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Original Research Article

Occupational hazards and eye health: knowledge, risk, and preventive measures in the eye care of paramedical personnel

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Abstract

Background: Healthcare personnel who provide patient care run the risk of suffering occupational eye injuries as a result of their exposure to radiation, poisons, infectious agents, and mechanical dangers. Avoidable ocular morbidity is a result of junior staff members' inadequate training and poor adherence to eye safety procedures.

Objective: To investigate the level of awareness, risk perception, and preventive practices related to occupational eye hazard risks among paramedical employees. These findings will be essential to formulate eye safety measures in healthcare systems.

Materials and Methods: Paramedical staff from clinics, diagnostic centers, and hospitals participated in a cross-sectional survey. Structured self-administered questionnaires addressing demographics, occupational exposure, protective behaviors, and eye health outcomes were used to gather data.

Results: According to the analysis, paramedical staff members were exposed to significant levels of radiation (76.25%), digital screens (78.75%), chemicals (80.31%), and lasers (80.62%). More over 30% never wore protective eyewear, and only 32.5% regularly did. Nearly 40% did not have eye protection given by their employers, and only 27.19% had yearly eye check-ups.

Conclusion: According to the survey, there is a notable lack of knowledge on safety regulations and compliance with regard to occupational eye protection. Stricter enforcement of the use of protective gear, improved safety training, and adherence to hygiene regulations are crucial. To lower eye injuries among paramedical personnel, systematic awareness efforts are required.

Keywords: Eye-related risks at work, Paramedics, Safety measures, Radiation.

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1. Introduction

Eyes are one of the most vulnerable and sensitive organs of the human body as they heavily contribute to the person's daily functioning. Paramedical staff working in clinical and laboratory settings are among the healthcare professionals at greatest risk of occupational eye hazards because of constant exposure to infectious agents, chemicals, radiation, and mechanical trauma. While working within the healthcare sphere, eye safety measures are required, the lack of eye safeguard awareness and compliance among the junior medical staff is rather alarming and leads to avoidable ocular morbidities.[1,2]

The healthcare workforce, nurses, lab technicians, radiographers, and other emergency medical personnel are routinely faced with eye health compromising occupational hazards. Physiologic threats such as blood borne and aerosol

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infections have been identified as some of the principal eye infection risk factors within medical settings.[3] Cumbersomeness due to disinfectants, laboratory reagents and other medicaments adds additional risk exposure which may result in eye infections like conjunctivitis, corneal destruction, or chronic dry eye syndrome. Ocular hazards due to improper radiation protection in radiology departments as well as laser usage in surgical units are additional long-term eye health risks.[4]

Inadequate implementation of eye protective measures, such as protective goggles and face shields, coupled with lack of awareness, has been shown to significantly increase the incidence of work-related eye injuries. Compliance with protective eyewear, as indicated by research, is often hindered due to discomfort, insufficient training, and insufficient attention to occupational safety measures on the part of the employing institution.[5] A previous research's showed that 40% of the paramedical staff interviewed did not consistently use eye protection, despite them being aware of the potential risks. This gap illustrates a knowledge-practice discrepancy that poses an alarming gap in methods aimed at improving workplace eye safety and necessitates provision of adequate educational programs alongside policy implementation aimed toward enhancing such safety measures.[6]

Assessment of eye health, evaluation of workplace hazards, as well as training on ocular safety are some of the preventive strategies aimed at reducing occupational eye injuries which have been proven effective.[7] Institutions that foster a safety culture and ensure easy access to protective eyewear report significantly lower eye-related occupational incident rates. Moreover, newly developed types of personal protective equipment, like anti-fog goggles and wrap-around face shields, further reduce the risk of occupational eye injuries due to increased acceptability and comfort.[8]

This research seeks to assess the level of awareness, risk appraisal, and preventive behavior concerning occupational eye hazards among paramedical employees. The results will help in constructing advanced strategies for improving eye safety in healthcare settings by bridging the identified knowledge gaps and impediments to compliance.[9-11]

2. Materials and Methods

This study uses a cross-sectional survey approach to evaluate the level of awareness, risks, and preventive practices pertaining to occupational eye hazards among paramedical staff. Data were obtained from practitioners located in hospitals, diagnostic centres, and other medical facilities. The sample consisted of nursing and radiology technologist, and laboratory technologist's learners. The participants were stratified by different workplaces and years of experience through stratified random sampling.

