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Job Safety Hazard Identification and Risk Assessment in the Park Rangers: A Case Study of Shirkooh Wildlife Refuge and the Masjed Mountain Private Protected Area

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ABSTRACT

Introduction: The aim of this study was to conduct a risk assessment of environmental protection jobs in Ashkezar and Taft counties.

Materials and Methods: This research is an applied-descriptive study. Data was collected and analyzed employing the Job Safety Analysis (JSA) method. Risk assessment of hazards was done applying a semi-quantitative approach which was based on the MIL-STD-882E military industry standard. The number of hazards identified across various categories, entailing physical, chemical, biological, ergonomic, psychological, mechanical, and social risks were 2.102 hazards.

Results: According to the risk assessment results, 312 hazards (14.8%) were categorize as high risk, 939 hazards (44.67%) were considered in the warning risk category, and 851 hazards (40.49%) were at a risk level which was acceptable risk level. Based on the Pareto principle, the top 20% of hazards with the highest average Risk Priority Number (RPN) included: inappropriate tools (e.g., heavy and inefficient bulletproof vests), conflicts and retaliation by offenders or individuals with prior motives, natural disasters, animal bites, lack of water and food resources, poisoning, exposure to accidents, traversing difficult and high-altitude routes, and gunfire. A total of 4,321 control measures were proposed to mitigate the risks associated with these hazards.

Conclusion: Administrative controls emphasize the importance of employee training, expertise, and experience, as well as the development of reference guides, instructions, and specialized regulations tailored to environmental protection. This database would serve as a valuable resource for analyzing occupational hazards and predicting effective control measures, benefiting environmental protection efforts across Iran.

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Introduction

Environmental guards are responsible for protecting biodiversity and managing ecosystems. The term environmental guard or ranger refers to an individual or group that plays a major role in conservation. Their responsibility is to protect nature, cultural and historical heritage, and preserve the rights and welfare of both present and future generations[1, 2]. The maximum estimated number of personnel for areas that are protected worldwide is 555,000 (37 square kilometers per person), of which 286,000 (72 square kilometers per person) are environmental guards. However, approximately 3 million personnel (one person per

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13 square kilometers), including 1.5 million environmental guards or equivalent (one person per 26 square kilometers), are required to improve working conditions, effectiveness, and sustainable management[3].

In Iran, there are approximately 3,500 environmental guards (77 square kilometers per guard) protecting approximately 270,000 square kilometers of protected areas. This severe shortage of environmental guards in Iran has contributed to the number of casualties among environmental guards in the country reaching triple digits[4].

The activities involved in environmental protection jobs are generally linked to a wide range of organizational and environmental human factors that significantly impact the safety and health of environmental guards[5]. Many environmental guards work under poor conditions and face hazardous work environments[2]. They are exposed to various physical and social risks in the workplace[6]. Individuals employed in environmental protection encounter numerous hazards, including physical, biological, chemical, and mechanical risks[7]. In addition to these hazards, this study examined ergonomic, psychological, and social risks. Common workplace hazards in environmental protection jobs include noise, ultraviolet radiation, dust, vibration, and exposure to extreme temperature[8].

From 2006 to 2021, throughout the world at least 1,535 environmental guards lost their lives while on duty. The number of casualties among environmental guards has been increasing annually. The causes of death include murder, accidents, wildlife attacks, and occupational diseases. Analyses indicate that death in the line of duty is a probable risk for environmental protection guards. The working conditions for environmental protection jobs in Asian countries are particularly severe compared to other regions, with Asian countries ranking first globally in terms of environmental guard casualties[9].

Since 1357 (1978-1979), 151 environmental guards in Iran have tragically lost their lives while safeguarding the environment, and 273 others have been disabled due to occupational accidents[10]. Hazard identification is the most critical component of any safety and health program or safety and health system. Hazards must first be identified to propose appropriate risk mitigation or elimination measures and establish safety and health objectives and programs. The more accurate the hazard identification, the better the system performance[11].

Job Safety Analysis (JSA) is a method for identifying hazards and assessing risks, specifically focusing on work-related hazards[12]. The implementation of JSA in industrialized countries dates back to before 1930[13, 14]. JSA is considered one of a systematic and detailed method for identifying existing or potential hazards in any job. Its implementation is recommended during the operational phase for hazard identification and analysis[15].

The most critical component of any safety and health program or safety and health system is hazard identification[11]. Hazards must first be identified to propose appropriate risk mitigation or elimination measures and to establish safety and health objectives and programs. The more accurate the hazard identification, the better the system performs[11]. According to the Occupational Safety and Health Administration (OSHA) standards, the proper implementation of JSA can prevent many occupational injuries. Furthermore, it aids in determining technical and managerial control measures, identifying training needs, selecting appropriate personal protective equipment based on personnel requirements, and establishing operational procedures for each activity[16].

Despite the numerous hazards associated with environmental protection jobs, comprehensive studies on risk identification and assessment of various environmental protection occupations in government-protected and community-based conservation areas in Iran have not yet been conducted. This descriptive study aimed to identify and semi-quantitatively evaluate the potential hazards of jobs related to environmental protection in the Shirkuh Wildlife Refuge and the proposed Masjed Mountain Wildlife Sanctuary using the JSA technique.

