life than men. These hypotheses are independent of use of dietary supplements.

METHODS

Participants

The study involved 95 students (27 males and 68 females). Within the participants, there were

30 vegetarians. The research women took the participants from the

Radboud University recruited through the Sona System (half a credit point for 30 minutes). Participants not studying at Radboud University were asked to voluntarily participate in the study without compensation. An exclusion criterion for study participants was an incompletely completed questionnaire. Sleep quantity, age, nationality and intake of iron supplements were controlled for.

Materials

The material consisted of three questionnaires. The first questionnaire was designed to collect demographic data.

The second questionnaire focused on collecting information on sleep quality. To measure sleep function, the abbreviated version of the Pittsburgh Sleep Quality Index (PSQI) was used (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

To measure subjective fatigue, the researchers used the Checklist Individual Strain Strength (CIS).

The Individual Tension Checklist consists of twenty statements that assess how the participants have felt over the past two weeks (Vercoulen et al., 1994).

Design

The non-experimental study had a between-subject design and the sample was collected cross-sectionally. The study had as dependent variable the degree of fatigue (the total score of the CIS, quantitative) and as independent variables eating pattern with the two levels: vegetarians and non-vegetarians (qualitative) and gender with the two levels: male and female (qualitative).

Before analysis could begin, the researchers first prepared the data. Eleven items of the CIS had to be mirrored and then all items were added up to a total score. Only then could the analysis begin. First, descriptive statistics were used to describe the sample. Participants were divided into vegetarians and non-vegetarians and men and women. Categorical variables (level of education, use of dietary supplements, nationality) were described using frequencies.

Continuous variables (sleep quality, age) were described using means and standard deviations.

Second, a histogram of CIS scores was requested to look at the normal distribution of these scores to look at. Third, the differences on demographics between the groups were tested and, if necessary, adjusted for variables that were significantly different. To test differences between groups for the variables dietary supplement, nationality and educational level, a chisquare test was performed. For the variables sleep and age, a t test was performed. When a variable was significantly different between the groups, it was included in the analysis. To answer the research question, the study uses an ANOVA analysis to compare the difference of the mean score on the CIS questionnaire between the groups. If only the variable sleep is significantly different between the two groups, an ANCOVA will be performed with sleep as a covariate to correct for it. If all variables differ significantly, gender and dietary supplements will be included as factors in the analysis. The strength of each significant effect was assessed by eta^2. An association can be called strong if eta^2

>.20, weak if eta^2 <.10 and moderate in between (Ellis, 2006). The Statistical Package for the Social Sciences (SPSS), Windows version 18.0 was used for all analyses.

RESULTS

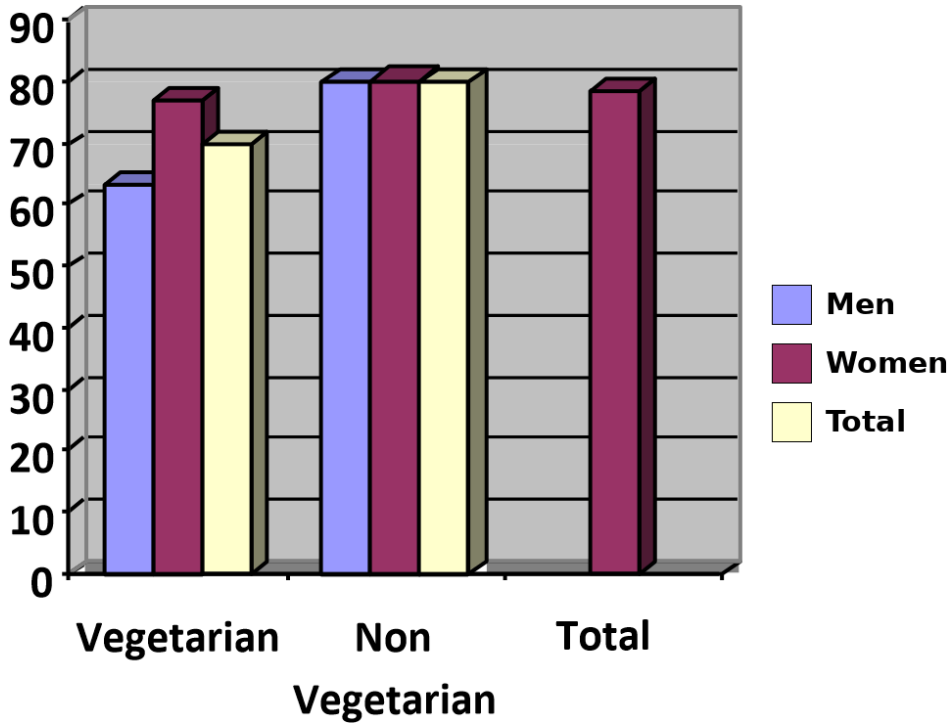
Within the 30 vegetarians, there were 9 participants who took dietary supplements. The mean age of all participants was 22 (SD = 3.27). Predominantly German students participated in the study (n = 70) and 44 Dutch students. The histogram showed that the scores on the CIS resembled a normal distribution (M = 76.72, SD= 10.01) with a maximum score of 109, a minimum score of 62.

There was only a significant difference between the groups on the following demographic variable: The use of dietary supplements and vegetarian eating (X^2(4)

= 100.42, p < .05). This means that vegetarians used more dietary supplements than nonvegetarians. However, whether or not they used dietary supplements was not included in the analysis because the n was too small for adequate analysis.

ANOVA analysis with the independent variables gender (male/female) and diet (vegetarian/non-vegetarian) and total score on CIS as the dependent variable revealed a moderately significant two-way interaction effect (F (1,91) = 11.49, p < .05, eta^2 = . 11). On average, women scored significantly higher (M = 78.43, SD = 1.55) than men (M = 71.30, SD = 1.19) on the CIS. Vegetarians scored significantly lower on average (M = 69.89, SD = 1.45) than non-vegetarians (M = 79.94, SD = 1.31). The two-way interaction showed that vegetarian women scored higher on the CIS (M = 76.71, SD = 10.03) than vegetarian men (M = 63.06, SD = 11.44). However, there was no significant difference between non-vegetarian men and nonvegetarian women on the CIS questionnaire. Figure 1 shows a graphical representation of the CIS scores of vegetarian and non-vegetarian participants and men and women.

