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# HEALTH EFFECTS OF OCCUPATIONAL EXPOSURE TO NON-IONIZING RADIATION IN HEALTHCARE WORKERS: A SYSTEMATIC LITERATURE REVIEW

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## ABSTRACT

***Relevance:*** *The expanded use of magnetic resonance imaging in clinical practice has increased the number of specialists in this field and their exposure to non-ionizing radiation. Although some side effects of non-ionizing radiation have been reported in the literature, the data are fragmentary and contain little volume. There is insufficient systematic data on medical workers exposed to non-ionizing radiation over extended periods, underscoring the need for further research.*

***The study aimed to*** *evaluate the health effects of occupational exposure to non-ionizing radiation among healthcare workers, using published scientific evidence.*

***Methods:*** *The review was conducted in accordance with PRISMA guidelines. A comprehensive search was conducted in the PubMed, Scopus, and Web of Science databases. Eligi-ble studies included original studies, systematic reviews, and meta-analyses that evaluated the health outcomes of healthcare workers exposed to non-ionizing radiation. Data on working conditions, symptoms, and diagnostic methods were collected. The survey included 21 studies that met the in-clusion criteria. Differences between studies, variations in exposure measurement methods, and reli-ance on employee self-reports are the main limitations that can affect the accuracy of the findings.*

***Results:*** *The studies included in this review consistently reported a high prevalence of short-term subjective complaints among healthcare personnel working with MRI, most commonly headache, dizziness, fatigue, sleep disturbances, sensory alterations, and cognitive problems. A relationship between dose and symptoms was observed, especially with high-field MRI systems (≥3T).*

***Conclusion:*** *Occupational exposure to non-ionizing radiation poses a significant health risk to med-ical workers. While non-ionizing radiation is primarily associated with acute subjective symptoms, these results underscore the importance of strengthening preventive measures, revising dose-limits, and implementing regular medical supervision to mitigate occupational risks.*

***Keywords:*** *Non-ionizing radiation; Occupational exposure; Healthcare workers; Electromagnetic fields (EMF); Magnetic resonance imaging (MRI).*

***Introduction:*** The growing use of magnetic resonance imaging (MRI) in clinical practice has led to an increasing number of specialists being exposed to specific physical factors. The literature highlights certain adverse effects; however, the available data are still incomplete and inconsistent. The sharp increase in environmental electromagnetic fields (EMFs) has raised global concerns about public health. Based on more than 70 years of research in this field, the World Health Organization has concluded that scientific knowledge in this area is currently more extensive than for most chemical substances, and current data do not support the existence of any health consequences from exposure to low-level EMFs [1].

Nevertheless, debates over electromagnetic safety continue. Two international groups – the International Committee on Electromagnetic Safety of the Institute of Electrical and Electronics Engineers (IEEE) and the International Commission on Non-Ionizing Radiation Protection - have been addressing this issue for decades. While both organizations aim to establish human exposure limits that protect against established or well-founded adverse health effects, some groups advocate for stricter exposure limits based on potential biological effects [2].

Acute exposure occurs only in accidents or gross violations of safety regulations, when a worker is subjected to a powerful EMF. Symptoms include fever (39-40°C), shortness of breath, muscle pain in the arms and legs, muscle weakness, headaches, palpitations, bradycardia, and hypertension. Marked autonomic-vascular disturbances have been described, including diencephalic crises, episodes of paroxysmal tachycardia, anxiety, and recurrent nosebleeds. Chronic exposure -the leading clinical manifestations are functional disorders of the central nervous and cardiovascular systems. Asthenic, neurotic, and autonomic reactions characterize changes in the nervous system [3].

Most commonly, patients complain of general weakness, rapid fatigue, reduced work capacity, sleep disturbances, irritability, sweating, and diffuse headaches. Some report chest pain, which can be constricting and radiate to the left arm and scapula, as well as shortness of breath. Cardiac discomfort is more common by the end of the workday, following emotional or physical stress. Some individuals also report visual darkening, dizziness, and impairments in memory and attention. Objective neurological examinations in many patients reveal unstable vascular responses, cyanosis of the extrem-

ities, excessive sweating, persistent dermographism (more often red), eyelid and finger tremors, and increased tendon reflexes. These findings manifest as an asthenic vegetative syndrome of varying severity. Cardiovascular disorders in individuals exposed to microwave radiation (MW) develop primarily against the background of functional disturbances of the central nervous system. Endocrine-metabolic disorders also manifest based on CNS dysfunction. Shifts in thyroid function toward increased activity are often noted, though clinical signs are usually absent. In severe cases, gonadal dysfunction may occur. There is evidence of disturbances in the gastrointestinal tract and liver function, as well as alterations in protein and pigment synthesis [3].