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Materials and Methods

This study was conducted in 2023 and 2024. The study population consisted of active personnel in the field of environmental protection working in protected areas in Taft and Ashkezar counties in Yazd Province, Iran. The study area includes two regions: the Shirkooh Wildlife Refuge, which is directly managed by the government (Department of Environment of Taft County), and the proposed Masjed Mountain Wildlife Hunting Prohibition Area, which is protected by civilian rangers and environmental volunteers under the supervision of the Department of Environment of Ashkezar and Taft counties. The high diversity of protected areas within the study region, including both civilian and government-managed zones, has resulted in an increased variety of environmental protection jobs and related activities in the area under study.

In this study, a comprehensive library research was initially conducted to examine the background of the subject and the necessity of carrying out this research both domestically and internationally. The general outline of this study was developed based on these library studies. The JSA method was used for data collection and analysis. In this study, risk assessment of hazards was conducted using a semi-quantitative method based on the military standard MIL-STD-882E, which was optimized throughout the research according to the incidents, hazards, and study population. The semi-quantitative method determines the risk level based on specific criteria by combining subjective data[17].

To better analyze the data, JSA teams were formed, and checklists were identified. The JSA teams were formed by 24 experienced individuals, and in all seven groups, individuals working in the field of environmental guards were included who were under the supervision of one risk evaluation expert from the research team. By considering the research conditions for quantifying the research criteria MIL-STD-882E was used as shown in Table 1. This method is highly useful for identifying the potential harm of events and evaluating them based on their severity[18].

In this study, in accordance with the JSA method, after forming a JSA team consisting of experienced individuals working in the field of environmental protection, relevant jobs were selected. Each job was then broken down into its constituent tasks, and the hazards associated with each task were identified. Finally, preventive measures to control hazards were identified[19, 20]. The team formed in this study was required to identify the tasks of each job and the hazards associated with each task. After identifying the hazards, the risk of each hazard was assessed, and control measures were proposed and implemented for each hazard. Data collection for identifying potential hazards was conducted using the one-on-one observation method in the JSA approach[21]. During the hazard identification phase, checklists were completed in the form of computerized tables. In the risk assessment phase, the hazards two parameters probability and severity of each risk were used to classify the hazards. The multiplication of these two numbers determines the Risk Priority Number (RPN). Finally, decision-making was performed based on the risk assessment matrix table, which was derived by combining the probability and severity tables and the risk evaluation indices[22].

Scoring tables (Tables 1 and 2) were used to quantify the JSA method. These tables were adapted to reflect the specific accidents and hazards associated with environmental protection work. Table 1 classifies the severity of risk occurrence into ten categories, considering the safety and health consequences of each risk.

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Table 1: Classification of Risk Occurrence Severity in the JSA Table

Rank	Safety	Health
10	Death or fatal injury affecting more than one person	Fatal disease affecting more than one person
9	Death or fatal injury affecting one person	Fatal disease affecting one person
8	Amputation or complete limb loss (e.g., blindness)	Irreversible and permanently disabling disease or complications (e.g., spinal cord injuries)
7	Injury requiring medical rest for more than 6 months (e.g., third-degree burns)	Irreversible permanent disease or complications (e.g., irreversible musculoskeletal injury)
6	Injury requiring medical rest between 1 to 6 months (e.g., second-degree burns)	Reversible disease or complications with treatment duration exceeding six months (e.g., reversible musculoskeletal injury)
5	Injury requiring medical rest for more than 7 days to 1 month (e.g., minor fractures)	Reversible disease or complications with treatment duration between one to six months (e.g., muscle spasms, severe infections)
4	Injury requiring medical rest between 3 to 7 days (e.g., first-degree burns)	Reversible disease or complications with treatment duration between one week to one month (e.g., frostbite)
3	Injury requiring medical rest between 1 to 3 days (e.g., minor bruising)	Disease or complications resolved with short-term treatment lasting between one day to one week (e.g., nausea, minor infections)
2	Outpatient first aid (e.g., scratches)	Transient complications requiring minimal treatment and rest of less than one day (e.g., minor skin sensitivity)
1	No injury	No complications

Table 2: Classification of Risk Occurrence Probability in the JSA Table

Explanation	Description	Level
Occurs frequently	Frequent	6
Occurs several times or often	Likely	5
Occurs occasionally	Occasional	4
Unlikely but possible; occurs very rarely	Very Low	3
Probability is so low it can be disregarded or never occurs	Unlikely	2
Incapable of occurring. This level is used for potential hazards that are identified and later eliminated	Improbable	1

In this study, the classification of risk criteria was finalized based on the conditions of the studied environment and the input of experts in the JSA study team (Table 3).

Table 3: Decision-Making Criteria Based on Risk Priority Number

Symbol in Risk Management Form	Risk Priority Number	Risk Criterion	Risk Level
Low = L	1-14	Acceptable risk	Low
Medium = M	15-29	Warning range	Medium
High = H	30 and above	Unacceptable risk	High

Results

In this case study, based on the input of JSA team experts and data collected from on-site observations, 73 types of hazards were identified. These hazards were categorized into groups of physical, biological, chemical, ergonomic, psychological, mechanical, and social harmful factors. The identified hazards are listed in Table 4.