Figure 1 Mean score on CIS among vegetarians/non-vegetarians and men/women.



DISCUSSION

The question of this study was: Is there a relationship between vegetarian eating, gender and fatigue in college students? The first hypothesis of this study was that vegetarians are more fatigued in daily life than non-vegetarians. The second hypothesis was that women are more fatigued in daily life than men. The results showed that there was a significant relationship between gender, diet and fatigue.

Contrary to the first research hypothesis, an inverse relationship was found between vegetarian eating and fatigue. Not vegetarians are more tired, but rather non-vegetarians. From this it can be concluded that the first research hypothesis is not confirmed. Linked back to the literature discussed, an inconsistent picture becomes clear. Saller et al. found in 2007 that a deficiency of the trace element iron can lead to fatigue and a risk group for deficiency of this trace element are mainly vegetarians. A possible explanation for the inverse relationship found is that vegetarians generally have a healthier lifestyle than nonvegetarians. They not only eat healthily but also live healthier lives than non-vegetarians. It has already been shown in the introduction that vegetarians have a lower risk of diseases (Wang et al., 2023). This could not just come from eating vegetarian, but also from other relevant factors that can positively influence health and therefore fatigue. Concrete examples that could have negative effects on fatigue are smoking and alcohol consumption. It is well known that vegetarians do not pay

attention to their health only when eating.

Vegetarians are more concerned with their own health than non-vegetarians. Therefore, the relationship found in this study that nonvegetarians are more tired than vegetarians can be explained by a healthier lifestyle of the vegetarians.

However, the two-way interaction reveals differences within vegetarians in terms of gender. Indeed, vegetarian women are significantly more fatigued than vegetarian men. But no difference can be seen among non-vegetarians. Non-vegetarian women and nonvegetarian men hardly differ from each other in terms of the degree of fatigue. This is confirmed by the discussed literature. In vegetarian women, two risk factors come together that can lead to fatigue lead, namely vegetarian eating and

gender (female). Women are already a potential risk group for fatigue. If they then go vegetarian, women may increase the risk of fatigue due to iron deficiency (Tang, & Sholzberg, 2024).

In contrast, the second research hypothesis is confirmed. Women are more tired than men in daily life. This is consistent with the literature discussed in the context of the introduction.

The results found can only be generalized to another population of German students, because predominantly German students participated in this study. This study makes an important contribution to science because it also aims to measure the negatives effects on fatigue that can result from a self-selected diet, namely vegetarian eating. Vegetarian women are especially at high risk for fatigue, as they have a double risk of being more fatigued in daily life than men.

Nevertheless, the study is not without shortcomings. On the methodological side, a further measurement can be included in the study, which is to measure blood iron levels. This could correct for iron levels, as iron deficiency can predict fatigue. However, measuring iron levels was not possible in this study because of the time limitation of this study. In addition, recruiting a more international sample may provide more scope for generalizing the results found. It may be interesting whether there are differences between fatigue, vegetarian eating and ethnicity. In this study, however, the majority of participants were German. Furthermore, after an overall healthy lifestyle can be looked at to correct for lifestyle. It follows that there is much room for follow-up research such as: (a) an additional measurement regarding blood iron levels; (b) an additional measurement regarding healthy lifestyle; and (c) recruiting a more international sample.

Despite its shortcomings, it can be concluded that the study prompt people to reflect on their diet, and vegetarian women in particular can thereby prevent fatigue in daily life. In particular, vegetarian female students can compensate for their fatigue with iron tablets, for example, with the goal of achieving increased concentration.

Fatigue remains an interesting and relevant topic for further research, because preventing fatigue can lead to a better quality of life.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 102–109

The Effect of Physiotherapy on Daily Activities in Patients With Non-specific Neck Pain

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Summary

Objective: The aim of this study was to assess the effectiveness of physiotherapy in the management of non-specific neck pain.

Design: The prospective clinical study.

Participants: 30 patients with non-specific neck pain aged 21 to 60 years.

Methods: Patients underwent kinesiotherapy using prenatal and postnatal autoreflex positions, applied in 12 sessions held twice a week for 6 weeks, each lasting 30 minutes.

Results: The average clinical improvement of participants was 54%. The Neck Disability Index (NDI) score was significantly reduced, from 19.5 points before to 9.4 points after treatment (p = <0.001, r = 0.93).

Conclusion: Physical therapy has been shown to be an effective method for the relief of non-specific neck pain, and the therapy resulted in significant clinical improvement and reduced disability among participants. Further research is needed to examine the long-term effects and to analyze their impact on active range of motion, muscle strength, proprioception, and psychosocial factors.

Keywords Non-specific neck pain. Physiotherapy. Kinesiotherapy. Autoreflex positions. Neck Disability Index.

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Cite as
Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 102–109. https://doi.org/10.22359/cswhi_17_1_12
Cited references: 40
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