Although non-ionizing radiation lacks sufficient energy to cause direct DNA damage, several studies suggest a potential association with oncogenic and physiological effects via indirect mechanisms, such as oxidative stress, altered cell signaling, and dose-dependent biological responses [4-7]. Recent radiation safety guidelines increasingly emphasize the importance of monitoring and regulating not only ionizing but also non-ionizing radiation, including MRI-related magnetic fields [8]. These considerations underline the need for further investigation and careful assessment of occupational risks among medical personnel with repeated or prolonged exposure to non-ionizing radiation. Consequently, systematic data are virtually absent for healthcare workers exposed to non-ionizing radiation in MRI environments, highlighting a gap in the literature and the need for further research.

***The study aimed to*** evaluate the health effects of occupational exposure to non-ionizing radiation among healthcare workers, using published scientific evidence.

***Materials and methods:*** This systematic review was conducted according to the PRISMA 2020 guidelines [3]. The literature search was conducted across the PubMed, Scopus, and Web of Science databases. The search strategy included combinations of keywords and MeSH terms such as occupational exposure, non-ionizing radiation, EMFs, MRI staff, healthcare workers, radiofrequency radiation, and occupational risk, using Boolean operators (AND/OR).

Additionally, reference lists of relevant publications were manually screened to identify potentially eligible studies. Grey literature (Google Scholar, ResearchGate) was also examined; however, dissertations, non-peer-reviewed materials, and unindexed sources were excluded due to insufficient methodological transparency.

*Source* Selection *Process*. The initial search identified 159 articles (61 from Web of Science and 98 from PubMed). After removing 25 duplicates, 122 studies remained for screening. During title and abstract screening, 95 articles were excluded due to irrelevance, lack of exposure data, or insufficient methodological quality.

A total of 27 full-text articles were assessed for eligibility. From these, 6 articles were excluded for the following reasons:

– No clear assessment of occupational exposure to non-ionizing radiation (n=3);

– Absence of clinically relevant cardiovascular or neuropsychological outcomes (n=2);

– Unclear description of healthcare worker population (n=1).

Ultimately, 21 studies met the inclusion criteria and were included in the final review. The selection process consisted of two steps: (1) title and abstract screening; and (2) full-text assessment. Duplicate removal was performed using EndNote and verified manually.

*Quality Assessment and Risk of Bias*. The methodological quality of included studies was assessed using the Joanna Briggs Institute (JBI) critical appraisal tools and the Newcastle-Ottawa Scale (NOS) for observational studies. The risk of bias was evaluated using the ROBINS-I tool. Most studies demonstrated moderate methodological quality, with common limitations including small sample sizes, lack of confounder adjustment, and variability in exposure assessment methods.

*Heterogeneity*. Considerable heterogeneity was observed in exposure types (static magnetic fields, radiofrequency radiation, ELF-EMF), study designs, outcome measures, and assessment tools. Due to this heterogeneity, a quantitative meta-analysis was not feasible; therefore, a narrative synthesis approach was applied.

*Inclusion criteria*: studies in which the study population consists of medical professionals (doctors, nurses, radiologists, dentists, and other medical personnel), studies evaluating the impact of occupational exposure to non-ionizing radiation on the health of medical professionals, including original research, systematic reviews, and meta-analyses.

*Exclusion criteria:* studies conducted exclusively on patients, without analyzing occupational risks among medical professionals, experimental studies in vitro or in vivo (on cell cultures or animal models) without clinical interpretation concerning medical personnel.

Figure 1 provides an overview of the included studies. It is worth noting that the number of studies on non-ionizing radiation is limited compared to the larger body of evidence on ionizing radiation.