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Table 4: Table of Harmful Factors in the Work Environment for Environmental Protection Jobs (Hazard Identification Checklist)

Viruses		**Gases and vapors**		**Steady noise**	
Bacteria	Biological Factors	Suspended particles	Chemical Factors	Unsteady noise	Physical Factors
Fungi		Dust		Trembling (hand and arm)	
Parasites		Mist		Trembling (whole body)	
Wild animal attacks		Fume		General lighting	
Animal bites		Smoke		Local lighting	
Fatigue and drowsiness		Contact with chemicals		Weather conditions (cold)	
Poisoning		Chemical spills and leaks		Weather conditions (heat)	
Lack of water and food		Chemical splashes		Ionizing radiation	
Physical disorders		Explosive sources		Non-ionizing radiation	
Job stress	Psychological Factors	Flammable materials		Low-pressure electromagnetic waves	
Sharp edges	Mechanical Factors	Awkward posture	Ergonomic Factors	Oxygen pressure reduction at high altitudes	
Hand and foot entrapment		Working in a bent position		Uneven surfaces	
Mechanical impacts		Repetitive movements		Slippery surfaces	
Rotating parts		Load carrying		Working at height	
Reciprocating parts		Load lifting		Use of ladder/stairs	
Lower limb impact		Load pushing		Traversing difficult and high terrain	
Exposure to rotating devices		Load pulling		Natural disasters	
Object projection		Inappropriate body rotation		Objects with hot surfaces	
Firearm discharge		Working alone		Heat sources	
Driving		Inappropriate tools		Pipeline leaks	
Accident exposure		Seated work		Electrical sources	
Conflict and revenge	Social Factors	Monotonous work		Tank deterioration	
		Eye strain		Pressurized cylinders	
		Shift work		Insufficient space	

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In Table (5), environmental protection jobs are categorized by the number of tasks per job and the number of identified hazards for each job. In total, across all seven groups of environmental protection jobs studied, 173 job tasks and 2102 hazards were identified. Environmental Guard (Area Supervisor), Environmental Guard (Executive Officer), and Environmental Soldier had the highest number of job tasks and identified hazards.

Table 5: Environmental Protection Jobs by Number of Tasks per Job and Number of Identified Hazards for Each Job

Number of Identified Hazards	Number of Identified Tasks	Number of Employees in Each Job	Job Title	Row
366	29	7	Environmental Guard (Executive Officer)	1
382	31	1	Environmental Guard (Area Supervisor)	2
304	25	3	Warden	3
334	26	9	Environmental Assistant	4
366	29	1	Environmental Soldier	5
230	21	2	Head of County Environmental Department	6
120	12	1	Administrative Expert (Natural Environment-Human Environment)	7
2102	173	24		Total

A portion of the risk analysis and proposed control measures for environmental protection jobs is shown in Table 6, which was completed in collaboration with experts on the study team.

The number and percentage of hazards falling into the unacceptable risk (H), warning (M), and acceptable (L) categories for all environmental protection jobs studied are shown in Figure (1). Hazards in the warning (M) risk category had the highest number, followed by hazards in the acceptable (L) and unacceptable (H) categories in terms of number and frequency percentage.

Figure (2) illustrates the frequency of identified risks for each job in the unacceptable (H), warning (M), and acceptable (L) categories.

Furthermore, Figure (3) compares the percentage distribution of hazards in different risk categories: unacceptable (H), warning (M), and acceptable (L), comparing environmental protection jobs with each other.

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Table 6: Part of the Risk Analysis Table and Proposed Control Measures for Environmental Protection Jobs

Proposed Control	unacceptable risk (H), warning (M), acceptable (L)	Risk Assessment			Consequence	Dangerous Event	Hazard	Routine (R) or Non-routine (N)	Task	Job
		RPN	Probability (p)	Severity (S)						
Using power-assisted vehicles instead of non-assisted vehicles.	L	8	4	2	Increased muscle contraction or cramping, interference with general body posture	Whole body vibration	Vibration	R	Patrol and inspection with motor vehicle	Environmental Guard (Executive Officer)
Performing activities in adequate daylight	M	15	3	5	Injury, fracture	Insufficient visibility and collision with objects	General lighting	R	Patrol and inspection with motor vehicle	Environmental Guard (Executive Officer)
Periodic inspection and maintenance of vehicle lights	M	20	4	5	Collision with objects and injury, fracture	Insufficient visibility	Local lighting	R	Patrol and inspection with motor vehicle	Environmental Guard (Executive Officer)
Job rotation, consuming warm fluids, wearing warm clothing	H	24	6	4	Cold and frostbite, low blood pressure	Cold stress	Cold	R	Patrol and inspection with motor vehicle	Environmental Guard (Executive Officer)
Job rotation, drinking cool fluids	M	18	6	3	Heat stroke and weakness, decreased concentration	Heat stress, dehydration	Heat	R	Patrol and inspection with motor vehicle	Environmental Guard (Executive Officer)