Definition and Importance of the Topic

Globally, cervical pain has been assessed as the fourth most common cause of work disability and ranked twenty-first in terms of total burden on society. The cervical spine is defined as the area between the superior nuchal line and the level of the spina scapulae (1). We can also talk about pain between the occipital bone and the thoracic vertebrae, which can spread towards the shoulder joint (2). Spinal pain is highly important as it is prevalent, particularly in economically developed countries, as it belongs to the group of civilization-related diseases associated with lifestyle. Moreover, its incidence increases with the aging of the population (3). Although, unlike epidemic infectious diseases, spinal pain does not lead to mass mortality (4), it is far from a rare occurrence (5). Instead, as a chronic condition affecting individuals, particularly in older age, it has emerged as a significant social issue in aging societies. Like many similar problems, it places a burden on the limited resources of the state (6), its healthcare system, and individual medical professionals (7). However, it generally does not reach the severity requiring institutional long-term care (8). Furthermore, unlike epidemic infectious diseases, effective prevention of spinal pain syndromes cannot be achieved through a single medical procedure (9). Instead, it necessitates the development of long-term habits that support a healthy lifestyle and the adoption of health-promoting behaviors over decades. In this case, there is also no widespread fear of the disease, which, in other circumstances, may serve as a motivating factor for early preventive actions (10). Cervical spine pain tends to persist or recur,

significantly reducing quality of life and posing a risk of complications (11). While modern medicine offers a variety of widely accessible treatment options (12), these approaches do not always need to be as aggressive as those used for many other conditions, particularly in contrast to oncological diseases (13) and their associated pain (14). A major limiting factor in treatment effectiveness is the necessity of sustained therapeutic interventions, including physical exercises, over extended periods. This requirement significantly hampers patient adherence (15) and necessitates accurate documentation of the patient's condition (16). Additionally, it demands efficient communication and information exchange between multiple institutions and individual healthcare professionals (17), often facilitated through modern teleinformatics systems (18).

In most cases of cervical pain, the causes are unclear. Most often, these causes are described as non-specific or mechanical (19). This pain can be caused by changes caused by degenerative processes in the area, long-term overload, or compensation of another part of the musculoskeletal system by the cervical spine area (2, 20).

Diagnosis of non-specific cervical spine pain consists of taking anamnesis, physical examination, and possible imaging examinations to clarify structural pathologies and exclude red flags. We pay attention to the type of work, bio-psycho-social factors, level of physical activity, and other possible comorbidities. We evaluate the active and passive range of motion of the cervical spine and adjacent regions, the presence of pain, and limitations. We examine muscle strength, positivity of stretching maneuvers in the upper limb, and palpation sensitivity of soft structures (21, 22, 23).

Other assessment options are questionnaires such as the Extended Aberdeen Spine Pain Scale, the Bournemouth Questionnaire, the Cervical Spine Outcome Questionnaire, the Current Perceived Health 42 Profile, the Neck Disability Index, the Northwick Park Neck Pain Questionnaire, and the Neck Pain and Disability Scale (19, 24).

The most commonly used forms of therapy include spinal manipulation, acupuncture, massage, active exercise, traction techniques, soft cervical collar, physical therapy, pharmacological treatment, education about ergonomic principles, and bio-psycho-social factors of pain (21, 25). Alternative forms of treatment include kinesiotape and cupping (2, 26).

The APPP® concept is based on the psychomotor development of a person from prenatal, i.e. sperm movement, to postnatal and bipedal locomotion. The patient assumes a therapeutic position under the guidance of a therapist, in which conscious isometric contraction of the skeletal muscles occurs. This position results in the brain receiving stimuli and subsequently activating the patient's natural and innate abilities. In this way, the relevant motor pattern is equipped. Upon repetition, activation of the impaired motor pattern and stereotype is assumed. The patient should be able to spontaneously include this motor pattern in his motor expression, without the need for further conscious learning (27, 28, 29).

These movement patterns are "required" by each individual throughout their life. The advantage of the concept is the automatic autoreflexive involvement of muscles, including deep stabilizers. The patient's active cooperation in setting and activating the position is important. After a certain period of time, the patient switches to a home self-therapy regimen, when he performs the therapy without the guidance of a therapist (28, 29).

Research Section

Objective of the work

The aim of the research is to verify the therapeutic efficacy of autoreflexive prenatal and postnatal positions in the kinesiotherapy treatment of non-specific cervical spine pain.

Research questions

Q1: Will the application of physiotherapy affect patients with non-specific cervical spine pain?

Q2: Will gender, age, and total duration of therapy affect the effect of physiotherapy on non-specific cervical spine pain?

Methods:

Study Design

The study was conducted as a prospective clinical trial. Patients underwent a clinical examination before starting therapy and after the end of therapy. At the beginning of each week, they provided

information about the duration of self-therapy they performed at home during the previous week. All patients signed an informed consent. A questionnaire form was used to obtain data.

Participants

30 patients with non-specific cervical spine pain were selected by purposive sampling between the ages of 21 and 60; the sample consisted of 14 men and 16 women. The average age of the patients was 36.7 years.

Inclusion criteria: age from 18 to 60 years, diagnosis of non-specific cervical spine pain, active occupation, consent to therapy and inclusion in the study, and agreed to anonymous data processing, with a duration of pain for at least four weeks.

Exclusion criteria: failure to complete therapy; interruption of therapy for more than three weeks; traumatic injury during the duration of therapy that could affect the result; occurrence of other changes in health status, pain of inflammatory, tumor nature, pain lasting less than four weeks.

Intervention/therapy

Patients underwent 12 therapies twice a week, with a total duration of six weeks. The duration of therapy was 30 minutes. The therapy included kinesiotherapy in the form of prenatal and postnatal autoreflex positions. Autoreflex prenatal and postnatal therapeutic positions were included in the form of kinesiotherapy, which patients performed under the supervision of a therapist as well as in the home environment independently according to the therapist's instructions and indications. Autoreflex prenatal and postnatal positions are primarily focused on isometric contractions in positions derived from the ontogenetic development of a person. They are characterized by low intensity of contraction and a focus on the quality of its execution, i.e. on control over the performed movement. Patients were instructed about possible lifestyle risk factors, stereotypes of cervical spine use, and its postural load during daily activities. In accordance with these instructions, patients underwent training in adjusting the performance of daily activities according to the specific criteria of individual patients.

Methodology

Patients assessed their condition using the Neck Disability Index (NDI) questionnaire (Musilová et. al. 2020), which they filled out before and after the end of the therapy, which lasted 6 weeks. We used the specialized statistical computer program Statistical Package for the Social Sciences (SPSS) to process the obtained data. In this computer program, we subsequently performed the evaluation with a paired T-test and a non-parametric Mann-Whitney U-test and correlation analyses.

