

# A Comprehensive Review of Occupational Hazards in Nursing

**Tufaha Saad Al-Osaimi** <sup>(1)</sup>, **Dahaba Ahmad Ali Madkhali** <sup>(2)</sup>, **Aisha Ahmed Ahmad Althbyty** <sup>(3)</sup>, **Rahman Ali Muhammad Qadah** <sup>(4)</sup>, **Nora Abed Abdullah Altowaitqi** <sup>(5)</sup>, **Basmah Saud Owaidh Alotaibi** <sup>(6)</sup>, **Hawazen Rajeh Mohammad Alzalfi** <sup>(7)</sup>, **Ashwaq Mohammad Algethamy** <sup>(8)</sup>, **wedad Saad Al osimey** <sup>(9)</sup>, **Asma Ghazai Ayedh Alotaibi** <sup>(10)</sup>, **Samar Fahad Gaed Alotaibi** <sup>(11)</sup>, **Khloud Bargash Alotaibi** <sup>(12)</sup>, **Nouf Khalifa Mohsen Al-Mutairi** <sup>(13)</sup>, **Munirah Abdullah Alqufaidi** <sup>(14)</sup>, **Tamyah Saad Alsugyan** <sup>(15)</sup>

<sup>1</sup>Nurse, Mental hospital, Ministry of Health, Kingdom of Saudi Arabia.

[tsalosaimy@moh.gov](mailto:tsalosaimy@moh.gov)

<sup>2</sup>Nurse, Mental Hospital, Ministry of Health, Kingdom of Saudi Arabia.

[dmagrashy@moh.gov](mailto:dmagrashy@moh.gov)

<sup>3</sup>Nurse, Mental Hospital, Ministry of Health, Kingdom of Saudi Arabia.

[aalthbyty@moh.gov.sa](mailto:aalthbyty@moh.gov.sa)

<sup>4</sup>Nurse, Commitment management, Ministry of Health, Kingdom of Saudi Arabia.

[rgudah@moh.gov.sa](mailto:rgudah@moh.gov.sa)

<sup>5</sup>Nurse, Eradah & Mental Health Complex, Ministry of Health, Kingdom of Saudi Arabia. [naaltowairqi@moh.gov.sa](mailto:naaltowairqi@moh.gov.sa)

<sup>6</sup>Nurse, Eradah & Mental Health Complex, Ministry of Health, Kingdom of Saudi Arabia. [basmahsa@moh.gov.sa](mailto:basmahsa@moh.gov.sa)

<sup>7</sup>Nurse, Irada and Mental Health Complex in Taif, Ministry of Health, Kingdom of Saudi Arabia. [halzalfi@moh.gov.sa](mailto:halzalfi@moh.gov.sa)

<sup>8</sup>Nurse, Irada and Mental Health Complex in Taif, Ministry of Health, Kingdom of Saudi Arabia. [aalgethamy@moh.gov.sa](mailto:aalgethamy@moh.gov.sa)

<sup>9</sup>Nurse, The main hospital in King Salman Medical City, Ministry of Health, Kingdom of Saudi Arabia. [Walosimey@moh.gov.sa](mailto:Walosimey@moh.gov.sa)

<sup>10</sup>Nursing, Sajer General Hospital, Ministry of Health, Kingdom of Saudi Arabia.

[asmalhlaj@gmail.com](mailto:asmalhlaj@gmail.com)

<sup>11</sup>Nursing, Sajer General Hospital, Ministry of Health, Kingdom of Saudi Arabia.

[samarfahad2017@gmail.com](mailto:samarfahad2017@gmail.com)

<sup>12</sup>Nursing, Diriyah Hospital, Ministry of Health, Kingdom of Saudi Arabia.

[Kotibi@moh.gov.sa](mailto:Kotibi@moh.gov.sa)

<sup>13</sup>Nursing Technician, Al-Iman General Hospital, Ministry of Health, Kingdom of Saudi Arabia. [nalmeteri@moh.gov.sa](mailto:nalmeteri@moh.gov.sa)

<sup>14</sup>Nurse, Ministry of Health, Kingdom of Saudi Arabia. [Malqufaidi@moh.gov.sa](mailto:Malqufaidi@moh.gov.sa)

<sup>15</sup>Nursing Technician, Ministry of Health, Kingdom of Saudi Arabia.