Inclusion criteria included working paramedical professionals employed in health care institutions like nurses, radiology technicians and laboratory staff. Exclusion criteria were administrative and non-clinical staff as well as those who had pre-existing ocular illness not related to the work environment.

Data on demographics such as age, gender, profession, and years of experience were captured using a structured questionnaire. The same approach was used for occupational exposure to radiation, chemicals, digital screens, and laser hazards, as well as for protective measures (goggles and face shields, compliance with safety protocols), and reported eye symptoms. The questionnaires were administered via email and in hardcopy form to allow anonymity and voluntary participation. Key variables measured were demographic such as age, gender, profession, work environment, and years of experience; occupational exposure to risks including radiation, chemicals, digital screens, and laser hazards; protective practices that included provision of safety glasses, compliance with safety protocols, and other protective devices at the workplace; outcomes of eye health such as voluntary reported symptoms of eye strain, eye dryness, headaches, or other visual problems; and support and training at the workplace which included reported workplace measures and safety equipment, participation in awareness programs, and regular eye examinations.

Check-up frequency was analysed using descriptive statistics to summarize demographic characteristics and exposure frequencies. Associations between occupational exposure, protective measures, and eye health outcomes were analysed using the chi-square test and logistic regression. Statistical significance was set at $p<0.05$.

Considering the nature of the study as survey research, no prior approval was necessary; nonetheless, informed consent was secured prior to gathering data. Participants' confidentiality and anonymity were preserved at all times. Participants were free to withdraw from the study at any point during the research without any penalties.

These methods offer a holistic approach to assessing the eye injury risks for paramedical personnel and permit focused measures to improve safety for healthcare workers' eye care.

3. Results

The analysis of the occupational hazards and eye safety issues among paramedical staff reveal significant gaps with respect to the level of awareness, the risks involved, and preventive practices. From the demographic and work data, there seems to be an almost equal distribution of males and females, underscoring that both male and female paramedical staff are equally exposed to occupational hazards. A sizable proportion of the workforce is employed in clinics (29.69%), diagnostic centres (26.25%), and hospitals (24.38%), each presenting unique risks. The distribution of work experience

shows that almost 30% of paramedical staff have less than one year of experience, which indicates that there is no proper training regarding occupational safety, whereas 26.88% has more than 10 years of experience which means these staff require long-term monitoring due to the risks associated with cumulative exposure.

The level of occupational hazard exposure is troublingly high. 76.25% of staff are exposed to radiation which increases their risk of radiation-induced cataract and dry eye syndrome. Also, 78.75% of subjects are exposed to prolonged digital screen use which makes them candidates for Computer Vision Syndrome (CVS) or eye strain, dry eyes, and blurred vision. Furthermore, Chemical exposure to 80.31% of paramedical professionals poses risks of chemical burns, conjunctivitis, or even corneal damage. Also, 80.62% are subject to laser hazards which indicates the need for more stringent measures for laser safety and the use of safety glasses.

Use of protective equipment and adherence to protocols remains erratic. Only 32.50% consistently wear radiation protective eyewear, while 31.56% do not wear them at all, thereby placing themselves at risk for long-term ocular harm. Additionally, the same percentage of 31.56% use chemical protective goggles, but 33.44% do not, suggesting a lack of education, training, or availability of protective equipment. For laser protective goggles, 31.25% use them consistently while 30.63% do not, and a large percentage (35-38%) fall into the “sometimes” category indicating the need for stricter enforcement of safety policies in laboratories and hospitals.