Results

The age range of the patients was from 21 to 60 years. The average age of the respondents was 37 years (SD= 12.603). The group consisted of 16 women (53.33% of N=30) and 14 men (46.66% of N=30). The female group had a mean age of 40.06 years (SD= 14.154), with the lowest age being 21 years and the highest being 60 years. In the male group, the mean age was 33.50 (SD= 9.921) and ranged from 21 years to 53 years.

All patients showed a statistically significant decrease in NDI score ($p = <0.001$, $r = 0.93$). Gender ($U = 110$, $p = 0.951$), age ($r = -0.302$, $p = 0.104$) and total duration of therapy ($r = -0.093$, $p = 0.627$) had no significant effect on the change in NDI score.

Statistical data analysis

Research question O1: Will the application of physiotherapy affect patients with non-specific cervical spine pain?

Table 1 Paired T-test of NDI scores

NDI	N	Median	Range	SD	t	p	r
Before	**30**	**19,5**	**21**	**5,257**	**19,699**	**<0,001**	**0,93**
After	30	10	17	4,731			

Two-way significance test

Based on the comparison of the results, we can conclude that the raw score of the NDI questionnaire before therapy (Mdn = 19.5) is significantly higher than in the questionnaire completed after completing therapy (Mdn = 9.4). Based on the results of the paired T-test ($T = 19.699$, $p = <0.001$) we can conclude that this

difference is statistically significant and the differences are very pronounced (r = 0.93).

Research Question O2: Will gender, age and total duration of therapy affect the effect of physiotherapy on non-specific cervical spine pain?

Table 2 Mann-Whitney U-test effect in men and women

Percentage improvement	N	Median	Range	SD	U	p
Women	**16**	**50**	**58,10**	**16,905**	**110**	**0,951**
men	14	54,15	45,4	14,205		

Two-tailed significance test

Based on the comparison of the results, we can conclude that the overall improvement in women (Mdn = 50) is almost the same as in men (Mdn = 54.15). Based on the results of the Mann-Whitney U-test (U = 110, p = 0.951), we can conclude that there is no significant difference between the groups.

Table 3 Correlation analysis coefficient of age

Variables	Age
Overall improvement	**-0,302**

Two-tailed significance test

Based on the above results, we can conclude that the age group does not have a significant relationship with the overall improvement in the clinical condition of the respondents (r= -0.302, p= 0.104) Based on these results, we answer question O3

Table 4 Correlation analysis coefficient of the duration of therapy

Variables	Age
Duration of therapy	**-0,093**

Two-tailed significance test

Based on the above results, we can conclude that the duration of the total therapy does not have a significant relationship with the overall improvement in the clinical condition of the respondents ntov (r= -0.093, p= 0.627) Based on these results, we answer question O4.

Discussion

The aim of the study was to evaluate the impact of the application of aureflex prenatal and postnatal positions on the health status of patients with non-specific cervical spine pain. The research sample consisted of 30 patients, 14 men and 16 women, who independently assessed their health status using the Neck Disability Index questionnaire. Patients completed this questionnaire before and after the end of therapy. At the beginning of each week, patients provided information about the duration of self-therapy they performed at home during the previous week. We noted an improvement in their health status to varying degrees in all patients.

The Neck Disability Index was chosen based on international consensus on its effectiveness and use in cervical spine pain. The NDI provides sufficient utility and effectiveness in the assessment of cervical spine pain (30). The NDI is often translated and used abroad, as confirmed by the study of the use of the Dutch version. After evaluating the results, the author concludes that the NDI is a valid option for self-assessment of disability associated with cervical spine pain (19).

We were unable to demonstrate the influence of age, gender, or duration of self-therapy on the eventual differential outcome of therapy. The professional literature describes the period of six weeks from the onset of symptoms as a period when spontaneous resolution of symptoms and almost complete return to full health often occur (31).

This was confirmed by Vos et. al. (32) in their study, where patients were referred to physiotherapy or a “wait and see” approach was adopted in their treatment. All patients underwent evaluations after one year. Patients who were referred to physiotherapy had a 75% success rate, and patients who were not had a 79% success rate. We can therefore conclude that in this case there is no significant difference between these groups (32). Since our patients were followed for six weeks. It is also necessary to mention that there is a frequent recurrence of similar or identical problems (31). Therefore, it could be interesting to see what results we would observe in further follow-up of patients.

Another possible cause of neck pain is depressive or anxiety disorders, which are difficult for a

physiotherapist to influence. Based on this information, it is therefore necessary, for the success of therapy, to diagnose the causes of the subjective difficulties in patients as accurately as possible and differentiate them from each other (33). These claims were further supported by the findings of Elbinoune et. al. from 2016. They state, based on the results of observation of 80 patients, that there is a connection between the finding of cervical spine pain and the prevalence of depression and anxiety among these patients (34). This claim was also supported by the results of an investigation of the relationship and prevalence of depression/anxiety and the occurrence of cervical spine pain (35). Since we did not monitor these parameters in our entry or exit examination, it is difficult to say whether they had an impact and whether they occurred in patients.

Dusuncell et. al. compared the effectiveness of therapy in three groups of patients who were divided based on the therapy provided. Group 1 underwent therapy: transcutaneous electrical stimulation, continuous ultrasound application, and infrared irradiation. Group 2 underwent therapy that included: physical therapy in combination with stretching and isometric exercises. Group 3: physical therapy in combination with stabilization exercises. Patients were evaluated based on the dose of indicated paracetamol, NDI results, Beck Depression Scale, and range of motion in the frontal plane. Patients were evaluated after 1, 3, 6, and 12 months. All groups showed improvement in health status for a period of six months (36). Based on these findings, we can conclude that the success of therapy, by applying autoreflex prenatal and postnatal therapeutic positions in combination with manual treatment, was similar to that of all other groups. Our patients were evaluated only after 6 weeks, and we cannot compare further results. These results confirm the application of physical therapy as a supportive therapy for cervical spine pain.

