

Z D R A V S T V E N O V A R S T V O

ZDR VARST 2025 • LETNIK 64 • ŠTEVILKA 1

UVODNIK

Jerneja FARKAŠ LAINŠČAK, Igor ŠVAB

REVIJA ZDRAVSTVENO VARSTVO: POTOVANJE DO SEDAJ IN POT NAPREJ (1-4)

IZVIRNI ZNANSTVENI ČLANKI

Brigita SKELA-SAVIČ, Mateja BAHUN, Sedina KALENDER SMAJLOVIČ, Sanela PIVAČ

IZKUŠNJE PACIENTOV Z ZDRAVSTVENO OSKRBO NA INTERNISTIČNIH IN KIRURŠKIH
ODDELKIH SLOVENSKEH BOLNIŠNIC – PRESEČNA RAZISKAVA (5-13)

Katja JARM, Eva ŠAJN, Enej HADŽIČ, Gregor JURAK, Mateja KRAJC, Urška IVANUŠ, Jasna BUT-HADŽIČ
OZAVEŠČENOST SLOVENSKEH MLADOSTNIKOV O NEVARNOSTNIH DEJAVNIKIH RAKA (14-23)

Mateja BAHUN, Bojana LOBE, Brigita SKELA-SAVIČ

UČINEK ZNAČILNOSTI DELOVNIH MEST MEDICINSKIH SESTER NA NEIZVEDENO ZDRAVSTVENO
NEGO NA INTERNISTIČNIH IN KIRURŠKIH ODDELKIH V IZBRANIH SLOVENSKEH BOLNIŠNICAH –
PRESEČNA RAZISKAVA (24-31)

Ines DUJC, Boštjan ŽVANUT, Igor KARNJUŠ

STALIŠČA JAVNOSTI DO PRISOTNOSTI DRUŽINSKIH ČLANOV MED OŽIVLJANJEM:
SLOVENSKA PRESEČNA RAZISKAVA (32-39)

Tanja CARLI, Igor LOCATELLI, Mitja KOŠNIK, Danilo BEVK, Andreja KUKEC

EPIDEMIOLOGIJA IN ANALIZA DEJAVNIKOV TVEGANJA ZA SISTEMSKO ALERGIJSKO
REAKCIJO PO PIKU ČEBELE V SLOVENSKE POPULACIJI ČEBELARJEV (40-48)

*Erika ZELKO, Thomas PEINBAUER, Lisa VOGGENBERGER, Fabian BEKELAER,
Julia PANTOGLOU, Denise STÜBL, Erwin REBHANDL*

ANALIZA DEJAVNOSTI SPLOŠNIH ZDRAVNIKOV V ZGORNJI AVSTRIJI: PILOTNA
RETROSPEKTIVNA OPAZOVALNA ŠTUDIJA V TRIDESETIH AMBULANTAH (49-58)

Maja MIKŠA PODOBNIK, Nejc ŠARABON, Marjan BILBAN, Vedran HADŽIČ

DEJAVNIKI BOLEČIN V SPODNJEM DELU HRBTA PRI ŠTUDENTIH
PROGRAMOV ŠPORTNIH SMERI – PROSPEKTIVNA ŠTUDIJA (59-67)

nacionalni inštitut za javno zdravje
national institute of public health

Trubarjeva 2, si-1000 Ljubljana

Zdravstveno varstvo

ISSN 0351-0026

IF(2023)=1.6

Izdajatelj/Publisher:

Nacionalni inštitut za javno zdravje
generalni direktor: Branko Gabrovec

Odgovorna urednica/Editor in Chief:

Jerneja Farkaš Lainščak

Izvršna urednica/Executive Editor:

Saša Zupanič

Uredniški odbor/Editorial Board:

Tit Albreht (Slovenija), Marjan Bilban (Slovenija), Ivan Eržen (Slovenija), Mitja Kos (Slovenija), Alenka Kraigher (Slovenija), Sara Atanasova (Slovenija), Ada Hočevar Grom (Slovenija), Mojca Gabrijelčič Blenkuš (Slovenija), Rado Pišot (Slovenija), Darja Barlič Maganja (Slovenija), Tanja Kamin (Slovenija), Lijana Zaletel-Kragelj (Slovenija), Valentina Prevolnik Rupel (Slovenija), Brigita Skela Savič (Slovenija), Ksenija Renner Sitar (Slovenija), Genc Burazeri (Nizozemska, Albanija), Niek Klazinga (Nizozemska), Jan de Maeseneer (Belgija), Jadranka Božikov (Hrvaška), Birgit Babitsch (Nemčija), Reinhard Burger (Nemčija), Björn Hibell (Švedska), David M. Salisbury (Velika Britanija), Debbie Tolson (Velika Britanija), John E. Morley (ZDA), Josep Figueras (Belgija), Lynne Friedli (Velika Britanija), Eva Kralikova (Češka), Douglas Crews (ZDA)

Lektoriranje slovenščine/Proofreading for Slovenian:

Mihaela Törnar

Lektoriranje angleščine/Proofreading for English:

AMIDAS d.o.o., Ljubljana

Prevajanje angleščine/English translation

AMIDAS d.o.o., Ljubljana

Naslov uredništva/Address of the Editorial Office:

Zdravstveno varstvo - Slovenian Journal of Public Health, Trubarjeva 2, 1000 Ljubljana, p.p. 260

Elektronski naslov uredništva/E-mail Address:

Zdrav.Var@nijz.si

Domača stran na internetu/Internet Home Page:

<https://nijz.si/objave/revije/revija-zdravstveno-varstvo/>
in
<https://sciendo.com/journal/SJPH>

Transakcijski račun/Current Account:

011006000043188, UJP

Zdravstveno varstvo izhaja praviloma štirikrat letno v nakladi 250 izvodov. Naročnino zaračunavamo z računom za predplačilo v začetku leta. Upoštevamo le pisne odpovedi do 1. decembra za naslednje leto. Vsako spremembo naslova sporočite naročniški službi pravočasno.

Revija Zdravstveno varstvo je pri Ministrstvu za kulturo RS vpisana v razvid medijev pod zaporedno številko 608.

Izid revije je finančno podprla ARRS iz sredstev državnega proračuna iz naslova razpisa za sofinanciranje domačih znanstvenih periodičnih publikacij.

Letna naročnina/Year subscription rate: 52,50 EUR (z vključenim 5 % DDV/including 5% VAT).

Naročniška služba: zdrav.var@nijz.si

Gradivo navaja predvsem poglede avtorjev, za katere ni nujno, da se ujemajo z načelnimi stališči stroke oziroma uredniškega odbora.

Naklada: 220

Likovna oprema ovitka: Jurij Kocbek

Grafično oblikovanje in prelom: Urška Stariha

Tisk: Tisk Žnidarič d.o.o., Laze 7, 4000 Kranj

SLOVENIAN JOURNAL OF PUBLIC HEALTH: THE JOURNEY SO FAR AND THE ROAD AHEAD

REVIJA ZDRAVSTVENO VARSTVO: POTOVANJE DO SEDAJ IN POT NAPREJ

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Received: Sep 19, 2024

Accepted: Oct 01, 2024

Invited editorial

ABSTRACT

Keywords:

International
scientific journals
Scientific publishing
Public health
Editorial teams

The Slovenian Journal of Public Health, established 63 years ago as the official publication of the National Institute of Public Health in Slovenia, was initially aimed at tracking the development of public health in Slovenia and disseminating scientific advancements to professionals in the field. In 2000, a new editorial board took over and shifted the journal's focus towards enhancing scientific rigour and achieving international recognition. This strategic transformation led to the journal being indexed in the Social Sciences Citation Index (SSCI) in 2009, specifically within the category of Public, Environmental & Occupational Health. The indexing enabled the journal to acquire its first impact factor in 2011, which has demonstrated a consistent upward trajectory, currently standing at 1.6 (IF2023). The journal has recently ascended to the third quartile of its field and is now recognised as the second highest-ranked medical journal in Slovenia. Following over two decades of successful leadership, the journal is poised to enter a new phase under an incoming editor-in-chief. It is imperative for the journal to sustain its contributions to public health by promoting high-quality scientific publications and facilitating critical discourse among researchers.

IZVLEČEK

Ključne besede:

mednarodne
znanstvene revije
znanstveno
publiciranje
javno zdravje
uredništva

Revija Zdravstveno Varstvo, ustanovljena pred 63 leti kot uradna publikacija Nacionalnega inštituta za javno zdravje, je bila prvotno namenjena spremljanju razvoja javnega zdravja v Sloveniji in širjenju znanstvenih dosežkov strokovnjakov na tem področju. Leta 2000 je novi uredniški odbor prevzel vodenje in usmeril revijo v smeri krepitve znanstvene odličnosti in doseganja mednarodne prepoznavnosti. Ta strateška preobrazba je vodila do tega, da je bila revija leta 2009 indeksirana v Social Sciences Citation Index (SSCI), natančneje v kategoriji Javno, okoljsko in poklicno zdravje. Indeksiranje je leta 2011 reviji omogočilo pridobitev prvega faktorja vpliva, ki je od takrat kazal dosleden trend naraščanja in trenutno znaša 1,6 (IF2023). Revija se je pred kratkim uvrstila v tretji kvartil na svojem področju in je zdaj druga najvišje uvrščena medicinska revija v Sloveniji. Po več kot dveh desetletjih uspešnega vodenja bo revija pod vodstvom prihajajoče odgovorne urednice vstopila v novo poglavje. Nujno je, da revija ohrani svoj prispevek k javnemu zdravju s spodbujanjem visokokakovostnih znanstvenih objav in omogočanjem kritičnega diskurza med raziskovalci.

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1 INTRODUCTION

“πάντα χωρεῖ καὶ οὐδὲν μένει.” Ἡράκλειτος (in Greek)
“Everything changes and nothing stands still.”

Heraclitus (535 BC-475 BC)

They say that change is the only constant in life and that everything comes to an end. The end is, in fact, an opportunity to take a hilltop view of the road travelled, analyse the rainbow of encounters and experiences, and pass on wisdom to those who will follow.

2 THE JOURNEY SO FAR

The Slovenian Journal of Public Health was established 63 years ago as the official journal of the National Institute of Public Health, Slovenia. Its initial objective was to monitor the evolution of public health in Slovenia and disseminate scientific achievements to professionals in the field. This focus persisted for approximately four decades, during which the journal did not pursue international recognition or attain a significant professional reputation. In 2000, a new editorial board assumed leadership and redirected the journal's trajectory towards enhancing scientific rigour and achieving international recognition. Over the two decades that followed, the editorial team undertook several strategic and sometimes challenging changes, including reducing the number of annual issues from ten to four (approximately 35 articles per year) and transitioning to an English-only publication format, with abstracts provided in both English and Slovenian. These transformative efforts culminated in 2009 when the journal was indexed in the Social Sciences Citation Index (SSCI) under the category of Public, Environmental & Occupational Health (1). This indexing facilitated the acquisition of an impact factor, which was first achieved in 2011. Since then, the impact factor has shown a consistent upward trend, reaching a current value of 1.6 (IF2023). The journal has recently entered the third quartile within its field and is now recognised as the second highest-ranked medical journal in Slovenia.

In addition to achieving scientific excellence, the Slovenian Journal of Public Health expanded its readership on a global scale through its indexation in prominent citation databases, namely Web of Science and Scopus. Furthermore, by indexing in the PubMed database, articles published in the journal became openly accessible also via the PubMed Central Repository, and not only the De Gruyter/Sciendopublisher.

In 2010, the editorial board initiated the development of a web edition of the journal (2), facilitated by De Gruyter, an independent academic publisher renowned for its extensive coverage across various disciplines. The implementation of the Editorial Manager system began in 2011, with enhancements introduced in 2023.

These strategic initiatives have enabled the journal to establish a global presence, resulting in submissions from authors worldwide. Consequently, numerous significant contributions have been published over the years that garnered international attention and were cited in esteemed journals such as *Nutrients*, *PLoS One*, *Journal of Clinical Medicine*, *Sustainability*, *Current Psychology*, *Frontiers in Public Health*, *Scientific Reports*, *Vaccines* and *BMC Public Health*, among others.

3 THE CURRENT OUTLOOK

The December 2024 issue will mark the conclusion of the tenure of the current editor-in-chief. After more than two decades, the journal will enter a new chapter under the guidance of Assist. Prof. Dr. Jerneja Farkaš Lainščak, who will assume the role of incoming editor-in-chief. Prof. Lainščak possesses extensive expertise in public health, with particular strengths in clinical epidemiology and the prevention of noncommunicable diseases. She has demonstrated a unique capacity to integrate diverse medical disciplines that may initially appear unrelated but can collectively contribute to significant research and clinical outcomes (3).

The journal boasts a rich legacy, built upon the knowledge, skills and dedicated voluntary efforts of its editorial board, section editors and notably Mrs. Saša Zupanič, the executive editor. However, the true asset of the journal lies in its reviewers. The commitment of these reviewers to uphold rigorous standards has been instrumental in developing the journal's reputation. This dedication has resulted in a rejection rate of approximately 80%, which, while not favourable among authors, is essential for maintaining the journal's success in today's competitive academic environment. This rigorous review process has streamlined subsequent editorial activities and significantly enhanced the journal's international standing.

4 THE ROAD AHEAD

Moving forward, the journal will adhere to established guidelines for article selection, with a continued emphasis on quality scientific publishing as a fundamental priority. The journal aims to sustain and enhance its role in showcasing significant advancements within the broad field of public health in Slovenia, as well as across Central and South East Europe.

Authors have expressed appreciation for the prompt responses from editors; even negative decisions are communicated swiftly, contributing to a trademark of efficiency. Although sometimes contentious (4, 5), the impact factor remains a critical metric for ranking journals

and assessing scientific performance; thus, efforts will be made to achieve higher impact factor values in the coming years. Refreshing the editorial board and expanding the network of reviewers will be vital components of future development, particularly in addressing emerging public health issues arising from an aging population that have not been sufficiently emphasised to date. To remain relevant in an increasingly visual and digital world, a graphic redesign is needed alongside an enhanced presence on social media platforms. Incorporating podcasts that discuss current editorials and feature articles will be integral to scientific communication and will help drive altmetric scores.

Strengthening connections or establishing new networks with editors of related journals—especially those affiliated with national public health institutes internationally—will also be prioritised. The journal will actively engage its community by encouraging participation as reviewers and social media ambassadors. In this, we will specifically focus on generations Y and Z, with those representing generations X and baby boomers serving as mentors and supervisors. This intergenerational collaboration is essential for knowledge transfer and professional development, especially as younger generations are characterised by their digital savviness but may lack experience in peer-reviewing and editorial decision making (6).

Contextually, the journal's ambition to transition from descriptive research to interventions at the whole population level aligns with broader trends in scientific publishing that emphasise the necessity for community-oriented research that not only describes health issues but also proposes actionable interventions. The focus on public health interventions therefore reflects an understanding that research must have tangible benefits for society, which is increasingly recognised as a critical aspect of impactful research (7). Across the board, all the measures demonstrate the international aspirations of the journal, which nowadays is not only feasible and possible but necessary in the scientific publishing arena.

5 CONCLUSIONS

The Slovenian Journal of Public Health has evolved over time to achieve significant scientific and international recognition. Joining this new editorial team presents both a privilege and a challenge, underscoring the importance of upholding previously established standards while maintaining journal autonomy. The transition period is expected to ensure continuity in scientific excellence. It is crucial for the journal to continue making substantial contributions to innovative public health research aimed at improving sustainable health outcomes for populations.

Our objective remains steadfast: to enhance public health by promoting the publication of high-quality scientific articles in this domain and fostering critical exchanges of ideas.

ACKNOWLEDGEMENT

The authors would like to thank Mrs. Saša Zupanič, executive editor, for her help and suggestions in the preparation of the manuscript.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

Not applicable.

ETHICAL APPROVAL

Not applicable.

AVAILABILITY OF DATA AND MATERIALS

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

LLM STATEMENT

During the preparation of this work the authors used the large language model Perplexity.ai in order to linguistically improve the manuscript. After using this tool/service, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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PATIENTS' EXPERIENCE WITH RECEIVED HEALTHCARE IN INTERNAL MEDICINE AND SURGERY WARDS OF SLOVENIAN HOSPITALS— A CROSS-SECTIONAL SURVEY

IZKUŠNJE PACIENTOV Z ZDRAVSTVENO OSKRBO NA INTERNISTIČNIH IN KIRURŠKIH ODDELKIH SLOVENSKE BOLNIŠNICE - PRESEČNA RAZISKAVA

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Received: Mar 20, 2024

Accepted: Sep 13, 2024

Original scientific article

ABSTRACT

Keywords:

Patient needs
Satisfaction
Hospital environment
Information
Discharge
Nurses
Doctors
Experiences

Aim: The aim of the study was to explore the experiences of patients with delivered healthcare in selected Slovenian hospitals.

Methods: A cross-sectional study was employed. A total of 1,748 patients participated. A shortened version of the Consumer Assessment of Healthcare Providers and Systems survey was used. Permission to conduct the study was obtained from the Slovenian Medical Ethics Committee. Data were collected between February and March 2020. Univariate, bivariate and multivariate analyses were conducted.

Results: The average hospital rating was 8.86 (SD=1.47; $p < 0.001$) out of 10. The hospital would be definitely recommended to others by 1,290 (75.7%) respondents. The regression model "patients' experience with care" was explained in 18%, mostly by "patients' general health status" (-0.267), "provision of written and oral information about symptoms or health problems post discharge" (-0.200), and "talking to patients about care post discharge" (-0.175). The model "hospital rate" was explained in 30.4% by "patients' experience with care" (0.576), "new medication was explained" (-0.242) and "patient age" (0.132).

Conclusion: The hospital rates are good and mostly explained by patient experience. The results revealed that tasks connected to comprehensive preparation of patients for healthcare treatment including communication, health education and appropriate discharge are only partially fulfilled. Improvements and holistic data capture are needed to make the measurement of patient experience a greater contribution to the improvement and efficiency of hospital care.

IZVLEČEK

Ključne besede:

potrebe pacientov
izkušnje
bolnišnično okolje
informiranje
odpusti
medicinske sestre
zdravniki

Namen: Namen raziskave je bil raziskati izkušnje pacientov z opravljeno zdravstveno oskrbo v izbranih slovenskih bolnišnicah.

Metode: Uporabljena je bila presečna raziskovalna zasnova raziskave. V raziskavi je sodelovalo 1.748 pacientov. Uporabljena je bila skrajšana različica vprašalnika Consumer Assessment of Healthcare Providers and Systems. Dovoljenje za izvedbo raziskave je podala Komisija za medicinsko etiko RS. Večina podatkov je bila zbrana med 10. februarjem in 7. marcem 2020. Opravljene so bile univariatne, bivariatne in multivariatne analize podatkov.

Rezultati: Povprečna ocena bolnišnice je bila 8,86 (SD = 1,47; $p < 0,001$). Bolnišnica bi bila zagotovo priporočena s strani 1.290 (75,7 %) anketirancev. Regresijski model 'Izkušnje pacientov z oskrbo' je mogoče razložiti v 18 % s "pacientovo samooceno zdravja" (-0,267), "pridobivanjem ustnih in pisnih informacij o simptomih in problemih po dopustu" (-0,200) in "pogovorom s pacientom o oskrbi po dopustu" (-0,175). Model 'Razvrščanje bolnišnice' je bil pojasnjen v 30,4 % z "izkušnje pacientov z oskrbo" (0,576), "razlago novo uvedenega zdravila" (-0,242) in "starostjo pacienta" (0,132).

Zaključek: Ocena bolnišnic je spodbudna in jo večinoma pojasnjujejo izkušnje pacientov. Naloge, povezane s celovito pripravo pacientov na zdravstveno obravnavo s komunikacijo in zdravstveno vzgojo ter ustreznim odpustom, so pomanjkljivo opravljene. Izboljšave in celostni zajem podatkov so potrebni, da bo merjenje pacientovih izkušenj imelo večji prispevek k izboljšanju in učinkovitosti bolnišnične oskrbe.

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1 INTRODUCTION

Patient experiences are valuable and reflect how they perceive the care received in the healthcare system; moreover, research on this topic shows a link between patient experience and clinical outcomes (1), and allows researchers, industry professionals and policymakers to identify problems and outline areas for improvement to ensure equity in access and the availability of care services (2). Bull et al. (3) summarize that patient-reported experiences are largely consistent with terms such as “patient satisfaction” and “patient expectation,” both of which are subjective terms that may reflect judgments about the adequacy of healthcare rather than quality.

1.1 Background

Patient experience is an important outcome measure guiding quality improvement in the healthcare setting, while the patient-centred care movement places increasing importance on patient engagement in clinical decision-making (4). Patient experience is positively related to clinical effectiveness and patient safety (5). Patient experience—which refers to a patient’s interaction with the healthcare system—enables quality of care through effective communication, respect, dignity and emotional support (6, 7) and to capture ‘what’ happened during an episode of care and ‘how’ it happened from the patient’s perspective (3). Patient experience includes areas such as communication with staff, access to information, care received, physical and emotional support, shared decision making and consideration of the hospital environment (8). Kim et al. (7) classified patient experience factors into six categories: practice, physical needs, psychological needs, social needs, practical needs and information needs. The key factors according to service users are the functional aspects of the service (professionalism, continuity and comprehensiveness). Adams et al. (9) identified three primary drivers of patient experience: the provision of safe, timely and effective treatment; fostering human connections with caring and attentive staff; and the provision of a comfortable and healing environment. Guan et al. (19) found patient age, gender, level of education, health condition and teaching hospital to be the most frequently mentioned factors. Moreover, communication has been found to be the most significant factor of patient experience (11, 12). Klint et al. (13) found that patients sometimes reported a lack of opportunities to talk and ask questions, while also finding it difficult to formulate questions (13). Friedel et al. (14) found that age and self-perceived health status were significant positive predictors of patient experience or satisfaction in many studies. Degabriel et al. (15) showed that age, environment and route to the hospital are objective factors that can influence patient experience. Damman et al. (16) revealed that age and

education were the most important case-mix adjustment factors for consumer experience. There is evidence that the hospital discharge process is an important part of the patient experience and is closely linked to patient safety issues (17). Park et al. (18) describe how patients’ quality experiences are significantly related to their interactions with staff. Roos et al. (12) point out the importance of staff actively listening, fostering an environment of mutual respect, and supporting patients’ active involvement in their healthcare decisions and plans. Communication skills, empathy and a patient-centred approach by the medical and nursing teams have a great impact on patient experience and satisfaction (15).

Patient experience surveys must elicit comparable responses across heterogeneous populations, including those that vary by education, literacy, access to technology, age, ethnicity and geographic region (19).

In Slovenia, data on patient experience with hospital care is collected once a year by the National Institute of Public Health. The data for 2021 was collected in 22 Slovenian hospitals covering five medical specialties (20). There are no in-depth multivariate analyses of the collected data in hospitals, only descriptive results are available (20), with the exception of the psychometric testing of the instrument for outpatient healthcare (21).

1.2 The aim

The first aim was to describe patients’ experience with care by nurses and doctors, with the received support and their involvement in care, and the hospital environment in the participating Slovenian hospitals. The second aim was to identify variables related to patient experience with care and the hospital rating given by patients.

2 METHODS

2.1 Study design

A cross-sectional explorative research design with a pilot study was employed.

2.2 Sample and settings

All public health service general hospitals in Slovenia that provide general surgical and internal medicine services (N=10) and university clinical centres (N=2) were invited to participate in the study. Eight general hospitals and two university clinical centres participated in the survey (n=10). All adult patients in internal medicine and surgical wards who were able to answer the questionnaire were invited to participate in the research during a 2-week window. The patient population and proportion of the sample was calculated based on the number of patients discharged from the participating wards within 14 days of data collection. A total of 4,958 patients discharged within

the 2-week window were invited to participate; of these, 1,756 returned the questionnaire (35.42%). The number of returned questionnaires varied across hospitals and ranged from 47 to 650, while the response rate ranged from 14.5% to 61.9%.

A total of 1,748 respondents reported their gender; of these, 960 (55%) were men and 788 (45%) were women. The mean age of respondents was 60.11 years (SD=17.66). In terms of educational background, the majority had a secondary school education (n=1012; 58.6%), followed by a primary school education (n=324; 18.8%), a two-year vocational college degree (n=234; 13.6%), a bachelor's degree (n=119; 6.9%), and a master's degree or a PhD (n=37; 2.2%).

2.3 Instrument

The instrument consisted of 27 questions, three of which were demographic questions. This instrument was used in the RN4CAST study (22); it is a slightly shortened version of the Hospital Consumer Assessment of Healthcare Providers and Systems survey (23). The item sets, using the same response scale (1-never, 2-sometimes, 3-usually, 4-always), were 'care from nurses' (4 items), 'care from doctors' (3 items), 'the hospital environment' (2 items), and 'experience with the hospital' (5 items), altogether 14 items ($\alpha=0.804$). The correlation analyses showed a statistically significant positive correlation between all 14 statements, and all statements explained the variance in patients' experience in 46.8% with three factors.

The item set 'experience with this hospital' included three nominal questions (1 yes, 2 no) and the item set 'hospital discharge' included two nominal questions. For the 'hospital rate', a scale ranging from 0 (worst hospital possible) to 10 (best hospital possible) was used. The question on recommendation of the hospital to friends and relatives used a four-point scale (1-definitely not, 2-probably not, 3-probably yes, 4-definitely yes). For a self-assessment of overall health, a five-point scale was used (1-excellent, 2-very good, 3-good, 4-fair, 5-poor).

The RN4CAST study translation methodology developed by Squires et al. (24) was applied. Each question and statement was thoroughly checked for understandability and substantive meaning in Slovenian. The pilot testing of the patient questionnaire involved forward and backward translations checked by a panel of experts for the relevance of each item and acceptability of translation. The pilot study was conducted in December 2019 at one general hospital where 90 patients (32.6%) from internal medicine and surgical wards returned the questionnaire. Cronbach's alpha score was good (n=14; $\alpha=0.825$).

2.4 Ethical approval and data collection

Permission to conduct the study was obtained from the National Medical Ethics Committee (No. 0120-488/2019/6, 7 January 2020). Each hospital had two weeks for data collection. The majority of data was collected between 10 February and 7 March 2020, prior to the first major wave of the COVID-19 pandemic in Slovenia. Due to the pandemic, one hospital collected data between 8 and 20 June 2020. The questionnaires were filled out with pen and paper. Participants received help from the department coordinators if they had problems filling out the questionnaire (e.g. due to visual impairment). Coordinators were not personally involved in the treatment of the patients, to minimize the influence on the results.

2.5 Data analysis

Data was analysed with the statistical software SPSS 22. It was important to receive over 30 responses per hospital so that all participating hospitals could be included in the data processing. When processing the data, we always indicate the number of responses. Basic univariate, bivariate and multivariate analyses were conducted. Content validity indexing calculations were completed using Polit and Beck (25) formulas. Cronbach's alpha and the Principal Component Analyses were used to check the reliabilities and validity of the measured scale. The mean values of the individual content strands were calculated using the derived variables from the linear regression model according to the results of the previous bivariate analysis. Statistical significance was set at the $p<0.05$ level.

3 RESULTS

On average, participants rated their overall health as good in 39.5% (n=683) of cases, as fair or poor in 36.8% (n=635), and as very good or excellent in 23.8% (n=411). The overall average hospital rate on a scale from 0 to 10 was 8.86 (SD=1.47; min=8.09, max=9.17; $p<0.001$). The hospital where the respondents were staying at the time of the survey would definitely be recommended by 1,290 (75.7%) of the respondents, probably recommended by 385 (22.5%), and probably not or definitely not by 31 (1.8%) of the respondents. The mean number of previous hospitalisations was 4.47 (SD=9.39). Self-assessment of the average number of days respondents expected to spend in the hospital was 2.37 (n=1,468; SD=4.268).

On average, 79.3% of respondents stated that they always received adequate 'care from nurses' in relation to the variables measured. For the variable 'care from doctors', this proportion was 80.9%. On average, 66% of respondents rated 'the hospital environment' as always adequate. The average 'support received and patient involvement' score was 70.18%. The lowest score was achieved in explaining

Table 1. Descriptive results for the categorical variables of patient experience (n=14) in percent (%).

	<i>n</i>	Never, sometimes %	Usually %	Always %
Care from nurses				
Items: During this hospital stay,				
how often did nurses treat you with courtesy and respect?	1749	1.5	14.1	84.4
how often did nurses listen carefully to you?	1745	2.8	21.1	76.1
how often did nurses explain things in a way you could understand?	1744	4.2	22.4	73.5
after you called for assistance, how often did you get help as soon as you wanted it?	1652	3.5	13.3	83.2
	<i>n</i>	Never, sometimes %	Usually %	Always %
Care from doctors				
Items: During this hospital stay,				
how often did doctors treat you with courtesy and respect?	1748	1.7	12.0	86.4
how often did doctors listen carefully to you?	1746	3.2	16.4	80.4
how often did doctors explain things in a way you could understand?	1740	4.5	19.4	76.0
	<i>n</i>	Never, sometimes %	Usually %	Always %
Hospital environment				
Items: During this hospital stay,				
how often were your room and bathroom kept clean?	1725	2.4	16.9	80.7
how often was the area around your room quiet at night?	1725	8.8	39.7	51.3
	<i>n</i>	Never, sometimes %	Usually %	Always %
Support received and patient involvement				
Items: During this hospital stay,				
how often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?	784	9.4	10.6	80.1
how often was your pain well controlled?	1282	4.0	29.0	67.0
how often did the hospital staff do everything they could to help you with your pain?	1286	2.0	13.8	84.2
before giving you any new medicine, how often did hospital staff tell you what the medicine was for?	1033	10.0	19.1	71.0
before giving you any new medicine, how often did hospital staff describe possible side effects in a way you could understand?	1012	27.6	23.8	48.6

Note: *n* - Number of answers

the side effects of medications (48.6%), followed by pain management (67%) (Table 1). The mean value of categorical variables for patient experience (n=14) (Table 1) was 3.67 (SD=0.32).

