NAZIV DISERTACIJE: PROCJENA FAKTORA RIZIKA I IZLOŽENOSTI ZRAČENJU INŽINJERA MEDICINSKE RADIOLOGIJE U PROFESIONALNOM OKRUŽENJU

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SAŽETAK

Uvod: Ovaj doktorski rad pod naslovom Procjena faktora rizika i izloženosti zračenju inženjera medicinske radiologije u profesionalnom okruženju analizira profesionalne rizike u zoni jonizirajućeg zračenja, organizaciju rada i implementirane kontrolne mjere, pri čemu su ispitanici isključivo inženjeri medicinske radiologije i bachelori radioloških tehnologija.Nedostupnost službenih podataka na našem području bila je osnovana motivacija za analizu i izradu Upitnika, za procjenu izloženosti i sigurnosti na radu u radijacijskim disciplinama, sa krajnjim ciljem da se na osnovu rezultata kreiraju preventivno-edukativni programi koji će pomoći očuvanju funkcionalnog kapaciteta zaposlenih tokom cijelog radnog vijeka. Razvijeni instrument u potpunosti zadovoljava psihometrijske karakteristike i adekvatan je za istraživanja na našim prostorima.

Hipoteze: Radne hipoteze

H1: Postoje razlike u znanju, stavu i praksi ispitanika u odnosu na oblast/granu radijacijske medicine.

H2: Postoji signifikantna usklađenost između profesionalne ekspozicije rizicima sa standardima sigurnosti zračenja.

Nulte hipoteze

H1: Ne postoje razlike u znanju, stavu i praksi ispitanika u odnosu na oblast/granu radijacijske medicine.

H2: Postoji signifikantna neusklađenost između profesionalne ekspozicije rizicima sa standardima sigurnosti zračenja.

Materijal (Ispitanici) i metode: Studija je obuhvatila 328 ispitanika oba spola, zaposlenih u javnim i privatnim zdravstvenim ustanovama na svim nivoima zdravstvene zaštite. Ispitanici su uključeni iz Bosne i Hercegovine, Srbije, Crne Gore, Sjeverne Makedonije i zemalja Evropske unije, a istraživanje je obuhvatilo tri oblasti radijacijske medicine: radiološku dijagnostiku, nuklearnu medicinu i radioterapiju. Uzorak je podijeljen na ispitivanu i kontrolnu skupinu, pri čemu je veličina uzorka u Bosni i Hercegovini određena pomoću intervala pouzdanosti (CI 95%), dok je u ostalim skupinama korištena metoda snježne kugle.

Rezultati: Analiza rezultata pokazala je značajne razlike između Bosne i Hercegovine, Regije i Evropske unije. U Bosni i Hercegovini 44,1% ispitanika radi u odjelima s manje od deset zaposlenih, što ukazuje na slabiju standardizaciju organizacije rada. Zdravstvene tegobe su najčešće u Bosni i Hercegovini (77,2% žena i 70,1% muškaraca), dok su vrijednosti niže u Regiji i EU. Ergonomija i mikroklima su nepovoljnije, a bol u leđima i stres prisutni su kod većine ispitanika. Korištenje lične zaštitne opreme je nedosljedno (68%), dok je u Regiji i EU znatno veće. Ekspozicija biološkim i hemijskim hazardima češća je u Bosni i Hercegovini, a kontinuirana edukacija slabije implementirana.

Daljnja analiza ukazuje na strukturne i organizacijske slabosti u znanju, stavovima i praksi. Iako je obrazovna struktura ispitanika povoljna, kontinuirana medicinska edukacija nije sistemski razvijena. Obuka prema međunarodnim protokolima (IAEA) obuhvatila je sve ispitanike, ali je dio njih naveo da takva edukacija nije provedena u njihovim ustanovama; pisane standardne operativne procedure za postupanje u akcidentalnim situacijama prisutne su u manje od polovine ustanova. Primjena ALARA principa pokazuje nedosljednosti, dok manje od polovine ustanova posjeduje akreditaciju. Profesionalno organiziranje je slabo izraženo, s malim udjelom članstva u stručnim asocijacijama.

Rezultati vezani za zdravstvene tegobe naglašavaju potrebu za razvojem sveobuhvatnih mjera koje bi osigurale bolju prevenciju i očuvanje zdravlja zaposlenih. Ispitanici često prijavljuju tegobe, ali rijetko traže medicinsku pomoć, što ukazuje na pasivan odnos prema vlastitom zdravlju.