***Results:*** A total of 21 studies met the inclusion criteria and were included in the final analysis. The main characteristics of these studies, including the author, publication year, country, type of personnel, exposure conditions, and reported symptoms, are summarized in Table 1. Most studies were conducted in European countries, particularly Sweden and Italy, and focused primarily on MRI and ultrasound operators. Several studies included in the analysis have shown that healthcare workers exposed to MRI sources report a range of subjective symptoms. Exposure to MRI has been associated with acute sensory disturbances, including tingling, muscle contractions, headache, reduced concentration, dizziness, a metallic taste, and visual phenomena (magnetophosphenes). A dependence on scanner power was noted: symptoms were reported significantly more often when working with MRI systems of 3T and higher.

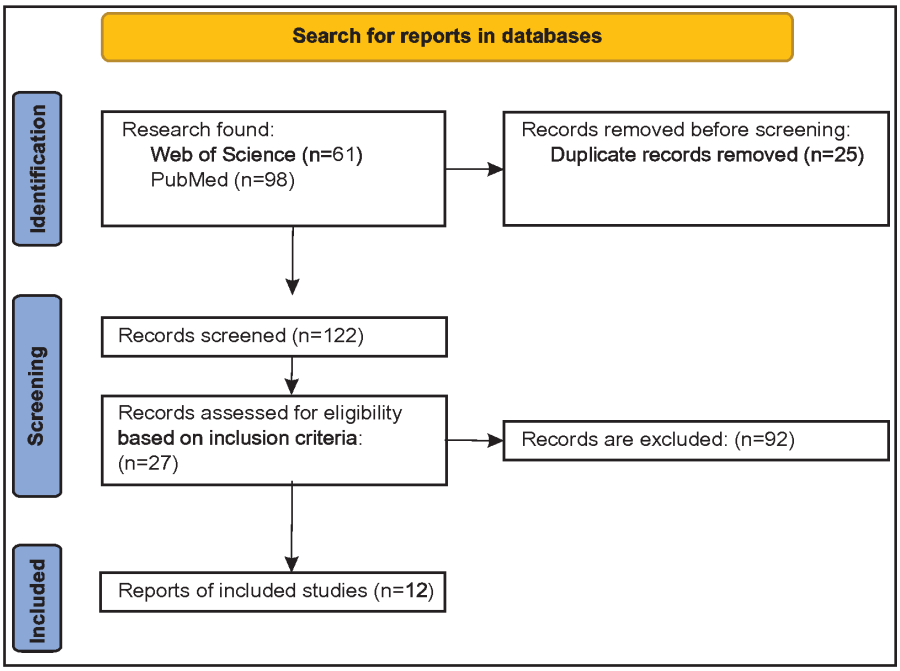


Figure 1 – Source selection algorithm according to PRISMA

*Neurological and sensory effects:* Personnel exposed to static magnetic fields (SMF) and motion-induced time-varying magnetic fields (TVMF) in MRI environments commonly report mild, short-term neurological symptoms. In a 2016 multicenter study of 234 employees across 14 MRI facilities, K. Schaap et al. (2016) observed dizziness in 20 workers across 22 shifts. Symptom frequency showed a clear dose–response relationship with both SMF and TVMF, with vertigo occurring at peak SMF levels of ~409 mT and TVMF of ~477 mT/s, and at average TWA values of 3 mT and 0.6 mT/s, indicating that acute effects can occur even below current exposure thresholds [9].

Similarly, Wilén and de Vocht reported in 2011 that 15% of MRI nurses experienced dizziness, nausea, headaches, or sleep disturbances, with symptom frequency rising with field strength [10]. P.C. Rathebe found in 2022 that MRI staff frequently reported headaches, fatigue, sleep disturbances, concentration difficulties, and sensations of vertigo or imbalance, with perceived risk higher among more experienced employees and those working with high-field MRI units (≥3T) [11].

M. Walker et al. reported in 2020 that 78% of MRI technologists experienced dizziness, visual disturbances, or a metallic taste, particularly among operators of high- and ultra-high-field systems [12]. In a cohort of physicians new to MRI, Zanotti et al. observed that 94% reported at least one MRI-related symptom (fatigue – 88%, reduced concentration – 82%, headache – 76%), with prevalence declining substantially after two months, suggesting partial adaptation [13].

Although the paper by Schaap et al. (2014) is more than 10 years old, it remains a key publication documenting a dose-dependent relationship between exposure to high-intensity SMF (1.5-7 T) and transient neurosensory and autonomic symptoms such as dizziness, metallic taste, nausea, and difficulty concentrating [14].