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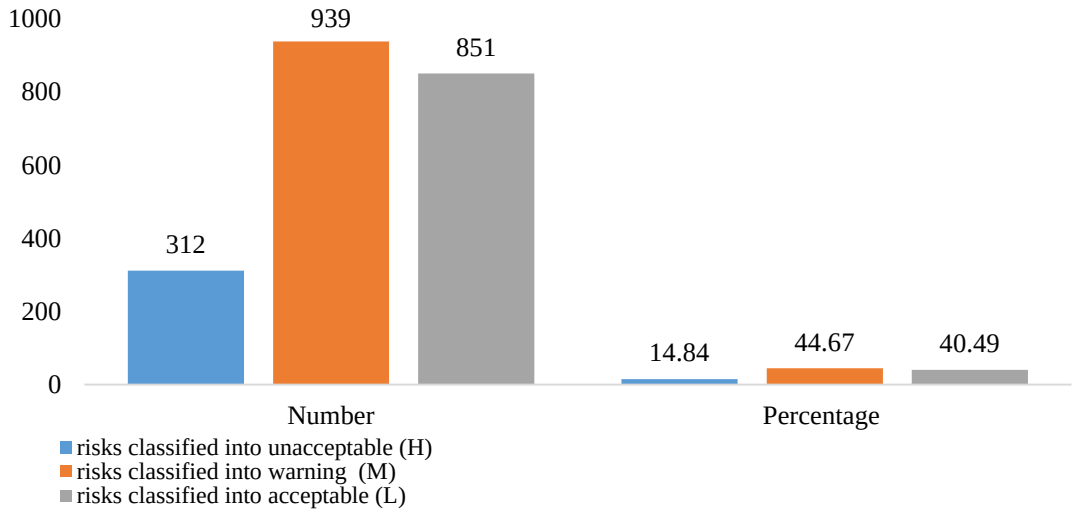

Figure 1: Number and percentage of risks classified as unacceptable (H), warning (M), and acceptable (L) risk categories for environmental monitoring jobs in Ashkezar and Taft counties, Yazd.