Table 2 shows significant differences by hospital and age in most of the variables studied, with the hospital score ranging from 8.09 to 9.17 and recommendation of hospital from 3.47 to 3.87. Gender differences were only established for two variables (overall health, hospital rate). Women rated the hospital significantly higher ($M=8.97$; $SD=1.377$) compared to men, and they also rated their overall health better ($M=3.27$; $SD=1.015$). Educational background only influenced two variables.

Differences between hospitals were established for all variables, with more than 50% of patients requiring assistance to use the bathroom in three hospitals and less than 40% in other hospitals. Women needed significantly more help in using the bathroom (55.1%), required more analgesics (78.5%), were given more new medications (60.8%), and received less oral (66.8%) and written (58.4%) information about post-discharge care. Although educational background would seem important for preparing the patient for discharge (oral and written information), this was not confirmed by the regression model (Table 3).

Table 2. Results of categorical and continuous variables by demographic data and hospitals.

Variables (scale)	M (SD)	Across hospitals p	Gender p	Education p	Age p
Care from nurses (cat 1-4)	3.76 (0.374)	0.030	0.289	0.520	0.001
Care from doctors (cat 1-4)	3.77 (0.414)	0.008	0.093	0.122	0.006
Hospital environment (cat 1-4)	3.62 (0.461)	<0.001	0.246	0.057	<0.001
Support received and patient involvement (cat 1-4)	3.56 (0.462)	0.080	0.270	0.627	0.726
Recommendation of hospital (cat 1-4)	3.74 (0.506)	<0.001	0.876	0.849	0.001
Hospital rate (con 0-10)	8.86 (1.471)	0.001	0.008	0.105	0.010
Overall health rate (cat 1-5)	3.15 (1.050)	<0.001	<0.001	<0.001	<0.001
Expected days in hospital (con)	2.37 (4.268)	0.038	0.236	0.020	0.001
Previous hospitalisations (con)	4.47 (9.391)	0.006	0.402	0.979	<0.001

Note: M - Mean of categorical or continuous variable; cat - Categorical variable; con - Continuous variable; SD - Standard deviation, p - P-value

Table 3. Descriptive and bivariate results of dichotomous variables

Items: During this hospital stay,	n	YES (%)	NO (%)	Between hospitals	Gender (p)	Education (p)	Age (p)
did you need help from nurses or other hospital staff in getting to the bathroom or in using a bedpan?	1654	752 (45.5%)	902 (54.5%)	<0.001	<0.001	0.516	<0.001
did you need medicine for pain?	1664	1221 (73.4%)	443 (26.6%)	<0.001	0.004	0.997	<0.001
were you given any medicine that you had not taken before?	1614	955 (59.2%)	656 (40.8%)	0.009	0.308	0.866	0.545
did nurses or other hospital staff talk with you about your care after you leave the hospital?	1635	1230 (75.2%)	405 (24.8%)	<0.001	0.428	<0.001	0.003
did you receive information in writing about what symptoms or health problems to look out for after you leave the hospital?	1564	1070 (68.4%)	494 (31.7%)	<0.001	0.901	0.002	0.131

Note: n - Number of answers

Table 4. Associations between research variables.

Variables	1	2	3	4	5	6	7	8	9	10
1 Care from nurses	1									
2 Care from doctors	0.552**	1								
3 Hospital environment	0.302**	0.219**	1							
4 Support received and patient involvement	0.480**	0.423**	0.378**	1						
5 Recommendation of hospital	0.340**	0.357**	0.249**	0.297**	1					
6 Hospital rate	0.384**	0.370**	0.300**	0.390**	0.539**	1				
7 Overall health rate	-0.185**	-0.180**	-0.071**	-0.175**	-0.153**	-0.159**	1			
8 Expected days in hospital	-0.137**	-0.088**	-0.050	-0.058	-0.018	-0.021	0.068*	1		
9 Age	-0.084**	-0.067**	0.100**	0.024	0.080**	0.063*	0.272**	0.115**	1	
10 Previous hospitalisations	-0.014	-0.029	-0.024	-0.036	-0.014	-0.040	0.104**	0.052	0.095**	1

Variables:	Written information about discharge <i>p</i>	Talk about discharge <i>p</i>	New medicine <i>p</i>	Medicine- pain <i>p</i>	Help- bathroom <i>p</i>
Care from nurses	<0.001	<0.001	0.643	0.534	0.083
Care from doctors	<0.001	<0.001	0.720	0.995	0.273
Hospital environment	0.001	<0.001	0.042	0.341	0.479
Support received and patient involvement	<0.001	<0.001	0.361	0.369	0.262
Recommendation of hospital	<0.001	<0.001	0.669	0.888	0.084
Hospital rate	<0.001	<0.001	0.138	0.572	0.054
Overall health rate	<0.001	<0.001	0.027	0.038	0.168
Expected days in hospital	0.035	<0.001	0.049	0.091	0.031
Previous hospitalisations	0.835	0.413	0.084	0.824	0.832

Note: M - Mean (four-point scale), SD - Standard deviation, p - P-value

**Correlation is significant at the 0.01 level (2-tailed)

Table 4 shows the associations between the variables studied; the statistically significant ones were used in the linear regression models (Table 5).

The regression Model 1 “Patients’ experience with care” which summarizes 14 statements from Table 1, was explained in 18% by “patients’ general health status” (-0.267), “provision of written and oral information” (-0.200), and finally “talking to patients about discharge” (-0.175). The regression Model 2 “Hospital rate” was explained in 30.4 % by “patients’ experience with care” (0.576), “new medication was explained” (-0.242), and “patient age” (0.132) (Table 5).

4 DISCUSSION

Our research findings provide some encouraging information and reveal areas that require immediate action. Generally, the results of our study can be compared to previous studies, at least in some variables (8, 10, 14-17).

The patients who completed the questionnaire had an average of 4.5 previous hospital stays. As many as three quarters of those surveyed would recommend the hospital to other patients, giving it 8.9 out of a possible 10 points. Appropriateness of the care provided by the nursing staff and doctors was reported by 80% of patients, a figure comparable to other studies in Slovenia (20) and abroad (5,7-8, 15, 26). Furthermore, descriptive analysis revealed that information about the side effects of newly prescribed medication and pain control was rated poorly, which is important considering that three-quarters of participants reported needing pain medication and that 60% of participants had received new medication. Communication with patients about their treatment and different aspects of care has been shown to be the

most important factor in measuring patient experience (11-12), followed by adequate preparation for discharge, as a quarter of participants did not receive discharge instructions and one third did not receive written discharge instructions on how to monitor symptoms and potential health problems depending on the reason for hospitalisation. The importance of comprehensive relief has also been recognised in other studies (17, 27).

Our descriptive results were compared with the results of the national survey (20), where the response rate was low, although other authors also face this problem (27). In terms of patients’ experience of care from nurses and physicians, involvement in care, hospital environment and average rating of the hospital, our results are comparable (20). Our study showed significantly poorer results in the implementation of verbal and written discharge information, information about a new medication and a significantly higher noise level on the hospital ward. In terms of the instrument used (23), the Centers for Medicare & Medicaid Services estimate that only 25% of eligible discharge patients will respond, so there is great potential for non-response bias (27, 30).

The two regression models provided important information on how to improve work with patients in Slovenian hospitals. All independent variables were significantly related to the dependent variables in bivariate analyses and could be potential indicators of improvements; they were also found to be important in other studies (5, 8, 10, 14-17, 28) but at the level of multivariate analyses, only six variables were significant in our study. Patient experience can be explained in our model by overall health status (5, 8, 10), receipt of written and oral information about symptoms and potential health problems post-discharge, and written information provided at discharge (5, 7, 9, 10, 15, 17, 27, 29). Other researchers also reported that patient health status self-assessment and comprehensive preparation

Table 5. Linear regression models of independent and dependent variables.

Independent variables (types)	Model 1: Patients' experience with care ($R^2=18\%$)	
	β	p
Previous hospitalisations (<i>continuous</i>)	0.045	0.399
Overall health rate (<i>ordinal</i>)	0.267	<0.001
More days in hospital (<i>continuous</i>)	-0.029	0.576
Hospitals (<i>discrete</i>)	-0.096	0.066
Help from nurses getting to bathroom (<i>nominal NO</i>)	-0.029	0.576
Medicine for pain (<i>nominal NO</i>)	-0.029	0.582
Get new medicine (<i>nominal NO</i>)	0.013	0.803
Talk about care after discharge from hospital (<i>nominal NO</i>)	-0.175	0.004
Get written information (symptoms, health problems) after leaving the hospital (<i>nominal NO</i>)	-0.200	0.001
Education (<i>ordinal</i>)	-0.065	0.219
Gender (<i>nominal Women</i>)	0.034	0.513
Age (<i>continuous</i>)	0.026	0.634
Independent variables (types)	Model 2: Hospital rate ($R^2=30.4\%$)	
	β	p
Patients' experience with care (<i>ordinal</i>)	0.576	<0.001
Overall health rate (<i>ordinal</i>)	-0.066	0.163
Education (<i>ordinal</i>)	-0.019	0.664
Gender (<i>nominal Women</i>)	0.043	0.331
Age (<i>continuous</i>)	0.132	0.004
Hospitals (<i>discrete</i>)	0.032	0.464
Help from nurses getting to bathroom (<i>nominal NO</i>)	-0.004	0.937
Medicine for pain (<i>nominal NO</i>)	-0.039	0.430
Talk about care after discharge from hospital (<i>nominal NO</i>)	0.029	0.550
Get written information (symptoms, health problems) after leaving the hospital (<i>nominal NO</i>)	-0.044	0.373
New medicine was explained (<i>ordinal</i>)	-0.242	<0.001
Side effects of new medicine were explained (<i>ordinal</i>)	0.118	0.056

Note: R^2 =Adjusted R-Squared, β =Standard regression coefficient, p =P-value

with discussions and written information for discharge had an effect on patient experience ratings (10, 14, 27). For patients' hospital rating, our study revealed that the most important factors were patients' experience with inpatient care (5), followed by an explanation of new medication during the care process, and patient age (10, 14-16).

4.1 Contribution of research to public health

Patients' experiences are becoming increasingly important in the context of quality assurance, but the measurement of these parameters is accompanied by several disadvantages,,, such as poor cross-country comparability and methodological problems. Schroeder et al. (31) recommended paying more attention to the patient's emotional and psychosocial state, employment status, family and other factors. Such a holistic approach was not adopted in our study and also not in the national survey of patient experience (20). Improvements and holistic data capture are needed to make the measurement of patient experience a greater contribution to the improvement and efficiency of health systems.

4.2 Limitations

The research results are influenced by the fact that the answers come from those who were able to complete the questionnaire. A higher response rate would be desirable, but it is comparable to the a national patient survey (20, 21). The personal administration of surveys in paper form led to lower response rates than surveys sent by post (29). Patients who were asked to participate in a survey by clinic staff at the point of care gave more positive responses than patients who responded in other ways (32). We cannot be sure that in some cases healthcare professionals were not involved. We believe that a five-point scale would yield more reliable results. The results are limited to answers provided by patients in selected areas and cannot be generalized to all hospital wards in Slovenia. It is possible that patients had some reservations or have been overly positive or negative. The cultural environment may play an important role—it could be difficult for patients to be critical towards the healthcare which they had to wait an extremely long time to receive. The translation of the instrument into Slovenian, even though done rigorously, is a limitation as context can vary due to different understanding of linguistic and cultural differences.

5 CONCLUSIONS

The importance of patient experience with healthcare provision in Slovenia remains researched but insufficiently substantiated. At first glance, the hospital rates are good, but the results of individual variables reveal that tasks connected to comprehensive preparation of patients for

healthcare treatment with communication and health education, and appropriate discharge, remain only partially completed. Improvements and holistic data capture are needed to make the measurement of patient experience a greater contribution to the improvement and efficiency of hospital care.

ACKNOWLEDGEMENT

We would like to acknowledge and thank all subjects participating in the survey.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

The paper presents, in part, the results of a broader non-profit applicative project entitled "Hospitals and faculties together for prosperous and scientific based healthcare (ProCare)" (ERASMUS +, Action KA2, Number 601092-EPP-1-2018-1-SI-EPPKA2-KA).

ETHICAL APPROVAL

Permission to conduct the study in hospitals was obtained from the Commission of the Republic of Slovenia for Medical Ethics (No. 0120-488/2019/6, January 7, 2020). Participants received written information about different aspects of the study; their rights on voluntary participation and withdrawal from the study at any time were explained to them as well as their privacy and confidentiality rights. The participants gave their consent to participate in the study and permission to use the data collected at the national level for professional and scientific purposes.

AVAILABILITY OF DATA AND MATERIALS

All data and materials used in this study were collected from publicly available sources and are available upon reasonable request.

LLM STATEMENT

During the preparation of this article the author(s) did not use any large language model.

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CANCER RISK FACTORS AWARENESS IN SLOVENIAN ADOLESCENTS

OZAVEŠČENOST SLOVENSКИH MLADOSTNIKOV O NEVARNOSTNIH DEJAVNIKI RAKA

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Received: May 06, 2024

Accepted: Sep 16, 2024

Original scientific article

ABSTRACT

Keywords:

Cancer risk factors
Adolescents
Prevention awareness
Health education
Alcohol consumption
Physical activity

Aim: To evaluate Slovenian adolescents' awareness of common cancer risk and protective factors, identifying knowledge gaps to develop targeted health education initiatives.

Methods: A cross-sectional questionnaire survey was conducted among 795 students aged 13 to 19 years in primary and secondary schools in Slovenia. The responses were analysed using descriptive and analytical statistics. The relationship between educational level, age and gender and awareness of selected cancer risk factors was analysed performing univariate and multivariate logistic regression.

Results: Overall, adolescents demonstrated good awareness of certain risk factors such as smoking (98%), sun exposure (90%) and physical activity (87%). Significant knowledge gaps were identified regarding dietary factors. While 49% recognized red meat consumption as a risk factor, knowledge of protective fruit and vegetable consumption and alcohol consumption as a risk was relatively low at 14% and 38%, respectively. Gender differences were found, with boys better at recognising smoking ($p=0.025$) and girls better at recognising alcohol ($p<0.001$). Older students were less aware of the importance of fruit and vegetable consumption ($p<0.001$), and secondary school students were less aware of the importance of healthy body mass, red meat and alcohol consumption (all $p<0.001$).

Conclusion: Slovenian adolescents have varied knowledge of cancer risks, showing both strengths and areas for improvement in preventive education. We have identified important gaps in knowledge about diet and alcohol consumption, particularly among older, secondary school students and boys, where targeted interventions can have a major impact on promoting healthier lifestyles and reducing future cancer risks.

IZVLEČEK

Ključne besede:

nevarnostni dejavniki
raka
mladostniki
ozaveščenost o
preventivi
zdravstvena vzgoja
pitje alkohola
telesna dejavnost

Namen: Namen raziskave je bil oceniti ozaveščenost slovenskih mladostnikov o najpogostejših nevarnostnih in zaščitnih dejavnikih raka ter ugotoviti vrzeli v znanju za razvoj ciljno usmerjenih intervencij zdravstvene vzgoje.

Metode: S pomočjo vprašalnika o nevarnostnih dejavnikih je bila izvedena presečna raziskava med 795 učenci osnovnih in srednjih šol v Sloveniji, starimi od 13 do 19 let. Odgovori so bili analizirani z opisno in analitično statistiko (univariatna in multivariatna logistična regresija), ocenjeno je bilo splošno poznavanje dejavnikov in proučene povezave s starostjo, spolom in ravni izobrazbe.

Rezultati: Na splošno so mladostniki pokazali dobro ozaveščenost o nekaterih nevarnostnih in zaščitnih dejavnikih, kot so kajenje (98 %), izpostavljenost soncu (90 %) in telesna dejavnost (87 %). Precejšnje vrzeli v znanju so bile ugotovljene zlasti glede prehranskih nevarnostnih dejavnikov. Medtem ko je 49 % vprašanih prepoznalo uživanje rdečega mesa kot nevarnostni dejavnik, je samo 14 % mladostnikov prepoznalo pomen uživanja sadja in zelenjave ter 38 % nevarnost pitja alkohola. Ugotovljene so bile razlike med spoloma, pri čemer so fantje bolje prepoznali kajenje ($p = 0,025$), dekleta pa pitje alkohola ($p < 0,001$). Starejši učenci so manj poznali pomen uživanja sadja in zelenjave ($p < 0,001$), učenci v srednjih šolah pa so slabše poznali pomen normalne telesne mase ter uživanja rdečega mesa in pitja alkohola ($p < 0,001$).

Zaključki: Slovenski mladostniki imajo različno znanje o tveganjih za nastanek raka, kar kaže tako na prednosti kot na področja, ki jih je treba izboljšati na področju preventivnega izobraževanja. Ugotovili smo pomembne vrzeli v znanju o prehrani in pitju alkohola, zlasti med starejšimi, srednješolci in fanti, kjer lahko ciljno usmerjeni ukrepi pomembno vplivajo na spodbujanje zdravega življenjskega sloga in zmanjšanje tveganja za nastanek raka v prihodnosti.

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1 INTRODUCTION

In Slovenia, cancer is the primary cause of death in men and the second leading cause in women (1). The incidence is increasing steadily at an average rate of 2% annually. Skin cancer emerges as the most frequent in both sexes, while prostate cancer ranks second for men and breast cancer for women. Altogether, the top five cancer types - skin, lung, breast, prostate and colorectal - represent 58% of all newly diagnosed cancer cases (2).

Important risk factors are well known for the most common types of cancer, enabling us to target prevention measures more effectively and efficiently (3-5). Many of these factors, such as smoking, alcohol consumption, physical activity, diet and body mass, are intertwined with lifestyle choices and can be influenced from early ages. While the impact of preventable risk factors on adolescents is comparatively lesser due to reduced exposure rates over time, fostering awareness among adolescents about these factors correlates with adopting health-protective measures, laying a foundation for healthier adulthood (6). Current projections indicate that half of today's boys and one third of girls may encounter cancer by the age of 75 (2). Adopting a healthy lifestyle and avoiding risk factors could potentially prevent up to 40% of cancers (7), underscoring the importance of informing adolescents about cancer risk factors to mitigate future disease incidence.

Slovenian data on the proportion of adolescents who smoke at least once a week show a favourable health-promoting trend with a decrease in smoking among adolescents from 29% in 2002 to 9% in 2022 (1). However, challenges persist in other areas; for instance, the percentage of adolescents involved in binge drinking rises significantly from 3.9% at age 13 to a concerning 13.2% by age 15. Alarming, as many as 45.4% of surveyed adolescents report having been drunk at least twice in their life by the age of 17 (1).

Similar concerns arise regarding the maintenance of a healthy body mass. During the pandemic lockdown the body composition of Slovenian children and adolescents deteriorated significantly. Currently, the prevalence of overweight and obesity is similar to pre-COVID-19 levels, affecting 24.9% of boys and 21.8% of girls aged 6 to 18 years (8). However, their levels of skinfold thickness and motor efficiency have not yet returned to pre-COVID-19 levels, indicating behavioural changes (8). It appears that children and adolescents are now more likely to regulate their body mass through dietary measures rather than physical activity. In 2022 only 21.4% of 13-year-olds were achieving the recommended daily moderate to vigorous physical activity of at least 60 minutes (1). Regarding dietary habits, only 36.0% of adolescents consume fresh vegetables daily, and a similar percentage consume fresh fruits (1).

Limited literature exists on adolescents' knowledge of cancer risk factors. Studies indicate low awareness levels among adolescents, with education interventions showing promising results in enhancing their understanding (9-12). Despite the widespread access to information in the digital era, recent studies from Australia highlight persistently low awareness levels among adolescents regarding cancer risk factors and warning signs (12).

The aim of our study was to reveal knowledge deficiencies about cancer prevention among adolescents to facilitate evidence-based targeted health education interventions, empowering this generation to actively participate in cancer prevention efforts and alleviate the burden of cancer for their and future populations. To achieve this aim the main objective was to assess Slovenian adolescents' awareness of common cancer risk and protective factors.

2 MATERIALS AND METHODS

2.1 Study design, setting and timeframe

We conducted a cross-sectional study with a questionnaire on cancer risk factors in Slovenian adolescents. The study was designed for the competition for young researchers (13) in the 2019/2020 academic year and was later extended to the entire age group of adolescents in 2022.

2.2 Target population, sampling and data collection process

Students aged 13 to 19 were included in the study. Study participation was anonymous and voluntary, with schoolteachers facilitating questionnaire distribution and collection. We secured permission from the school head teachers for participation, which was consistent with parents' approval, with one school opting for electronic completion via the open-source platform 1KA (14), while others used paper questionnaires. In the academic year 2019/2020 34-item surveys were conducted among 8th and 9th grade students in three primary schools in the Ljubljana region and one in the Štajerska region. Because of the pandemic lockdown, only questionnaires from Ljubljana (three out of four primary schools) were initially analysed in 2020 (15). After initial analysis a simplified questionnaire (22-item) was disseminated to three upper secondary schools in the Ljubljana region, one general high school and two professional schools, from January to June 2022 (Figure 1).

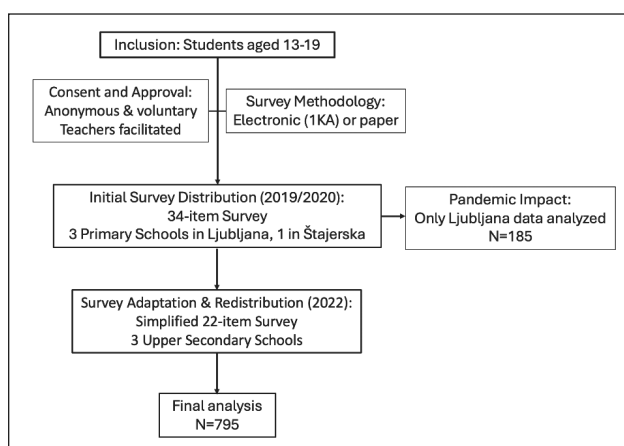


Figure 1. Study flowchart.

2.3 Instrument

We used a questionnaire previously employed in an adult population (16). This questionnaire fitted the most for our study due to its comprehensive coverage of common factors and cancer types. With the author's permission, investigators translated the questionnaire into Slovenian and adapted it for the adolescent population (16) by excluding the questions related to the adult and cancer patients population. The questionnaire was shortened from the original 48 to 34 items. The translation of the 34 open and closed questions was not validated, but the questionnaire was tested for comprehensibility and usability with a small sample (N=15) of primary school students (aged 13-14), demonstrating full question comprehension and approximately 15 minutes completion time. After an initial analysis and primary school teachers' feedback collection in 2020, the questionnaire was shortened for simplification. Twenty-two open and closed-ended questions were considered by the researchers to be the most important for assessing adolescents' risk factor awareness. The simplified questionnaire began with demographic questions to gather basic information about the participants. The section on main risk factors used open-ended questions to allow for more detailed responses. General facts about risk factors were collected using a mixture of closed dichotomous questions and rating scales. Closed dichotomous questions were also used in the questionnaire to find out how participants search for information about risk factors. For dietary habits, including alcohol consumption, a combination of open-ended questions, Likert scales and closed questions were used. For questions on body mass, participants were asked to respond to closed dichotomous questions, choose from pictures and use Likert scales. Finally, the questionnaire explored topics related to physical activity using a mixture of open-ended questions and Likert scales to capture a range of responses. The questionnaire is available upon request from the authors.

2.4 Observed phenomena

Observed outcomes were appropriate awareness of cancer risk and protective factors: smoking, passive smoking, age, alcohol consumption, fruit and vegetable consumption, impact of red meat, body mass, heredity, physical activity and sun exposure. Based on responses to the wording of the questions regarding impact of the risk, we generated new variables. These variables of individual risk factors were assigned a value of 1 if the respondents were aware of the risk factor ("increased" and "greatly increased") and 0 if they were not aware ("decreased", "greatly decreased", "had no affect"). These newly created variables were then utilised to compute an overall cancer knowledge score, ranging from 0 to 10. A higher score indicates a greater understanding of cancer-related factors. If a respondent did not answer any of the ten designated questions, they did not receive a score and were excluded from the total score calculation. Total score of awareness was carried out with the intention of comparing the results with other studies. It has not been validated. Additional observed outcomes were awareness of cancer potential risk and protective factors, and myths. Age, gender and level of education were considered as explanatory factors for awareness of cancer risk and protective factors. Age was a continuous variable in years (13-19 years), and gender (male, female) and level of education (primary school, upper secondary school) were dichotomous variables.

2.5 Statistical analysis

All data collected (questionnaires from four primary and three upper secondary schools) is included in the present analysis. The results are presented using descriptive statistics. The percentages provided represent valid proportions, reflecting the actual responses to the questions.

The relationship between explanatory factors (level of education, age and gender) on chosen cancer risk factors awareness was assessed with univariate and multivariate logistic regression. For an overall cancer knowledge score, a univariate and multivariate general linear model was applied using the same explanatory factors.

2.6 Ethical considerations

The study was first registered at The Association for Technical Culture of Slovenia for the 33rd Meeting of young researchers and was later approved by the Institutional Ethics Committee and the Institutional Review Board of the Institute of Oncology, Ljubljana (No. ERIDNPVO-0007/2022).

3 RESULTS

3.1 Descriptions of participants

The study included 795 adolescents from primary schools (N=224; 13-15 years old; 50% girls) and upper secondary schools (N=571; 15-19 years old; 71% girls) in Slovenia. The age of the participants was between 13 and 19 years (mean 15.8 years, median 16 years).

3.2 Results of the descriptive analysis

The cancer risk factors awareness of Slovenian adolescents is shown in Table 1. Most of our students believe that the incidence of cancer increases with age (82%) and that cancer may be related to genetics (83%). However, when students were asked to name three main risk factors for cancer in an open question, the results for primary and upper secondary schools were slightly different. In primary schools, the most important risk factors were smoking (60%), alcohol consumption (25%) and an unhealthy diet (15%). In upper secondary schools, the three main risk factors perceived were smoking (54%), UV radiation (18%) and an unhealthy diet (15%).

More than 60% of the participants were searching for different cancer information and the main source for the search was the internet (29%). Only 1% received this information from their parents.

More than 70% of students believe that certain diets can have a protective effect against cancer, and at the same time they also believe that some nutrients can increase the risk of cancer (81%). More than 25% of students believe that spirits are more likely to cause cancer than beer and wine, and more than 50% that abstaining from alcohol is the best way to prevent cancer. Alcohol consumption as a risk factor was recognised by 51% of girls and 45% of boys in primary school, and 39% of girls and 22% of boys in upper secondary school.

When it comes to fruit and vegetable consumption, only 14% of students stated the correct number of fruit and vegetable portions (e.g. >5 portions). However, knowledge of the possible negative effects of excessive red meat consumption is emphasized by 49% of students. The same applies to excessive salt consumption: 63% of students believe that this could be linked to the occurrence of cancer, but only 49% can correctly categorize the recommended daily salt intake of less than 5 g/day.

Most students (68%) believe that maintaining a healthy body mass is important for cancer prevention. Primary school students (56%) are more aware of the risk of visceral obesity than upper secondary school students (22%).

Awareness of the importance of regular physical activity in reducing the risk of cancer is high (87%). Almost 60% of all students believe that they should be physically active 5 to 7 days a week to reduce risk, and almost 65%

of them believe that the duration of physical activity on these days should be 60 minutes or more. However, when calculating minutes of physical activity per day, primary school students (65 minutes) compared to upper secondary school students (48 minutes) believe that more exercise is needed to prevent cancer.

At the end of the survey, students were given a list of potential factors and myths that could increase their risk of cancer and were asked to decide whether these factors increase, decrease or have no effect on the cancer risk. Over 70% of students recognised food, radiation, genetically modified food, environmental pollution, cleaning products and stress as risk factors. More than 60% recognise mobile phones and the use of aerosols as not related to elevated cancer risk. More than half of the students believe that vitamin supplements and organic food protect against cancer. Finally, 41% of students see chest blow and tight underwear as a risk factor. Only 25% of students believe that breastfeeding is a protective factor, also, students are aware of the dangers of unprotected sex, with 57% of students believing that this increases the cancer risk.

Table 1. Slovenian adolescents' knowledge of cancer risk and protective factors.

Cancer risk and protective factors	Knowledge
Smoking	86%
Passive smoking	81%
Advancing age	82%
Alcohol consumption	38%
Red meat consumption	49%
Maintaining healthy body mass	68%
Genetics	83%
Regular physical activity	87%
UV radiation (sun exposure)	90%
Fruit and vegetable consumption	14%
Number of portions of fruit and vegetables	2.9 portions

3.3 Results of the analysis of awareness of the importance of individual risk factors

The univariate logistic regression model indicated that age, gender and level of education can significantly influence the level of awareness for different cancer risk factors (Table 2). Although boys were more aware of smoking ($p=0.025$), they expressed less knowledge of risk associated with alcohol consumption ($p=0.004$), genetics ($p<0.001$) and red meat consumption ($p=0.011$) compared to girls. Older students had better knowledge of passive smoking ($p<0.001$), advancing age ($p=0.003$), genetics ($p<0.001$) and sun exposure ($p<0.001$), but showed less awareness of fruit and vegetable consumption ($p<0.001$) and maintaining healthy body mass ($p=0.002$). Level of education was positively linked to awareness

of passive smoking ($p=0.003$), advancing age ($p=0.007$), genetics ($p<0.001$), regular physical activity ($p=0.007$) and sun exposure ($p<0.001$). Dietary factors and healthy body mass were more accurately identified by primary school students (alcohol, red meat, fruit and vegetable consumption and healthy body mass; all $p<0.001$).

In multivariate analysis gender showed the same effect as in univariate analysis (alcohol consumption $p<0.001$, genetics $p=0.002$, read meat consumption $p=0.011$ and smoking $p=0.010$). Age remained significant and positively linked to passive smoking ($p=0.012$), but also to smoking ($p=0.048$), and remained negatively linked to fruit and vegetable consumption ($p=0.007$), but also to alcohol consumption ($p=0.026$). Level of education remained significant for regular physical activity ($p=0.003$), alcohol and red meat consumption, genetics, and sun exposure (all $p<0.001$).