Occupational exposure may also affect sleep. Huss et al. reported that MRI technicians exposed to stray magnetic fields within the preceding four weeks had a slightly higher likelihood of sleep disturbances (OR = 1.93, 95% CI: 1.00-3.70). Frequent exposure (7-20 days) was associated with shorter sleep duration compared to occasional exposure (1-6 days; OR = 1.95, 95% CI: 1.11-3.44). Most participants with suboptimal sleep reported sleeping less than seven hours [15].

In sum, the reviewed studies indicate that acute neurological complaints – predominantly dizziness, headache, and fatigue – are generally mild and affect between 15% and 78% of MRI staff, and are associated with both field strength and movement within magnetic gradients; repeated exposure may attenuate some symptoms.

*Cardiovascular and microcirculatory effects:* Available experimental and epidemiological data suggest that EMF exposure may influence circulatory dynamics, but evidence remains limited and inconclusive. V.D. Vencel et al. described mechanisms by which magnetic field fluctuations could magnetize blood microelements, potentially promoting the formation of thrombus-like aggregates, slowing capillary flow, thereby impairing tissue oxygenation, contributing to neuronal changes, and influencing blood pressure regulation [16]. Epidemiological observations among workers in MRI manufacturing have suggested a possible correlation between prolonged SMF exposure and slightly increased incidence of hypertension [17]. Overall, these data suggest potential, but not firmly established, vascular or microcirculatory effects associated with chronic SMF and ELF-EMF exposure.

*Cognitive and psychophysiological outcomes:* Personnel exposed to occupational EMF commonly report transient cognitive complaints, such as fatigue, sleepiness, and reduced concentration, particularly during the initial months of employment in MRI settings [13]. Vencel and colleagues linked long-term EMF exposure to possible chronic fatigue

and early cognitive changes, conceivably via altered cerebral microcirculation and hypoxia [16]. A 2006 meta-analysis investigating ELF-EMF exposure and Alzheimer's disease reported elevated risk estimates (case-control combined OR =2.03; 95% CI: 1.38-3.00; cohort combined RR=1.62; 95% CI: 1.16-2.27), with particularly consistent findings among men (RR=2.05; 95% CI: 1.51-2.80) [18]. By contrast, meta-analytic evidence on short-term cognitive performance after 50 Hz ELF-MF exposure is weak and inconsistent [19].

*Oncological outcomes:* Recent comprehensive reviews by Caripidis et al. (2024-2025) evaluated the relationship between radiofrequency EMF (RF-EMF) and cancer. The 2024 analysis found no statistically significant evidence linking RF-EMF exposure (from mobile phones, cordless phones, or fixed transmitters) with risks of glioma, meningioma, acoustic neuroma, or childhood brain tumors [20]. The 2025 update addressing less common malignancies (leukemia, non-Hodgkin lymphoma, thyroid and oral cancers) likewise identified no consistent associations, although the evidence base was limited by small study numbers and heterogeneity in design and exposure assessment [21]. Accordingly, current evidence does not support a causal link between occupational RF-EMF exposure and cancer risk, but further studies with rigorous dosimetry and long follow-up are warranted.

The most robust and recurrent findings across occupational groups indicate mild, short-term neurovestibular and sensory symptoms among MRI personnel, closely related to magnetic field intensity and motion-induced exposure. Chronic EMF exposure may influence vascular regulation and contribute to subjective neurocognitive complaints, while evidence for a carcinogenic effect of occupational RF-EMF remains inconclusive. Heterogeneity in exposure metrics and outcome definitions highlights the need for standardized exposure assessment and harmonized health outcome measures in future occupational research.