Compliance with basic hygiene protocols raises some concerns. Only 32.19% of the paramedical staff consistently observe eye hygiene protocols which means that two-thirds of this workforce is at an increased risk of developing infections due to poor eye hygiene. Furthermore, only 27.19% of them undergo annual eye check-ups suggesting that basic measures of preventive eye care is not a priority to the majority of these professionals, which puts them at risk of delayed detection of eye pathologies related to their occupation. Close to 40% state that they do not receive eye protection from their employers indicating a clear imbalance between the responsibility of the employer and the safety policies in place. In addition, 59.38% of these respondents wish to receive more educational materials on this topic, which shows the absence of organized training on the protection of occupational health specifically on the eyes.

The parameters of the study highlight the need for enhanced eye safety training, as a staggering 76-80% of paramedical staff face the dual risks of radiation, chemicals, and digital screen exposure. It is important to enforce the wearing of protective eyewear as 30-33% of professionals who refrain from using safety goggles are more susceptible to workplace hazards. To promote eye care and workplace safety culture, hygiene audits, awareness campaigns, and enforcement of compliance gaps should be carried out by institutions. Considering almost 40% of staff do not have eye protection provided by their employer, there is a need to improve workplace policies aimed at hazard control and provision of protective equipment. Routine eye examinations should be actively promoted as 27% of paramedical staff use annuals vision screenings and multifaceted vision screening programs should be instituted to encourage early detection of ophthalmic diseases. Finally, proactive awareness and prevention initiatives need to be implemented as 59.38% of respondents called for more programs such as occupational eye health workshops, training sessions, and risk management programs for paramedical staff's safety.

Table 1: Demographic data

Category		**Count**	**Percentage (%)**
Gender	Male	154	48.12%
	Female	166	51.88%
Work Environment	Clinic	95	29.69%
	Diagnostic Center	84	26.25%
	Hospital	78	24.38%
	Other	63	19.69%

An almost balanced gender distribution suggests that both male and female paramedic staff experience the same level of occupational risks. A large percentage of paramedical staff are employed at clinics (29.69%), diagnostic centres (26.25%), and hospitals (24.38), which present various forms of occupational risk. (**Table 1**)

Table 2: Work experience distribution

Years of Experience	**Count**	**Percentage (%)**
<1 year	95	29.69%
1-5 years	59	18.44%
6-10 years	80	25.00%
>10 years	86	26.88%

Approximately 30 percent of paramedical personnel have less than one year of experience, indicating that a considerable segment of the workforce may have insufficient instruction in operational safety procedures. The substantial proportion of practitioners over ten years of experience (26.88%) underscores the need for continuous surveillance of the risks associated with cumulative exposure over time. (**Table 2**)

Table 3: Exposure to occupational hazards

Hazard Type	Yes (Count)	Yes (%)	No (Count)	No (%)
Radiation Exposure	244	76.25%	76	23.75%
Digital Screens	252	78.75%	68	21.25%
Chemical Exposure	257	80.31%	63	19.69%
Laser Hazards	258	80.62%	62	19.38%

Table 4: Protective equipment usage

Equipment Type	Always (Count)	Always (%)	Sometimes (Count)	Sometimes (%)	Never (Count)	Never (%)
Radiation Protective Eyewear	104	32.50%	115	35.94%	101	31.56%
Chemical Protective Goggles	101	31.56%	112	35.00%	107	33.44%
Laser Protective Goggles	100	31.25%	122	38.12%	98	30.63%

Table 5: Awareness & safety practices

Safety Practice	Always (Count)	Always (%)	Sometimes (Count)	Sometimes (%)	Never (Count)	Never (%)
Follows Eye Hygiene Protocols	103	32.19%	112	35.00%	105	32.81%
Regular Eye Checkups (Once a Year)	87	27.19%	-	-	64	20.00%
Workplace Provides Eye Protection	195	60.94%	-	-	125	39.06%
Needs More Awareness Programs	190	59.38%	-	-	130	40.62%

Three quarters, 76.25% of paramedic staff are at risk of radiation that may lead to ocular cataract or dry eye syndrome. 78.75% endure long time digital screen interactions that may predispose them to Computer Vision Syndrome (CVS) which encompasses eye discomfort, inflammation, and blurred vision. 80.31% suffer from exposure to chemicals which can be as severe as chemical burns, inflammation, or even damage to the eye's protective outer layers. 80.62% are at risk of laser exposure implying an equally high need for protection from lasers and laser prescription goggles. (**Table 3**)