3.4 Results of analysis of overall cancer knowledge score

The mean overall cancer score for all students was 6.782 (standard deviation=1.595). In the univariate general linear model age ($F=2.646$, $p=0.015$), gender ($F=6.392$, $p=0.012$) and level of education ($F=9.888$, $p=0.002$) all significantly influenced the overall cancer score. However, on the multivariate level (Table 3) there was only significant interaction effect between age and gender ($F=2.437$, $p=0.024$), indicating that older girls are achieving a higher mean overall knowledge score (Figure 2).

Table 2. The association between age, gender and level of education and cancer risk/protective factors awareness in Slovenian adolescents.

Risk factors	Explanatory factors	Category	UNIVARIATE ANALYSIS*		MULTIVARIATE ANALYSIS*	
			OR (95% CI)	p	OR (95% CI)	p
Smoking	Age		1.102 (0.978-1.242)	0.111	1.215 (1.002-1.474)	0.048
	Gender	M	1	0.025	1	0.010
		F	0.593 (0.376-0.936)		0.542 (0.340-0.865)	
	School	P	1	0.536	1	0.410
		S	1.148 (7.742-1.777)		0.748 (0.376-1.490)	
Passive smoking	Age		1.238 (1.111-1.380)	<0.001	1.259 (1.053-1.504)	0.012
	Gender	M	1	0.541	1	0.831
		F	1.122 (0.777-1.620)		0.959 (0.656-1.403)	
	School	P	1	0.003	1	0.845
		S	1.772 (1.222-2.572)		0.941 (0.511-1.732)	
Alcohol consumption	Age		0.954 (0.877-1.038)	0.275	1.163 (1.018-1.328)	0.026
	Gender	M	1	0.004	1	0.001
		F	1.573 (1.156-2.141)		1.765 (1.277-2.438)	
	School	P	1	<0.001	1	< 0.001
		S	0.566 (0.413-0.774)		0.321 (0.193-0.532)	

Risk factors	Explanatory factors	Category	UNIVARIATE ANALYSIS*		MULTIVARIATE ANALYSIS*	
			OR (95% CI)	p	OR (95% CI)	p
Advancing age	Age		1.183 (1.060-1.321)	0.003	1.153 (0.965-1.377)	0.117
	Gender	M	1	0.704	1	0.284
		F	0.928 (0.631-1.364)		0.805 (0.541-1.198)	
	School	P	1	0.007	1	0.586
		S	1.701 (1.160-2.495)		1.190 (0.637-2.224)	
Genetics	Age		1.835 (1.601-2.104)	<0.001	0.947 (0.759-1.183)	0.634
	Gender	M	1	<0.001	1	0.001
		F	2.701 (1.858-3.925)		1.983 (1.307-3.009)	
	School	P	1	<0.001	1	< 0.001
		S	10.325 (6.812-15.650)		10.858 (5.037-23.405)	
Regular physical activity	Age		1.065 (0.942-1.203)	0.315	0.836 (0.689-1.014)	0.069
	Gender	M	1	0.280	1	0.457
		F	1.263 (0.827-1.929)		1.181 (0.761-1.833)	
	School	P	1	0.007	1	0.003
		S	1.807 (1.177-2.772)		2.964 (1.436-6.115)	
Red meat consumption	Age		0.950 (0.875-1.031)	0.216	1.123 (0.987-1.278)	0.077
	Gender	M	1	0.011	1	0.002
		F	1.463 (1.090-1.964)		1.624 (1.194-2.208)	
	School	P	1	<0.001	1	<0.001
		S	0.585 (0.428-0.800)		0.375 (0.230-0.612)	
Maintaining healthy body mass	Age		0.867 (0.793-0.948)	0.002	0.936 (0.818-1.0719)	0.339
	Gender	M	1	0.732	1	0.677
		F	0.946 (0.691-1.297)		1.072 (0.774-1.484)	
	School	P	1	<0.001	1	0.111
		S	0.547 (0.383-0.781)		0.651 (0.384-1.104)	
UV radiation (sun exposure)	Age		1.981 (1.653-2.375)	<0.001	0.914 (0.679-1.230)	0.553
	Gender	M	1	0.327	1	0.251
		F	1.271 (0.787-2.052)		0.733 (0.431-1.245)	
	School	P	1	<0.001	1	<0.001
		S	14.504 (8.042-26.160)		20.248 (6.940-59.073)	

Legend: M-male, F-female, P-Primary school, S-upper secondary school; OR-odds ratio; CI-confidence interval. *logistic regression, p<0.05 highlighted in bold.

Table 3. The association between age, gender and level of education and overall cancer knowledge score in Slovenian adolescents.

Dependent variable: overall cancer score	df*	F*	p*
Explanatory variables (main effects)			
School	1	0.678	0.411
Gender	1	0.181	0.671
Age	6	1.269	0.269
Explanatory variables (interactions)			
School * Gender	1	0.417	0.519
School * Age	2	0.813	0.444
Gender * Age	6	2.437	0.024

Legend: *Multivariate general linear model, df-degrees of freedom, p<0.05 are highlighted in bold.

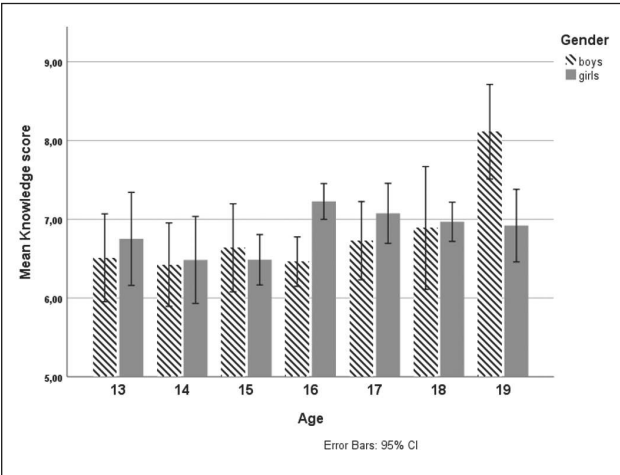


Figure 2. Mean overall cancer risk knowledge scores for Slovenian boys and girls of different ages.

4 DISCUSSION

The main finding of our study is that Slovenian adolescents have a fairly good knowledge of cancer risk and protective factors compared to other published series. The highest knowledge is related to smoking, aging, genetics, sun exposure and regular physical activity, while clear knowledge gaps were found in relation to alcohol consumption and the consumption of fruits and vegetables (Table 1). Higher level education students and boys show the lowest awareness of alcohol and older students regarding the consumption of fruits and vegetables (Table 2). There is also a knowledge gap regarding the consumption of red meat, with girls and primary school students being more aware of the risk (Table 2).

In contrast to British adolescents aged 11-17, Slovenian adolescents demonstrate superior awareness across most risk factors, with the highest differences in advancing age (82% vs. 22%), genetics (83% vs. 41%) and regular physical activity (87% vs. 26%) (10). Analyzing the percentages of accurate responses, the average number of correct answers in the UK stood at 4.4 out of 11. These findings imply that Slovenian adolescents exhibit higher awareness of risk factors in comparison to their British counterparts (68% vs. 40% correct answers). Such disparities likely stem from differences in educational curricula between Slovenia and the UK. Our students also showed a more pronounced awareness of genetic predisposition, which was strongly associated with a higher level of education (Table 2), reflecting the biology curriculum. One could argue that the disparity in knowledge may be attributable to the 10-year gap between the studies. However, a more recent and comprehensive study conducted in Australia found that 11-19 year olds had a similar awareness of cancer risk factors to UK adolescents, but still lagged behind Slovenian adolescents in recognising advancing age (39%), genetics (51%) and regular physical activity (28%) (12).

Active and passive tobacco smoking was the most identified risk factor amongst students, which is consistent with other countries around the world (10-12,17,18). Smoking was also mentioned as the number one risk factor in the open question, but the recall of smoking was lower for both primary and upper secondary school students. Those results are identical to those of Australian adolescents, where recall of smoking as a risk factor was 57% (12).

Slovenian adolescents also expressed a high awareness of older age and UV radiation exposure (e.g. sunbathing) as being important cancer risk factors. As regards UV radiation, our finding that almost all of adolescents know the link between UV radiation and skin cancer is similar to the findings of a Swiss study, where 80% knew the link (19).

This study reveals a concerning lack of recognition regarding diet-related cancer risk factors among participants. While two-thirds of students acknowledge obesity as a risk factor, fewer than half are aware of the negative impact that red and processed meat, excessive salt intake, and insufficient fruit and vegetable consumption have on cancer risk. Adequate consumption of fruits and vegetables is also lacking, as evidenced by another Australian study where only 14% of adolescents consumed enough vegetables and 71% consumed enough fruit (20). It is worth noting that adolescents in the UK are better informed about the recommended portions of fruits and vegetables (Table 2) (10), with an average portion of 6.5, compared to Slovenia's mere 2.9. As myths and misconceptions can shape health behaviour, we should be aware that more than two thirds of Slovenian adolescents believe that vitamin supplements are recommended for cancer prevention.

This study revealed that the strongest area of knowledge among participants was in the field of physical activity, while the weakest point was in understanding alcohol consumption and its relation to cancer risk. The superior knowledge of Slovenian adolescents about physical activity can be attributed to several factors. Firstly, the physical education curricula emphasise physical literacy, which not only promotes engagement in physical activity but also enhances understanding of its importance (21-23). Additionally, the high competences of Slovenia's physical education teachers play a vital role, as they serve as the primary advocates for physical activity within the school setting (24). Furthermore, several initiatives, including the well-established national physical fitness monitoring system SLOfit, contribute significantly to promoting physical literacy among adolescents (25).

In contrast, participants' knowledge about alcohol consumption is lacking, and their beliefs about it are often incorrect. Like the adult population (15), students are not aware that all types of alcohol have the same effect. It is worrying that knowledge about the risk factors of alcohol among boys decreases significantly from primary school to upper secondary school.

The main limitation of our study is that the survey focuses on the central Slovenian region, so the student selection may not be representative for all Slovenia. Since the questionnaires were distributed by different teachers, important information about the response rate was lost. Although we did not calculate the sample size, our study is one of the largest, with a sample size of 795 students compared to 871 Italian, 766 Australian and 478 British students (10, 12, 17). Furthermore, we did not directly observe or measure adolescents' behaviour, which may differ from their perceptions of participating in cancer risk factors. Additionally, as a cross-sectional study, we were unable to track changes in adolescents' perspectives over time. Also, we dichotomised the results of interest and shortened the questionnaire, potentially leading to some loss of information. The institutional ethics committee was particularly concerned about the study because the students may have a fear of cancer. For this reason, we had to omit the questions about thinking about cancer. This shows that cancer stigma is still very present today. When Oakley et al. conducted a study with British children and adolescents in 1995, the main reason for the school's refusal to participate was that cancer was not an appropriate topic to discuss with children (11). However, we received no negative feedback from students or teachers who completed the original questionnaire.

The importance of the study for public health is in identifying the students' behaviour for future preventive measures. One would expect higher knowledge with higher age and higher levels of education. Although this is true for sun exposure and genetics, the negative association with preventable dietary risk factors suggests the need to improve the curriculum in upper secondary school education (Table 2). The decline in risk awareness related to alcohol consumption among male students and high school students should also be addressed. In our culture, alcohol consumption is often considered normal or even glorified, leading adolescents to view alcohol consumption as a way to fit in with peers or gain social acceptance. Interestingly, we have also shown that risk awareness of red meat and fruit and vegetable consumption decreases with increasing age or level of education. This points to an important area for intervention, especially as the incidence of colorectal cancer is increasing in young adults (26). Although adolescents showed excellent awareness for other preventable cancer risk factors like smoking, they are still likely to engage in them (27). Our findings highlight a gender and age discrepancy in smoking awareness, where girls have less likelihood of recognising smoking as a risk factor (Table 2). This underscores the necessity for targeted prevention efforts among girls, especially considering that the prevalence of smoking among girls in this age group surpasses that of boys, and the incidence of lung cancer is on the rise among Slovenian women (1, 2).

Based on the study results, specific preventive activities for specific student groups can be planned. The impact of the interventions can be verified by a similar post-implementation survey. When planning interventions for modern adolescents, we must consider that their main sources of information to learn about cancer risk factors are the internet and social media.

5 CONCLUSION

In this study, Slovenian adolescents showed excellent awareness of smoking, sun exposure and lack of physical activity as preventable cancer risk factors. On the other hand, knowledge about diet-related cancer risk factors, especially alcohol consumption, was found to be very low, especially in older students. We believe that the current generation of young people has the potential and privileged opportunity to decrease their cancer incidence and cancer mortality to a greater extent than previous generations. With increased knowledge about cancer prevention, advances in early detection, growing awareness, healthier lifestyle choices, better education on risk factors, and a greater emphasis on proactive health measures, these adolescents are better equipped to reduce their cancer risk.

ACKNOWLEDGEMENT

The authors express their sincere appreciation to all the adolescents who participated in this study. We are indebted to the schools for their cooperation, without which this study would not have been possible.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

The research was supported by the Slovenian research programme for comprehensive cancer control, SLORApr (P3-0429).

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee and the Institutional Review Board of the Institute of Oncology, Ljubljana (No. ERIDNPVO-0007/2022).

AVAILABILITY OF DATA AND MATERIALS

All data and materials used in this study are available upon reasonable request. The questionnaire is available upon request.

LLM STATEMENT

During the preparation of this work corresponding author Jasna But-Hadžić used InstaText for improving the grammatical and linguistic correctness of the written text. Mendeley was used to format the references. All authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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THE EFFECT OF NURSES' JOB CHARACTERISTICS ON MISSED NURSING CARE IN MEDICAL AND SURGICAL DEPARTMENTS IN SELECTED SLOVENIAN HOSPITALS—A CROSS-SECTIONAL STUDY

UČINEK ZNAČILNOSTI DELOVNIH MEST MEDICINSKIH SESTER NA NEIZVEDENO ZDRAVSTVENO NEGO NA INTERNISTIČNIH IN KIRURŠKIH ODDELKIH V IZBRANIH SLOVENSKIH BOLNIŠNICAH - PRESEČNA RAZISKAVA

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Received: May 21, 2024

Accepted: Sep 16, 2024

Original scientific article

ABSTRACT

Keywords:

BERNCA-R
MISSCARE
Work environment
Nurse retention
Quality of healthcare
Workforce

Aim: The aim was to examine the extent of missed nursing care (MNC), the reasons behind it and the contribution of nurses' job characteristics to MNC in Slovenian hospitals.

Methods: A cross-sectional explorative research was conducted. The BERNCA-R and part B of the MISSCARE questionnaire were used. A total of 880 nurses from 10 hospitals in Slovenia participated with completed questionnaires; of those, 57.6% were healthcare assistants and 42.4% were registered nurses. Univariate, bivariate and multivariate analyses were performed.

Results: In the five-component solution of the MNC, the activities of 'Monitoring' (M=2.09; SD=0.909) and 'Caring, support, activation, education' (M=2.03; SD=0.822) were the most frequently missed, with the leading item being 'Conversation with a patient or their family' (M=2.45; SD=0.940). Labour resources (M=3.44; SD=0.642) were the most common reason for MNC, with inadequate number of staff (M=3.75; SD=0.660) as the leading item. The stepwise multiple regression model showed that the more significant the labour resources are, the more frequently MNC occurs in all five dimensions ($p=0.000-0.002$). Most job characteristics proved to be significant; however, as satisfaction with wages, years of employment and assessment of the quality of nursing care increase, MNC decreases in all five dimensions.

Conclusions: This study enables healthcare decision makers and managers at the national level and in healthcare organisations to understand the problem of missed nursing care and to plan and implement changes accordingly.

IZVLEČEK

Ključne besede:

BERNCA-R
MISSCARE
delovno okolje
zadržanje medicinskih sester
kakovost zdravstvene oskrbe
delovna sila

Namen: Namen je bil preučiti obseg neizvedene zdravstvene nege (NZN), vzroke in vpliv značilnosti dela medicinskih sester na NZN v slovenskih bolnišnicah.

Metode: Izvedena je bila presečna raziskava. Uporabljena sta bila BERNCA-R in MISSCARE (del B) vprašalnika. S popolno izpolnjenimi vprašalniki je sodelovalo 880 medicinskih sester iz 10 bolnišnic v Sloveniji, od tega 57,6 % tehnikov zdravstvene nege in 42,4 % diplomiranih medicinskih sester. Izvedene so bile univariatne, bivariatne in multivariatne analize.

Rezultati: V pet-komponentnem modelu NZN sta bili najpogostejše neizvedeni aktivnosti »Nadzor« ($PV = 2,09$; $SO = 0,909$) in »Skrb, čustvena podpora, aktivacija, edukacija« ($P = 2,03$; $SO = 0,822$), najpogostejše neizveden je bil pogovor s pacientom ali njegovo družino ($PV = 2,45$; $SO = 0,940$). Kadrovski viri ($PV = 3,44$; $SO = 0,642$) so bili najpogostejši razlog za NZN, pri čemer je bilo neustrezno število zaposlenih ($PV = 3,75$; $SO = 0,660$) najpogostejše izbrana trditev. Model postopne multiple regresije je pokazal, da pomembnejši, kot so kadrovski viri, pogostejše se NZN pojavlja v vseh 5 dimenzijah ($p = 0,000-0,002$). Večina značilnosti se je izkazala za pomembne; toda, ko se poveča zadovoljstvo s plačami, delovna doba in oceno kakovosti zdravstvene nege, se NZN zmanjša v vseh petih dimenzijah.

Zaključki: Ta raziskava omogoča odločevalcem in managerjem v zdravstvu na nacionalni ravni in v zdravstvenih organizacijah, da razumejo problem ter načrtujejo in uvedejo spremembe.

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1 INTRODUCTION

Missed nursing care (MNC) has been researched in many countries around the world. It is a phenomenon present in nursing care worldwide and was first described in a qualitative study by Kalisch (1). MNC refers to the withdrawal or non-performance of certain nursing care activities due to limited resources such as time, staff or knowledge (2). When nurses are faced with multiple demands and insufficient resources, they tend to prioritise, so they choose to leave some parts of nursing care delayed, only partially done or even undone (3). Since nursing care plays an important role in promoting the health and well-being of individuals, families and communities, MNC can lead to various negative public health consequences. Failure to provide nursing care in healthcare facilities decreases the quality of nursing care, causes dangerous events and complications, and ultimately leads to negative patient outcomes, such as patient dissatisfaction and readmissions, affecting patients' health or even lives (2, 4-12). The antecedents of MNC such as staffing, patient-to-nurse ratios, workload, non-nursing tasks, work environment, nurse characteristics, their experience and education levels, and satisfaction as well as the impact of these antecedents in terms of reducing or increasing MNC are well documented and have been researched over the last fifteen years (13, 14). Different aspects of work environment influenced the extent of MNC (15, 16), so paying attention to variables in the work environment and organisational characteristics is important for decreasing MNC. An unfavourable work environment is an important reason for an increased intent to leave nursing, and the decrease in the nursing care workforce is a predominant reason for the increase in MNC (17).

A representative survey on MNC in medical and surgical departments in Slovenian hospitals has not yet been conducted. Country-specific research is required to identify peculiarities related to the organisation of nursing care and the reasons given by nurses in order to convince policy makers to implement changes in decision-making and resource allocation.

The aim of this study was to investigate and describe the extent of MNC in Slovenian hospitals, the reasons for MNC as identified by nurses and the contribution of nurses' job characteristics to MNC in medical and surgical departments in selected Slovenian hospitals.

2 METHODS

Cross-sectional explorative research was conducted. The study design was modelled after research on this topic conducted worldwide, with the capacity to compare results from other European countries.

2.1 Instruments

The BERNCA-R questionnaire with 32 items was used for describing missed nursing activities. Using a 5-point scale (0-Not required, 1-Never, 2-Rarely, 3-Sometimes, 4-Often), respondents were asked to rate how frequently in the past seven working days they were unable to perform the tasks. We also used part B of the MISSCARE questionnaire with items on reasons for MNC; according to the authors, the two sections of the instrument can be used independently (3). The part B scale consists of 17 items, each having four response options (0-Not a reason for MNC, 1-Minor reason, 2-Moderate reason, and 3-Significant reason). The forward and backward translations were done by two translators specialising in healthcare terminology, using the same translation methodology as the RN4CAST study (18). Following the translation, content validation of the translated instrument items was conducted by a panel of Slovenian experts. Each statement was thoroughly checked for understandability and for substantive meaning in Slovenian with conceptual clarification. The next step was pilot testing of the instrument in a general hospital (this data was not included in the final results), additional post-test editing of the instrument, and repeated content validation. As previously established by other authors and thoroughly described in a systematic review of psychometric properties (19), our instruments are also valid (RMSR=0.0186 for BERNCA-R and RMSR=0.0154 for MISSCARE part B). Reliability in our case was also good, with BERNCA-R α =0.967, and MISSCARE, part B α =0.928. Consent to use the questionnaires was obtained from the authors. The study was approved by the National Medical Ethics Committee of Slovenia and informed consent was obtained from the participants.

2.2 Setting, sample characteristics and data collection

The data capture for this study was done at the same time as the RN4CAST data capture. All general hospitals in Slovenia were invited to participate in the survey. Eight general hospitals and both university medical centres (n=10) confirmed participation. Next, all registered nurses and healthcare assistants who provided direct nursing care in adult surgical and medical wards and worked shifts in a predetermined 14-days' time window (N=2813) were invited to participate in the study. Those on maternity leave, extended sick leave or study leave were excluded from participation. Data collection with paper-and-pencil approach was performed over a two-week period. Respondents returned the sealed envelope to the research coordinator at the agreed collection point. The majority of data was collected between 10 February and 7 March 2020, prior to the first wave of the COVID-19 pandemic in Slovenia. One hospital collected data between 8 and 20 June 2020, when the first COVID-19 wave was over.

2.3 Data analysis

Data was analysed using SPSS, version 27 software. Univariate, bivariate and multivariate statistical analyses were performed. Using the Principal Component Analysis (PCA) method, we changed the basic set of variables from the MISSCARE survey instrument and the BERNCA-R questionnaire into a new set of principal components (20). Communalities were set at 0.50. Bartlett’s test of sphericity ($p<0.05$) and the Kaiser-Meyer-Olkin test (>0.6) were used. Cronbach’s alpha was used to check for component reliability. Furthermore, a multiple regression model was used with the method of gradual inclusion of variables (STEPWISE) to determine the mutual dependence between groups of variables and to establish causality. The level of statistical significance was set at $p\leq0.05$.

3 RESULTS

3.1 Participants

The response rate among nurses was 35.91% ($n=1010$), with hospital response rates ranging from 23.1 to 61.2%. Of the 1,010 respondents participating, 880 surveys were duly completed, so the database of 880 surveys thus created serves as the basis for all analyses.

3.2 Extent of missed nursing care

All 32 nursing activities included in the survey were missed to some extent. Here, the most and the least common missed nursing care activities are specified. The most

frequently missed nursing activity was conversation with a patient or their family members ($M=2.45$, $SD=0.940$), or nurses could not monitor confused patients closely enough so patients had to be sedated ($M=2.42$, $SD=1.005$) or restrained ($M=2.39$, $SD=0.992$). The least frequently missed activities were those related to daily living, such as assisting with the intake of food ($M=1.56$, $SD=0.809$), performing a sponge bath ($M=1.62$, $SD=0.833$), or changing the patient’s bed linen ($M=1.64$, $SD=0.813$). According to the components of the MNC (the five-component solution), the activities of ‘Monitoring’ ($M=2.09$) and ‘Caring, support, activation, education’ ($M=2.03$) were the most commonly missed. To a lesser extent but still missing are the activities of ‘Documentation’ ($M=2.02$), ‘Safety’ ($M=1.85$), and ‘Activities of daily living’ ($M=1.72$) (Table 2).

Looking at the data according to the participating hospitals (Table 3), the average values of MNC reveal a trend of missing activities in the component of ‘Caring, support, activation, education’ occurring more frequently compared to the ‘Activities of daily living’. Activities of ‘Caring, support, activation, education’ were missed significantly more often ($t=-13.548$; $p<0.001$; $d=0.457$) than ‘Activities of daily living’.

3.3 Reasons for missed nursing care

The data on the reasons for MNC was collected using the MISSCARE part B questionnaire. The most common reasons for MNC as identified by respondents were inadequate number of staff ($M=3.75$, $SD=0.660$), an unexpected rise in patient volume and/or acuity on the unit ($M=3.48$, $SD=0.838$), and urgent patient situations (e.g. a patient’s condition worsening) ($M=3.40$, $SD=0.913$). The three-component solution on reasons for MNC reflects the same situation: ‘Labour resources’ ($M=3.44$) are the most common reason for MNC, followed by ‘Material resources’ ($M=3.20$), and finally ‘Communication’ ($M=2.98$) (Table 4).

3.4 Contribution of nurses’ job characteristics to missed nursing care

Table 4 shows the results of multiple regressions, measuring the effect of reasons for MNC, and nurses’ job characteristics on MNC (Table 5).

Table 1. Participant characteristics.

Nurse characteristics	n	%
General care registered nurses (RNs)	373	42.4
Healthcare assistants (HCAs)	507	57.6
Female	733	83.3
Male	147	16.7
Employment at surgical units	486	55.22
Employment at medical units	394	44.77
	M	SD
Mean age	37.08	10.55
Mean length of employment in nursing	15.34	11.12

Note: M-mean, SD-standard deviation

Table 2. 5-component PCA solution on MNC.

Component of MNC	M	SD	% of total variance explained	α
1 Monitoring	2.09	0.909	72.658	0.872
2 Caring, support, activation, education	2.03	0.822	68.555	0.997
3 Documentation	2.02	0.846	77.059	0.900
4 Safety	1.85	0.679	73.125	0.947
5 Activities of daily living	1.72	0.773	68.904	0.911

Note: 1-never, 2-rarely, 3-sometimes and 4-often missed; M-mean, SD-standard deviation, α -Cronbach’s alpha

Table 3. Extent of MNC by participating institution.

Component of MNC	Monitoring		Caring, support, activation, education		Documentation		Safety		Activities of daily living	
	M	SD	M	SD	M	SD	M	SD	M	SD
Hospital										
1	2.07	0.832	2.13	0.934	1.95	0.714	2.01	0.741	1.79	0.777
2	1.73	0.669	2.11	0.860	1.63	0.504	1.87	0.734	1.53	0.528
3	1.96	0.808	2.01	0.763	1.77	0.752	1.91	0.755	1.62	0.617
4	1.96	0.679	2.18	0.643	1.73	0.535	1.87	0.589	1.45	0.533
5	2.12	0.815	2.09	0.926	1.89	0.674	2.05	0.805	1.86	0.743
6	2.04	0.582	1.99	0.809	1.78	0.502	1.96	0.733	1.73	0.451
7	1.99	0.961	2.49	1.059	2.12	0.623	2.48	0.872	1.94	0.899
8	2.19	0.708	2.34	0.754	1.93	0.462	2.24	0.911	2.29	0.782
9	1.91	0.929	1.89	1.020	1.77	0.760	1.94	0.956	1.52	0.928
10	2.11	0.764	2.20	0.803	1.88	0.657	2.01	0.833	1.78	0.640

Table 4. 3-component PCA solution on reasons for MNC.

Component	M	SD	% of total variance explained	α
1 Labour resources	3.44	0.642	63.809	0.962
2 Material resources	3.20	0.852	77.897	0.858
3 Communication	2.98	0.792	61.510	0.911

Note: 1- not a reason for MNC, 2-minor reason, 3-moderate reason and 4-significant reason; M-mean, SD-standard deviation, α -Cronbach's alpha

Table 5. The effect of reasons for MNC and different job characteristics on MNC.

	Dependent variables of MNC in 5 regression models									
	Monitoring		Documentation		Activities of daily living		Safety		Caring, support, activation, education	
R ²	0.128		0.165		0.178		0.228		0.143	
Constant	1.647		1.669		1.782		2.079		1.544	
Independent variables	B	p	B	p	B	p	B	p	B	p
Reasons										
Labour resources	0.186	<0.001	0.200	<0.001	0.127	0.002	0.197	<0.001	0.245	<0.001
Communication									-0.102	0.015
Material resources							-0.108	0.002		
Job characteristics*										
Work schedule flexibility			-0.078	0.034	-0.094	0.015				
Opportunities for advancement					0.165	<0.001	0.084	0.039		
Independence at work										
Professional status	-0.070	0.047					-0.092	0.015		
Wages	-0.059	0.050	-0.115	0.001	-0.103	0.006	-0.158	<0.001	-0.076	0.028
Educational opportunities										
Annual leave			-0.117	0.007			-0.109	0.010		
Sick leave			0.119	0.005	0.103	0.016	0.147	0.001	0.121	0.004
Study leave					-0.111	0.008	-0.069	0.049	-0.084	0.044
Other aspects of work										
No. of patients on recent shift			0.061	0.046						
Satisfaction with career			-0.096	0.005						
Years of work in nursing	-0.135	0.050	-0.138	0.049	-0.052	0.050	-0.170	0.031	-0.241	0.003
Quality of nursing care in unit	-0.138	<0.001	-0.130	<0.001	-0.201	<0.001	-0.213	<0.001	-0.137	<0.001
Assessment of work environment	-0.109	0.004			-0.117	0.002	-0.070	0.046	-0.140	<0.001
Intention to leave= nursing but not in hospital	0.071	0.028	0.086	0.007					0.088	0.006
Intention to leave=not in nursing							-0.072	0.020		

Note: R²-adjusted R-Squared, B-standard regression coefficient, p-statistical significance; *1-very dissatisfied, 2-a little dissatisfied, 3-moderately satisfied, 4-very satisfied.

As shown in Table 5, of the three components describing the reasons for MNC, 'Labour resources' explained all five dimensions of MNC. The more significant the 'Labour resources' become, the more MNC there is. Communication explains MNC in the dimension 'Caring', and 'Material resources' explain MNC in the dimension 'Safety'. The different variables describing nurses' work characteristics also proved to be significant, with only satisfaction with wages explaining all five dimensions. MNC decreases as satisfaction with wages increases. The variables 'Educational opportunities' and 'Independence at work' did not prove to be important in any dimension of MNC. The variables 'Years of work in nursing' and assessment of 'Quality of nursing care in unit' also proved to be important, as they both explain all five dimensions of MNC. The longer the respondents had worked in nursing and the better their assessment of nursing work quality at their unit, the lower the MNC. Similarly, we found that a better assessment of the work environment led to lower MNC in four dimensions, except 'Documentation'. On the other hand, we expected that a higher patient-to-nurse ratio in respondents' most recent shift would lead to a higher rate of MNC, but this was confirmed only for the 'Documentation' dimension. The last two rows show dummy variables. The intention to leave the hospital explains MNC for the dimensions 'Monitoring', 'Documentation' and 'Caring, support, activation, education', but only for respondents who would leave their current job for another nursing position but not in the current hospital. The intention to leave the hospital explains MNC for the dimension 'Safety', but only for respondents who would leave the nursing profession.