**Table 1 – The main characteristics of articles on professional exposure to non-ionizing radiation**

| Symptom / Effect | Studies | Personnel Type | Exposure / Field Conditions |
|---|---|---|---|
| *Dizziness / Vertigo / Disorientation / Illusion of Movement* | lans A. et al. [7]<br>Schaap K. et al. [9]<br>Wilén J. et al. [10]<br>Walker M. et al. [12]<br>Zanotti G. et al. [13]<br>Huss A. et al. [15]<br>K. Schaap et al. [22]<br>Glans A. et al. [28]<br>Bongers C.M. et al. [29] | MRI nurses, radiographers, and engineers | SMF 1.5-9.4 T, static and time-varying fields, symptoms increase with movement near the magnet, higher intensity fields linked to stronger symptoms |
| *Headache / Fatigue / Sleepiness / Reduced Concentration* | Fedorovich TM et al. [4]<br>Glans A. et al. [7]<br>Rathebe et al. [11]<br>Walker M. et al. [12]<br>Zanotti G. et al. [13]<br>Huss A. et al. [15]<br>Glans A. et al. [28]<br>Bongers C.M. et al. [29]<br>Ghadimi-Moghadam A. et al. [30] | Nurses, MRI/ultrasound technicians, students | SMF 1.5-3 T, ultrasound/ microwave co-exposure, acoustic noise, duration of exposure; symptoms often transient and intensity-dependent |
| *Nausea / Metallic Taste / Tinnitus / Sensory Disturbances* | Glans A. et al. [7]<br>Schaap K. et al. [9]<br>Walker M. et al. [12]<br>Zanotti G. et al. [13] | MRI technicians, radiographers | SMF 1.5-3 T, movement near scanner, acoustic noise; metallic taste often brief and correlated with proximity to magnet |
| *Cognitive Impairment / Memory Decline / Slower Reaction / Attention Deficits* | Rathebe et al. [11]<br>Barth A. et al. [19] meta-analysis)<br>Caripidis K. et al. [20]<br>Ghadimi-Moghadam A. et al. [30] | MRI staff, students, volunteers | SMF 1.5-7 T, ELF EMF, RF exposure; cognitive tests, working memory, reaction times; dose-response effects observed in some studies |
| *Sleep Disturbances* | Glans A. et al. [7]<br>Walker M. et al. [12]<br>Huss A. et al. [15] | MRI technicians/radiographers | SMF and acoustic noise; symptoms reported after shifts, sometimes cumulative |
| *Risk of Injury / Accidents / Near-Miss Events* | Rathebe P.C. et al. [11]<br>Huss A. et al. [25]<br>Bongers C.M. et al. [29] | MRI technicians, production personnel | High recent and cumulative SMF exposure; movement near the scanner associated with near-miss events and accidents |

***Discussion:*** The most consistently reported effects among MRI personnel are acute neurological and vestibular symptoms. Observed exposure levels ranged from approximately 0.3 to 3 mT (TWA) and up to 400-500 mT for peak static fields, with 5-15% prevalence of neurovestibular complaints in several observational studies]. Across the broader evidence base, 15-78% of healthcare workers reported transient symptoms such as dizziness, headache, or fatigue following exposure to static or motion-induced time-varying magnetic fields [10, 12, 13, 22].

In 2015, De Vocht et al. demonstrated that healthcare workers exposed to 1.5 T and 3.0 T MRI scanners frequently experienced dizziness, nausea, metallic taste, and balance disturbances, supporting a dose-response relationship between field strength and symptom occurrence [23]. Schaap et al. [22] similarly documented vertigo even at relatively low average TWA exposure (3 mT and 0.6 mT/s). Wilén and de Vocht [10] reported increased dizziness and headache at higher field strengths.

Sleep disturbances have also been observed. Huss et al. [15] reported that workers who frequently entered MRI rooms had nearly double the risk of sleep problems (OR=1.93), though the mechanisms remain unclear and may involve both occupational and individual factors. These findings suggest a potential association but do not establish causality.

Evidence regarding vascular or circulatory changes is limited and mostly theoretical. Some experimental studies suggest that magnetic fields may affect microcirculation by magnetizing and aggregating blood elements. Observational data indicating slightly higher prevalence of hypertension among chronically exposed workers [17] remain inconclusive due to small sample sizes, potential confounders, and lack of standardized exposure assessment. These results should therefore be interpreted with caution.

Cognitive complaints, including reduced concentration, sleepiness, and chronic fatigue, were reported in several studies [13, 16]. These are mainly self-reported, and no consistent objective cognitive impairment has been demonstrated. Hypotheses involving microcirculation or mild cerebral hypoxia remain speculative. MRI personnel may experience impaired balance, transient cognitive effects, and increased risk of accidents due to peak exposures, particularly at higher field strengths [18, 24]. Consistent with this, Huss et al. (2017) identified an elevated risk of commuting accidents among MRI workers, suggesting that exposure-related neurovestibular disturbances or reduced alertness could have safety implications even beyond the workplace environment [25].