Another option for supportive treatment is cupping and kinesiotape. Lauche et. al. studied the effect of cupping, specifically one application, on pain and disability. Based on their results, they concluded that cupping is an effective option for supportive therapy (2). Ay et. al. studied the effect of kinesiotape on range of motion, pain, and disability. They applied therapy in the form of kinesiotape and kinesiotherapy in the home environment to patients. Patients showed improvement in all parameters except rotation, lateroflexion, and disability. The results show that kinesiotaping can be used as a supportive form of therapy (26).

Jandvahen et. al. conducted a study on a sample of 72 patients with cervical spine pain. They examined the differences in the effectiveness of therapy when applying scapular exercises and scapular exercises in combination with functional cognitive therapy. The patients' condition was evaluated after 6 weeks. Patients assessed their condition on a visual analog scale of pain and secondary kinesiophobia and muscle activity. The group of patients who underwent combined therapy showed greater pain reduction and improvement in kinesiophobia and muscle activity (37). Therapy in the form of scapular training shows similarities with the principles of autoreflex prenatal and postnatal positions. Since there is activation of muscle chains in the scapula area and its subsequent stabilization. If we want to compare the results with our research, we will encounter the problem of different evaluation methods. We can state that in both cases there was an improvement in health status.

Khan et. al. compared the effect of isometric exercises in comparison with therapy focused on active movements and active range of motion. Both groups consisted of 34 patients. Both groups showed an improvement in the values of the visual analogue scale of pain and the Nortwick Park Neck Pain Questionnaire. However, the groups focusing on isometric exercises showed a more significant improvement in these values (38). The concept of autoreflex prenatal and postnatal therapeutic positions is largely based on long-term isometric contraction in specific positions, which aim to induce a spontaneous autoreflex response of the organism. We can therefore assume that the isometric contraction component will be beneficial in the therapy of non-specific cervical spine pain.

Another therapy option is neuromuscular control exercise. The effectiveness of this method was compared with two other groups. 44 patients were divided into three groups according to the type of therapy. Group 1 applied neuromuscular control exercises, group 2 applied stretching, and group 3

applied stabilization exercises. Pain level, range of motion, and proprioception level were measured before and after the end of therapy. Group 1 showed the greatest improvement in perceived pain when measuring proprioception. The increase in range of motion was the same in all groups (39). The concept of autoreflexive prenatal and postnatal positions has the described effect of improving proprioception and control of the segments that are therapeutically affected in therapy. The results of the above study indicate a positive impact of these elements on the therapy of patients with cervical spine pain. Tunwattanapong et. al. (25) compared the effectiveness of specific stretching of the cervical spine and a control group. Ninety-six patients with cervical spine pain participated in this research. All participants received information brochures that focused on the principles of ergonomic positions in the work environment. The therapeutic group was instructed and educated on performing stretching in the home environment. The patients were to perform this stretching twice a day, five days a week, for four weeks. The group that performed stretching showed significantly greater improvement in the dimensions of pain and quality of life. Compared with patients who exercised <3 times a week, those who exercised ≥3 times a week brought a significantly greater improvement in cervical spine function and quality of life scores.

Limitations of the Study

The biggest limitation of this research was the size of the observed sample and the length of the observation itself. Also, a control group and random selection of patients are absent.

Conclusion:

The aim of this work was to evaluate the effect of the application of autoreflex prenatal and postnatal therapeutic positions in patients with non-specific cervical spine pain.

We investigated the impact on the overall condition of patients before and after the end of therapy, as well as the correlation between the results of therapy and the gender or age of our patient sample. After statistical evaluation of the results, we can conclude that the overall condition of patients improved. We were unable to prove a significant correlation between the age, gender, or duration of therapy of patients and their resulting improvement in health status.

Based on these results, we can conclude that patients who underwent physiotherapy showed a significant improvement in their health status based on their own assessment.

Suggestions for further research

Implementation of a control group and random selection to increase the reliability of the evaluated data. Further detailed research is needed to determine the impact on the active range of motion, the influence of muscle strength, proprioception, the occurrence of psychological factors, and other factors. It would also be appropriate to focus on the long-term effect of therapy in the future, as well as differentiate between individual stages of non-specific cervical spine pain.

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ORIGINAL ARTICLE CPSPHI 2026; 17(1): 110–116

Prevention of Surgical Site Infection – Nurse Interventions

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Summary

Background: The aim of this study is to analyse nursing interventions in preventing infection in surgical wounds and to determine whether the nurses' education level influences adherence to infection prevention criteria in surgical wound care within the established patient safety culture.

Sample and Methods: We used a questionnaire developed by authors Saad Tarabichi and Javad Parvizi – SSI prevention practice items. We analysed responses from 110 nurses working in inpatient surgical departments of university and teaching hospitals in Slovakia.

Results: We found that the level of education of nurses influences adherence to proper handwashing technique, p = .000, influences the use of protective masks during surgical wound care, p = 0.027, but has no impact on monitoring and assessing surgical wounds, p = 0.67. Completing specialized studies does not influence adherence to aseptic procedures during surgical wound dressing changes, p = 0.73.

Conclusion: We recommend that nurses follow the criteria of nursing standards and guidelines for preventing SSI (Surgical Site Infection).

Keywords Infection, Surgical wound, Prevention, Nurses, Questionnaire SSI prevention practice items

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Reviewers

Dr. Daniel J. West, Jr.