4 DISCUSSION

Understanding the most frequently missed activities and the underlying reasons for that provides an opportunity to plan changes in the organisation of nursing care in Slovenia by providing decision makers with concrete and valid data on the current situation in hospitals. We found that nursing activities related to the basic life needs and safety of patients are the least frequently missed. For these activities, not implementing them would have the most visible results. The most frequently missed activities are those of talking to patients and their families. A study conducted in 12 European countries (33,659 nurses in 488 hospitals) (21) has also shown that the most frequently missed nursing activity was comforting/talking to patients. Those activities are extremely important for the quality of patient care, but are sidelined due to the priority that medical/technical procedures and nursing interventions take in practice. The absence of these activities is not visible (unlike missed skin care or oral hygiene) and they do not affect immediate patient safety (such as,

for example, missed administration of a prescribed medication). As noted by Kirwan & Matthews (22), nurses are more likely to provide care that achieves immediate or short-term outcomes. However, missed psychological care (the dimension 'Caring, support, activation, education' falls into that category) which may not have immediate negative effects, often goes unaddressed. The unpredictability of the time required for psychological care, as opposed to physical care, may contribute to a tendency to ration these activities. Other authors (23) also noted that patient education is a frequently cited omission in nursing care. In their qualitative study, the theme of 'Not priority nursing care due to competing work demands and the missing workplace culture' emerged, and they emphasised the need for developing strategies for increasing patient education to prevent MNC and to recognise patient education as the next care-related indicator of quality of care. The next frequently missed activity is monitoring confused patients, which led to more frequent physical and drug immobilisation of patients due to a lack of monitoring. Monitoring confused patients is a challenge because it requires constant to very frequent presence of a nurse in the patient's room. In a Polish study (24), the authors came to somewhat different conclusions. The most frequently missed nursing activities were reviewing nursing care plans to familiarise themselves with the patient's condition, talking to the patient and/or their family and identifying the needs of newly admitted patients. The average rating of the individual components in our survey shows that 'Monitoring' is the most frequently missed nursing activity in Slovenia, closely followed by 'Care, support, activation, education'. Monitoring of hospital patients is a critical aspect of healthcare and can pose a high safety risk if missed. Interventions that are part of the dimension 'Care' have a major impact on the quality of life of patients and their relatives, especially post discharge. As authors (25) state in their comprehensive scoping review, regardless of the concept analysed—missed, rationed or unfinished nursing care—all have a negative impact on patient outcomes related to patient safety and quality of care.

Missed nursing care can be linked to its underlying reasons, the topmost being the insufficient number of staff, which in Slovenia is related to the long-standing and worsening shortage of nurses. We found that the highest mean value in the significance of reasons for MNC is related to 'Labour resources' and is confirmed as the most important reason. A shortage of nurses has been recorded since 2007 and varies between 20% and 30% (26). In addition, the number of patients per registered nurse in Slovenia is currently the highest in Europe and higher than in some non-European countries, which poses a high risk to the quality of nursing and healthcare overall (27). The regression model results did not confirm our expectations—that a higher number of patients cared for by the respondents in their last shift

would increase MNC—as this was only shown this for the dimension ‘Documentation’. The International Council of Nurses, representing nurses around the world (28), developed guidelines for the retention and continued employment of nurses, but unless policy makers make changes, labour resources will remain high on the list of reasons for MNC. Other authors have come to similar conclusions (22, 29-32), as labour resources were also cited as the most prevalent reason for MNC.

The association between nurse-related organisational factors and missed nursing care shows that, in addition to staffing, the working environment of nursing staff is also a significant reason for MNC. Hospitals with a more favourable working environment, lower patient-to-nurse ratios and fewer professional nurses reporting often carrying out non-nursing tasks had a lower prevalence of nurse-reported MNC (21). In relation to the nurses’ work environment, previous findings (33) have already stated that the working environment in Slovenia needs to be changed and that nurses lack opportunities for professional development; therefore, self-assessment of various aspects of work (e.g. wages, opportunities for advancement and professional development) is low. The results (34) indicate that nursing care is missed due to staff shortages, organisational problems and the working climate. A good working environment reduces MNC, less MNC is present when nurses have no intention of leaving the hospital, when they perceive adequate staffing in the unit, when they are satisfied with their current position, and with being a nurse, and when they are satisfied with the level of teamwork (35, 36). Organisational characteristics, nursing unit features and the degree of teamwork among nursing staff have an impact on MNC. Among other characteristics, professional roles, working hours, and adequate staffing can also potentially contribute to the occurrence of MNC. Our results showed which characteristics of the work environment and job satisfaction have an impact on whether or not nursing care is provided. We found that less nursing care was missed when satisfaction with wages, annual leave, study leave, professional status and work flexibility increased. The same applies to the number of years employed in nursing, the evaluation of nursing care quality, satisfaction with the career and the evaluation of the working environment. Nurses’ work environment has a strong influence on levels of missed care (4, 37), and nurses’ leadership is a very important element of the work environment. As the authors (38) state, the role of management and leadership of the healthcare service is central to mitigating the factors that contribute to the emergence of MNCs, especially labour resources. The main effects of lack of nursing care in the adult setting were an increase in mortality, adverse events and failure of care. A number of causative factors have been identified relating to ward environments, inadequate staffing and skill mix,

although the findings are inconclusive. Solutions include continuing education, reorganisation of wards and work, and appropriate skill levels (39).

The differences in the functioning and management of different national healthcare systems are the reason why it is of utmost importance to have national data based on which national solutions can be implemented. Identifying and addressing missed nursing care is crucial for the nursing profession and healthcare organisations so that optimal outcomes for patients and the well-being of nurses can be achieved (22, 34).

5 CONCLUSION

Missed nursing care needs to be addressed by healthcare management and policy, especially given the severe shortage of nurses in Slovenia and Europe and the potentially harmful consequences this can have for patients. If we look at the problem from a public health perspective, several consequences are possible: increased morbidity and mortality, delayed or inappropriate treatment, reduced patient safety, increased healthcare costs, poor management of chronic conditions and reduced effectiveness of healthcare interventions and prevention strategies. Nurse leaders can help address missed nursing care by having the opportunity to openly acknowledge and discuss missed nursing care. It is important to recognise this as a possible consequence of staff shortages. However, its effectiveness depends on support from the organisation (22). This study contributes to the understanding of nursing care practices in Slovenia and is internationally comparable, as MNC is an existing problem and the reasons for it need to be known in order for healthcare management to be able to plan and implement change.

ACKNOWLEDGMENT

We would like to thank and acknowledge the contribution of all the nurses who participated in the study and the staff who helped with organisation of the survey in healthcare institutions. The data capture for this study was carried out simultaneously with the RN4CAST study data capture. Our study presents part of the results of a doctoral dissertation.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist. The manuscript has not been published and is not under consideration for publication elsewhere.

FUNDING

The research received no external funding.

ETHICAL APPROVAL

Formal approval was obtained from the authors of the questionnaires Beatrice J. Kalisch (MISSCARE survey) and Maria Schubert (BERNCA-R survey). The study was approved by the National Medical Ethics Committee (No. 0120-488/2019/6) and informed consent was obtained from participants.

AVAILABILITY OF DATA AND MATERIALS

Data used in this study are available upon request.

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PUBLIC PERCEPTIONS OF FAMILY PRESENCE DURING RESUSCITATION: A CROSS-SECTIONAL SURVEY IN SLOVENIA

STALIŠČA JAVNOSTI DO PRISOTNOSTI DRUŽINSKIH ČLANOV MED OŽIVLJANJEM: SLOVENSKA PRESEČNA RAZISKAVA

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Received: Jun 22, 2024

Original scientific article

Accepted: Sep 19, 2024

ABSTRACT

Keywords:

Family-witnessed
resuscitation
Cardiopulmonary
resuscitation
Perception
Public opinion
Family-centred care
Quantitative study

Background: In Slovenia, the practice of having family present during resuscitation (FPDR) in the clinical setting is still controversial. Therefore, the aim of the study was to explore current public perceptions regarding FPDR in Slovenia and to investigate whether demographic characteristics are related to these perceptions.

Methods: A cross-sectional study was conducted using the FPDR Benefit-Risk Scale (BRS) to collect data from a sample of 618 participants. The FPDR-BRS includes 23 items rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). The online survey was conducted from 15 September to 30 December 2023. Inferential statistics were computed using IBM SPSS version 25.

Results: The results indicate moderately favourable attitudes towards FPDR among participants in general. Older individuals (aged 60-82) and respondents not affiliated with the healthcare sector scored higher on the overall FPDR-BRS, indicating more favourable attitudes towards the practice of FPDR. Respondents who had previous experience with cardiopulmonary resuscitation were less concerned that FPDR could cause psychological trauma to family members.

Conclusions: These findings have significant implications for the adoption of FPDR policies and practices in the healthcare sector. Healthcare providers should prioritise education, training and support as the presence of family members during resuscitation becomes more widely accepted.

IZVLEČEK

Ključne besede:

oživljanje v prisotnosti
družinskih članov
kardiopulmonalno
oživljanje
percepcija
javno mnenje
oskrba osredotočena
na družino
kvantitativna študija

Izhodišča: V Sloveniji praksa glede prisotnosti družinskih članov med oživljanjem (FPDR) v kliničnem okolju ostaja sporna. Namen raziskave je bil ugotoviti trenutna stališča javnosti glede FPDR v Sloveniji, in ugotoviti, ali so demografske značilnosti populacije povezane s temi stališči.

Metode: V presečni študiji smo z uporabo FPDR lestvice koristi in tveganj (BRS) zbrali podatke na vzorcu 618 anketirancev. Vprašalnik FPDR-BRS vključuje 23 trditev, ki so jih anketiranci ocenjevali s pomočjo petstopenjske Likertove lestvice (1 = močno se ne strinjam do 5 = močno se strinjam). Spletna anketa je potekala od 15. septembra do 30. decembra 2023. Inferenčna statistika je bila izračunana z uporabo programa IBM SPSS različice 25.

Rezultati: Rezultati kažejo na zmerno pozitivno naklonjenost anketirancev do FPDR na splošno. Starejši posamezniki (60-82 let) in anketiranci, ki niso povezani z zdravstvenim sektorjem, so dosegli višje število točk na celotni lestvici FPDR-BRS, kar kaže na večjo naklonjenost do prakse FPDR. Anketiranci, ki so imeli predhodne izkušnje s kardiopulmonalnim oživljanjem, so bili manj zaskrbljeni, da bi FPDR lahko povzročila psihološko travmo družinskim članom.

Zaključki: Te ugotovitve pomembno vplivajo na sprejetje politik in praks FPDR v zdravstvenem sektorju. Zdravstveni delavci bi morali dati prednost izobraževanju, usposabljanju in podpori, saj je prisotnost družinskih članov med oživljanjem vse bolj razširjena.

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1 INTRODUCTION

Cardiopulmonary resuscitation (CPR) is a challenging and emotional situation for healthcare teams, requiring quick thinking and responsiveness. Traditionally, family members have been kept away from the resuscitation area, but research conducted internationally, notably in England and the United States, supports the presence of family members during resuscitation (1-4). It is noteworthy that approximately 70% of relatives prefer to be present during health-related procedures, including resuscitation (5). Studies have indicated diverse implications of family-witnessed resuscitation. The existing international literature suggests that the presence of family members has a positive impact, particularly in terms of establishing trust between family members and the medical staff resuscitating the patient, creating a more humane atmosphere that facilitates farewell and provides solace during grief in the event of a potential fatal outcome (6-8). These benefits are not limited to patients and their families, but also apply to clinicians (9). However, opponents of this viewpoint raise the possibility of psychological trauma (stress, anxiety) caused by being present during resuscitation, and express concerns that family members might interfere with and disrupt the resuscitation process. These studies also mention ethical dilemmas regarding inviting family members into the resuscitation room, as well as the potential for legal disputes (10, 11).

A broad consensus among international medical associations, including the American Heart Association (AHA), the European Resuscitation Council (ERC) and the European Federation of Critical Care Nursing Associations, supports the presence of relatives during CPR (12-14). However, despite the existing perspectives on this topic, there is still an ongoing debate in many countries, including Slovenia, regarding the involvement of the patient's family members during resuscitation. The latest research on this topic highlights the evolving standard of care and the importance of introducing institutional policies to support family presence during resuscitation (FPDR) (15-17). Studies emphasise the need for a patient-centred approach that balances safety, family autonomy and interprofessional teamwork skills, and involves a designated family facilitator such as an on-call chaplain (18).

The adoption of policies allowing FPDR into clinical practice presents a number of challenges, including legal, ethical and procedural considerations (15). From a personnel perspective, a major barrier to adopting these policies is the lack of written instructions (8). However, there is a paucity of data on the attitudes of patients and their families towards FPDR (7, 8, 19). Moreover, Toronto and LaRocco (7) highlight the limited literature available on the viewpoints of families from Eastern countries, indicating the need for further research on

this topic to understand potential cultural variations in the perceptions of FPDR. In Slovenia, the topic of FPDR is under-researched, particularly with regard to the perspectives of relatives themselves. The main objectives of this exploratory study were: i) to assess current public perceptions of FPDR in Slovenia and ii) to investigate whether demographic characteristics are associated with the general population's perceptions of this topic.

2 METHODS

2.1 Study design

The study employed a quantitative, empirical, non-experimental, cross-sectional design and was approved by the Ethics Committee of the University of Primorska (Ethics Committee No. 4264-19-6/23).

2.2 Instrument

Data were collected using the Family Presence During Resuscitation Benefits-Risks Scale (FPDR-BRS), a tool developed by Parial et al. and freely accessible for use (20). The questionnaire contains 23 items rated on a 5-point Likert scale, with 1 representing "strongly disagree", 3 representing "no opinion", and 5 representing "strongly agree". It is relevant to note that ten items of the questionnaire are reverse coded due to negatively worded sentences. In this context, higher scores in the questionnaire indicate a more positive perception of FPDR by relatives, while lower scores indicate a more negative attitude towards this practice. This scale includes four subscales: Insight-Building Benefits (a 7-item subscale focusing on relatives' knowledge-forming perceptions of processes, procedures and patient status during resuscitation), Personnel Risks (a 7-item subscale addressing the potential threats of FPDR to healthcare team performance, ethical and legal competence, and psychological well-being), Connection-Forming Benefits (a 6-item subscale assessing relatives' perceptions of building more meaningful bonds and securing connections with higher entities (such as their Creator) and living beings (including the healthcare team, patients, and other relatives), and Personal Risks (a 3-item subscale examining the psychosocial impact of FPDR on relatives' emotional well-being). These four subscales were identified following an extensive literature review. The estimated internal consistency of reliability for the total scale was reported to be 0.90, with all subscales demonstrating satisfactory Cronbach's α values ranging from 0.86 to 0.94 (17).

The 23-item questionnaire was first translated from English into Slovenian independently by two authors with experience in critical care nursing. To ensure consistency between the Slovenian version and the original text, a back-translation was then performed.

2.3 Sampling procedure and data collection

The study focused on Slovenian residents as the target population. It was conducted on a convenience sample of 618 individuals (21). The required minimum sample size was determined on the basis of population data from the Statistical Office of the Republic of Slovenia, with a confidence level of 95% and a margin of error of 5%. The online survey, which was accompanied by the study purpose statement and an informed consent form, was accessible from 15 September to 30 December 2023. To reach different groups of respondents, the online questionnaire was initially shared via two posts on Facebook and Instagram by the first author of the article. Furthermore, social media followers of diverse age and genders were asked to share the aforementioned posts through their own network, ensuring a diverse sample. Respondents agreed to participate by clicking on the embedded link and completing the electronic survey, which was facilitated by the 1KA One Click Survey online platform (1ka.si; <https://www.1ka.si/d/en>). The data provided by the respondents were securely collected on the 1ka.si server and managed by a researcher via a password-protected 1KA account. To ensure anonymity, no identifiable information such as IP addresses, names, surnames or email addresses were tracked or collected during data collection. The participants who completed and submitted the questionnaire gave informed consent, which included a statement that their participation was anonymous and voluntary and could be withdrawn at any time.

2.4 Data analysis

The prerequisite for including the respondent in the final analysis was the completion of all FPDR-BRS items. If demographic data were not fully provided, we still included those respondents in the final analysis. The empirical data collected were processed and statistically analysed using IBM SPSS version 25 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics such as frequencies, percentages, skewness, kurtosis, means (M), medians (Me) and standard deviations (SD) were calculated to present and summarise the data. Given the normal distribution of the data, the independent sample T-test and one-way ANOVA were applied to determine statistically significant differences between the demographic groups. The threshold for statistical significance was set at $p<0.05$.

3 RESULTS

Of the 1,120 people who clicked on the survey link, 799 started the survey and 618 completed it. As participation in the study was voluntary, the overall response rate was 51%. The average age of respondents was 42.8 years (SD=13.8; range: 18-82 years). Participants' demographic and other characteristics are listed in Table 1. In addition, 60.9% of participants stated that they had a relative who

Table 1. Participant demographics.

Variables	n	%
Gender		
Male	170	27.6
Female	445	72.4
Age (years)		
18-39	232	37.7
40-59	321	52.1
60-82	63	10.2
Marital status		
Married	279	46.9
Long-term partnership	212	35.6
Single	104	17.5
Educational attainment		
≤ Higher secondary	274	45.0
≥ Undergraduate degree	335	55.0
Work sector		
Healthcare	121	19.9
Other work sector	487	80.1
Religious		
Yes	353	58.7
No	248	41.3

had been treated in an intensive care unit, and 27.5% had either attended or experienced CPR.

The internal consistency reliability of individual subscales and the overall scale of the translated instrument was assessed using Cronbach's alpha. The Cronbach's alpha for the total scale was 0.913, and the coefficients for the subscales ranged from 0.916 (Insight-Building Benefits) to 0.848 (Personal Risks). These values indicate a high degree of internal consistency. The mean, standard deviation, actual and possible score range of the instrument with the respective median values are presented in Table 2. Of the two benefits scales, subscale 1 obtained a mean value of 24.2 (SD=7.5) and was also the subscale that was rated highest by respondents, while subscale 3 obtained a mean value of 17.0 (SD=5.9). Of the two risks scales, subscale 2 obtained a mean value of 20.3 (SD=6.6) and subscale 4 obtained a mean value of 8.6 (SD=3.2). Subscale 1 (Insight-Building Benefits) showed a negative skewness (-0.368), while the other subscales displayed a positive skewness as follows: 0.170, 0.114 and 0.232. Overall, respondents were moderately favourably disposed towards FPDR (mean=70.1; SD=17.1). A total of 50.5% of respondents attained a score of 70 points or above on the total score scale.

Table 2. Descriptive statistics of the Family Presence During Resuscitation Benefits-Risks Scale (N=618).

Subscales (No. of items)	M	SD	Possible score range (Me)	Actual score range (Me)	Cronbach's α
Insight-Building Benefits (7)	24.2	7.5	7-35 (21)	7-35 (25.0)	0.916
Personnel Risk* (7)	20.3	6.6	7-35 (21)	7-35 (20.0)	0.865
Connection-Forming Benefits (6)	17.0	5.9	6-30 (18)	6-30 (17.0)	0.884
Personal Risks* (3)	8.6	3.2	3-15 (9)	3-15 (8.0)	0.848
Total scale (23)	70.1	17.1	23-115 (69)	25-115 (70.0)	0.913

Note: FPDR-BRS — all items were rated on a 5-point Likert-type scale ranging from 1=strongly disagree to 5=strongly agree. Ten items were reverse coded. M=mean, Me=median

Table 3 shows the descriptive statistics of the sample population's demographic characteristics with respect to the four FPDR-BRS subscales. To establish statistically significant differences among demographic groups, independent sample T-tests and one-way ANOVA were performed. Statistically significant differences in responses were observed in the following three demographic variables: age group, work sector and previous experience with cardiopulmonary resuscitation. Across all four subscales, the younger population (aged between 18 and 39) expressed less favourable views towards the practice of FPDR compared to the other age groups. Post-hoc tests revealed statistically significant differences in the four subscales only between the 18-39 age group and the other two groups ($p < 0.001$). In addition, respondents not affiliated with the healthcare sector showed a more positive perception of FPDR in the first three subscales (Insight-Building Benefits, Personnel

Risk, and Connection-Forming Benefits). Respondents with previous CPR experience scored higher on subscale 4, indicating less concern that the practice of FPDR could cause psychological trauma to family members.

The results also reveal differences among individual groups in relation to the overall FPDR-BRS. Older individuals (age group 60-82) and respondents who were not affiliated with the healthcare sector scored higher on the total FPDR-BRS, indicating a more positive perception of FPDR among family members.

In our study, factors such as marital status, educational level, religious affiliation and prior exposure to a loved one's treatment in an intensive care unit showed no significant association with the general population's perceptions of FPDR. No statistically significant differences were observed in the subscales or the overall FPDR-BRS scores pertaining to these variables.

Table 3. Demographic characteristics of the sample population concerning overall FPDR-BRS and its subscales — descriptive statistics.

Variable		Subscale 1	Subscale 2	Subscale 3	Subscale 4	Total
Age						
18-39	M (SD)	23.2 (7.1)	18.3 (6.0)	16.2 (5.4)	7.9 (3.1)	65.5 (15.5)
40-59	M (SD)	24.5 (7.7)	21.5 (6.9)	17.3 (6.1)	9.0 (3.2)	72.2 (17.3)
60-82	M (SD)	26.7 (8.3)	22.1 (5.9)	19.1 (7.1)	9.0 (3.4)	76.7 (18.6)
ANOVA	p	0.004	<0.001	0.002	<0.001	<0.001
Work sector						
Healthcare	M (SD)	22.7 (8.4)	19.3 (6.9)	16.0 (5.7)	8.1 (3.1)	65.9 (18.3)
Other	M (SD)	24.6 (7.3)	20.6 (6.6)	17.3 (6.0)	8.7 (3.2)	71.0 (16.8)
Independent samples t-test	p	0.014	0.049	0.043	0.055	0.004
Level of education						
Higher secondary and lower	M (SD)	24.5 (7.6)	20.4 (7.1)	16.9 (5.9)	8.4 (3.2)	69.9 (17.4)
BA and higher	M (SD)	23.9 (7.6)	20.4 (6.4)	17.1 (6.0)	8.8 (3.2)	70.1 (17.0)
Independent samples t-test	p	0.346	0.947	0.672	0.220	0.915
Experience with resuscitation						
Yes	M (SD)	23.6 (8.6)	20.5 (7.6)	16.7 (6.3)	9.4 (3.4)	69.9 (19.3)
No	M (SD)	24.4 (7.2)	20.3 (6.3)	17.2 (5.8)	8.3 (3.1)	70.1 (16.4)
Independent samples t-test	p	0.932	0.804	0.348	< 0.001	0.932

Note: Subscale 1-Insight-Building Benefits; Subscale 2-Personnel Risk; Subscale 3-Connection-Forming Benefits; Subscale 4-Personal Risks; p=statistical significance

4 DISCUSSION

FPDR represents a multifaceted and emotionally charged subject within the context of healthcare. The aim of this study was twofold: firstly, to assess the prevailing perceptions of the Slovenian public regarding FPDR, and secondly, to identify potential associations between demographic characteristics and attitudes towards this practice.

The results from the present study show that over 50% of respondents tend to be in favour of FPDR practice. This is consistent with the findings of a recent study in which family members were interviewed and stated that they would like to have the option to be present if their family member underwent CPR (22). However, a recent study in Poland indicates that both patients and their family members have insufficient knowledge regarding their permission to be present during CPR interventions (19). Hence, to effectively address this issue, it is imperative to establish unambiguous guidelines that endorse FPDR as an option within a patient-centred approach, rather than making it mandatory (7).

Attitudes towards FPDR vary considerably between different groups (Table 3), with individuals aged 18-39 being less favourably disposed towards FPDR. This discrepancy could be due to different views on the role of family members in medical emergencies. Younger people may place more emphasis on the efficiency of the resuscitation process and be more concerned about possible distractions or interference from family members (23). Another possible explanation for this discrepancy could be that younger people have too little experience with critical care scenarios, which could lead to a sense of unease at the prospect of witnessing a resuscitation procedure (23). Another factor that could play a role is the influence of media portrayals of resuscitation procedures. These are often characterised by over-dramatisation, which can trigger feelings of anxiety (24). However, this area is still largely unexplored, and further research, taking into account different values, life expectations and the influence of social media, would provide a better insight into this phenomenon. Conversely, older individuals may possess a more nuanced understanding of the emotional needs of family members during such critical situations. In fact, individuals over the age of 60 had a more positive overall perception of FPDR. This suggests that age may influence attitudes towards the presence of family members in resuscitation scenarios. These findings may indicate a generational shift in attitudes, with older people placing more importance on the traditional role of family presence and support at critical moments than their younger counterparts (22).

In our study, respondents who were not affiliated with the healthcare work environment tended to have a more positive attitude towards FPDR. Healthcare professionals,

particularly physicians, often express reluctance towards the presence of family members during invasive procedures, indicating a lower degree of willingness to allow FPDR (16). On the other hand, patients' family members have been reported to have significantly more positive attitudes towards FPDR compared to healthcare professionals, with family members believing that it may be beneficial for the relatives' grieving process (7). These findings suggest that healthcare professionals may have a more pragmatic view of FPDR and focus more on the potential challenges and risks that FPDR may pose during resuscitation efforts. In contrast, the general public may emphasise the emotional support and closure that FPDR can provide (25). Non-healthcare individuals may also be more open to recognising the potential emotional and psychological benefits of FPDR without being influenced by professional concerns about procedural risks and clinical effectiveness (26).

Despite some reluctance among healthcare professionals to accept FPDR, training in this practice combined with advanced resuscitation instruction significantly increases its acceptance. This emphasises the importance of education and training in this area (27,28). As demonstrated by Chapman et al. (29), enhanced familiarity with FPDR practices could encourage support, and repeated exposure could raise clinicians' awareness of the benefits rather than of the potential drawbacks of these practices. Research suggests several strategies for training healthcare professionals in FPDR, including simulations with standardised patients, role-playing, case studies, asynchronous online modules and traditional face-to-face lectures (7, 30, 31).

Experience with CPR appears to have a significant impact on attitudes, particularly regarding concerns about the psychological trauma experienced by family members. Respondents who had experienced CPR were less concerned about potential psychological harm, possibly because first-hand experience tends to demystify the process and its effects. This finding is consistent with the literature that suggests that familiarity with medical procedures can reduce anxiety and increase understanding in laypersons (2, 8).

Contrary to expectations, no significant association was found between factors such as marital status, educational level, religious affiliation and previous exposure to intensive care unit treatment and perceptions of FPDR. This suggests that these variables may not be relevant to shaping attitudes towards family presence during resuscitation. Previous studies have reported conflicting results regarding the effects of these variables on the perceptions of FPDR (23, 25). This may suggest that attitudes towards FPDR are influenced more by personal and experiential factors rather than broader demographic characteristics.

Findings from the present study have important implications for both the adoption of FPDR policies and their practical implementation in healthcare settings. It is important to acknowledge that the perceptions of FPDR are not homogeneous across demographic groups. This understanding can help tailor communication and education efforts to the specific needs of different groups. For example, education programmes aimed at younger people could focus on demystifying the resuscitation process and addressing their specific concerns. Consequently, working with healthcare professionals to address their concerns and provide evidence-based guidance on how to perform FPDR is recommended. This would help to allay fears and increase acceptance of the practice.

Overall, this study contributes to the ongoing debate on FPDR by highlighting the complexities of public perceptions and the potential influence of demographic factors on attitudes towards the inclusion of family members in resuscitation scenarios. In the context of healthcare systems striving to provide compassionate and patient-centred care, understanding and addressing the public's concerns and preferences regarding FPDR will be of utmost importance. This will be crucial in shaping future policies and practices. Furthermore, future research could investigate the influence of cultural and social norms on perceptions of FPDR. This could provide further insight into the promotion of patient-centred care in resuscitation settings. A comparison of different cultural contexts could also shed light on the way different societies manage the tension between medical effectiveness and emotional support during medical crises.

Even though the study provides an insight into public opinion on FPDR in Slovenia, certain limitations need to be taken into account. One of the most important limitations is the possibility of sample bias. One of the most important limitations is the potential for sample bias. The survey was based on a convenience sample. Therefore, the sample may not fully represent the general population. Furthermore, the participants were invited to complete the questionnaire through different communication channels (e.g., social media, friends, work colleagues' invitations). This recruitment method represents a potential bias, as participants may share similar perspectives or attitudes toward FPDR. In fact, in our sample a considerably high percentage of healthcare workers participated in our study. Although the study attempted to capture the perceptions of all demographic categories, certain subgroups may be underrepresented, for example people from rural areas, people from poorer socio-economic backgrounds and people with limited access to digital technology. In fact, the older population is underrepresented in our sample (Table 1). Further investigations should focus on this group's perceptions of FPDR, as they are more likely to require resuscitation,

and family members are often present during such events. Moreover, as this was a cross-sectional study, it captured public perceptions at a single point in time. Due to the design of the study, causality cannot be inferred from the results and any observed associations should be interpreted with caution. This approach did not take into account the potential change in the perceptions of FPDR over time, particularly in light of increasing public awareness and changing healthcare regulations and practices. Longitudinal studies would be needed to observe changes in perceptions over time. To adequately evaluate the results of the study, these limitations should be fully acknowledged. Future studies could overcome these limitations by using more representative sampling methods, incorporating qualitative data, and examining long-term changes in public perceptions. Despite these limitations, the study provides an important foundation for understanding public perceptions of FPDR in Slovenia and suggests avenues for future research.