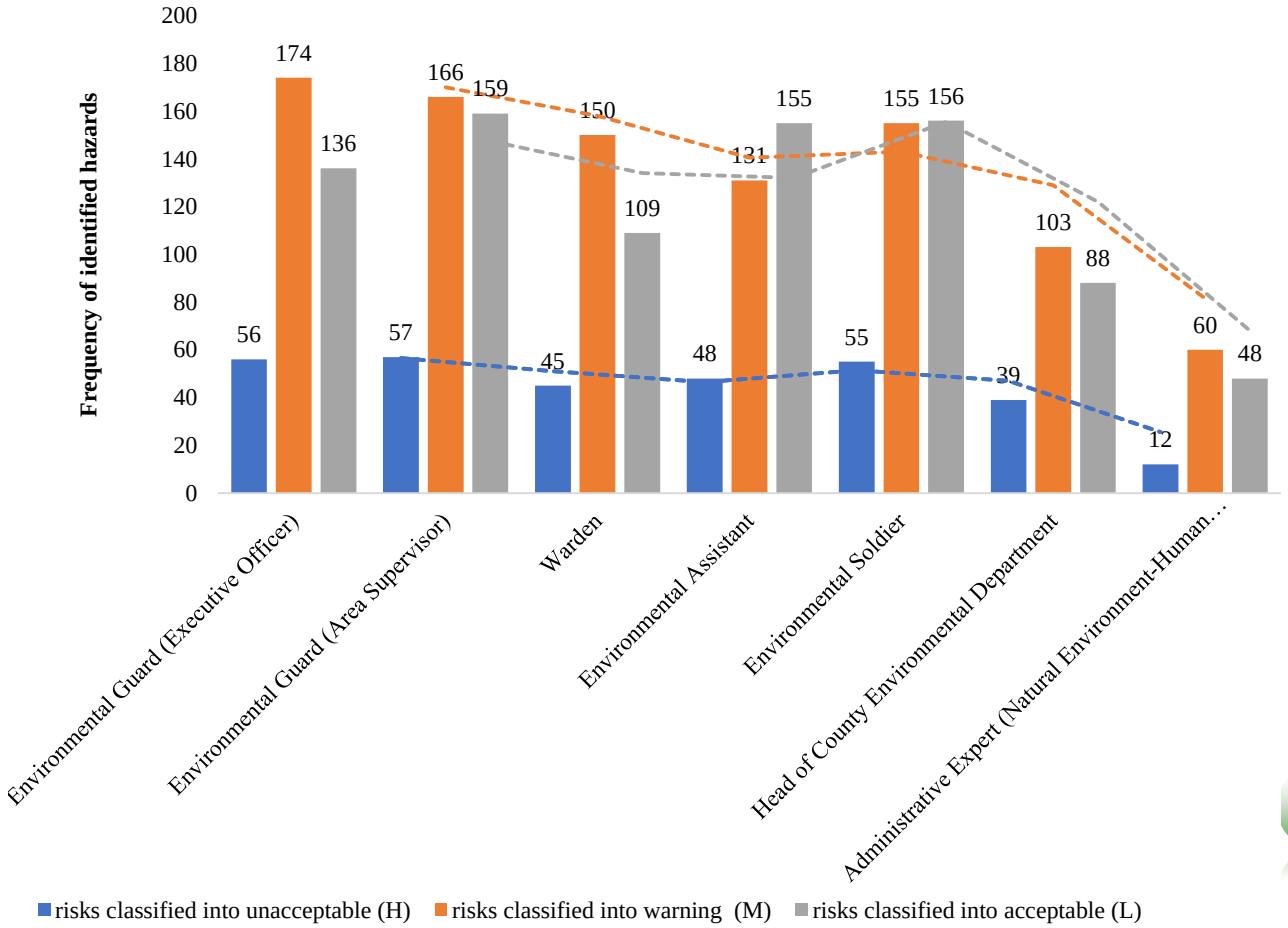

Figure 2: Frequency of identified hazards for environmental protection jobs in unacceptable (H), warning (M), and acceptable (L) risk categories.

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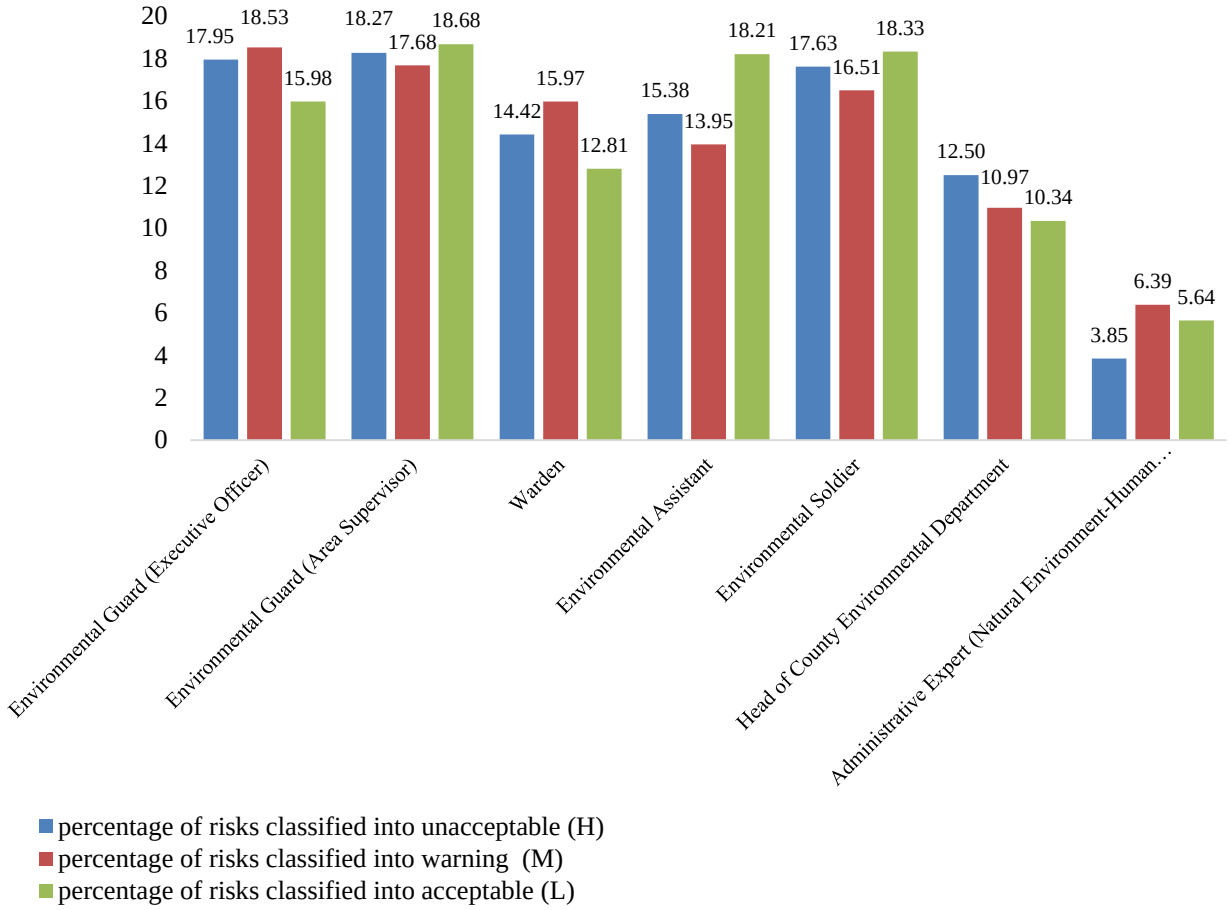

Figure 3: Comparison of the percentage distribution of hazards in different risk categories: unacceptable (H), warning (M), and acceptable (L), comparing environmental protection jobs.

As shown in Figures (2) and (3), the highest number of hazards in the H (unacceptable) category are associated with the following jobs, in descending order: environmental ranger (area supervisor), environmental ranger (executive officer), environmental soldier, environmental assistant, game warden, head of the county's environmental department, and administrative expert (natural environment–human environment). This indicates that environmental rangers (area supervisors and executive officers) are exposed to the highest level of hazards in the unacceptable category of risk. Consequently, it is essential to develop and implement control measures to mitigate the risks associated with these types of hazards.