Cite as

Clinical Psychological and Social Practice in Health Intervention. 2026; 17(1): 110–116. https://doi.org/10.22359/cswhi_17_1_13

Cited references: 29
Publisher: International Society of Applied Preventive Medicine i-gap

Introduction

The European Wound Management Association (EWMA 2002) recommends the assessment and evaluation of the wound, ensuring adequate moisture, and supporting epithelialization as the basic principle of the Anglo-Saxon concept under the acronym TIME (Schultz, Barillo, Mozingo, Chin 2024). T – Tissues, non-viable tissue – this refers to the removal of devitalized tissue – debridement. Chronic wounds require repeated debridement, unlike acute surgical wounds, which do not. I – Inflammation, suppression of inflammation and infection. In some cases, it is necessary to open the wound, perform surgical debridement, and ensure the proper drainage of wound exudate with appropriate drainage selection (Bukovčan, 2019) M – Moisture, moisture balance – every wound contains exudate, which can aid in wound healing by preventing desiccation of the wound bed, promoting cell regeneration, and providing nutrients (Holloway, Pokorná, Probst 2024). An optimal moist environment is recommended for wound healing; excessive fluid can lead to maceration of the wound edges and surrounding skin. E – Epithelialization, epithelialization – evaluating the wound edges is the final step in the wound healing process according to the TIME procedures. The goal is a healthy wound edge and the formation of clean granulation tissue at the wound base. Epithelialization begins at the edges of the wound, and epithelial islands form within the wound. The wound is strengthened by collagen fibers, and the scar gradually transforms into healthy pink tissue (Schultz, Barillo, Mozingo, Chin 2024). The goal of the TIME concept is to reduce

swelling, decrease exudate production, and lower bacterial load. Despite the recommendation for TIME for chronic wounds, it can be adapted for the treatment of acute surgical wounds, reducing treatment costs and duration. Ulrych (2020) mentions that one of the causes of infection in surgical wounds is nosocomial infections. Infections can lead to wound dehiscence and even necrosis (Brabcová 2021).

Nursing Interventions in Preventing Infection in Surgical Wounds

The culture of patient safety in the domain of "prevention of nosocomial infections" includes effective handwashing techniques, adherence to aseptic procedures, and the safe disposal of biologically contaminated materials. The nursing management of a patient in preventing infection in a surgical wound includes interventions such as wound assessment, critical evaluation of the wound, analysis of appropriate wound dressing, application of barrier nursing care principles, and ensuring the patient receives nutritional support. Wounds healing "per primam" are indicated for dry dressings using traditional dressing materials. If the wound is without secretion, it is appropriate to use special self-adhesive non-adherent dressings. To increase comfort and protect the wound, ointment compresses, or non-adherent meshes can be used, which help maintain flexible wound edges. These compresses are made of mesh netting and ointments and can be without any active ingredients. A second group includes compresses enriched with additional antimicrobial agents such as iodine-povidone or silver. They are applied directly to the wound and covered with sterile secondary dressings. The advantage is minimal trauma to the wound. Hydrogel dressings are suitable for poorly to moderately exuding wounds. Hydrocolloids are recommended for wounds in the granulation and epithelialization phases without signs of infection and support healing in an oxygen-free environment (Ren at al. 2024). Part of the wound treatment protocol includes the wound assessment: location, size, depth, shape and direction, secretion, and amount of exudate, wound characteristics, surrounding skin and edges, phase of healing, presence of drains and sutures, performed dressing changes, current wound condition, materials used, medications, and individual risk factors for the patient (Brabcová, 2021). Postoperative septic complications hinder and prolong the treatment process, particularly in elderly patients, and significantly increase its cost (Pobrotyn, 2020). Moreover, these complications negatively impact patients' functional status and independence (Wróblewska, 2018). Unfortunately, unlike many other infection-related health problems, postoperative infections cannot be effectively prevented through vaccination (Paplicki, 2020). Consequently, a traditional approach remains necessary, focusing on interrupting pathogen transmission pathways. Both education and fear of causing or experiencing an infection and its consequences can substantially influence the effectiveness of these preventive measures (Sus2ɔ, 2022). The susceptibility of surgical sites to infections results from a complex interplay of seemingly unrelated factors, as is often the case in various fields of medicine (Waszczuk, 2008). Patients are also informed about the risks associated with surgical site infections (Drobnik, 2017), which is a crucial component not only of infection prevention but also of obtaining informed consent for surgical procedures (Trnka, 2017), especially for high-risk major surgeries (Sus2ɔ, 2008). The COVID-19 pandemic has significantly altered hygiene habits among both hospital patients and healthcare personnel (Drobnik, 2021) to an extent unparalleled by other factors, including other epidemic infectious diseases such as influenza (Sus2ɔ, 2021). Infection control, including the prevention of surgical site infections, has evolved into a systemic approach in recent decades and is legally supported by state regulations aimed at fulfilling the government's role in ensuring public health security (Paplicki, 2018). New information technology solutions are being implemented (Sus2ɔ, 2017) to facilitate infection monitoring (Sus2ɔ, 2008), document preventive measures (Sus2ɔ, 2009), and enhance communication between healthcare providers responsible for postoperative wound care, particularly between hospitals and primary healthcare facilities (Trnka, 2010).

File and Methods

The risk of infection in a surgical wound is one of the most common postoperative complications. We analyzed the interventions of nurses in the prevention of surgical wound infections. We

focused on dependent variables such as adherence to hand washing techniques, use of sterile gloves, monitoring and assessment of the surgical wound, adherence to aseptic procedures during the dressing of the surgical wound, and the use of face masks during the treatment of the surgical wound. For the purpose of the thesis, with the authors' consent, Saad Tarabichi and Javad Parvizi, we used a sample questionnaire – Questionnaire SSI prevention practice items from the article Prevention of Surgical Site Infection: A Ten-Step Approach, focused on nursing practices and procedures that ensure the prevention of infection in wounds. The demographic part of the questionnaire tracks three independent variables: education, length of practice in the surgical department, and completion of specialized study. Each question was assessed on a Likert scale, offering four response options with the following score weights: never (0), rather not (1), rather yes (2), always (3). The questionnaire was anonymous, voluntary, and ethical principles of scientific research were followed.