5 CONCLUSION

In conclusion, this study provides valuable insights into public perceptions of FPDR. The results show that the public is generally positively disposed towards FPDR. Certain demographic groups, such as older adults aged 60-82 and those not employed in healthcare, tend to have a more favourable attitude towards FPDR. Interestingly, respondents with prior experience with CPR were less concerned that FPDR could lead to psychological trauma in family members.

The results suggest that FPDR is gaining acceptance, particularly among certain demographic groups and people with relevant experience. However, there is still room for improvement when it comes to increasing overall positive attitudes and reducing concerns about the emotional impact of this practice on families. As FPDR becomes more widely accepted, it will be important for healthcare providers to prioritise education, training and support in order to achieve the best possible outcomes for patients and their families.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

ETHICAL APPROVAL

This study was approved by the Ethical Committee of the University of Primorska (Approval No./4265-25/21). Participation in the study was voluntary and participants had the right to withdraw from the study at any time without consequences.

FUNDING

The study received no funding.

AVAILABILITY OF DATA AND MATERIALS

All data used in this study are available upon reasonable request.

LLM STATEMENT

The authors of this article utilized the GPT-3.5 language model during the preparation process to:

- review and amend grammatical and spelling mistakes,
- ensure linguistic consistency and coherence,
- test and fine-tune the article's wording.

After utilising the language model, the authors thoroughly reviewed and edited the content as needed. The authors take full responsibility for the final published content.

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EPIDEMIOLOGY AND RISK FACTOR ANALYSIS OF SYSTEMIC ALLERGIC REACTION TO BEE VENOM IN THE SLOVENIAN POPULATION OF BEEKEEPERS

EPIDEMIOLOGIJA IN ANALIZA DEJAVNIKOV TVEGANJA ZA SISTEMSKO ALERGIJSKO REAKCIJO PO PIKU ČEBELE V SLOVENSKI POPULACIJI ČEBELARJEV

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Received: Jul 11, 2024

Original scientific article

Accepted: Sep 30, 2024

ABSTRACT

Keywords:

Public Health

Venom Hypersensitivity
Prevalence

Beekeeping

Objectives: To estimate the lifetime prevalence of first and recurrent systemic allergic reaction to bee venom among Slovenian beekeepers. Additionally, we aimed to elucidate the risk factors predisposing beekeepers to developing systemic allergic reaction to bee venom.

Methods: A nationwide cross-sectional study was conducted among 1,080 beekeepers who are members of the Slovenian beekeeper's association, between 1 November 2021 and 31 May 2023. Epidemiological data were collected using a validated questionnaire, with the clinician-confirmed observed health outcome.

Results: The estimated overall lifetime prevalence of self-reported first systemic allergic reaction to bee venom was 9.4% (102/1,080), with 40.7% (24/59) of the clinician-confirmed cases being severe (grade III-IV according to the Mueller classification). The estimated overall lifetime prevalence of reported recurrent systemic allergic reaction to bee venom was lower at 3.7% (40/1,080), with 60.0% (9/15) of the clinician-confirmed cases being severe (grade III-IV according to the Mueller classification). Risk factors associated with the first systemic allergic reaction to bee venom included age, male sex, number of bee stings per season, a history of large local reaction and experiencing nasal symptoms while working at hives. Younger male beekeepers, with a low number of bee stings per season, a history of large local reaction and nasal symptoms while working at hives, are at a high risk of having systemic allergic reaction to bee venom.

Conclusions: High lifetime prevalence of clinician-confirmed severe first and recurrent systemic allergic reaction to bee venom underscored the importance of targeted public health strategies and clinical interventions to protect this high-risk population.

IZVLEČEK

Ključne besede:

javno zdravje
preobčutljivost
prevalenca
čebelarjenje

Namen: Oceniti vseživljenjsko prevalenco prve in ponovne sistemske alergijske reakcije po piku čebele med slovenskimi čebelarji ter opredeliti dejavnike tveganja za sistemsko alergijsko reakcijo po piku čebele.

Metode: V nacionalno presečno raziskavo, ki je potekala od 1. novembra 2021 do 31. maja 2023 smo vključili 1.080 čebelarjev, včlanjenih pri Slovenski čebelarski zvezi. Za zbiranje epidemioloških podatkov smo uporabili vsebinsko veljaven celostni vprašalnik. Opazovani zdravstveni izid (sistemska alergijska reakcija po piku čebele) je bil potrjen s strani zdravnika.

Rezultati: Ocenjena vseživljenjska prevalenca samoporočane prve sistemske alergijske reakcije po piku čebele je bila 9,4 % (102/1.080), z visokim deležem, 40,7 % (24/59), s strani zdravnika potrjene težke sistemske alergijske reakcije (stopnja III-IV po Muellerjevi klasifikaciji). Ocenjena vseživljenjska prevalenca samoporočane ponovne sistemske alergijske reakcije po piku čebele je bila nižja, 3,7 % (40/1.080), prav tako z visokim deležem, 60,0 % (9/15), s strani zdravnika potrjene težke sistemske alergijske reakcije (stopnja III-IV po Muellerjevi klasifikaciji). Opredeljeni dejavniki tveganja za prvo sistemsko alergijsko reakcijo po piku čebele so bili starost, moški spol, število pikov čebel na sezono, anamneza velike lokalne reakcije in simptomi s strani nosu med delom pri panjih. Mlajši čebelarji, moškega spola, z manjšim številom pikov čebel na sezono, anamnezo velike lokalne reakcije in simptomi s strani nosu med delom pri panjih, so bolj ogroženi za razvoj sistemske alergijske reakcije po piku čebele.

Zaključki: Visok delež s strani zdravnika potrjene težke prve in ponovne sistemske alergijske reakcije po piku čebele nakazuje potrebo po oblikovanju ciljno naravnanih javnozdravstvenih strategij in vpeljavo kliničnih ukrepov z namenom zaščite te visoko rizične populacijske skupine.

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1 INTRODUCTION

Hymenoptera is one of the largest and most species-rich insect orders (1), capable of venom injection in case of direct interactions with humans. Sting reactions, ranging from normal (non-allergic) to allergic can occur at any age. Species known to trigger allergic reactions (ARs) belong to the family and subfamily of *Apidae*, *Vespinae*, *Polistinae* and *Formicidae* (2).

The most frequently clinician-observed ARs are large local reaction (LLR) and systemic allergic reaction (SAR). LLR, a delayed IgE-mediated reaction, manifests as induration typically exceeding 10 cm in diameter, and resolving within 3 to 10 days (3). SAR involves IgE-mediated allergy symptoms, affecting one or more organ systems with varying degrees of severity, commonly graded to Mueller (4) or Ring and Messmer classification (5). It can progress into potentially fatal anaphylaxis, with yellow jackets, bees and hornets identified as the most common culprits in adult anaphylaxis cases (6, 7), and the leading triggers of occupational anaphylaxis (3, 8) among professions such as beekeepers, outdoor workers (gardeners), gastronomy employees and farmers (8).

Beekeepers face unique risks owing to their high degree of exposure to bees (9). A recent meta-analysis of observational studies among beekeepers worldwide estimated the overall lifetime prevalence of self-reported first SAR to bee venom at 23.7% (10), a number much higher compared to the (assisted) self-reporting in the general adult population (3.3%-8.9%) (11). Although not recently updated, several risk factors for AR among beekeepers have been identified (12), with fewer than 10 stings annually, an atopic constitution and upper respiratory allergy during work in the beehive as the major ones (9). Despite a positive history of SAR to bee venom, many beekeepers persist in their work, thereby exposing themselves to the potential risk of recurrent SAR (13). Annala's calculations indicate that a prior SAR to bee venom in beekeepers increases the risk of future SAR eightfold. Additionally, an Italian study among beekeepers and their relatives with a history of LLR or SAR to *Hymenoptera* stings reported up to a 20% increased risk for SAR in the case of the first mild SAR and up to a 45% increased risk in the case of the first severe SAR (14).

To the best of our knowledge, there is no nationwide lifetime prevalence data on SAR to bee venom among the Slovenian population of beekeepers. Therefore, aiming to gain insight into the extent of this problem within this population group, our first objective was to estimate the lifetime prevalence of the first and recurrent SAR to bee venom. Our second objective was to identify the associated risk factors.

2 METHODS

2.1 Study design, setting, and participants

A nationwide cross-sectional study was conducted among Slovenian beekeepers who are members of the Slovenian Beekeeper's Association (SBA), from 1 November 2021 to 31 May 2023. A beekeeper was defined as an SBA member who had completed educational and training programmes within the association's lifelong learning framework, regardless of their beekeeping status (15). The exclusion criteria were: toxic reaction to multiple (more than 100) bee stings; retired beekeepers; refusal to participate after obtaining informed consent.

2.2 Sample size and sampling technique

The sample size was determined using a 95% confidence interval, with an estimated overall lifetime prevalence of the self-reported first SAR to bee venom at 10% and a margin of error of 1.9%. This estimation was derived from epidemiological data on Italian beekeepers in Lombardy (16), a region geographically adjacent to Slovenia. Given the overall population size of 11,293 registered beekeepers in the Central beekeeping register (17), and referring to a previous Slovenian study among beekeepers (18), the calculated sample size was set at $n=728$ (19). The list of all beekeeping societies (BS) ($N=210$) was accessible on the SBA website (20), with contact details available for 193 BS (91.9%). Using a convenience sampling method, we reached out to 193 presidents of BS. A cover letter, along with a predetermined number of informed consents, each having an option to indicate the beekeeper's preferred time for a follow-up telephone interview, and a prepaid return envelope were sent to each BS president expressing willingness to participate in the survey.

2.3 Data collection

2.3.1 The questionnaire

A comprehensive questionnaire, APISS-Q, was developed to collect self-reported environmental and medical history data. The developmental process of the questionnaire is described elsewhere (15).

2.3.2 Epidemiological data

Epidemiological data were collected from 1 November 2021 to 31 October 2022 by the medical doctor (first author). After the COVID-19 pandemic, the survey methodology was adapted from face-to-face to telephone-based interviews.

2.3.3 Clinical data

The observed health outcome for all beekeepers diagnosed with SAR to bee venom at their local Community Health Centre was collected from medical health records between 1 November 2022 and 31 May 2023. For allergic beekeepers treated at the reference centre for *Hymenoptera* venom

allergy (University Clinic Golnik), data were obtained from the hospital information system.

2.4 Observed health outcome

The occurrence of the first SAR to bee venom was assessed using a symptom-based question: “Have you ever had an AR to bee venom or experienced any of the symptoms and signs listed in the table?” Beekeepers could select from five available options. Self-reported subjective symptoms (e.g., pruritus of the palm, soles, scalp) were transformed into the corresponding objective signs by a medical doctor (e.g., generalized urticaria) during telephone interviews. The severity and leading symptoms of SAR were graded using the Mueller classification (4).

Recurrent SAR to bee venom was assessed with the question: “Approximately how many SAR to bee venom have you experienced in your lifetime?” The severity progression of each recurrent SAR to bee venom was evaluated with the question: “If you experienced recurrent SAR, how severe was the reaction compared to the first SAR (decreased severity, no change, increased severity)?” Decreased severity was defined as e.g. SAR turning from grade III in the initial event to grade I in subsequent occurrences. Increased severity was defined as e.g. SAR progressing from grade I to grade II in subsequent reactions.

The lifetime prevalence of the first self-reported SAR to bee venom was calculated as the proportion of beekeepers who self-reported experiencing their first SAR to bee venom at any point in their lifetime, divided by the total observed population of beekeepers at risk of SAR to bee venom.

Similarly, the lifetime prevalence of self-reported recurrent SAR to bee venom was calculated as the proportion of beekeepers who self-reported experiencing recurrent SAR to bee venom at any point in their lifetime, divided by the total observed population of beekeepers at risk of SAR to bee venom.

2.5 Assessment of the degree of exposure

The exposure of interest was defined as the estimated number of bee stings per season. Exposure levels were grouped into the following categories: 1-9, 10-50, 51-99 and ≥ 100 bee stings per season (21). For statistical analysis, data were grouped into two categories: ≤ 50 (1-9, 10-50) and > 50 (51-99, ≥ 100) bee stings per season.

2.6 Confounding variables

The following variables were considered as potential confounders: age, sex, education, self-reported comorbidities, smoking status, beekeeping status, type of beekeeping, beekeeping duration, number of active working days per week, use of protective equipment,

usual management options after bee sting, beekeeping among first-degree relatives (FDR) and family members (FM), symptoms when working at hives, personal history of LLR, personal history of atopic disease (atopic dermatitis, allergic rhinitis and physician-confirmed asthma), personal history of other allergic diseases (other *Hymenoptera*, drug, food), history of AR to bee venom among FDR, history of atopic disease among FDR (atopic dermatitis, allergic rhinitis and physician-confirmed asthma) and history of other allergic disease among FDR (other *Hymenoptera*, drug, food). Detailed information regarding the potential confounders is available upon request.

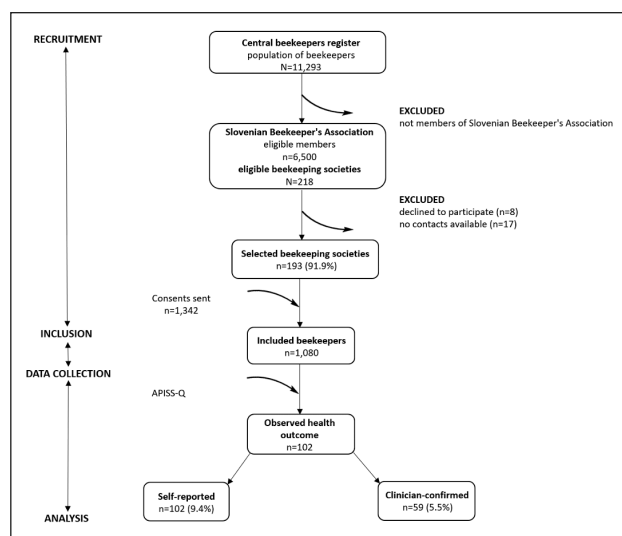
2.7 Statistical analysis

Continuous variables were presented as mean \pm SD (standard deviation), and categorical variables as numbers (percentages). A chi-square test was performed to compare two independent samples. A logistic regression model was applied to identify risk factors associated with the estimated overall lifetime prevalence of self-reported first SAR to bee venom. For each categorical variable, the “normal” situation was defined as the reference category and odds were estimated for the other categories against the reference category (odds ratio=1). The logistic regression started with all independent variables, while only the statistically significant and biologically meaningful were kept in the final model. Data were analysed with SPSS statistical software version 27 (SPSS Inc., Chicago, Illinois, USA). A p value < 0.05 was considered for statistical significance.

3 RESULTS

3.1 Characteristics of the study population

Data were collected from 1,080 beekeepers, with a mean age of 58.9 ± 14.3 years, achieving a response rate of 80.5% (1,080/1,342) (Fig. 1). The characteristics of the study population are presented in Table 1.



Legend: APISS-Q-Apis for “bee”, the letter “S” for “Slovenia” and the letter “Q” for “questionnaire”.

Figure 1. Study flow diagram.

Table 1. The characteristics of the study population according to the categories of selected potential risk factors (N=1,080).

Category	Variable	Total N _{cat} (%)
Demography	Age	
	18-39	123 (11.4)
	40-64	507 (46.9)
	≥65	450 (41.7)
	Sex	
	Female	163 (15.1)
	Male	917 (84.9)
	Education	
	Lower	651 (60.3)
	Upper	429 (39.7)
Environmental exposure	BMI	
	18.5-24.9	295 (27.3)
	25-29.9	547 (50.7)
	≥30	238 (22.0)
	Smoking status	
	Yes	365 (33.8)
	No	715 (66.2)
	Beekeeping status	
	Hobby	1058 (98.0)
	Professional	22 (2.0)
	Type of beekeeping	
	Stationary	894 (82.8)
	Other	186 (17.2)
	Beekeeping duration (yr)	
	≤10	356 (33.0)
	>11	724 (67.0)

Category	Variable	Total N _{cat} (%)
	No. of active working days in a week	
	1-2	843 (78.1)
	≥3	237 (21.9)
	Use of protective equipment	
	Some elements	629 (58.2)
	Complete outfit	252 (23.3)
	None	199 (18.5)
	Beekeeping among FDR ^a and FM ^b	
	Bee contact	825 (76.4)
	No bee contact	255 (23.6)
Host predisposition to SAR	Symptoms when working at hives	
	Nasal	17 (1.6)
	Other	9 (0.8)
	None	1054 (97.6)
	Personal history of LLR	
	Yes	175 (16.2)
	No	905 (83.8)
	Personal history of atopic disease	
	Yes	126 (11.7)
	No	954 (88.3)
	Personal history of other allergic diseases	
	Yes	89 (8.2)
	No	991 (91.8)
	History of AR to bee venom among FDR ^a	
	Yes	174 (16.1)
	No	906 (83.9)
	History of atopic disease among FDR ^a	
	Yes	91 (8.4)
	No	989 (91.6)
	History of other allergic diseases among FDR ^a	
	Yes	32 (3.0)
	No	1048 (97.0)

Legend: AR-allergic reaction, BK-beekeeper, BMI-body mass index, FDR-first-degree relative, FM-family members, LLR-large local reaction, No.-number, Ncat=number of respondents within the category, yr-years. ^aFDR: parents, siblings, children; ^bFM: self, spouse.

3.2 Estimated lifetime prevalence of the first SAR to bee venom and exposure assessment

The estimated lifetime prevalence of self-reported first SAR to bee venom is 9.4% (102/1,080). Grading for severity according to Mueller is displayed in Table 2. Allergic beekeepers self-reported a statistically significant lower estimated annual bee sting frequency compared to non-allergics (≤ 50 annual stings: 21.3% vs 78.7%, respectively, $p < 0.001$ and > 51 annual bee sting: 4.2% vs 95.8%, $p < 0.001$), with 76.2% out of 102 self-reporting the first SAR to bee venom occurring in the first 5 years of beekeeping.

Table 2. The estimated lifetime prevalence of self-reported first systemic allergic reaction to bee venom in 1,080 beekeepers and graded for severity according to Mueller.

Grade	N _{cat} (%)	95% CI
SAR I	27 (26.5)	24.5-28.5
SAR II	29 (28.4)	28.4-28.4
SAR III	26 (25.5)	23.5-27.5
SAR IV	20 (19.6)	17.4-21.4
TOTAL	102 (100.0)	

Legend: CI-confidence interval for proportion, N_{cat}=number of respondents within the category, SAR-systemic allergic reaction.

Out of 102 beekeepers who self-reported their first SAR to bee venom, 59 (57.8%) had clinician-confirmed SAR, 20 categorised as SAR I (33.9%), 15 as SAR II (25.4%), 14 as SAR III (23.7%), and 10 as SAR IV (17.0%). Clinician-confirmed SAR most commonly occurred after a single bee sting (46/59; 78.0%) in spring (30/49; 61.2%), with symptoms onset within the first five minutes (12/24; 50.0%) or later. The most common sting sites were the head and neck (23/40; 57.5%). 13 beekeepers developed first SAR to bee venom following multiple bee stings (median 3.0). No statistically significant difference for all variables was observed comparing 13 beekeepers to those 46 beekeepers having first SAR to a single bee sting. Seven out of 59 beekeepers (11.9%) (7/59) initially experienced LLR, followed by SAR to bee venom, of which a significant percentage were severe SAR (grade III-IV, 71.4%). Forty-nine out of 59 beekeepers (83.1%) beekeepers were referred to an allergologist. Of these, 24 (49.0%) were prescribed a self-emergency set and an adrenaline autoinjector, nine (18.4%) a self-emergency set and four (8.2%) an adrenaline autoinjector. Thirty-one (63.3%) beekeepers underwent venom immunotherapy (VIT), with four withdrawing due to personal reasons.

3.3 Estimated lifetime prevalence of recurrent SAR to bee venom

The estimated overall lifetime prevalence of reported recurrent SAR to bee venom is 3.7% (40/1,080). Thirty-two beekeepers self-reported their first recurrent SAR, of which there were 15 clinician-confirmed cases, categorised as SAR I (20.0%), SAR II (20.0%), SAR III (40.0%), SAR IV (20.0%). Fourteen beekeepers self-reported their second recurrent SAR to bee venom, with one case clinician-confirmed and categorised as SAR III (7.1%). One beekeeper self-reported a third recurrent SAR. All beekeepers self-reported experiencing up to 10 bee stings between the first and each recurrent SAR, all of which were well tolerated.

3.4 Association analysis

Associations between the estimated overall lifetime prevalence of self-reported first SAR to bee venom and risk factors, adjusted for potential confounders using multivariate logistic regression, are summarised in Table 3. Age, male sex, number of bee stings per season, a history of LLR and nasal symptoms while working at hives were identified as risk factors for developing the first SAR to bee venom. Therefore, younger male beekeepers with a low number of bee stings per season, a history of LLR and nasal symptoms while working at hives, are at a high risk of having SAR.

4 DISCUSSION

The estimated overall lifetime prevalence of self-reported first SAR to bee venom was high. Of these self-reported cases, nearly half were classified as severe (grade III-IV according to Mueller classification). A comparison between the self-reported and clinician-confirmed cases revealed an overestimation in self-reporting. However, more than half of the SAR were clinician-confirmed, with a high percentage categorised as severe. The estimated overall lifetime prevalence of reported recurrent SAR to bee venom was expectedly lower, yet more than half of the clinician-confirmed cases were severe (grade III-IV according to the Mueller classification). Age, male sex, number of bee stings per season, a history of LLR and nasal symptoms while working at hives were identified as risk factors that may predispose individuals to develop first SAR to bee venom.

Our estimated overall lifetime prevalence of self-reported first SAR to bee venom was substantially lower than the global rate of 23.7%. However, these results are challenging to compare due to methodological differences (i.e., data collection technique, definition of AR, classification systems used to grade the severity of SAR across different regions) and varying degrees of sting

Table 3. Multiple logistic regression analysis of the overall lifetime prevalence of self-reported first systemic allergic reaction to bee venom associated with risk factors among the Slovenian population of beekeepers (N=1,080).

Risk factor	Variable	OR	95% CI		p-value
			lower	upper	
Estimated number of bee stings per season	>51	1			
	≤50	5.274	3.250	8.559	<0.001
Demography	Age ^a				
	≥65	1			
	18-39	1.477	1.160	1.881	<0.002
	40-64	1.270	1.055	1.527	<0.011
	Sex ^a				
	Female	1			
Environmental exposure	Male	1.712	1.007	2.911	0.047
	Beekeeping duration (yr)				
	>11	1			
	≤10	1.235	0.759	2.010	0.395
Host predisposition to SAR	Symptoms when working at hives				
	None	1			
	Nasal	9.693	2.469	38.045	0.001
	Personal history of LLR				
	No	1			
	Yes	20.654	4.747	89.877	<0.001
	Personal history of atopic disease				
	No	1			
	Physician-confirmed asthma	1.288	0.707	2.346	0.408
	Personal history of other allergic diseases				
	No	1			
	Yes	1.664	0.841	3.291	0.143

Legend: CI-confidence interval, LLR-large local reaction, OR-odds ratio, yr-years; aadjusted to confounders (age, sex). Estimate was statistically significant at p<0.05.

exposure across geographic regions, as reported in our recent meta-analysis (10).

Our findings align with several prior studies indicating that beekeepers stung infrequently (16, 21-23) or managing fewer hives (24) are at the highest risk of SAR or severe reactions to bee venom, respectively. This underscores the concept that prolonged exposure to bee venom can lead to immunopathogenic changes underlying bee venom allergy (9, 25-27). The beekeeper model suggests that peripheral T-cell responses outside and during the beekeeping season differ. In vitro studies have demonstrated increased T-cell proliferation and cytokine secretion in allergen-stimulated T-cells during sting-free winter months, accompanied by a decrease in serum-specific IgG4 antibodies. This trend reverses after significant re-exposure in spring. Not surprisingly, the first stings in spring were identified as definite risk factors for developing AR to bee venom (9). This is consistent with our clinician-confirmed data, as the majority of allergic beekeepers developed the first SAR after the winter break.

The majority of beekeepers initially reacted within the first two years of beekeeping (55.9%), a period characterised by heightened exposure to bee stings, aligning our findings with several previous studies (21, 27, 28), but contrasting with British data (29). It is suggested that these early years of beekeeping pose the highest risk, with peripheral tolerance developing later in a beekeeper’s life (21). Nonetheless, despite chronic exposure, some beekeepers still develop SAR, suggesting that factors beyond T-cell regulation play a crucial role in determining the nature of an individual’s immune response. Furthermore, the mechanisms underlying the transition from one type of AR (LLR) to another (SAR) remain unclear (30). This is important, given our identification of a history of LLR as a novel risk factor in this population group. Prior studies suggested that patients with LLR have a relatively low risk (5%-10%) of developing SAR upon subsequent stings (31). However, a recent study by Bilo reported a higher frequency of SAR, particularly severe cases (24% and 11%, respectively), challenging previous estimates (32).

Nonetheless, it should be noted that some concerns have been raised about the quality of the study design (33), therefore caution is needed when interpreting its results. Consistent with findings from other studies, the presence of nasal symptoms during hive work exhibited a significant association with SAR. Among Finnish beekeepers, experiencing nasal or eye symptoms while tending hives was associated with a fourfold (21) and tenfold increase (13) in SAR risk. Similarly, among German beekeepers, symptoms of upper respiratory allergies during hive activities emerged as the strongest predictor of bee venom allergy (24).

Contrary to our expectations, we did not find evidence confirming an atopic constitution as a prerequisite risk factor for SAR, possibly due to the lower prevalence of atopic constitution in our study sample (11.7%) compared to other studies (ranging from 41.0% (34) to 51.7% (35)). However, numerous studies consistently show that a history of atopic disease is more frequently reported among beekeepers with bee venom allergy compared to those without it (21, 34-36). Importantly, with the exception of one study (35), atopy was clinically-confirmed (history and skin or serum methods), underscoring the robustness of this evidence. Miyachi also suggested that sensitisation occurs more readily among atopic beekeepers than non-atopics, likely due to exposure through bee dust inhalation or multiple stings (36). Given that the nasal mucosa is highly exposed to inhaled allergens and that allergic sensitisation typically begins in the upper respiratory tract mucosa, it is plausible that sensitisation to bee venom through nasal mucous membranes may contribute to the pathogenesis of bee venom allergy.

SAR was most commonly found among younger beekeepers, consistent with some previous studies (21, 27), although no significant association between age and SAR was reported by others (29, 35, 37). Additionally, among the German beekeepers, an inverse correlation between the severity of the reaction to bee stings and the beekeeper's age was observed (24). This finding is supported by Matysiak, who suggested that clinical symptoms following bee stings tend to be less severe with increasing age (26). Furthermore, we confirmed a male-to-female preponderance, likely due to greater exposure of men rather than inherent sex differences. This observation stands in contrast to the British study (29). However, the sample included a high percentage of women and no sex hormones were measured to demonstrate the role of oestrogens in enhancing IgE-dependent mast cell activation.

Our study is limited by its cross-sectional design, precluding causal associations. Additionally, the convenience sampling method used may have introduced selection bias, potentially affecting the generalisability of our findings to the broader population. Furthermore, the small sample size of recurrent SAR prevents us from

conducting multivariate analyses to explore potential risk factors associated with recurrent SAR.

However, to the best of our knowledge, this study is the first to assess the lifetime prevalence of the first SAR to bee venom among Slovenian beekeepers and its association with risk factors.

In addition, this study represents the largest study in Europe and possibly worldwide per million per capita, with the highest response rate (80.5%). It is also the first cross-sectional study to estimate recurrent SAR to bee venom, with clinician-confirmed health outcomes. A validated tool was used for data collection, and by clearly distinguishing between non-and ARs, we are confident that our cross-sectional questionnaire results specifically pertain to ARs and do not include non-allergic responses. Lastly, our study identified a novel risk factor for SAR to bee venom among beekeepers.

Addressing the current results is vital not only for Slovenia, but also for all countries and regions with strong beekeeping practices, as taking care of bees is of existential importance for humanity. We anticipate that as more individuals engage in beekeeping—crucial for maintaining biodiversity and ensuring food security—the burden of AR (SAR) will increase. Therefore, this trend underscores the urgent need for targeted clinical and preventive public health strategies among beekeepers. In addition, since the severity of a previous reaction is a major predictive factor for recurrent SAR to bee venom (11), larger prospective studies in this population group are mandatory to elucidate risk factors for recurrent SAR, to better understand underlying mechanisms and improve management practices.

5 CONCLUSIONS

A comprehensive understanding of the prevalence and severity of SAR is crucial for developing effective prevention programmes, enhancing awareness among beekeepers and healthcare providers, and improving emergency preparedness for those at risk. By informing policymakers and public health officials, our research could contribute to the formulation of guidelines that prioritise the proactive measures to mitigate risks associated with bee venom and those working in proximity to bees.

CONFLICT OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

The work was supported by the Slovenian Research Agency [grant No. P3-0429, grant No. P3-0360, grant No. P1-0255].

ETHICAL APPROVAL

The study was approved by the National Medical Ethics Committee of the Republic of Slovenia (No. 0120-423/2020-3, academic research). All participants gave written, informed consent prior to survey participation.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study can be obtained upon request from the corresponding author.

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EXPLORING GENERAL PRACTITIONER WORK IN UPPER AUSTRIA: A PILOT RETROSPECTIVE OBSERVATIONAL STUDY ACROSS THIRTY PRACTICES

ANALIZA DEJAVNOSTI SPLOŠNIH ZDRAVNIKOV V ZGORNJI AVSTRIJI: PILOTNA RETROSPEKTIVNA OPAZOVALNA ŠTUDIJA V TRIDESETIH AMBULANTAH

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Received: Jul 11, 2024

Original scientific article

Accepted: Oct 04, 2024

ABSTRACT

Keywords:

Primary healthcare,
general/family medicine
Upper Austria
Organisational
type of practice
Scope of activities

Introduction: This study investigates the differences in patient care across various organisational forms of general practitioners (GPs) in Upper Austria.

Methods: Data was collected from GPs across Upper Austria, examining patient demographics, prescription patterns, staff employment, services offered and the proximity of practices to hospitals. The variability in recording patient visit reasons was also analysed.