Regarding cancer risk, current systematic reviews do not support a causal relationship between occupational RF-EMF exposure and malignancies. Research on rare tumors and long-term effects remains insufficient [20, 21]. The absence of evidence should not be interpreted as definitive evidence of no risk.

The findings align with those of Franco and Murolo (2018), who documented a range of transient neurovestibular and cognitive symptoms among MRI workers, especially at higher field strengths [26]. Mild et al. (2019) highlighted that non-ionizing radiation exposure in healthcare remains insufficiently regulated and poorly monitored, indicating a gap between occupational risk and existing safety measures [27].

Overall, occupational exposure to non-ionizing radiation is most consistently associated with short-term sensory and neurovestibular symptoms, particularly at higher field strengths or during motion-induced exposure. Evidence for long-term cardiovascular, cognitive, or oncological effects remains limited. Substantial heterogeneity in study design, exposure metrics, and outcome definitions limits comparability across studies, emphasizing the need for standardized longitudinal research with objective exposure characterization.

***Conclusion:*** Healthcare workers exposed to non-ionizing EMFs, particularly MRI operators, frequently report short-term symptoms such as dizziness, headache, fatigue, and sleep disturbances. These symptoms may depend on the intensity and duration of exposure and may diminish with repeated exposure, suggesting possible adaptation over time. While some studies indicate that chronic exposure might contribute to subtle vascular or cognitive alterations, current evidence remains limited and insufficient to confirm long-term health effects or increased cancer risk.

Although exposure levels are generally below harmful thresholds, even low-intensity non-ionizing radiation may have temporary functional effects on the nervous system. This highlights the importance of monitoring occupational exposure, optimizing ergonomic and work–rest conditions, and improving awareness of protective measures.

Given the limited number of studies and the predominance of short-term symptom reporting, it remains difficult to establish clear causal links between non-ionizing radiation and disease progression. Future longitudinal studies with standardized methods, objective exposure assessment, and larger sample sizes are required to clarify mechanisms and potential long-term implications of occupational EMF exposure.

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**АҢДАТПА**

# ИОНДАУШЫ ЕМЕС СӘУЛЕЛЕНУДІҢ МЕДИЦИНА ҚЫЗМЕТКЕРЛЕРІНІҢ ДЕНСАУЛЫҒЫНА ҚӘСІБИ ӘСЕРІНІҢ САЛДАРЫ: ЖҮЙЕЛІ ШОЛУ

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***Кіріспе:*** *Клиникалық тәжірибеде магнитті-резонансты томографияны (МРТ) қолданудың артуы сол саладағы мамандардың көбеюіне және олардың иондаушы емес сәулеленудің әсеріне ұшырауына әкелді. Әдебиеттерде иондаушы емес сәулеленудің кейбір жанама әсерлері туралы хабарланғанымен, деректер фрагментарлы және аз көлемді қамтиды. Ұзақ уақыт бойы иондаушы емес сәулеленуге ұшыраған медицина қызметкерлері туралы жүйеленген деректер жеткіліксіз, бұл осы тақырып аясында одан әрі зерттеу қажеттілігін көрсетеді.*

***Зерттеу мақсаты*** *– жарияланған ғылыми деректер негізінде иондаушы емес сәулеленудің медицина қызметкерлерінің денсаулығына кәсіби әсерін бағалау..*

***Әдістері:*** *Жүйелі шолу PRISMA нұсқауларына сәйкес, PubMed, Scopus және Web of Science дерекқорларында мақалаларды кешенді іздеу жүргізілді. Зерттеуге иондаушы емес сәулеленуге ұшыраған медицина қызметкерлерінің денсаулығының нәтижелерін бағалайтын түпнұсқа зерттеулер, жүйелі шолулар және мета-талдаулар кірді. Медициналық қызметкерлердің еңбек жағдайлары, мазалайтын симптомдары және диагностикалық әдістер туралы мәліметтер жиналды. 21 зерттеу жұмыстары зерттеу критерийлеріне сәйкес келді. Зерттеулер арасындағы айырмашылықтар, экспозицияны өлшеу әдістері және қызметкерлердің өзіндік есептері негізгі шектеулер болып табылады, олар нәтижелердің дәлдігіне әсер етуі мүмкін.*