Zaključak: Istraživanje je potvrdilo značajne razlike u profesionalnim rizicima, organizaciji rada i zdravstvenim ishodima između Bosne i Hercegovine, regije i Evropske unije. Identifikovane nedosljednosti u primjeni sigurnosnih standarda, ALARA principa i kontinuirane edukacije ukazuju na potrebu za sistemskim unapređenjem. Rezultati naglašavaju važnost jačanja institucionalne odgovornosti, standardizacije procedura i razvoja preventivnih mjera radi očuvanja zdravlja zaposlenih u radijacijskoj medicini.

Ključne riječi: jonizirajuće zračenje, radijacijska medicina, profesionalni rizik, zaštitna oprema, kontinuirana edukacija

DISSERTATION TITTLE: ASSESSMENT OF RISK FACTORS AND RADIATION EXPOSURE OF MEDICAL RADIOLOGY ENGINEERS IN THE PROFESSIONAL ENVIRONMENT

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ABSTRACT

Introduction: This doctoral dissertation entitled Assessment of Risk Factors and Radiation Exposure of Medical Radiology Engineers in the Professional Environment examines occupational risks in the zone of ionizing radiation, work organization, and implemented control measures, with participants consisting exclusively of medical radiology engineers and bachelors of radiological technologies. The lack of official data in the region served as the primary motivation for conducting the analysis and developing a Questionnaire to assess exposure and workplace safety in radiation disciplines, with the ultimate aim of creating preventive and educational programs that will help preserve the functional capacity of employees throughout their working life. The developed instrument fully meets psychometric standards and is suitable for research in our context.

Hypotheses: Working hypotheses

H1: There are differences in knowledge, attitudes, and practices of respondents depending on the branch of radiation medicine.

H2: There is significant compliance between professional exposure to risks and radiation safety standards.

Null hypotheses

H1: There are no differences in knowledge, attitudes, and practices of respondents depending on the branch of radiation medicine.

H2: There is significant non-compliance between professional exposure to risks and radiation safety standards.

Materials (Respondents) and Methods: The study included 328 participants of both genders, employed in public and private healthcare institutions across all levels of healthcare. Respondents were drawn from

Bosnia and Herzegovina, Serbia, Montenegro, North Macedonia, and European Union countries, covering three branches of radiation medicine: radiological diagnostics, nuclear medicine, and radiotherapy. The sample was divided into experimental and control groups, with the Bosnia and Herzegovina subgroup determined using a 95% confidence interval, while the other subgroups applied the snowball sampling method.

Results: The analysis revealed significant differences between Bosnia and Herzegovina, the wider Region, and the European Union. In Bosnia and Herzegovina, 44.1% of respondents worked in departments with fewer than ten employees, indicating weaker standardization of work organization. Health complaints were most frequent in Bosnia and Herzegovina (77.2% of women and 70.1% of men), compared to lower values in the Region and EU. Ergonomic and microclimatic conditions were less favorable, with back pain and stress reported by the majority of respondents. The use of personal protective equipment was inconsistent (68%), while exposure to biological and chemical hazards was more frequent. Continuous education was less systematically implemented.

Further analysis highlighted structural and organizational weaknesses in knowledge, attitudes, and practice. Although the educational profile of respondents was favorable, continuous medical education was not systematically developed. Training according to international protocols (IAEA) included all respondents, but some reported that such education was not conducted in their institutions; written standard operating procedures for accidental situations were present in less than half of institutions. The application of the ALARA principle showed inconsistencies, while fewer than half of institutions held valid accreditation. Professional organization was weakly expressed, with limited membership in professional associations.

Findings related to health complaints emphasize the need for comprehensive measures to ensure better prevention and preservation of employee health. Respondents frequently reported complaints but rarely sought medical assistance, indicating a passive attitude toward personal health. The high prevalence of back pain and musculoskeletal disorders further underscores the lack of ergonomic adjustments in workplaces.

Conclusion: The study confirmed significant differences in occupational risks, work organization, and health outcomes between Bosnia and Herzegovina, the region, and the European Union. Identified inconsistencies in the application of safety standards, the ALARA principle, and continuous education highlight the need for systemic improvements. The findings

emphasize strengthening institutional responsibility, standardizing procedures, and developing preventive measures to safeguard the health of professionals in radiation medicine.

Keywords: ionizing radiation, radiation medicine, occupational risk, protective equipment, continuing education