Results: Of the 30 participating GPs (Response Rate 5.1%), 17 worked in single practices, 7 in group practices, and 6 in PHC units. In our sample, single practices tend to prescribe more medications for chronic conditions. Group practices and PHC centres are more prevalent in areas with larger populations, offer online appointment bookings more frequently and employ more staff. The study also highlights variability in documenting patient visit reasons, emphasising the need for standardised documentation practices. The most common reasons for the patient to contact their GP, based on ICPC-2 categories, were general and non-specific, respiratory and locomotor problems, and the most common chronic diseases seen in the practice are cardiovascular, endocrine diseases and locomotor system problems. The most common therapeutic procedures were counselling and prescription of medication.

Conclusion: Our study, the first of its kind, reveals significant insights into the variability and adaptability of general medicine outpatient practices in Upper Austria, highlighting the need for improved diagnosis coding at the primary care level.

IZVLEČEK

Ključne besede:

primarna zdravstvena
oskrba
splošna/družinska
medicina
Zgornja Avstrija
organizacijske oblike
storitve
kodiranje

Uvod: Raziskava se osredotoča na razlike v oskrbi bolnikov pri različnih organizacijskih oblikah dela splošnih oziroma družinskih zdravnikov (GP) v Zgornji Avstriji.

Metode: Podatke so prispevali splošni zdravniki iz Zgornje Avstrije, pri čemer so nas zanimalo predvsem naslednje informacije: demografska struktura bolnikov, najpogostejši razlogi za obiske, predpisovanje zdravil, kadrovska zasedba v ambulantah, storitve, ki jih zdravniki opravljajo v svojih ambulantah, ter lokacija ambulate glede na bližino bolnišnice.

Rezultati: Od 30 sodelujočih zdravnikov (odzivnost 5,1-odstotna) jih 17 dela v samostojnih praksah, 7 v skupinskih praksah in 6 v zdravstvenih centrih (PHC). Zdravniki v samostojnih praksah so predpisovali več zdravil za kronične bolezni. Skupinske prakse in PHC so pogostejši na območjih z večjim številom prebivalcev, pogostejše omogočajo spletno naročanje in zaposlujejo več osebja. Študija prav tako izpostavlja raznolikost pri dokumentiranju razlogov za obiske bolnikov, kar poudarja potrebo po standardizaciji dokumentacije. Glede na ICPC-2 kodirni sistem, so najpogostejši razlogi, zaradi katerih pacienti obiščejo svojega družinskega zdravnika sledeči: splošne in nespecifične težave, težave z dihalnim sistemom ter gibalne težave. Najpogostejša kronična obolenja, ki jih zdravniki obravnavajo v praksi, so bolezni srca in ožilja, endokrine bolezni ter težave z gibalnim sistemom. Najpogostejši terapevtski postopki pa so svetovanje in predpisovanje zdravil.

Zaključek: Naša študija, prva te vrste v Zgornji Avstriji, omogoča vpogled v raznolikost delovanja in organizacije splošnih ambulant v tej regiji. Prav tako izpostavlja potrebo po izboljšanju kodiranja diagnoz na primarni ravni zdravstvene oskrbe.

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1 INTRODUCTION

Since the Alma-Ata Declaration of 1978, the World Health Organization (WHO) has emphasized the pivotal role of Primary Health Care (PHC) and family medicine in delivering effective population health care, and numerous definitions of family medicine and primary healthcare have emerged (1-3).

Despite these recognised values, PHC globally faces significant challenges, such as increasing workloads and the intricate interplay between physician satisfaction and patient outcomes (4). Evaluations of different health systems reveal a complex landscape: countries like Norway and Austria struggle with recruiting general practitioners (GPs), while the UK faces a growing retention crisis, threatening the core values of family medicine across many EU countries (5-11).

Research further underscores the factors influencing GP practice choices. According to Gisler et al. (8), the three most important criteria are work environment, location and workload. Harris et al. (12) also point to the issue of loneliness in GP work environments as a critical problem that requires attention. These themes - workload, patient outcomes, job satisfaction and burnout - highlight the pressing need for targeted interventions to support and strengthen the healthcare workforce. Addressing the workload of GPs and improving access to primary care, especially close to patients' homes, remains a global challenge (13-15).

Efforts to address these challenges will likely involve demand management strategies and increased interprofessional collaboration (13, 14, 16). Canadian researchers, for instance, have identified difficulties in implementing team-based approaches at the primary care level, including overcoming traditional professional role divisions and managing the barriers and facilitators to effective teamwork (17). These issues are also pertinent to the Austrian health system, which is both complex and fragmented in its organizational and financial structure, as well as relatively costly (15).

In response to these challenges, digitalisation and the use of artificial intelligence in patient care have been proposed as potential solutions to reduce GP workloads. However, some studies suggest that current digital solutions may have increased rather than alleviated the workload of healthcare workers (14, 18). One common conclusion across numerous studies is that patient safety and quality of care are negatively affected by high workloads (18-20). Another critical concern is the low interest among young physicians in fields characterised by high workloads, burnout and the pressures of working in single-handed practices (8, 12, 21).

Austria faces similar challenges in its primary care system. Most GPs work in single-handed practices, hospitals, or group practices, including PHC units. They can either enter into contracts with social insurance organizations, work independently as private practitioners, or be employed within medical practices. In Upper Austria, which had a population of 1,522,825 in 2023, there are 2,307 active GPs (as of 03 July 2024, Upper Austrian Medical Chamber). Of these, 49% (1,124 GPs) work in single-handed practices, 11% (248 GPs) in group practices, including PHC units, and 40% are employed in hospitals. Additionally, 30% (692) of all extramural GPs in Upper Austria work as contract physicians, with 57% being male and 43% female (22).

GPs with social insurance contracts in Austria are reimbursed through a combination of capitation and fee-for-service payments. Billing occurs quarterly, with compensation based on a per capita flat rate for enrolled patients, as well as specific service items, such as counselling. Currently, there are 666 family physicians in Upper Austria practising privately, without a health insurance contract (as of September 2024). In 2026, Austria will introduce speciality training in family medicine, a move that has been supported by both GPs and policymakers (23, 24, 15).

Given these systemic complexities and the ongoing challenges faced by practising physicians, it is essential to thoroughly examine the current state of the healthcare system. Before introducing new technologies or implementing best practices, a clear understanding of the existing workloads and challenges is necessary. Therefore, the aim of our study was to assess the scope of activities of GPs in Upper Austria.

2 METHODS

2.1 Study design

In this observational cross-sectional pilot study, we invited 587 GPs in Upper Austria to participate. Data collection occurred between April and November 2023 (Figure 1).

2.2 Participants

2.2.3 General practitioners

We invited GPs in Upper Austria contracted with the health insurance company (Österreichische Gesundheitskasse; ÖGK) to participate in the study. GPs without a health insurance contract were initially not invited to participate due to typically shorter operating hours, fewer patient contacts per week, and longer individual appointment durations, which could have hindered the achievement of comparable data across the various practice types.

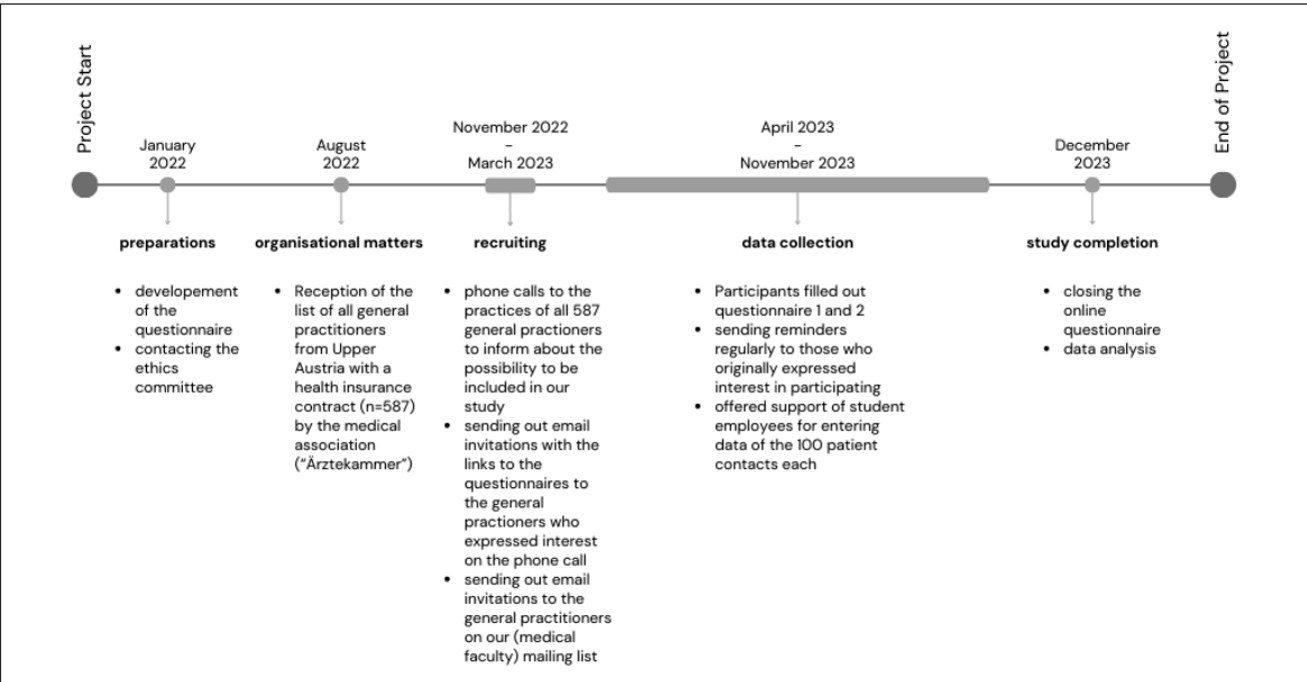


Figure 1. Timeline of the study.

Table 1. Inclusion and exclusion criteria.

Inclusion criteria	Exclusion criteria
GPs working in single practices	GPs working primarily in hospitals
GPs working in group practices	GPs working in social or institutional settings
GPs working in PHC (Primary Health Care) units	GPs without a health insurance contract
GPs with a valid contract with the national health insurance system	

2.2.4 Patient contacts

We invited each participating GP to record data from 100 consecutive patient interactions during the second week of October 2022, covering in-person, phone and video consultations, both in the practice and during home visits within regular practice hours.

2.3 Data collection

Email invitations to participate in the study were originally sent out to GPs using the database provided by the Medical Association (Ärztchamber) of Upper Austria (587 email addresses and phone numbers). Research students also contacted all 587 GPs by phone to offer assistance with data collection at their practices.

2.3.1 Instructions for participating physicians

Physicians received a detailed write-up explaining the study's purpose, objectives, procedure, and data collection methods. A video tutorial guided them on collection of study data, with researchers available by phone or email for support. Research students were also available to physically assist with data collection in practices. All physician interactions with patients, relatives and medical staff were counted as contacts, whether in-person or for health services such as prescriptions or referrals. Emergency consultations during regular practice hours were also documented.

2.3.2 Questionnaires

With the permission of Slovenian researchers, we translated and adapted their questionnaire (25) into German using the forward and backward translation method and validated it through cognitive debriefing methodology. The questionnaire used for data collection included basic patient data, visit type and purpose, diagnostic procedures, referrals to clinical specialists, diagnoses observed, interventions performed, sick leave status and follow-up appointments. Additionally, a separate questionnaire on practice characteristics and participating GP demographics was completed at the study's start.

2.3.3 Ethical approval

The Ethics Committee of the Medical Faculty at Johannes Kepler University Linz confirmed that ethical approval was not necessary for the study.

2.4 Statistical analysis

Data analysis utilised SPSS (Version 28) and MedCalc Software Ltd. Descriptive statistics summarised the data, while the chi-square test of independence examined associations between categorical variables and practice types. The Kruskal-Wallis test compared differences among practice types due to small sample sizes and non-normal distribution. The significance level was $\alpha=0.05$, with only valid cases included.

3 RESULTS

The study was conducted in 30 GP practices in Upper Austria, with a response rate of 5.1%. The GPs were distributed as follows: 17 in single practices, 7 in group practices, and 6 in PHC units. The mean age of GPs was 53.7 years (SD 9.8), ranging from 26 to 68 years. There was no significant age difference between GPs from different practice types ($p=0.297$; Table 2).

The demographic profile showed 73.3% male GPs, 19.4% female, and 6.4% non-binary/unspecified. Most practices were in rural areas (77.4%), with some in urban (12.9%) and suburban (9.7%) areas. Patient catchment areas, as reported by the GPs themselves, varied: 16.1% reported their patients originate from areas with populations above 10,000, 45.2% from areas with populations of 3,000-10,000 and 38.7% from areas with populations below 3,000. Most practices were within a 30-minute (45.2%) or 15-minute

(41.9%) drive of a hospital. The regions predominantly had three or more GPs (93.5%). The most commonly employed professionals were practice assistants (93.5%) and registered nurses (64.5%). Additional services included teaching practices (71.0%) and nursing home care (64.5%). Pharmacies were present in just under 50% of practices, with other services (acupuncture, social prescribing, chiropractic, complementary medicine) in 35.5%. There were significant associations between certain activities (pharmacies, teaching practices) and practice type, with pharmacies more common in group practices ($p=0.002$) and teaching practices more common in PHC units ($p=0.049$). All practices offered telephone contact; 29.0% had websites, 35.3% offered scheduling an appointment online, 83.9% had an email contact, and 16.1% offered video consultations. Websites with appointment booking were more common in group practices and PHC units ($p=0.041$).

3.1 Patient contacts

The study included 1,145 patient contacts with the largest proportions from group (36.2%) and single practices (35.7%). PHC units accounted for 28.1%. While the goal was for each GP to register 100 consecutive patient contacts, the actual number of contacts varied due to incomplete data entry from some practices, leading to a total of 1,145 patient contacts instead of the expected 3,000. Patient age did not vary significantly across practice types ($p=0.332$; see Table 3).

The most common reasons for patients to contact their GPs, based on ICPC-2 categories, were general and non-specific (27.3%), respiratory (25.0%) and locomotor (12.4%) medical issues (Table 4). The chi-square test of independence showed a statistically significant result

Table 2. Organizational structure of the practice and age of the GP.

	N	Minimum Age	Maximum Age	Median Age	Mean Age	SD	KW H	df	p
Single practice	17	39	68	51	53.7	9.8	2.428	2	0.297
Group practice	7	32	55	48	46.3	9.8			
PHC unit	6	26	59	48	45.5	11.9			
Total	30	26	68	49	50.3	10.6			

Table 3. Patients' age according to organizational structure of the practice.

	Single practice	Group practice	PHC unit	Total	KW H	df	p
n	409	414	322	1145	2.203	2	0.332
Minimum Age	0	1	1	0			
Maximum Age	99	94	94	99			
Mean Age	51.2	50.4	49.4	50.4			
Median Age	54	54	51	53			
SD	24.3	23.1	20.8	22.9			

($p=0.007$), indicating an association between the type of medical practice and reason for the contact. The most common reasons in single practices were general and non-specific (29.6%), followed by respiratory (23.2%) and locomotor (11.2%) medical issues. Similar to single practices, in group practices general and non-specific issues (33.1%) were the most common reason for the patient to contact the GP, followed by respiratory (22.5%) and locomotor (10.9%) medical issues. On the other hand, the most common reason in PHC units were respiratory (30.4%), followed by general and non-specific (17.1%) medical issues and locomotor system problems (15.8%).

Table 5 presents the prevalence of chronic diseases among patients across various types of medical practices. A chi-square test of independence with the most common diseases ($n>100$) revealed a significant association with the type of practice ($p<0.001$). The most common chronic diseases seen in single practices included cardiovascular system-related issues (42.5%), followed by endocrine, metabolic, nutritional disorders (33.5%) and locomotor system problems (33.3%). In group practices, chronic conditions (no illness) (32.4%) and endocrine, metabolic and nutritional disorders (33.1%) were the most prevalent among patients, followed by cardiovascular system-related diseases (28.7%). The PHC units most commonly dealt with endocrine, metabolic and nutritional disorders (34.5%), cardiovascular system-related diseases (30.1%) and locomotor system diseases (25.8%).

Table 4. Reason for doctor's visit based on ICPC-2 categories.

	Organisational structure of practice								χ^2 or LR	df	p
	Single practice		Group practice		PHC unit		Total				
	n	%	n	%	n	%	n	%			
A General and non-specific	121	29.6	137	33.1	55	17.1	313	27.3	55,189	32	0.007
B Blood, blood-forming organs, immune system	6	1.5	7	1.7	2	0.6	15	1.3			
D Digestive system	24	5.9	29	7.0	19	5.9	72	6.3			
F Eye	2	0.5	2	0.5	5	1.6	9	0.8			
H Ear	10	2.4	9	2.2	4	1.2	23	2.0			
K Cardiovascular System	29	7.1	19	4.6	15	4.7	63	5.5			
L Locomotor	46	11.2	45	10.9	51	15.8	142	12.4			
N Neurology System	9	2.2	12	2.9	14	4.3	35	3.1			
P Mental Health	11	2.7	16	3.9	11	3.4	38	3.3			
R Respiratory	95	23.2	93	22.5	98	30.4	286	25.0			
S Dermatology	25	6.1	13	3.1	17	5.3	55	4.8			
T Endocrine, metabolic, nutritional	17	4.2	17	4.1	17	5.3	51	4.5			
U Urology	6	1.5	10	2.4	7	2.2	23	2.0			
W Pregnancy, childbirth, family planning	0	0.0	0	0.0	2	0.6	2	0.2			
X Gynaecology	3	0.7	1	0.2	2	0.6	6	0.5			
Y Andrology	3	0.7	2	0.5	1	0.3	6	0.5			
Z Social problems	2	0.5	2	0.5	2	0.6	6	0.5			
Total	409	100.0	414	100.0	322	100.0	1145	100.0			

Table 5. Chronic diseases and conditions.

	Organisational structure of practice								χ^2 or LR	df	p
	Single practice (n=409)		Group practice (n=414)		PHCunit (n=322)		Total (n=1223)				
	n	%	n	%	n	%	n	%			
O Chronic conditions (No Illness) **	92	22.5	134	32.4	78	24.2	304	26.6	41,781	14	<0.001
A General and non-specific	28	6.8	10	2.4	20	6.2	58	5.1			
B Blood, blood-forming organs, immune system	33	8.1	21	5.1	14	4.3	68	5.9			
D Digestive system**	93	22.7	48	11.6	36	11.2	177	15.5			
F Eye	14	3.4	6	1.4	12	3.7	32	2.8			
H Ear	11	2.7	9	2.2	12	3.7	32	2.8			
K Cardiovascular System**	174	42.5	119	28.7	97	30.1	390	34.1			
L Locomotor System**	136	33.3	88	21.3	83	25.8	307	26.8			
N Neurology**	45	11.0	45	10.9	31	9.6	121	10.6			
P Mental Health**	71	17.4	72	17.4	58	18.0	201	17.6			
R Respiratory System**	46	11.2	26	6.3	35	10.9	107	9.3			
S Skin	35	8.6	18	4.3	32	9.9	85	7.4			
T Endocrine, metabolic, nutritional**	137	33.5	137	33.1	111	34.5	385	33.6			
U Urology	24	5.9	20	4.8	19	5.9	63	5.5			
W Pregnancy, childbirth, family planning	0	0.0	2	0.5	4	1.2	6	0.5			
X Gynaecology	4	1.0	10	2.4	13	4.0	27	2.4			
Y Andrology	21	5.1	17	4.1	19	5.9	57	5.0			
Z Social problem	0	0.0	1	0.2	1	0.3	2	0.2			

Multiple responses possible, frequency and percentage of selected categories are shown.

** Results of chi-square test for 8 most often selected categories (n>100).

The most common therapeutic procedures were counselling (86.4%) and prescription of medicines (51.3%; Table 6). Counselling was the most commonly used therapeutic procedure across all practice types, with no significant difference among them ($p=0.126$). There are differences in medication prescription in group practices (50.5%) and PHC units (43.8%); they exhibited lower rates compared to single practices (57.9%) and showed a significance ($p=0.001$). Group practices (5.3%) showed significantly ($p<0.001$) higher utilisation of injections compared to other practice types. Moreover, single practices (6.1%) and group practices (4.1%) had higher rates of vaccination administration compared to PHC units ($p<0.001$). PHC units provide significantly more ($p<0.001$) other therapeutic procedures.

The number of referrals was quite low, most patients were referred to physiotherapy 3.3% ($n=40$) and to other specialists 9.9% ($n=121$), most commonly to specialists for radiology (46 patients), dermatology (21 patients) and internal medicine (21 patients).

The most commonly prescribed long-term medications were antihypertensives 26.8%, psychopharmacological 15.8%, statins 13.1% and dietary supplements 13.1%, followed by anticoagulants 12.2% (Table 7). Significantly higher prescription rates were found in single practices compared to group practices and PHC units for the prescription of antihypertensives ($p<0.001$), ointments ($p=0.002$), intestinal medication ($p<0.001$), psychopharmacological drugs ($p=0.029$), anticoagulants ($p=0.018$) and chronic antibiotics ($p=0.031$), with the results of the chi-square test of independence being significant ($p<0.05$). Only biological medicines were more often prescribed in group practices ($p=0.002$).

Table 6. Therapeutic procedures performed.

	Organisational structure of practice								χ^2 or LR	df	p
	Single practice (n=409)		Group practice (n=414)		PHCunit (n=322)		Total (n=1145)				
	n	%	n	%	n	%	n	%			
Counselling	342	83.6	363	87.7	284	88.2	989	86.4	4.151 ^a	2	0.126
Drug Prescription	237	57.9	209	50.5	141	43.8	587	51.3	14.613 ^a	2	0.001
Injection	3	0.7	22	5.3	2	0.6	27	2.4	24.618 ^a	2	<0.001
Infiltration	3	0.7	4	1.0	3	0.9	10	0.9	0.150	2	0.928
Infusion	10	2.4	14	3.4	6	1.9	30	2.6	1.713 ^a	2	0.425
Vaccination	25	6.1	17	4.1	2	0.6	44	3.8	14.824 ^a	2	0.001
Manual Therapy	3	0.7	3	0.7	3	0.9	9	0.8	0.118	2	0.943
Minor Surgery	2	0.5	1	0.2	2	0.6	5	0.4	0.680	2	0.7122
Acute wound care	10	2.4	7	1.7	5	1.6	22	1.9	0.944 ^a	2	0.624
Chronic wound care	5	1.2	2	0.5	2	0.6	9	0.8	1.540	2	0.463
Other*	6	1.5	13	3.1	22	6.8	41	3.6	15.386 ^a	2	<0.001

Multiple responses possible, frequency and percentage of selected answers are shown.

*Other: Throat swabs and other tests, removal of foreign bodies and cerumen, physical therapy, conversational therapy, administrative, other non-categorised.

^a0 cells (0.0%) have an expected count less than 5.

Table 7. Prescription of chronic medication.

	Organisational structure of practice									χ^2 or LR	df	p
	Single practice (n=409)		Group practice (n=414)		PHCunit (n=322)		Total (n=1145)					
	n	%	n	%	n	%	n	%				
Antibiotics	5	1.2	1	0.2	0	0.0	6	0.5	6.955	2	0.031	
Analgesics	44	10.8	27	6.5	29	9.0	100	8.7	4.674	2	0.097	
Antihypertensives	137	33.5	110	26.6	60	18.6	307	26.8	20.300	2	<0.001	
Gastrointestinal	68	16.6	29	7.0	23	7.1	120	10.5	25.618	2	<0.001	
Statins	55	13.4	58	14.0	37	11.5	150	13.1	1.077	2	0.584	
Hormones	46	11.2	44	10.6	26	8.1	116	10.1	2.167	2	0.338	
Psychopharmacological	78	19.1	51	12.3	52	16.1	181	15.8	7.087	2	0.029	
Anticoagulants	65	15.9	43	10.4	32	9.9	140	12.2	7.999	2	0.018	
Pulmonary	19	4.6	20	4.8	11	3.4	50	4.4	0.986	2	0.611	
Antidiabetic	36	8.8	33	8.0	18	5.6	87	7.6	2.776	2	0.250	
Ointments	18	4.4	3	0.7	6	1.9	27	2.4	12.553	2	0.002	
Nutritional supplements	66	16.1	42	10.1	42	13.0	150	13.1	6.490	2	0.039	
Biological medicines	4	1.0	18	4.3	4	1.2	26	2.3	12.663	2	0.002	
Anti-rheumatic drugs	23	5.6	17	4.1	8	2.5	48	4.2	4.432	2	0.109	

Multiple responses possible, frequency and percentage of selected answers are shown.

4 DISCUSSION

Our research highlights differences in patient care across various GP organizational forms in Upper Austria. Single practices tend to prescribe more medications for chronic conditions. Group practices and PHC centres are more common in areas with larger populations, offer online appointment booking and employ more staff. Most practices are within a 15-30-minute drive from the nearest hospital, offer a wide range of services and frequently refer patients for radiological examinations. With a referral rate to other specialists of 9.9%, this is a rather low referral rate compared to other countries (26). Since specialist access in Austria does not always require GP referrals, referral data should be interpreted cautiously. Recording formats for patient visit reasons varied, thus complicating data interpretation. Legal coding requirements apply only to PHC units, possibly leading to inconsistent data entry. The provisions of the EU General Data Protection Regulation (GDPR) came into effect in 2018, which entails new obligations for general practitioners including in the mode of communication with patients (27). Common reasons for patient visits include non-specific issues, respiratory problems, musculoskeletal issues, cardiovascular conditions and dermatological concerns, consistent with findings from other studies (25, 28). Counselling, which accounts for 86.4% of cases, is the most frequently used and reimbursed therapeutic procedure. This high percentage likely reflects the fact that GPs in Austria routinely include counselling as part of standard medical consultations, with potential contributions from coding inaccuracies. The age and gender of doctors in our sample align with data from the Upper Austria Medical Chamber (22). Therapeutic procedures depend on insurance-covered services, influenced by annual negotiations between the medical association and social insurance companies. Similar financial procedures are noted by other authors (29-31). Differences in medication prescriptions can be partially explained by the older age structure of patients in single practices. According to the insurance company (32), the most frequently prescribed medications at the primary level are antidepressants, lipid-lowering agents and non-insulin antidiabetics. In our sample, regarding patient contacts in the second week of October of 2022, the most frequently prescribed medications were antihypertensives, psychotropic drugs and lipid-lowering agents. At the 2012 WONCA conference, Kleinbichler and colleagues presented an analysis of 9,674 patient consultations from three Austrian GP practices. They identified arterial hypertension as the most common reason for patient contact with a physician, which also aligns with our findings (33).

4.1 Limitations

Our study provides valuable insights into the situation of family medicine in Upper Austria, but it is important to note that the results are not representative of the entire country. While the findings offer an understanding of the current organizational structures and patient care practices in the region, they cannot be generalised to all of Austria. The non-random sampling method and the focus on GPs with insurance contracts further limit the representativeness of the results.

Although our data may not be generalisable, they can serve as a valuable resource for strengthening primary care in Austria.

5 CONCLUSION

Our study, the first of its kind, offers valuable insights into the operations of family medicine outpatient practices in Upper Austria. The data indicates significant variability in the structure and functioning of these practices. The variation in organizational structures, services offered, staffing and diagnosis coding, underscores the complexity and adaptability of outpatient care. Our findings offer important insights into the work of GPs amidst evolving changes in general medicine in Austria, particularly with the introduction of a specialisation in family medicine. We view organizational variability as a strength of Austrian general medicine, as it offers greater flexibility, enables better adaptation to local population needs, and promotes cost efficiency (e.g., a PHC centre may not be economically viable in areas with smaller populations). However, the lack of standardised diagnosis coding remains a limitation, hindering accurate comparisons with international best practices. We plan to do a follow-up study with a larger number of participating GPs to observe trends and changes over time. This future study will provide a more comprehensive understanding of the evolution of general practice, including the development of group practices and PHC centres, which involve more healthcare professionals and emphasise holistic, team-based care and interprofessional collaboration.

ACKNOWLEDGEMENT

We would like to extend our sincere gratitude to all the contributors who supported the completion of this manuscript. Special thanks to the student employees who assisted with contacting practices and data collection: Laura Eggers, Laura Koch, Astrid Kathrein, Markus Mader, Miles Walker.

We are also deeply appreciative of the (anonymous) general practitioners in Upper Austria who participated in this pilot study. Your cooperation and willingness to share your practice data made this research possible.

CONFLICT OF INTEREST

The authors declare no conflicts of interest related to this study.

FUNDING

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

ETHICAL APPROVAL

This study has been granted an exemption from requiring ethics approval by the Ethics Committee of the Medical Faculty of the Johannes Kepler University Linz, Austria, via email on the 26 January 2022 from Eva Vormüdl to Erika Zelko.

AVAILABILITY OF DATA AND MATERIALS

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

LLM STATEMENT

During the preparation of this article the authors used the GPT-4 language model to test and fine-tune the article's wording. After using this model, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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FACTORS ASSOCIATED WITH LOW BACK OVERUSE INJURIES IN SPORTS SCIENCE STUDENTS - A PROSPECTIVE STUDY

DEJAVNIKI BOLEČIN V SPODNJEM DELU HRBTA PRI ŠTUDENTIH PROGRAMOV ŠPORTNIH SMERI - PROSPEKTIVNA ŠTUDIJA

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Received: Aug 19, 2024

Accepted: Oct 11, 2024

Original scientific article

ABSTRACT

Keywords:

Students
Low back pain
Ferritin level
Muscle strength
Prevention

Background: Sports science students (SPS) are more likely to be affected by low back pain (LBP) compared to the young, physically active population. The aim of this prospective study was to evaluate potential risk factors for LBP in the population of SPS.

Methods: Before the beginning of the study the participants (n=54) performed initial physical performance testing and gave blood samples. Then they were followed up for 10 weeks. The observed outcome was LBP occurrence. The presence of the observed outcome was recorded using the Oslo Sports Trauma Research Centre Overuse Injury Questionnaire weekly. The association between LBP and potential explanatory factors - potential overtraining parameters (e.g. ferritin and iron levels, amount of sleep) and motor ability parameters (e.g. muscle strength, vertical jump) - was assessed using multiple binary logistic regression.