***Нәтижелері:*** *Жүйелі шолуға енген мақалалардың нәтижесі бойынша магнитті-резонансты томографиямен жұмыс жасайтын медицина мамандары арасында бас ауруы, бас айналу, шаршау, ұйқының бұзылуы, сенсорлық өзгерістер және когнитивті бұзылуларды қоса алғанда, өткір субъективті белгілердің жоғары таралғандығы анықталды. Доза мен симптомдар арасындағы байланыс, әсіресе жоғаргы ажыратымдылықтағы МРТ жүйелерін (≥3 Tl) пайдаланған кезде анықталды.*

***Қорытынды:*** *Иондаушы емес сәулеленудің кәсіби әсері денсаулық сақтау мамандарының денсаулығына айтарлықтай қауіп төндіреді. Иондаушы емес сәулелену, ең алдымен, өткір субъективті белгілермен байланысты болса да, бұл нәтижелер профилактикалық шараларды күшейтудің, дозаны шектеу ережелерін қайта қараудың және кәсіби тәуекелдерді азайту үшін тұрақты медициналық бақылауды жүзеге асырудың маңыздылығын көрсетеді.*

***Түйін сөздер:*** *иондаушы емес сәулелену, кәсіптік әсер ету, медицина қызметкерлері, электромагниттік өрістер, магнитті-резонанстық томография (МРТ), Денсаулыққа әсер.*

**АННОТАЦИЯ**

# ПОСЛЕДСТВИЯ ПРОФЕССИОНАЛЬНОГО ВОЗДЕЙСТВИЯ НЕИОНИЗИРУЮЩЕГО ИЗЛУЧЕНИЯ НА ЗДОРОВЬЕ МЕДИЦИНСКИХ РАБОТНИКОВ: СИСТЕМАТИЧЕСКИЙ ОБЗОР ЛИТЕРАТУРЫ

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***Актуальность:*** *Все более широкое использование магнитно-резонансной томографии (МРТ) в клинической практике привело к увеличению числа специалистов в этой области и их подверженности воздействию неионизирующего излучения. Хотя в литературе сообщалось о некоторых побочных эффектах неионизирующего излучения, данные фрагментарны и содержат небольшой объем. Систематизированных данных о медицинских работниках, подвергшихся длительному воздействию неионизирующего излучения, недостаточно, что свидетельствует о необходимости дальнейших исследований в рамках данной темы.*

***Цель исследования*** *– оценить воздействие профессионального воздействия неионизирующего излучения на здоровье медицинских работников на основе опубликованных научных данных.*

***Методы:*** *Обзор проводился в соответствии с рекомендациями PRISMA. Был проведен всесторонний поиск в базах данных PubMed, Scopus и Web of Science за период 2005-2025 годы. Приемлемые исследования включали оригинальные исследования, систематические обзоры и мета-анализы, в которых оценивались результаты для здоровья медицинских работников, подвергшихся воздействию неионизирующего излучения. Были собраны данные об условиях труда, признаках воздействия на организм и методах диагностики. 21 исследований соответствовали критериям включения. Различия между исследованиями, способы измерения экспозиции и опора на самоотчёты сотрудников являются основными ограничениями, которые могут влиять на точность выводов.*

***Результаты:*** *Согласно результатам статей, включенных в систематический обзор, среди медицинских работников, работающих магнитно-резонансной томографией (МРТ), была выявлена высокая распространенность острых субъективных симптомов, включая головную боль, головокружение, усталость, нарушения сна, сенсорные изменения и когнитивные нарушения. Была обнаружена взаимосвязь между дозой и симптомами, особенно при использовании систем МРТ с высоким разрешением (≥3 Тл).*

***Заключение:*** *Профессиональное воздействие неионизирующего излучения представляет значительный риск для здоровья медицинских работников. Хотя неионизирующее излучение в первую очередь связано с острыми субъективными симптомами, эти результаты подчеркивают важность усиления профилактических мер, пересмотра правил ограничения дозы и осуществления регулярного медицинского наблюдения для снижения профессиональных рисков.*

***Ключевые слова:*** *неионизирующее излучение, профессиональное облучение, медицинские работники, электромагнитные поля, магнитно-резонансная томография (МРТ), Воздействие на здоровье.*

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