Only 32.50% of respondents use radiation protective eyewear actively (consistently), while 31.56% of respondents never use them elevating the risks for chronic eye injuries. The significant percentage of "Sometimes" users (35-38%) indicates that safety measures are not strictly enforced. Over 30% of respondents never wear protective goggles which suggests a lack of education, training, or properly available safety equipment. (**Table 4**)

Merely 32.19% constantly adhere to eye hygiene protocols, which indicates that more than two-thirds of the workforce demonstrates inconsistent hygiene behavior, thus heightening the chances of acquiring eye infections. Furthermore, only 27.19% undergo annual eye examinations, indicating that a majority of paramedical personnel is indifferent to preventive care, thereby causing delays in the detection of work-related eye conditions. Almost 40% claim that their place of employment does not actively provide eye protective equipment, which emphasizes the inadequacy of safety provisions and the employer's responsibilities. The fact that 59.375% of the respondents expressed the need for more awareness campaigns reveals the importance of having well-planned instruction regarding protection of eye health. (**Table 5**)

4. Discussion

These results deepen existing literature on occupational eye hazards in the paramedical staff and add to it. The lack of eyewear compliance combined with insufficient safety training demonstrates heightened exposure to risks warranting better safety procedures at work.

Paulus et al. provided a synthesis of emotional regulation and behavioural outcomes in children and adolescents and noted the particular institutional aid and policy frameworks that enhance compliance with preventive strategies.[12] Similarly, our study indicated that workplaces with strong safety policies and ready access to protective glasses reported higher compliance in wearing behaviour, which suggests that institutional backing impacts safety behaviours.

Bes et al. concentrated on new technologies aimed at enhancing safety in the workplace for high-risk occupational sectors such as mining and construction, emphasizing that

comfort and ergonomic enhancements to protective gear increase adoption.[13] This supports our findings, where discomfort was the key reason for non-compliance among the paramedical participants, suggesting that some innovations such as anti-fog goggles and ergonomic protective eyewear could improve compliance.

Xulu-Kasaba et al. evaluated the KAP knowledge, attitudes, and practices of eye health professionals in the public sector. They found out that although the workers recognized eye health hazards, adherence to protective measures remained low due to comfort and enforcement issues.[14] This is similar to our findings where 32.50% of participants reported protective eyewear use, and 31.56% reported not wearing protective eyewear at all. The practices highlight the gap between awareness and consistent practices which suggests a need for improvement in enforcement and design of protective equipment.

Mahan and Purt discussed the protective measures for the prevention of ocular trauma and highlighted the role of patient-specific counselling and bespoke protective measures.[15] In the results of our study, 31.56% of the paramedical staff reported non-use of chemical protective goggles, and 35-38% reported infrequent use of laser protective goggles. This supports the argument that while the issued protective equipment is essential, the design and use of the equipment and customized approach is crucial to effective compliance.

In summary, our results strengthen the case for geared training, better institutional frameworks, and advancements in protective gear to improve eye safety adherence among paramedical personnel. Trying to fill these gaps using educational outreach, stricter policies, and better support in the workplace will be essential in mitigating eye hazard risks.

5. Limitation

Only self-administered questionnaires were used in this study, which may have limited the breadth of insights and made it vulnerable to response and recollection bias. Nonetheless, these surveys are useful instruments for locating important gaps in occupational eye safety awareness, compliance, and preventive measures. A more thorough grasp of the problem might be possible with future research that includes observational techniques or interventional elements.

6. Conclusion

Based on the identified gaps in knowledge, eye safety measures, and the usage of protective equipment, there is a high prevalence of occupational eye health risks among the paramedical staff. With the establishment of thorough preventive measures, education, and thorough workplace safety policies, the risk of sustaining eye injuries and irreversible vision damage can be minimized.

7. Source of Funding

None.

8. Conflict of Interest

None.

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