Results: During the 10 week prospective follow-up LBP was the most common problem affecting 13% of students. From the group of explanatory factors for LBP only two were included in the final model as statistically significant: low ferritin level (OR=8.70, p=0.008), and history of previous LBP (OR=8.69; p=0.006) made students more likely experience new LBP problems.

Conclusions: The SPS that are more at risk of experiencing LBP are those with a history of LBP and those with low ferritin level. Awareness should be raised among students about the importance of comprehensive LBP prevention (preventive exercise, preventive medical check up including blood test).

IZVLEČEK

Ključne besede:

študenti
bolečine v križu
raven feritina
mišična moč
preventiva

Uvod: Študenti programov športne smeri (SPS) so bolj dovzetni za bolečine v spodnjem delu hrbta (BSH) kot mlada, telesno dejavna populacija. Namen prospektivne študije je bil oceniti potencialne dejavnike tveganja za BSH med populacijo SPS.

Metode: Pred začetkom raziskave so udeleženci (n = 54) opravili testiranje telesne zmogljivosti in oddali vzorce krvi. Nato smo jih spremljali 10 tednov. Opazovan izid je bila bolečina v spodnjem delu hrbta (BSH). Pojavnost opazovanega izida je bila beležena z vprašalnikom Oslo Sports Trauma Research Centre Overuse Injury Questionnaire na tedenski bazi. Povezanost med BSH in možnimi pojasnjevalnimi dejavniki - morebitnimi dejavniki pretreniranosti (npr. raven železa in feritina, količina spanca) in dejavniki gibalnih sposobnosti (npr. mišična moč, vertikalni skok) - smo ocenili z uporabo multiple binarne logistične regresije.

Rezultati: Tekom 10-tedenskega prospektivnega spremljanja je bila BSH najpogostejša težava, ki je prizadela 13 % študentov. Iz skupine pojasnjevalnih dejavnikov za BSH sta bila v končni model vključena samo dva kot statistično pomembna: nizka raven feritina (OR = 8,70; p = 0,008) in anamneza predhodne BSH (OR = 8,69; p = 0,006) sta pomenila večjo verjetnost pojava BSH.

Zaključki: SPS, pri katerih obstaja večje tveganje za BSH, so tisti z anamnezo BSH in tisti z nizko ravno feritina. Študente je treba ozaveščati glede pomembnosti celovite preventive BSH (preventivna vadba, preventivni zdravstveni pregledi vključno s preiskavami krvi).

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1 INTRODUCTION

Students in sports science faculties (including future physical education teachers, kinesiologists and coaches) (SPS) are more likely to be affected by injuries compared to the young, physically active population (1) due to higher physical load. Injuries interfere with the fulfilment of study responsibilities, prolong study time, and impact graduation rates and students' health (2). After graduation, these occupations place high demands on physical fitness and performance. Injuries that occur at a young age during university may increase susceptibility to injury later in the career (3). Many injuries can lead to limitations in work ability, reduction in years of service, change of occupation, and disability (4). Considering these facts, exploring potential risk factors for injury in this population is an important public health issue.

The incidence of injury among SPS is 11.7/1,000 hours of physical activity (1). Lower extremity injuries are the most common (1, 4). Most injuries are acute, non-contact, medical attention is required in 80% of cases, and approximately half of the injuries result in absence from class and training and/or competition for at least one week or longer (2). Apart from acute injuries, SPS may also suffer from chronic overuse injuries, where low back overuse injuries are quite common, with low back pain (LBP) being the most common symptom. The incidence of LBP in the general population is estimated to be 15% with the point prevalence of 30% (5). The annual LBP prevalence in young adults ranges from 32.4% (6) to 42.4% (7). The prevalence of LBP in young athletes was shown to have a point prevalence ranging from 10% to 67%, a one-year prevalence ranging from 17% to 94% and a life-time prevalence ranging from 33% to 84% (8).

Previous studies mainly analysed non-modifiable risk factors (e.g., sex, age, previous injuries and general health) (3, 9). Among the various modifiable risk factors, postural stability, flexibility and muscle strength have been investigated, and it appears that some physical performance tests may be important for injury prediction. Additional potential causes of LBP in young adults were marital status, strenuous exercise, job satisfaction, monotony, stress, daily number of studying hours and family history of spine problems ($p < 0.05$), all associated with LBP (7). Because first-year SPS are exposed to a high physical activity load determined by the curriculum, it is surprising that previous studies have not included potential overtraining parameters (e.g. training load, ferritin) in injury prediction models.

An increased number of hours of physical activity in the young active population and consequently higher physical load (10) may lead to fatigue and/or overtraining (11, 12), resulting in a decrease in athletic performance (13). Increased load can affect biochemical indicators

of overtraining (14). In addition to students' study commitments, the development of overtraining is also influenced by extracurricular commitments and lifestyle: amount of sleep, diet, habits (14).

Aiming to identify risk factors for overuse injuries among SPS, the objective was to evaluate the relationship between LBP occurrence and the potential overtraining parameters (e.g. ferritin and iron levels, amount of sleep) and motor ability parameters (e.g. muscle strength, vertical jump).

2 MATERIAL AND METHODS

2.1 Study design, setting and time frame

The present study was designed as a prospective study that investigated different musculo-skeletal problems in the group of students at the Faculty of Sports of the University of Ljubljana in the academic year 2019/2020. The present paper is only reporting findings about LBP problems.

2.2 Study population and inclusion criteria

A total generation of 160 students of the first academic year was invited to participate in the study. The main inclusion criteria were: age ≥ 18 years and no major injuries upon entry into the study (injuries that would demand more than 4 weeks to return to physical activity).

2.3 Study course, study instruments and procedures

2.3.1 Study course

At the start of the academic year study participants underwent the battery of physical performance testing, and blood samples were taken for subsequent analysis. The follow-up took place over 10 weeks during the first study semester.

2.3.2 Biochemical analyses

Blood samples included potential biochemical factors (indicators of overtraining): iron, ferritin and haemoglobin. The haemoglobin [g/L] was analysed from EDTA-blood (Vacutube, Burnik, Slovenia) with automated haematology analyser ABX Pentra XL 80 (Horiba, Ltd., Japan. Serum iron [$\mu\text{mol/L}$] and ferritin [$\mu\text{g/L}$] were analysed on a Dimension EXL 200 integrated clinical chemistry and immunoassay analyser (Siemens Healthineers, Germany) with IRON, FERR-ferritin (H-Modul) reagents respectively (all Siemens Healthineers, Newark, USA). Ferritin values were afterwards grouped into normal ($\geq 35 \mu\text{g/L}$) and low values ($0-34 \mu\text{g/L}$), which formed a new categorical variable "ferritin level": 0 = normal level, 1 = low level. Samples were collected in the morning following overnight fasting. They were drawn from the antecubital vein using a 21-gauge needle (40 mm) into 2.5 mL and 10 mL BD Vacutainer® vacuum serum tubes with silica particles

coating (Becton, Dickinson and Company, Vacutainer System Europe, Heidelberg, Germany). The blood samples were analysed in 4 hours after the blood drawing. Serum tubes were centrifuged on 1,500 g for 10 minutes and the aliquots of serum were stored at -30° C for a maximum of one month. For all laboratory findings, the lower the values, the greater the possibility of LBP.

2.3.3 Physical performance

The physical performance testing included vertical jump, balance and knee, ankle and trunk isometric strength tests.

For the vertical jump testing a bilateral force plate was used (Kistler, model 9260AA6, Winterthur, Switzerland). After the warm up/familiarisation the subjects performed 3 maximal countermovement jumps and 3 maximal squat jumps with 30 sec rest between jumps. The main outcome measures were jump height (cm) and mean power (P) normalised to body weight (W/kg).

For assessment of balance the body sway test was applied during a single leg stand on a force platform, with hands on the hips. The participants were asked to look at a fixed point approximately 4 m in front of the participant and at eye level. They performed three 30-second repetitions for each leg, with 60-second breaks between repetitions. The data that we used were mean CoP velocity [total, anterior-posterior (AP), and medial-lateral (ML)], CoP amplitude (AP and ML), and CoP frequency.

The main outcome measure for strength testing was force in Newtons or torque in Newton-meters. Knee strength was assessed using a Dynamometer S2P, Science to Practice Ltd, Ljubljana, Slovenia. Measurement was performed in seated position with proper fixation and the mechanical axis of the dynamometer aligned with the subject's knee. After warm-up and familiarisation the subjects performed three maximal voluntary contractions (MVC) three seconds long with 60-sec rest between repetition for knee flexion (KF) and extension (KE). Assessment of trunk strength was done by having the subjects standing next to the dynamometer firmly fixed across the pelvis with a belt. Arms were positioned on the shoulder or were hanging free. The instruction given was to gradually increase the force to the maximum and the keep it for 3-5 sec. The lever arm was recorded for each measurement. Assessment of ankle strength was done by having the subject's shins tightly fixed on the dynamometer, so the feet were placed and firmly fixed with a strap on a firm plate adjusted on the torque sensor. The ankle was in neutral position and the axis of the dynamometer was aligned to the medial malleolus. Finally, the subjects were asked to do plantar (PF) and dorsal flexion (DF).

For all tests, the higher the value, the lower the chance of LBP.

2.3.4 Reporting of musculoskeletal system problems and overuse injuries

For the follow-up and reporting of musculoskeletal system problems and overuse injuries, the Oslo Sports Trauma Research Centre Overuse Injury Questionnaire (OSTRC-O), established as a reliable (Cronbach's $\alpha=0.91$) and valid instrument (PCA results: factor weighting 0.86-0.91), was used (15). The OSTRC-O consists of four questions that relate to participation, modification of training volume, performance and symptoms, which are repeated for each area of interest (15). For the first and fourth questions, which have 4 options each, the answers are scored 0-8-17-25, and for the second and third questions, which have 5 options each, the answers are scored 0-6-13-19-25. The answer to each question is scored with min=0 and max=25. These scores were afterwards summed and were grouped into no injury group (score equals 0) and injury group (score >0), which formed a new categorical variable "injury status": 0=no injury, 1=injury. The instrument was administered to participants on a weekly basis.

2.3.5 Other data collection

SPS training and pedagogical workload at the faculty was self-reported in hours using questionnaires on a weekly basis. Data on sleep were self-reported in terms of quantity (average sleep hours in the last week) and quality (as VAS; values 0-10) also on a weekly basis. Sleep hours were additionally grouped into two groups forming a new variable "sleep deficit": 0 = no (≥ 7 hours), 1=yes (<7 hours).

Participants were also asked to provide information on LBP and knee injury, both in the past year prior the study (0=no, 1=yes).

2.4 Observed phenomena

For the purpose of this study, it was only observed whether the participant had lower back problems or not (the sum of the items in the OSTRC-O was equal to 0), and as a result the variable "the presence of LBP in the observed period" was created (0=no, 1=yes) as the observed outcome.

As explanatory factors biochemical factors, physical performance factors, workload factors, sleep and wellbeing factors, and history of pain were considered. Sex and body mass index were used as confounders.

2.5 Methods of analysis

First, statistical description of the variables was carried out using standard descriptive statistical methods.

Afterwards, a univariate logistic regression was performed to ascertain the effects of different predictors on the likelihood that students will experience LBP during the 10-weeks of winter semester at the sports science faculty.

Finally, multiple stepwise logistic regression (Forward Selection Likelihood Ratio method) was performed to identify the best model to explain the relationship between LBP and potential factors. Only factors with p-value in the univariate analysis up to $p<0.050$ were included in the multivariate analysis.

The analysis was performed using IBM SPSS 25 software (SPSS Inc., Armonk, NY, USA) and the overall level of statistical significance was set at $p<0.050$.

3 RESULTS

3.1 Basic characteristics of participants

Out of 160 invited students 69 responded to the invitation, of which 54 completed the full follow-up. Basic characteristics are presented in Table 1. During the 10-week prospective follow-up the prevalence of LBP was between 6% and 24% (13% on average across the 10-week period) without sex differences in the prevalence of LBP ($p=0.211$).

Table 1. Basic characteristics of participants of the study of factors associated with LBP in sports science students of Ljubljana University Faculty of Sports; n=54.

Characteristic	Category	Count (%)	Mean±SD
Sex	Females	25 (46.3%)	19.1±0.6
	Males	29 (53.7%)	
Age (years)			19.1±0.6
BMI (kg/m2)			22.4±2.2
BMI	Normal weight	47 (87.0%)	
	Overweight	7 (13.0%)	

Legend: LBP=low back pain; SD=standard deviation; BMI=body mass index

3.2 Description of explanatory factors

Basic characteristics of explanatory factors for LBP are presented in Table 2.

3.3 Results of univariate analysis

The univariate logistic regression model has shown some statistically significant predictors of LBP (Table 3).

Table 2. Basic characteristics of explanatory factors for LBP in sports science students of Ljubljana University Faculty of Sports; n=54.

Group of factors	Factor	Category	Count (%)	Mean±SD
BIOCHEMICAL FACTORS				
	Iron [μmol/L]	Normal	37 (68.5%)	18.5±6.6
	Ferritin [μg/L]			51.6±29.1
	Ferritin level			
		Low	17 (31.5%)	
	Haemoglobin [g/L]			141.7±14.7
PHYSICAL FITNESS FACTORS				
Balance	Overall PSV left [mm/s]			38.4±9.1
	Overall PSV right [mm/s]			37.2±8.6
	AP PSV left [mm/s]			23.8±5.8
	AP PSV right [mm/s]			23.2±5.8
	ML PSV left [mm/s]			25.6±6.4
	ML PSV right [mm/s]			24.6±5.8
Vertical jump	SJ height [cm]			27.0.0±5.0
	SJ power [W/kg]			48.1±7.4
	CMJ height [cm]			30.0±7.0
	CMJ power [W/kg]			47.1±7.7
Trunk strength	Extension [Nm]			229.1±98.1
	Flexion [Nm]			181.4±79.5
	Lateral flexion left [Nm]			162.9±70.3
	Lateral flexion right [Nm]			161.3±75.0
Knee strength	Extension left [N]			193.8±55.1
	Extension right [N]			184.1±54.9
	Flexion left [N]			106.9±32.6
	Flexion right [N]			112.4±35.7

Group of factors	Factor	Category	Count (%)	Mean±SD
Ankle strength	Plantar flexion [N]			250.5±83.1
	Plantar flexion left [N]			126.5±43.2
	Plantar flexion right [N]			124.9±41.2
	Dorsal flexion [N]			75.1±28.5
	Dorsal flexion left [N]			34.3±15.0
	Dorsal flexion right [N]			41.2±13.9
WORKLOAD AND SLEEP FACTORS				
	Training (h)			8.9±5.3
	Practical courses (h)			8.0±3.0
	Sleep quantity (h)			6.9±0.7
	Sleep deficit	No	24 (44.5%)	
		Yes	30 (55.6%)	
	Sleep quality (VAS)			6.3±1.5
PREVIOUS INJURY FACTORS				
	Previous LBP	No	35 (64.8%)	
		Yes	19 (35.2%)	
	Previous knee injury	No	47 (87.0%)	
		Yes	7 (13.0%)	

Legend: LBP=low back pain; SD=standard deviation; PSV=postural sway velocity; AP=anterior-posterior; ML=medial-lateral; SJ=squat jump; CMJ=countermovement jump; VAS=visual analogue scale

Table 3. Results of univariate analysis of relationship between LBP and different explanatory factors in sports science students of Ljubljana University Faculty of Sports; n=54.

Group of factors	Factor	Category	OR (95% CI for OR)	p
BIOCHEMICAL FACTORS	Iron [μmol/L]		0.98 (0.91-1.08)	0.764
	Ferritin [μg/L]		0.99 (0.97-1.01)	0.282
	Ferritin level	Normal	1.00	0.043
		Low	3.50 (1.04-11.77)	
	Haemoglobin [g/L]		0.98 (0.94-1.02)	0.232
PHYSICAL FITNESS FACTORS				
Balance	Overall PSV left [mm/s]		0.99 (0.94-1.06)	0.928
	Overall PSV right [mm/s]		0.98 (0.92-1.05)	0.611
	AP PSV left [mm/s]		1.01 (0.92-1.12)	0.779
	AP PSV right [mm/s]		0.98 (0.89-1.08)	0.684
	ML PSV left [mm/s]		0.98 (0.89-1.07)	0.655
	ML PSV right [mm/s]		0.97 (0.87-1.07)	0.549
Vertical jump	SJ height [cm]		0.00 (0.00-2.19)	0.068
	SJ power [W/kg]		0.93 (0.85-1.01)	0.098
	CMJ height [cm]		0.00 (0.00-1.16)	0.054
	CMJ power [W/kg]		0.92 (0.84-0.99)	0.044
Trunk strength	Extension [Nm]		0.99 (0.99-1.00)	0.059
	Flexion [Nm]		0.99 (0.98-0.99)	0.030
	Lateral flexion left [Nm]		0.99 (0.99-1.01)	0.451
	Lateral flexion right [Nm]		0.99 (0.99-1.00)	0.170
Knee strength	Extension left [N]		0.99 (0.98-1.00)	0.096
	Extension right [N]		0.99 (0.98-1.00)	0.103
	Flexion left [N]		0.98 (0.96-0.99)	0.026
	Flexion right [N]		0.98 (0.96-1.00)	0.045

Group of factors	Factor	Category	OR (95% CI for OR)	p
Ankle strength	Plantar flexion [N]		0.99 (0.98-1.02)	0.687
	Plantar flexion left [N]		0.99 (0.96-1.04)	0.769
	Plantar flexion right [N]		0.99 (0.95-1.04)	0.724
	Dorsal flexion [N]		0.99 (0.99-1.00)	0.093
	Dorsal flexion left [N]		0.99 (0.98-1.00)	0.115
	Dorsal flexion right [N]		0.99 (0.97-1.00)	0.086
WORKLOAD AND SLEEP FACTORS				
	Training (h)		0.99 (0.98-1.01)	0.842
	Practical courses (h)		1.02 (0.99-1.04)	0.144
	Sleep quantity (h)		0.57 (0.23-1.41)	0.221
	Sleep deficit	No	1.00	0.087
		Yes	2.91 (0.86-9.86)	
	Sleep quality (VAS)		0.77 (0.51-1.16)	0.218
PREVIOUS INJURY FACTORS				
	Previous LBP	No	1.00	0.007
		Yes	5.50 (1.61-18.84)	
	Previous knee injury	No	1.00	0.775
		Yes	0.78 (0.14-4.45)	
CONFOUNDING FACTORS				
	Sex	Males	1.00	0.127
		Females	2.47 (0.77-7.88)	
	BMI	Overweight	1.00	0.275
		Normal weight	0.29 (0.03-2.65)	

Legend: LBP=low back pain; OR=odds ratio; CI=confidence interval; PSV=postural sway velocity; AP=anterior-posterior; ML=medial-lateral; SJ=squat jump; CMJ=countermovement jump; VAS=visual analogue scale

Presence of low ferritin level and the experience of LBP in the past year prior to the study showed a statistically significant positive association, while all statistically important physical fitness indicators (countermovement jump power, trunk flexion strength, and left and right knee flexion strengths) expressed a statistically significant negative association with the observed outcome.

Table 4. Results of multivariate analysis of relationship between LBP and different explanatory factors in sports science students adjusted for BMI and sex; n=54.

Factor	Category	OR (95% CI for OR)	p
Ferritin level	Normal	1.00	0.008
	Low	8.70 (1.78-42.60)	
Previous LBP	No	1.00	0.006
	Yes	8.69 (1.94-38.98)	

Legend: LBP=low back pain; OR=odds ratio; CI=confidence interval.

3.4 Results of multivariate analysis

The multivariate logistic regression with forward selection likelihood ratio model (Table 4) was statistically significant (p <0.001). The model explained 37.9% (Nagelkerke R2) of the variance in LBP and correctly classified 94.4% of cases. Students with low ferritin level (95% CI for OR 1.78-42.60), and history of previous LBP (95% CI for OR.94-38.98) were more likely to experience new LBP problems when controlled for sex and BMI categories.

4 DISCUSSION

LBP was the most common overuse problem in SPS during the first 10 weeks of study and accounted for an average of 13% of all musculo-skeletal disorders (MSD). We showed that LBP was associated with low ferritin level and a history of LBP.

All previous studies that reported the prevalence of LBP in SPS (16-21) were retrospective cross-sectional studies and reported much higher prevalence, ranging from 15% to 76%. However, the study with the largest sample (19) showed that 15% of physical education students reported LBP, which was strongly associated with fatigue. This is

the only study whose results are comparable to those of our study, as all other studies showed a much higher prevalence of LBP. We must emphasise the importance of tracking injuries prospectively on a weekly basis (as was the case in our study), as we believe this provides more reliable data. Even in our sample, the reported prevalence of previous LBP was much higher (35%) than that calculated from the prospective follow-up (15%). The most comparable study (21) showed that the six-month prevalence (each time data was collected cross-sectionally) was 61%, but in a follow-up of the 74 students from the original group after the end of the first semester, the reported prevalence was 18%, which is consistent with our data. Among the different types of physical activity and sports, gymnastics has been identified as a high-risk sport for LBP (22) and since it is part of the mandatory curriculum for Slovenian SPS, it may partly explain the prevalence of LBP.

Previous history of LBP was a strong risk factor for a future episode of LBP in our study. This is consistent with a study (23) that showed that recurrence of LBP is very common, with more than two-thirds of individuals having a recurrence within 12 months of recovery. A systematic review (24) reported that a history of LBP is the most consistent risk factor for transition to LBP after a pain-free baseline.

We have also shown that low ferritin level is associated with LBP occurrence in SPS over a 10-week period, which is in line with the findings of the clinical study (25) which showed that serum ferritin was negatively correlated with the degree of intervertebral disc degeneration and can be used for its severity prediction. A case control study (26) reported that serum iron levels were significantly different in patients with LBP compared to healthy individuals. In patients with LBP a strong link with iron level and severity of LBP was also reported (26), showing that low iron level and high inflammatory indicators were not only connected with the prevalence of LBP but also with its severity. The underlying mechanism for association between LBP and ferritin level could be via induction of oxidative stress and ferroptosis in endplate chondrocytes (27). High physical demands can lead to excessive stress and inflammatory reaction (28) and thus lower iron and ferritin. Since oxidative stress and inflammatory reaction are present in overtraining syndrome (29), both low ferritin level and LBP in our study could also be attributed to possible underlying overtraining. Iron status and its impact on LBP remains controversial in literature, and well planned randomised controlled trials are needed to fully understand this association. As LBP is one of the most common musculoskeletal disorders in the young physically active population, and iron status blood indicators are often used for health status follow-up, the influence of iron disorder and LBP could therefore represent added value in the diagnostic and therapeutic area.

Maximal trunk flexor strength was identified as a significant risk factor on the univariate level for the development of LBP. A cross-sectional study (30) showed that trunk isometric strength (flexion and/or extension) and its ratios have low predictive validity for differentiation in relation to LBP history, but it seems that these variables, when used in a prospective manner, may have some predictive validity for LBP, which should be investigated in the future. For such purposes, maximal isometric trunk strength should be measured along with trunk muscle endurance, as a study (31) using EMG (Electromyography) showed that young tennis players with LBP are expected to have lower trunk extensor activation, fewer co-contraction patterns and lower abdominal endurance. A cross-sectional study on physiotherapy students also showed that LBP was the main MSD and was connected to poor trunk flexibility (32). Maximal knee flexor strength both right and left side was also recognised as a significant risk factor on a univariate level for LBP. A study on a group of soccer players also showed a statistical difference in maximal strength of knee flexors on both sides in the group with LBP (33). On the other hand meta-analysis reported no significant difference in knee flexor strength in patients with LBP compared to the healthy population (34). The limitations and different survey results are due to the use of various dynamometers and protocols which does not allow a direct comparison between studies.

The main limitations of our study are the small sample size and the short prospective follow-up period precluding gender-specific analysis. Because of the SARS-Cov-2 pandemic and lockdown, we were able to follow up students only during the winter semester (ten weeks) and it prevented us from repeating some tests as planned before. However, the prospective data are one of the strengths of our study, because students' health problems were recorded weekly, which allowed us to track workload and LBP occurrence simultaneously. One could dispute the small numbers of participants in the study. However, the most comparable study also had such a small number of participants. Participation in the study was time consuming and an additional burden for SPS, which is one of the reasons they decided not to participate.

The type of LBP might be important (e.g., different patho-anatomy and biopsychosocial prognosis in spondylolysis versus degenerative disc problems), so future studies should also make this distinction. Iron status and its impact on LBP remains controversial in literature and well planned randomised controlled trials are needed to fully understand this association. We must also take into account that our model has explained only about 38% of the LBP occurrence, and that there may be other factors that could have caused the LBP that were not included in our study (e.g. psycho-social factors, family predisposition).

The study's strength is that it provides a novel approach in LBP in SPS in the form of a prospective follow-up, and includes determinants that have rarely been studied before such as blood ferritin level.

The results of the study are of significant importance and use in occupational and sports medicine in terms of preventive medical check-up content and developing strategies to prevent LBP in the active population.

Further research in this field should be upgraded by applying preventive strategies in active young adults and athletes including follow-up to evaluate the effect of the measures.

5 CONCLUSION

First-year SPS are exposed to high workloads due to concurrent training and faculty curriculum. Students most at risk are those with a history of LBP and low ferritin level. Our findings could be of interest for sports medicine physicians to better implement preventive strategies to mitigate the risk of LBP. This means that students with a history of LBP and concomitant low ferritin levels could be prompted to do more preventive exercise (e.g. core stability training) and additional nutritional consultation with sports dietitians to improve the iron status. Future studies including longer follow-up, larger samples and with implementation of such clinical approach are needed.

CONFLICTS OF INTEREST

The authors declare that no conflicts of interest exist.

FUNDING

The study was financially supported by Institute of Occupational Safety, Ljubljana, which had no influence over the study design or results.

ETHICAL APPROVAL

The study was approved by the Committee of Medical Ethics at the Ministry of Health in Ljubljana (No. 0120-492/2019). Prior to inclusion all students were informed about the methods, procedures and potential risk during the study and gave their written consent.

AVAILABILITY OF DATA AND MATERIALS

The data presented in this study can be obtained upon request from the corresponding author.

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October 2023

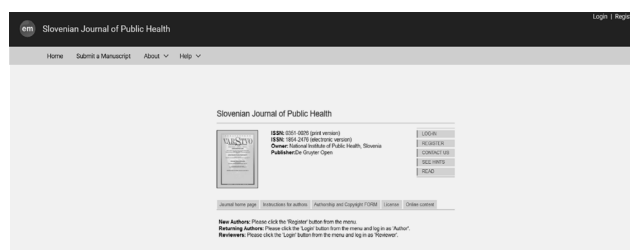
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The Slovenian Journal of Public Health has been published since 1962 by the National Institute of Public Health in Slovenia. Since 2003, the journal has been a peer-reviewed scientific journal with English abstracts, and since 2014, an international scientific public health journal in English only. The journal's mission is to promote new achievements in the broad field of public health in Slovenia and Central and South-East Europe. The Slovenian Journal of Public Health publishes internationally oriented articles and encourages an interdisciplinary approach to public health. The journal is a source for exchanging new public health concepts and solutions among researchers. The journal mainly publishes original scientific articles, and on occasion also systematic reviews, methodological articles, and invited editorials. It is published four times a year, with up to 35 articles each year, and has an average annual rejection rate of around 80%. The journal is indexed in major international databases, such as PubMed, Web of Science, and Scopus, and has had an impact factor since 2011, ranging from 0.16 to 1.6. As an open-access journal it is available online on De Gruyter, Sciendo <https://sciendo.com/journal/SJPH>. The manuscripts are peer-reviewed by three international reviewers, and the process is double-blinded, fair and constructive.

MANUSCRIPT SUBMISSION

We recommend the use of the video instructions for authors. The journal welcomes submissions in electronic form to the web-based peer-review system, Editorial Manager at <http://www.editorialmanager.com/sjph/>, and no longer accepts submissions by email or post.