The selection criteria for respondents included: active nursing practice in a three-shift system in a surgical department. Age, gender, and length of practice with no limitations, as well as willingness to cooperate by answering all the questionnaire's questions. In 2024, we approached 150 nurses via stratified sampling from university and faculty hospitals in Slovakia. We received 126 responses, of which 16 were excluded due to incomplete answers. We analysed 73.33% of the responses from the nurses approached. The data from the nurses' responses were analysed using the Shapiro-Wilk normality test – Royston Test. The null hypothesis that the data come from a normal distribution was rejected, indicating that the sample data have a non-normal distribution. To evaluate the relationship between two observed variables, we chose the non-parametric Chi-square test. The null hypothesis (H0) was set up with the assumption that there is no difference between the expected and theoretical results. Tests were evaluated at the significance level $\alpha = 5\%$. We used the Microsoft Excel software function CHISQ.TEST to calculate the p-value. The criterion for evaluating the data analysis was the statement: if the p-value is $< \alpha$, then we reject H0, and the differences between the expected and observed frequencies are statistically significant.

Characteristics of the Sample

The sample consisted of 57% nurses with a university degree and approximately 33% with a completed high school diploma. 45% of the total respondents had completed specialized studies, 13% were currently studying, and as many as 43% of the nurses had not started or completed specialized studies.

Table 1 Descriptive Characteristics of the Nurse Sample

Descriptive Category	Length of Practice
Average	**12,8 years**
Minimum	1 year
Maximum	45 years
Mode	3 years
Median	10 years
Variance	102,78
Standard deviation	10,14

Results

We analysed the patient safety culture through the indicator: the application of independent competencies by Slovak nurses in preventing infection during the dressing of a surgical wound. We based our approach on the EBN principle (evidence-based nursing) and specifically on the SSI Guidelines and clinical standardized procedures valid in Slovakia. Procedurally, we focused on the risk analysis of wound infection development, influenced by factors before the surgery, and during and after the dressing of the surgical wound. We evaluated the nurses' responses and calculated a risk score for the nursing interventions. The variation range of the achieved score can range from a minimum of 0 (indicating risks to patient safety culture in the evaluated area) to a score of 300 (indicating the strengths of the patient safety culture).

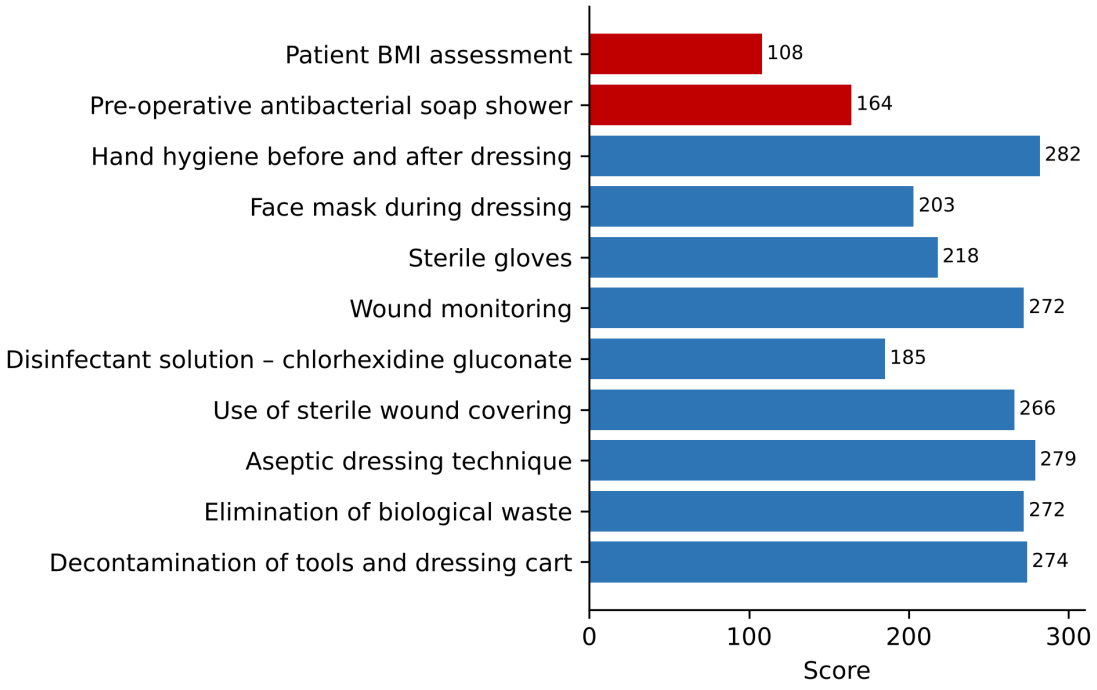
The lowest score of 108 was achieved for the item "assessment of the patient's BMI," meaning nurses perform it only sporadically. The priority intervention for infection prevention in surgical wounds identified by the nurses was the intervention "hand hygiene and disinfection by the nurse before and after dressing change," with a score of 282. The nurses identified the strong points of patient safety culture as the interventions

"aseptic technique for wound dressing," with a score of 279, and "decontamination of equipment and dressing trolley," with a score of 274.

Table 2 Nursing Interventions in the Prevention of Surgical Wound Infection

Category / Score	Never (0)	Rather No (1)	Rather Yes (2)	Always (3)	Score
Preoperative Preparation					
Patient BMI assessment ↓	28%	45%	18%	9%	108
Pre – operative antibacterial soap shower	16%	30%	28%	26%	164
Pre-dressing Preparation					
Hand hygiene before and after dressing ↑	-	-	18%	82%	282
Face mask during dressing	3%	26%	36%	35%	203
Dressing Process					
Sterile gloves	4%	20%	30%	46%	218
Wound monitoring	-	2%	24%	74%	272
Disinfectant solution for the wound – chlorhexidine gluconate	9%	22%	44%	25%	185
Use of sterile wound covering	1%	2%	27%	70%	266
Aseptic dressing technique	-	-	21%	79%	279
Post-dressing Procedures					
Elimination of biological waste	-	2%	24%	74%	272
Decontamination of tools and dressing cart	-	1%	24%	75%	274

Graph 1 Nurses' intervention scores in preventing infection in surgical wounds



Nurses' responses in the categories "never" and "rather not" signal a risk and weak points in the established safety culture system. Nurses who do not implement these interventions put the patient at risk of infection. The dominance of responses in the categories "rather yes" and "always" indicates

that nurses consider interventions for preventing infection in surgical wounds during nursing care to be significant and have become a routine part of their work. The resulting scores of the assessed categories, which are dominant in positive evaluative statements, confirm the application of the EBN principle, specifically the Guidelines for SSI and clinical standardized procedures in practice.