The Pareto principle (also known as the 80-20 rule or the law of the vital few) states that for many events, approximately 80% of the effects come from 20% of the causes. Based on this principle, the top 20% of hazards with the highest average risk priority number across all environmental protection jobs were analyzed. Figure (4) illustrates these top 20% of hazards, which, in accordance with the Pareto principle, have the most significant impact on the risk levels associated with environmental protection work.

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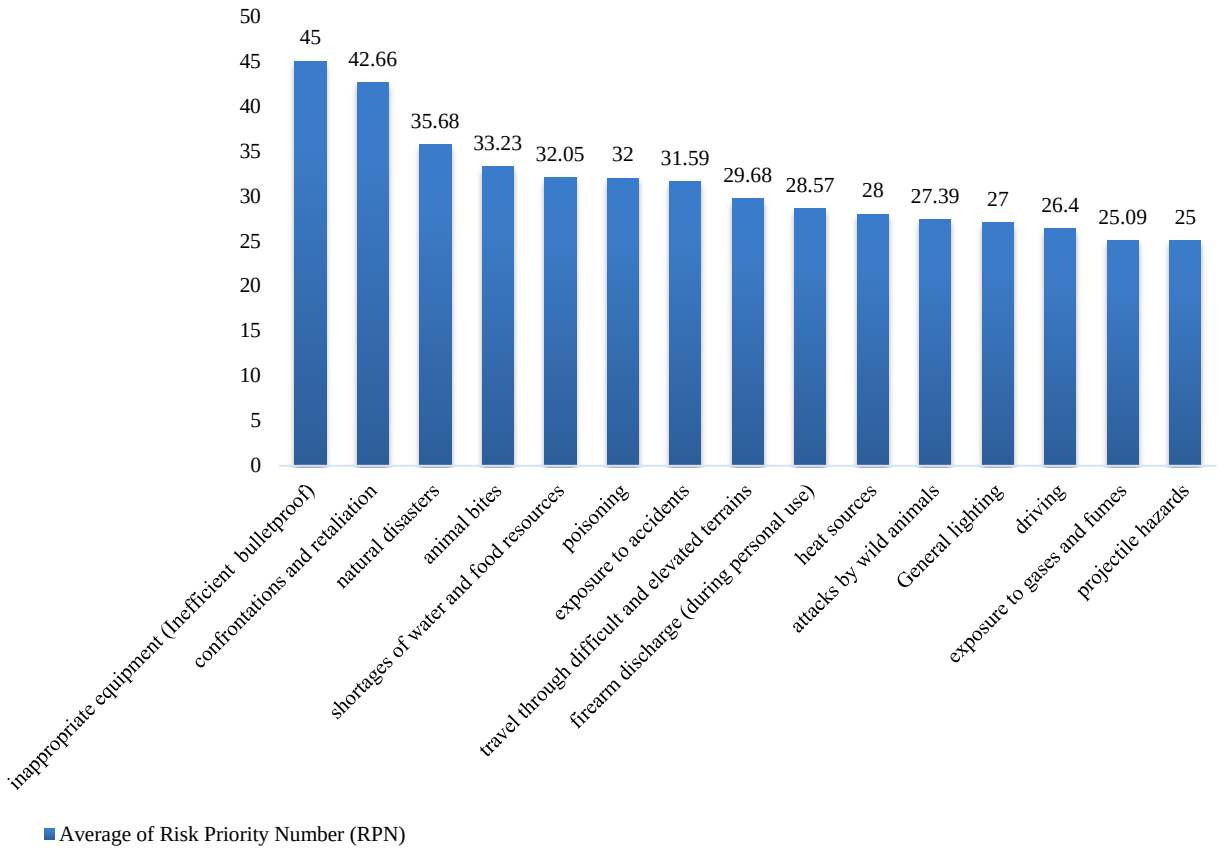

Figure 4: 20% of the risks with the highest average Risk Priority Number (RPN) among all the risks of the studied ranger jobs based on the Pareto principle.

As shown in Figure (4), among the identified risks, the use of inappropriate equipment (heavy and ill-fitting bulletproof vests unsuitable for ranger duties) has led to the avoidance of wearing such vests because of their weight and difficulty of use. Other significant risks include confrontations and retaliation by offenders or individuals with prior motives, natural disasters, animal bites, shortages of water and food resources, poisoning, exposure to accidents, travel through difficult and elevated terrain, firearm discharge (during personal use), heat sources, attacks by wild animals, inadequate lighting during firearm use, driving, exposure to gases and fumes, and projectile hazards. These risks pose the highest level of danger, potentially resulting in severe injury or fatality.

A total of 4,321 control measures were proposed to mitigate these risks in this study. Figure (5) illustrates the percentage distribution of the various control measures implemented in ranger jobs to manage the identified risks.