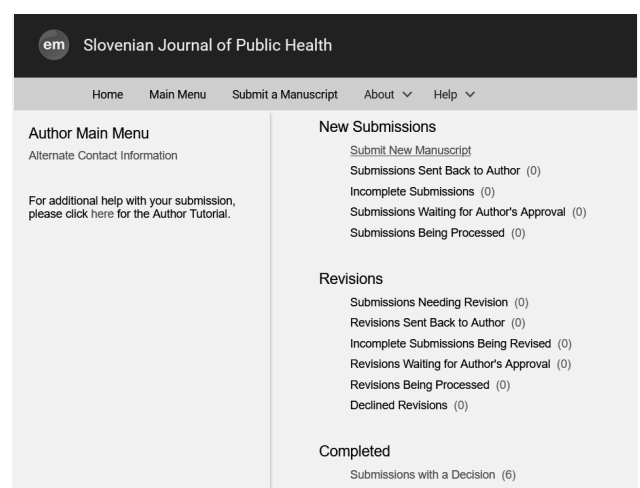
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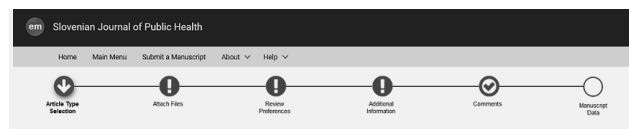
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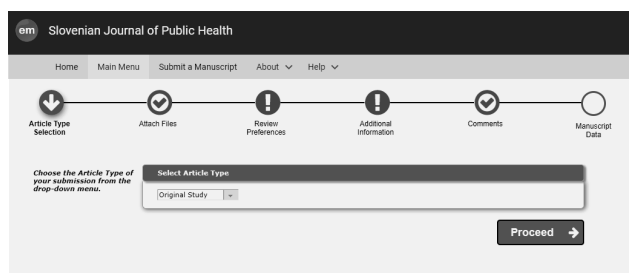
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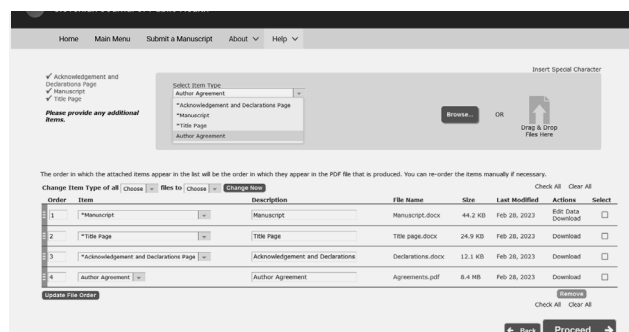


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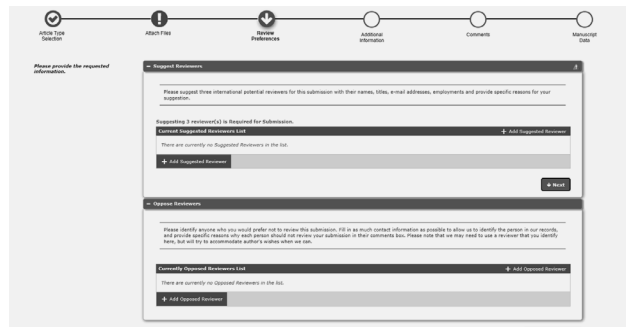


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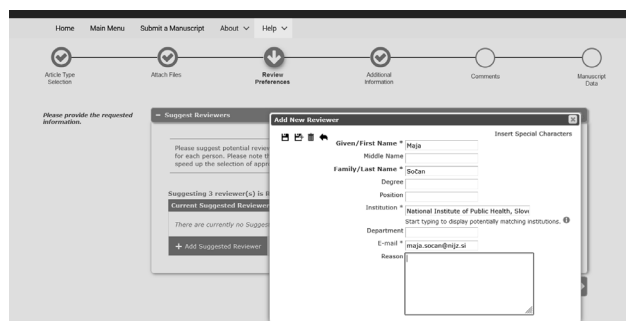


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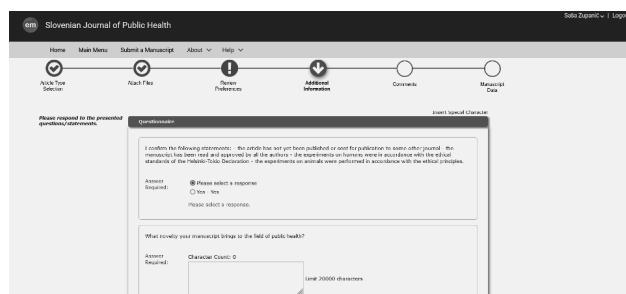
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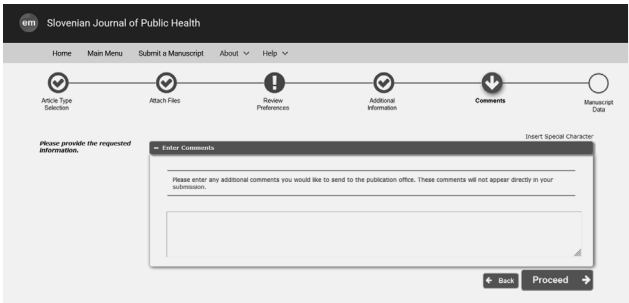
- the article has not yet been published or sent for publication to some other journal,
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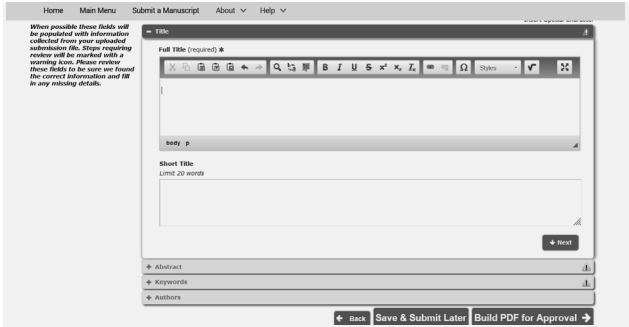
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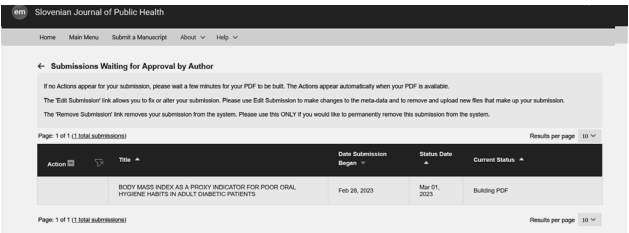
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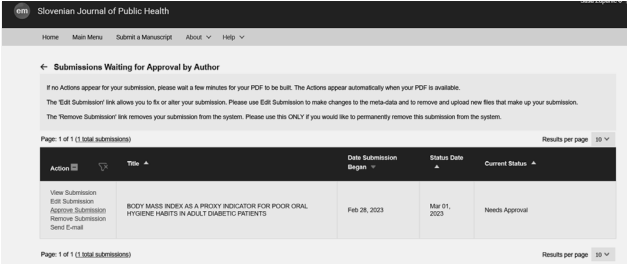


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The manuscript should have the following sections: introduction, methods, results, discussion, conclusion and references. Invited editorials may be structured differently, but the division into chapters and sub-chapters should be clearly indicated by the bolding of the letters in the headings. Chapters and subchapters should be numbered in decimal form according to SIST ISO 2145 and SIST ISO 690 (e. g. 1, 1.1, 1.1.1, etc.).

Avoid abbreviations and acronyms, with the exception of internationally valid unit designations. If an abbreviation of a term will be used, then the first time the term appears in the text it should be written in full, followed by the abbreviation used thereafter in parentheses.

Include graphic material (tables and figures) in the text where it belongs, with headings and legends explaining abbreviations. Use black and white images, and the background should always be white. Letters, numbers or symbols in figures should be clear, uniform and large enough to be readable even when reproduced in a smaller size.

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Adam et al. state that the data is 'unreliable' (1, p. 122).
This argument is increasingly relevant to the topic (2, 3) ...
Several studies (1, 4-8, 12) ...

Each entry starts with the author's surname and initials. When a source has more than one author, their names are separated by commas. If a source has more than six authors, list the first six followed by 'et al.' Only the first word of the title and subtitle, along with any proper nouns, are capitalized. Titles in Vancouver referencing are consistently written in plain text, without italics or quotation marks. Journal titles should be abbreviated according to the National Library of Medicine's [List of Journals Indexed for Medline](#); for unlisted journals, please provide complete journal titles. If the article/book has a DOI number, please include it at the end of the reference.

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de Villiers TJ. The role of menopausal hormone therapy in the management of osteoporosis. *Climacteric.* 2015;18 Suppl 2:19-21. doi: 10.3109/13697137.2015.1099806.

Book

Wilkinson IB, Raine T, Wiles K, Goodhart A, Hall C, O'Neill H, et al. *Oxford handbook of clinical medicine.* 10th ed. Oxford: Oxford University Press; 2017. 123 p.

Kaplan SJ. *Post-hospital home health care: the elderly's access and utilization [dissertation].* St. Louis (MO): Washington University; 1995.

Book chapter

Goldberg BW. Population-based health care. In: Taylor RB, Robin S, editors. *Family medicine.* 5th ed. Cambridge: Cambridge University Press; 1999. p. 32-36.

Website

Cancer Research UK. Current research into breast cancer [Internet]. 2020 [cited 2022 Dec 14]. Available from: <https://www.cancerresearchuk.org/our-research/our-research-by-cancer-type/our-research-into-breast-cancer/current-breast-cancer-research>

McNeil DG. Vaccines against HIV, malaria and tuberculosis unlikely, study says. *New York Times.* 2018 Sep 7. [cited 2018 Nov 14]. Available from: <https://www.nytimes.com/2018/09/07/health/vaccines-hiv-malaria-tuberculosis.html>

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The title page should include the following information: title, authors, affiliations, [ORCID](#) numbers of authors, email address of corresponding author, abstract, and keywords.

The title should be informative and precise, descriptive and not assertive (full sentences are not allowed in titles). The title should not contain abbreviations.

The names of the authors should be given in the order preferred, with the full addresses of the institutions where the authors are employed. Authors must meet the conditions for authorship. They must contribute to the conception and design or analysis and interpretation of the data, they must intellectually conceive of and critically review the manuscript, and they must agree with the final version of the manuscript. Simply collecting data is not sufficient for authorship. Shared first authorship is allowed for up to two authors. Please give the ORCID numbers of the authors and the email address of the corresponding author.

The abstract should be structured in the IMRC structure and no longer than 250 words in English and 400 words in Slovenian. The abstract for invited editorials may be unstructured. The abstract should summarize the content of the manuscript, written in the third person, and avoid abbreviations and acronyms.

Between 3 and 6 keywords should be listed.

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The acknowledgement should be placed first in the document. It should thank all contributors who did not receive authorship of the manuscript.

The document should then include the following statements:

CONFLICTS OF INTEREST

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(Received from the... or description of the ethical aspect of the research)

AVAILABILITY OF DATA AND MATERIALS

(All data and materials used in this study were collected from publicly available sources and are available upon reasonable request.

or

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.)

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Submitted manuscripts with a public health theme of international relevance are forwarded to two editors for review after technical integrity and plagiarism checking with [Crossref Ithenticate](#) (if the editorial office finds a manuscript to be plagiarized, the manuscript is immediately excluded from the editorial process). If a manuscript is judged worthy of the peer review process, the editor sends it to three internationally renowned peer reviewers for review, at least one of whom must be from outside Slovenia. The review process is double-blind. Once the review process is complete, the manuscript is returned to the corresponding author for confirmation and consideration of corrections. The revision of the manuscript must be submitted to the Editorial Manager system within two months (first revision) or within one month (subsequent revisions). The journal allows a maximum of three revisions. If the third revision does not take into account all the comments of the reviewers, the manuscript will be rejected. After acceptance of the manuscript, a linguistic proofreading follows. During the editorial process, the confidentiality of the content of the manuscript is guaranteed. The author will receive the first, so-called brush proofs, but at this stage only corrections of typographical errors are taken into account. The brush proofs must be returned within three days, otherwise we consider that the author has no objections.

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NAVODILA AVTORJEM REVIJE ZDRAVSTVENO VARSTVO

Oktober 2023

Navodila so v skladu s priporočili ICMJE recommendations for the conduct, reporting, editing and publication of scholarly work in medical journals. Popolna navodila so objavljena na spletni strani <http://www.icmje.org/icmje-recommendations.pdf>.

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Revija Zdravstveno varstvo (SJPH) izhaja od leta 1962 in danes predstavlja temeljno znanstveno revijo s področja javnega zdravja na območju centralne in JV Evrope.

Revija objavlja članke s širšo mednarodno tematiko s področja javnega zdravja in spodbuja objavo rezultatov interdisciplinarnih raziskav na tem področju. Objavlja izvirne znanstvene članke, v manjši meri tudi sistematične pregledne znanstvene članke in metodološke članke ter vabljene uvodnike. Letno objavi štiri številke, skupno do 35 člankov. Povprečni letni osip je okoli 80 %. Revija je vključena v številne mednarodne podatkovne zbirke, tudi v PubMed in v oba citatna indeksa WoS in Scopus ter ima faktor vpliva neprekinjeno že od leta 2011; giblje se med 0,16 in 1,6. Revija Zdravstveno varstvo se v e-obliki nahaja na straneh založbe De Gruyter, Sciendo <https://sciendo.com/journal/SJPH>.

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Priporočamo ogled videoposnetka z navodili za avtorje.

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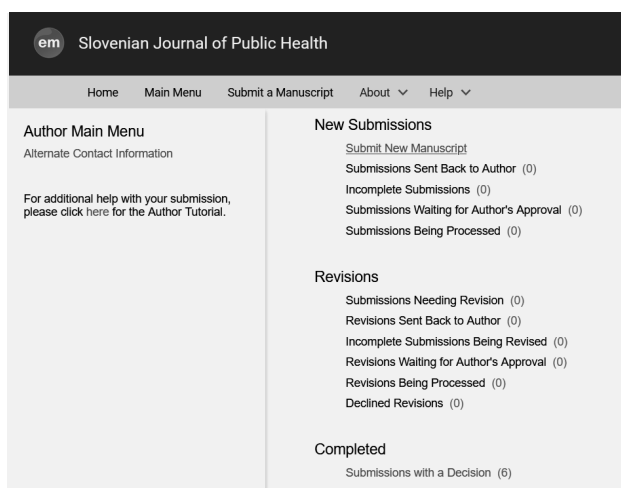
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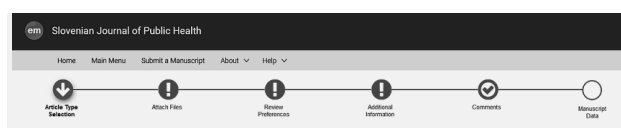
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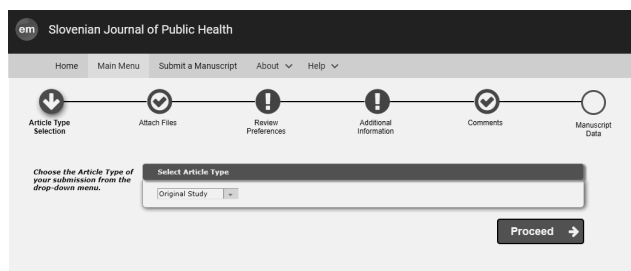
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KATEGORIJA ROKOPISA (Article Type Selection)

Kategorijo rokopisa določite z izborom vrste rokopisa. Objavljamo izvirne znanstvene članke in metodološke članke (izberete Original Study), sistematične pregledne znanstvene članke (izberete Systematic Review) in vabljeni uvodniki (izberete Invited Editorial). Po izboru kliknete na gumb Proceed.

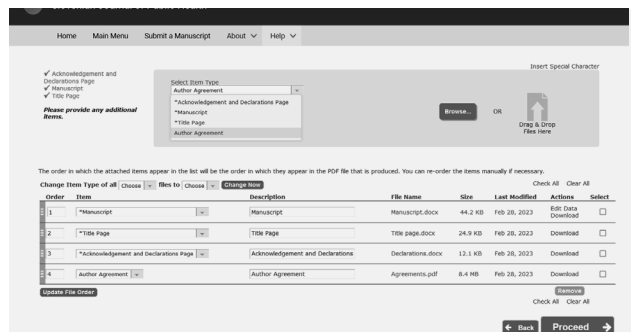


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Sledi vnos priponk: rokopisa, naslovne strani, izjav z morebitno zahvalo in avtorskih pogodb. Obvezno oddate tri Wordove priponke: Manuscript, Title Page, Acknowledgement and Declaration Page. Podpisane pogodbe Authorship and Copyright Transfer Agreements za vse soavtorje združite v en PDF dokument. Oddaja v tej fazi je zaželen, a ni obvezna. Podpisane pogodbe so pogoj za objavo članka. V uredništvo jih lahko oddate tudi naknadno po sprejemu članka v objavo po e-pošti zdrav.var@nijz.si.

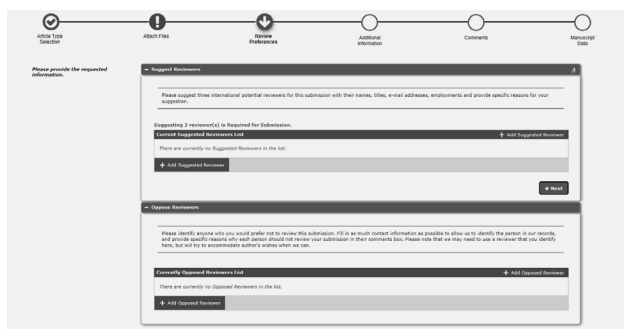


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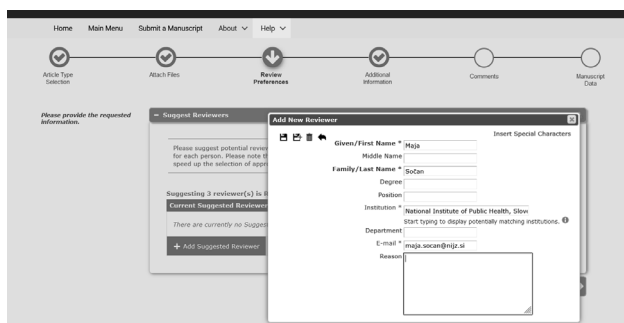


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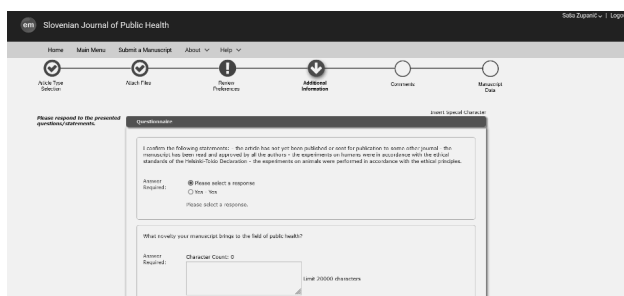


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ROKOPIS

Jezik rokopisa je angleščina. Ime datoteke z rokopisom ne sme zajemati avtorjevih osebnih podatkov, prav tako ne imen ustanov, vključenih v pripravo rokopisa. Besedila naj bodo napisana z urejevalnikom besedil Word for Windows. Robovi naj bodo široki 25 mm, izberite črke Ariel in velikost črk 12. V Wordu uporabite možnost Postavitev strani/Številke vrstic/Zaporedno (tako bo na robu vsake vrstice rokopisa dodana številka vrstice, na katero se lahko referirajo recenzenti pri pisanju recenzij).

Rokopis naj ima naslednja poglavja: uvod, metode, rezultati, razprava, zaključek in reference. Vabljeni uvodniki so lahko zasnovani drugače, vendar naj bo razdelitev na poglavja in podpoglavja jasno razvidna iz odelitve črk v naslovih. Poglavja in podpoglavja naj bodo številčena dekadno po standardu SIST ISO 2145 in SIST ISO 690 (npr. 1, 1.1, 1.1.1 itd.).

Kraticam in okrajšavam se izogibajte, izjema so mednarodno veljavne oznake merskih enot. Na mestu, kjer se kratica prvič pojavi v besedilu, naj bo izraz, ki ga nadomešča, polno izpisan, v nadaljnjem besedilu uporabljano kratico navajajte v oklepaju.

Grafično in slikovno gradivo vključite v besedilo na mesto, kamor le-to sodi in ga opremite z naslovi in legendami, v katerih pojasnite okrajšave. Uporabite črno-bele prikaze, ozadje naj bo vselej belo. Črke, številke ali simboli na slikah naj bodo jasni, enotni in dovolj veliki, da so berljivi tudi na pomanjšanem prikazu.

Merske enote naj bodo v skladu z mednarodnim sistemom enot (SI).

Zahtevana dolžina rokopisa je za vabljeni uvodnik od 250 do 2000 besed, za ostale vrste rokopisov pa od 2000 do 4500 besed s slikovnim gradivom in literaturo vred. Revizija sme obsegati 5000 besed.

Reference: Zdravstveno varstvo uporablja Vancouverski numerični stil citiranja in navajanja literature, ki je v biomedicini splošno v uporabi. Urejeni citati si v seznamu literature na koncu rokopisa sledijo zaporedno, kot so zapisani v besedilu rokopisa. V to zaporedje vključite tudi citate, ki se pojavljajo v tabelah, njihovih legendah ali v slikovnem gradivu. Za citiranje in navajanje literature ne uporabljajte opomb pod črto. Izogibajte se citiranju osebnih pogovorov, neobjavljenih podatkov in rokopisov, ki so v uredniškem postopku.

Citiranje v besedilu: Vsako navajanje trditev ali dognanj drugih avtorjev morate podpreti s citatom. Številka reference naj bo navedena v običajni velikosti na koncu citirane trditve v okroglih oklepajih. Uporabljajte arabske številke, navedete lahko tudi stran citata:

Adam et al. state that the data is 'unreliable' (1, p. 122).
This argument is increasingly relevant to the topic (2, 3) ...
Several studies (1, 4-8, 12) ...

Seznam literature: Numerično urejen seznam literature poimenujete z besedo "References" in ga postavite na konec rokopisa. Avtorje beležite s priimkom in kraticami imena, med posameznimi avtorji postavite vejico.

Navedite imena vseh avtorjev; v primeru, da je avtorjev šest ali več, navedite prvih šest avtorjev in dodajte kratico et al. Naslov in podnaslov pišite z malimi začetnicami z izjemo prve besede in lastnih imen. Uporabljajte običajno pisavo in se izogibajte ležeči pisavi ali zapisu v navednicah. Naslove revij krajšajte tako kot baza Medline/PubMed. Popoln seznam kratic revij najdete na naslovu National Library of Medicine's [List of Journals Indexed for Medline](#). Naslovov revij, katerih kratic v seznamu ni, ne krajšajte. Če ima objava DOI številko, jo navedite na koncu reference. Primeri navajanja najbolj pogosto uporabljenih vrst objav:

Članek v reviji

Vodička S, Zelko E. Remote consultations in general practice: A systematic review. *Zdr Varst*. 2022 Sep 28;61(4):224-230. doi: 10.2478/sjph-2022-0030.

de Villiers TJ. The role of menopausal hormone therapy in the management of osteoporosis. *Climacteric*. 2015;18 Suppl 2:19-21. doi: 10.3109/13697137.2015.1099806.

Knjiga

Wilkinson IB, Raine T, Wiles K, Goodhart A, Hall C, O'Neill H, et al. *Oxford handbook of clinical medicine*. 10th ed. Oxford: Oxford University Press; 2017. 123 p.

Kaplan SJ. *Post-hospital home health care: the elderly's access and utilization [dissertation]*. St. Louis (MO): Washington University; 1995.

Poglavje v knjigi

Goldberg BW. Population-based health care. In: Taylor RB, Robin S, editors. *Family medicine*. 5th ed. Cambridge: Cambridge University Press; 1999. p. 32-36.

Spletna stran

Cancer Research UK. Current research into breast cancer [Internet]. 2020 [cited 2022 Dec 14]. Available from: <https://www.cancerresearchuk.org/our-research/our-research-by-cancer-type/our-research-into-breast-cancer/current-breast-cancer-research>

McNeil DG. Vaccines against HIV, malaria and tuberculosis unlikely, study says. *New York Times*. 2018 Sep 7. [cited 2018 Nov 14]. Available from: <https://www.nytimes.com/2018/09/07/health/vaccines-hiv-malaria-tuberculosis.html>

Primere navajanja redkeje uporabljenih vrst objav lahko najdete na spletni strani [NLM knjižnice](#). Uredništvo pred objavo članka v reviji Zdravstveno varstvo seznam literature pregleda in ga po potrebi popravi v skladu z navodili. Za navajanje literature lahko uporabljate urejevalnike referenc, pri čemer izberete Vancouverski stil citiranja. Avtorjem priporočamo, da ob pripravi rokopisa pregledajo slovensko literaturo na temo svojega rokopisa, objavljeno v obdobju zadnjih petih let.

NASLOVNA STRAN

Naslovna stran naj zajema sledeče podatke: title / naslov, avtorji, zaposlitve, [ORCID](#) številke avtorjev, e-poštni naslov korespondenčnega avtorja, abstract / izvleček, keywords / ključne besede.

Naslov v angleškem in slovenskem jeziku naj bo informativen in natančen, opisen in ne trdilen (povedi v naslovih niso dopustne). V naslovu naj ne bo kratic.

Imena avtorjev naj bodo navedena v zelenem zaporedju, dodani naj bodo popolni naslovi ustanov, kjer so avtorji zaposleni. Avtorji morajo izpolnjevati pogoje za avtorstvo. Prispevati morajo k zasnovi in oblikovanju oz. analizi in interpretaciji podatkov, rokopis morajo intelektualno zasnovati in ga kritično pregledati, strinjati se morajo s končno različico rokopisa. Zgolj zbiranje podatkov ne zadostuje za avtorstvo. Deljeno prvo avtorstvo je dovoljeno za največ dva avtorja. Dopišite [ORCID](#) številke avtorjev in e-poštni naslov korespondenčnega avtorja.

Izvleček v angleškem in slovenskem jeziku naj bo strukturiran v IMRC strukturi in naj ne bo daljši od 250 besed v angleščini in 400 besed v slovenščini. Izvleček pri vabljenih uvodnikih je lahko nestrukturiran. Izvleček naj vsebinsko povzema in ne le našteva bistvene vsebine rokopisa. Napisan naj bo v 3. osebi. Izogibajte se kraticam in okrajšavam.

Navedenih naj bo med 3 in 6 ključnih besed, ki bodo v pomoč pri indeksiranju.

ZAHVALA IN IZJAVE

Zahvala se naj nahaja na prvem mestu v dokumentu. Vsebuje naj zahvalo vsem sodelujočim pri rokopisu, ki niso prejeli avtorstva rokopisa.

Dokument naj nato zajema še sledeče izjave:

CONFLICTS OF INTEREST

(The authors declare that no conflicts of interest exist.)

FUNDING

(The study was financed by ...)

ETHICAL APPROVAL

(Received from the... ali opis etičnega vidika raziskave)

AVAILABILITY OF DATA AND MATERIALS

(All data and materials used in this study were collected from publicly available sources and are available upon reasonable request.

ali

Data sharing is not applicable to this article as no datasets were generated or analysed during the current study.)

LLM STATEMENT

(V LLM izjavi morajo avtorji obvezno navesti morebitno uporabo generativnih jezikovnih modelov (kot je ChatGPT) za izboljšanje jezika in berljivosti rokopisa. Primer: During the preparation of this work the author(s) used [NAME TOOL /SERVICE] in order to [REASON]. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.)

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Shranjevanje preprintov v priznanih repozitorijih preprintov, kot so bioRxiv, medRxiv in drugi akademski repozitoriji preprintov, je dovoljeno pred oddajo rokopisa v SJPH, vendar ne smejo biti objavljeni ali oddani v postopek še kje drugje.

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Za SJPH javni komentarji o preprintih niso sprejemljivi kot recenzije.

Po sprejemu rokopisa v objavo v naši reviji in pred samo objavo morajo avtorji povezati preprint s sprejetim člankom z DOI številko.

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Raziskave na ljudeh (vključno s človeškimi materiali in osebni podatki) morajo biti izpeljane v skladu s Helsinško deklaracijo in potrjene s strani nacionalne etične komisije.

V izjavi o etiki morajo avtorji podati izjavo o etiki raziskav na ljudeh, ki mora vsebovati ime etične komisije in referenčno številko obravnave. Poročanje o raziskavah na ljudeh brez potrdila etične komisije zahteva dodatno razlago v poglavju o metodah dela. Na zahtevo Uredništva je avtor dolžan predložiti vso dokumentacijo o obravnavi raziskovalne etike njegovega rokopisa. Uredništvo si pridržuje pravico, da kontaktira etično komisijo.

Prav tako morajo avtorji, ki poročajo o ljudeh ali posredujejo javnosti njihovo slikovno gradivo, pridobiti dovoljenja vseh sodelujočih, da se z vključitvijo v raziskavo strinjajo (v primeru otrok so to starši ali skrbniki). Izjavo o pridobitvi teh dovoljenj morajo avtorji podati v poglavju o metodah dela. Uredništvo si pridržuje pravico vpogleda v to dokumentacijo.

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V izjavah morajo biti zapisani morebitni finančni ali drugi interesi farmacevtske industrije ali proizvajalcev opreme ter inštitucij, povezanih z rokopisom.

Primere priponk najdete na spletni strani revije.

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Morebitne pritožbe avtorjev obravnava uredniški odbor revije.

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Člankov in recenzij ne honoriramo. Stroškov obravnave rokopisov in objave člankov avtorjem ne zaračunavamo.

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Jerneja FARKAŠ LAINŠČAK, Igor ŠVAB

SLOVENIAN JOURNAL OF PUBLIC HEALTH: THE JOURNEY SO FAR AND THE ROAD AHEAD (1-4)

ORIGINAL SCIENTIFIC ARTICLES

Brigita SKELA-SAVIČ, Mateja BAHUN, Sedina KALENDER SMAJLOVIČ, Sanela PIVAČ

PATIENTS' EXPERIENCE WITH RECEIVED HEALTHCARE IN INTERNAL MEDICINE AND SURGERY WARDS
OF SLOVENIAN HOSPITALS—A CROSS-SECTIONAL SURVEY (5-13)

Katja JARM, Eva ŠAJN, Enej HADŽIČ, Gregor JURAK, Mateja KRAJC, Urška IVANUŠ, Jasna BUT-HADŽIČ

CANCER RISK FACTORS AWARENESS IN SLOVENIAN ADOLESCENTS (14-23)

Mateja BAHUN, Bojana LOBE, Brigita SKELA-SAVIČ

THE EFFECT OF NURSES' JOB CHARACTERISTICS ON MISSED NURSING CARE IN MEDICAL AND SURGICAL
DEPARTMENTS IN SELECTED SLOVENIAN HOSPITALS—A CROSS-SECTIONAL STUDY (24-31)

Ines DUJC, Boštjan ŽVANUT, Igor KARNJUŠ

PUBLIC PERCEPTIONS OF FAMILY PRESENCE DURING RESUSCITATION: A
CROSS-SECTIONAL SURVEY IN SLOVENIA (32-39)

Tanja CARLI, Igor LOCATELLI, Mitja KOŠNIK, Danilo BEVK, Andreja KUKEC

EPIDEMIOLOGY AND RISK FACTOR ANALYSIS OF SYSTEMIC ALLERGIC REACTION
TO BEE VENOM IN THE SLOVENIAN POPULATION OF BEEKEEPERS (40-48)

*Erika ZELKO, Thomas PEINBAUER, Lisa VOGGENBERGER, Fabian BEKELAER,
Julia PANTOGLOU, Denise STÜBL, Erwin REBHANDL*

EXPLORING GENERAL PRACTITIONER WORK IN UPPER AUSTRIA: A PILOT RETROSPECTIVE
OBSERVATIONAL STUDY ACROSS THIRTY PRACTICES (49-58)

Maja MIKŠA PODOBNIK, Nejc ŠARABON, Marjan BILBAN, Vedran HADŽIČ

FACTORS ASSOCIATED WITH LOW BACK OVERUSE INJURIES
IN SPORTS SCIENCE STUDENTS – A PROSPECTIVE STUDY (59-67)