The nurses' responses to the analysed variables were compared with independent variables using the Chi-square test. We found that the nurses' level of education influences adherence to proper handwashing technique, $p = 0.000 < \alpha = 0.05$, which confirms the validity of the statement for the sample, but it has no effect on the monitoring and assessment of the surgical wound, $p = 0.67$. The deviations between the measured and theoretical values resulted from chance, indicating no dependency between the two monitored indicators. Completion of specialized studies has no effect on adherence to aseptic procedures during surgical wound dressing, $p = 0.73$. We confirmed in the surveyed sample of surgical nurses that the highest level of education influences the use of protective face masks during surgical wound care, $p = 0.027 < \alpha = 0.05$.

Discussion

Infection prevention in surgical wounds (SSI) is an independent competency of nurses, even in Slovakia. The issue we addressed was analysed within the nursing practice of university and teaching hospitals. From the SSI Guidelines, we analysed selected preventive interventions by nurses based on the results of the project in terms of ensuring the process, structure, and outcome criteria of clinical standardized procedures valid in Slovakia.

In our project, we found that the least frequently performed intervention, with a score of 108, was the "assessment of the patient's BMI." We found that the most frequently performed intervention, with a score of 282, was the "nurse hand hygiene and disinfection before and after dressing."

In the next part of the survey, we focused on the impact of education on adherence to proper hand hygiene techniques and the assessment of surgical wounds. We found that the nurses' level of education influences adherence to proper handwashing technique, $p = 0.000 < \alpha = 0.05$, but education has no effect on the assessment of surgical wounds, $p = 0.67$. The study focused on hand hygiene technique show that the major barriers for not practicing the appropriate technique of wound dressing are time-consuming procedure, heavy workload, lack of adequate staff to assist in dressing procedure and lack of sufficient supplies (Sijimol 2021).

The use of face masks by the team during dressing wound should be mandatory to prevent infection. Marsons (2021) recommends the use of face masks by all staff during surgical procedures to protect both the patient and the staff. There are two reasons for staff to wear surgical masks: firstly, to protect surgical sites from microorganisms transferred from the faces and respiratory tract of scrubbed staff and, secondly, to protect health care professionals from sprays and splashes of patients' blood and body fluids during surgery. SSI contribute to the increase in the burden of both patients and health care systems by increasing the length of hospitalisation, the cost of care, mortality and morbidity. Since surgical masks were introduced as a preventive practice for SSI, over a hundred years ago, they have been used to provide a physical barrier between the mouth and nose of health care personnel and surgical wounds of patients (Ogo N, Foran P 2020). In our study, we focused on the relationship between wearing a face mask during wound dressing and the nurses' level of education. We confirmed in the surveyed sample of surgical nurses that the highest level of education influences the use of protective face masks during surgical wound care, $p = 0.027 < \alpha = 0.05$.

A very important intervention is knowing how to properly assess a surgical wound. There are tools to describe SSI using objective criteria. These include the ASEPSIS (Additional treatment, the presence of Serous discharge, Erythema, Purulent exudate, and Separation of the deep tissues, the Isolation of bacteria, and the duration of inpatient Stay) scoring system, which was created to assess wounds Campwala (2019).

Obesity is considered a risk factor for surgical site infection (SSI). In our study, nurses assigned the lowest score in the preoperative preparation category – 108, among the categories observed. Several studies examining the impact of body mass index (BMI) on the risk of SSI have demonstrated a

trend of increasing SSI risk with higher BMI. This increase is most notable in surgeries involving "clean wounds," with the relative risk of SSI for morbidly obese patients being up to 7 times higher than for patients with a normal BMI (Meijs et al., 2019). Further analyses also showed that BMI was significantly positively associated with a higher risk of SSI. Risk estimates indicated that an increase of 5 BMI units was associated with a 13% increased risk of SSI (Abdelaziz, 2021). The preoperative shower with antibacterial soap was another category monitored in preoperative preparation. Our respondents achieved the second-lowest score in this item – 164. This simple intervention, which is within the nurse's responsibility, can significantly reduce the risk of SSI. A preoperative bath with 4% CHG is effective in preventing SSI because 4% CHG is bactericidal, bacteriostatic, and remains on the skin for a long time, reducing bacterial colonies by nine times and increasing the skin's ability to act antiseptically for a longer period (Prayugo et al. 2022).

A very significant competency of nurses is the dressing of surgical wounds. Preparation for the dressing, the dressing itself, and the processes following the dressing significantly influence SSI. As many as 66% of our respondents reported using a chlorhexidine solution in alcohol. Its effectiveness has been confirmed by several studies. In adult patients undergoing surgery of any wound classification, skin preparation using 2.0-2.5% chlorhexidine in alcohol is the most effective method for preventing SSI (Jalalzadeh et al. 2024).

Conclusion

Nurses play a pivotal role in preventing SSIs. Their responsibility includes implementing evidence-based practices, adhering to infection control guidelines, and maintaining a high standard of care to minimize infection risks by applying infection control practices, assessing patient risks, and educating both patients and staff. Adherence to evidence-based guidelines and standardized procedures in clinical practice is essential to ensure the highest level of care and reduce the incidence of SSI.

Study Limits

The study's limitations include the purposive selection of respondents restricted to nurses from university hospitals, the smaller sample size, and the fact that nurses were contacted electronically. Based on the above, our results are valid for the sample and can be considered pilot. For analysis prevention of surgical site infection, we suggest increasing the sample, and futher analyzing solved problem.

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JOURNAL INFORMATION

ISSN 2076-9741 (online)
ISSN 2222-386X (print)
Journal DOI 10.22359/cswhi
Issue DOI 10.22359/cswhi_17_1

Open access · no publication fees
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Published exclusively in English

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