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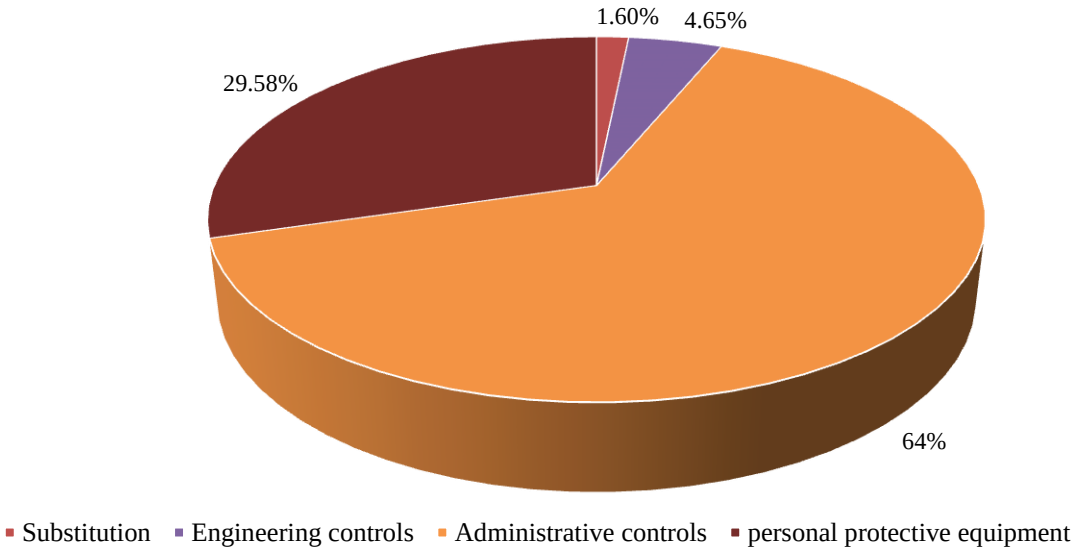

Figure 5: Distribution percentage of control measures for ranger jobs to manage identified risk hazards.

Figure (5) highlights the need for implementing more administrative control measures and the provision and use of personal protective equipment (PPE) to manage most existing risk hazards. In the current study, it was not possible to eliminate any of the workplace activity risks. Instead, proposed control measures were provided for each risk, categorized into substitution, engineering controls, administrative controls, and personal protective equipment (PPE).

Discussion

In this study, to identify different hazards of environmental jobs in government-protected areas, the JSA method was employed. Before the last decade, because of the lack of specific public protected areas, environmental protection jobs in Iran for protecting the environment did not exist for the people, and this has been considered in this study.

Following the identification of hazards through the designed checklists and scoring matrices, the risks were quantified using the Risk Priority Number (RPN) index, which was derived by multiplying the parameters of probability and severity of the hazard. This study examined seven job roles in the field of ranger work. A total of 2,102 hazards were identified and categorized into 73 types. Among these, 312 hazards (14.8%) were classified as high-risk, 939 hazards (44.67%) as moderate-risk, and 851 hazards (40.49%) as acceptable risk. The identified hazards fell into the following categories: physical, biological, chemical, ergonomic, psychological, mechanical, and social. A 2022 study by Anagnostou et al. highlighted that the most commonly discussed aspects of rangers' working conditions were hazardous social and physical environments[6]. These risks are often associated with severe income shortages, job insecurity, lack of social security, insufficient support from regulatory bodies, and inadequate legal protection in the workplace. The adverse effects of such conditions include impacts on mental and physical health, well-being, safety, and the ability to protect biodiversity. Similar conditions were observed in this study. In addition to various occupational hazards, this research identified factors such as insufficient legal support, lack of backing from responsible and judicial authorities, severe income shortages (sometimes leading to job changes and demotivation among rangers), and job and social insecurity.

The highest number of high-risk hazards classified as unacceptable were associated with the roles of ranger (area supervisor) and (field officer). One reason for the high number of risks in these roles could be the diversity of their responsibilities

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compared to other ranger positions, which inherently carry higher risk. Based on the Pareto principle and as shown in Figure (4), 20% of the hazards with the highest average RPN included inappropriate equipment (heavy and uncomfortable bulletproof vests leading to their non-use), confrontations and retaliation by offenders or individuals with prior motives, natural disasters, animal bites, shortages of water and food resources, poisoning, exposure to accidents, travel through difficult and elevated terrains, firearm discharge (resulting in self-injury), heat sources, attacks by wild animals, inadequate lighting during firearm use, driving, exposure to gases and fumes, and projectile hazards. A 2022 study by Galliers et al., which examined ranger fatalities worldwide between 2006 and 2021, found that homicide was the leading cause of ranger deaths, followed by accidents, illnesses, wildlife attacks and fires[9]. In the present study, confrontations and retaliation (which could lead to the killing of rangers), accidents, wildlife attacks, and exposure to gases and fumes from fires were identified as the highest risks. Illnesses were another frequently reported hazardous event (226 instances), with some cases, such as rabies from animal bites or Crimean-Congo hemorrhagic fever (CCHF) from tick bites or direct contact with infected carcasses, meat, blood, secretions, and tissues, resulting in death. In a study by Rerolle et al. (2024), which examined the health risks faced by rangers in 24 countries across five regions of the world—South America, Central Africa, East Africa, South Asia, and Southeast Asia—it was found that rangers are more likely to be exposed to infectious diseases such as malaria compared to the general population, and the poor health conditions associated with their profession negatively impact their well-being[23].

In 2019, Pecyna et al. conducted a study in Poland, surveying 135 forestry workers to identify occupational hazards. Their study highlighted biological hazards, particularly exposure to extreme cold and heat and encounters with wild animals, as significant risks[8]. Similarly, in the present study, wildlife attacks and animal bites were identified as higher-risk hazards than others, including extreme temperatures. However, exposure to cold and heat in the workplace was also a frequently reported hazard (194 instances) in this study.

In a 2020 study, Abedi et al. investigated occupational stress among forest rangers in the Golestan Province. Their findings revealed that the occupational stress levels of forest rangers were above the average. In the present study, occupational stress was identified as a frequently occurring hazard (95 instances) across many ranger-related activities, with 23 cases classified as moderate risk (M)[24].

In the study by Zare and Adelizadeh (2022) on the identification and assessment of occupational hazards for rangers in the government environmental organization using the JSA method in Iran, they emphasized that having sufficient and up-to-date information, as well as adequate and necessary equipment, is essential for controlling the risks associated with ranger jobs[25]. In this study, a total of 4,321 control measures were proposed to mitigate the identified risks, tailored to the specific hazards of each job role. Of these, 64.17%, 29.58%, 4.65%, and 1.60% fell under the categories of control measures, administrative controls, personal protective equipment (PPE), engineering controls, and substitution controls, respectively. The predominance of administrative controls underscores the importance of training, expertise, and experience among workers, as well as the need for specialized guidelines, manuals, and regulations to reduce safety and health risks in ranger jobs. The results of this study also emphasized the critical role of up-to-date and appropriate personal protective equipment, such as lightweight and well-fitted bulletproof vests designed for the specific working conditions of the rangers, in mitigating occupational hazards.

Conclusion

Rangers are associated with a wide range of organizational and environmental activities that impact their safety and health owing to their involvement in diverse natural and human

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environments. This study assessed the risks related to ranger jobs in Ashkezar and Taft counties. The Job Safety Analysis (JSA) method was employed to collect data and perform the analysis. Risk assessment was performed using a semi-quantitative approach based on the military standard MIL-STD-882E. In total, 2,102 hazards were identified, spanning the physical, chemical, biological, ergonomic, psychological, mechanical, and social categories. According to the risk assessment results, 312 hazards (14.8%) were classified as high-risk, 939 hazards (44.67%) as moderate-risk, and 851 hazards (40.49%) as acceptable risk. Based on the Pareto principle, 20% of the hazards with the highest average risk priority numbers (RPN) were identified. These include inappropriate equipment (heavy and ineffective bulletproof vests), confrontations and retaliation by offenders or individuals with prior motives, natural disasters, animal bites, shortages of water and food resources, poisoning, exposure to accidents, travel through difficult and elevated terrain, and firearm discharge. Ultimately, 4,321 control measures were proposed to mitigate these risks in the study. The results highlighted the need for greater emphasis on administrative controls and personal protective equipment (PPE) to reduce risks in ranger activities. Administrative controls underscore the importance of training, expertise, and experience among workers, as well as the development of specialized guidelines, manuals, and regulations to mitigate safety and health risks in ranger work.

Establishing a database for recording occupational incidents in ranger jobs is recommended. This database can serve as a resource for analyzing occupational hazards and planning control measures across Iran. Additionally, to reduce risks, community-based conservation efforts and local community involvement should be strengthened in the future. This approach could help address the shortage of rangers by engaging the public, thereby reducing rangers' exposure to occupational hazards such as confrontations and retaliation. Public education and participation in programs such as wildlife conservation initiatives can also be effective.

Owing to the diverse hazards and incidents occurring in remote areas where rescue operations are challenging, it is advisable to provide rangers with medical emergency training and first-aid kits. Improving communication tools, such as radios, can help decrease the severity of incidents by ensuring constant contact and support among the rangers. Additionally, collaboration and information sharing with international organizations, such as the International Ranger Federation, are recommended.

The study encountered several limitations, including high research costs from accompanying rangers in remote and difficult environments, the need for vehicles and equipment for fieldwork, and the physical demands of the work itself. The extended duration of the study, required for planning and fieldwork, along with the researcher's exposure to occupational hazards, were also significant challenges.

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Conflict of Interest

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

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Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. The study protocol was reviewed and approved by the Ethics Committee of the University of Science and Culture.

Ethical issues

There are no ethical issues related to the writing of this article.

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Code of Ethics

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The authors adhered to the ethical guidelines and regulations throughout the study, ensuring the integrity and reliability of the research process. Data collection, analysis, and reporting were conducted transparently with due regard to scientific and ethical standards.

Authors' Contributions

Hesan Akhavan Ghalibaf: Investigation, validation, data curation, visualization, writing – original draft preparation, writing. Gholamhossein Halvani: Methodology, supervision, writing - reviewing and editing. Afarin Akhavan: Conceptualization, supervision. Rohollah Fallah Madvari: Reviewing and Editing.

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