[talsugyan@moh.gov.sa](mailto:talsugyan@moh.gov.sa)

## ABSTRACT

Nurses, the largest group of healthcare workers, face a wide range of occupational health hazards, including biological, chemical, physical, and psychosocial risks.

Tufaha Saad Al-Osaimi, Dahaba Ahmad Ali Madkhali, Aisha Ahmed Ahmad Althbyty, Rahman Ali Muhammad Qadah, Nora Abed Abdullah Altowaitqi, Basmah Saud Owaidh Alotaibi, Hawazen Rajeh Mohammad Alzalfi, Ashwaq Mohammad Algethamy, wedad Saad Al osimey, Asma Ghazai Ayedh Alotaibi, Samar Fahad Gaed Alotaibi, Khloud Bargash Alotaibi, Nouf Khalifa Mohsen Al-Mutairi, Munirah Abdullah Alqufaidi, Tamyah Saad Alsugyan

Biological hazards encompass infectious diseases such as hepatitis B, hepatitis non-A non-B, AIDS, and tuberculosis. Chemical hazards arise from exposure to drugs like cytotoxic agents and anesthetic gases, as well as sterilizing agents such as ethylene oxide, formaldehyde, and glutaraldehyde. Nurses also encounter physical hazards, with needlestick injuries being the most frequent. Back pain and injuries, often associated with patient handling activities, are prevalent among nurses and contribute significantly to morbidity and ill-health retirement. Assaults pose another physical risk, particularly in high-risk areas like emergency departments and psychiatric units. Exposure to ionizing and non-ionizing radiation is an additional concern. Psychosocial hazards include stress, with nurses reporting higher levels compared to other healthcare professionals. Shift work can lead to circadian rhythm disruption, causing sleep disturbances and reduced performance. Notably, nurses exhibit one of the highest suicide rates among professional groups, highlighting the mental health impact of their work. Addressing these diverse occupational health issues requires a multifaceted approach, including adherence to safety guidelines, proper training, and interventions to mitigate the psychological strain inherent in nursing.

**Keywords:** Nurses, Occupational Hazards

## **Introduction**

In the nursing profession, a wide range of health hazards are encountered. Some of these hazards have persisted since the inception of the nursing industry but have only recently gained recognition. Others are newer, arising primarily due to the rapid advancements in the healthcare field in recent years. For simplicity, occupational health issues among nurses can be categorized into four main types: biological hazards, chemical hazards, physical hazards, and psychosocial hazards. The order of discussion in this text does not signify their relative importance. Nurses are the focus of this discussion because they represent the largest group of healthcare workers in many countries and play a pivotal role in the healthcare delivery system. They often act as the primary point of contact with patients. It is reasonable to assert that the healthcare delivery system would be rendered nonfunctional without nurses (Vecchio et al., 2003).

This article endeavors to examine some of the occupational health problems faced by nurses. It is not an exhaustive review of all literature on the subject.

## **Biological Hazards**

Biological hazards encompass a variety of infectious diseases. According to Lunn (2), a report by a working group from the World Health Organization (WHO), Regional Office for Europe, emphasized that fear of contracting severe infections at work is a primary concern for most healthcare workers.

## **Hepatitis B**

Hepatitis B is recognized as an occupational hazard for hospital staff. A WHO review indicated that hospital personnel exhibit prevalence rates three to six times higher than those observed in the general population. A study involving sera from

3,770 employees of the Medical School of Hannover in Germany found that 20.1% of nurses had evidence of prior exposure to the hepatitis B virus (HBV). This rate was second only to that of hospital cleaners (26.3%), exceeding the prevalence among physicians (18.2%). When adjusted for age and gender, nurses exhibited a significantly higher rate of hepatitis B infection ( $P < 0.01$ ) compared to a reference group with less exposure to infected materials. Furthermore, the study revealed that those caring for hepatitis B patients were significantly more likely ( $P < 0.05$ ) to be carriers of the hepatitis B surface antigen (HBsAg) or to possess antibodies to HBsAg (anti-HBs) than a comparable group (Shiny A et al., 2023).

The primary mode of HBV transmission is blood. Consequently, injuries from contaminated needles and scalpels, as well as the contamination of skin abrasions or wounds with infected blood, present considerable risks. The rate of seroconversion following percutaneous injection of blood or serum from HBsAg-positive patients ranges between 12% and 17%, even with the passive immunization of recipients using immune serum globulins. However, the introduction of effective hepatitis B vaccines, including human plasma-derived and recombinant yeast vaccines, is expected to significantly reduce the occupational risk of this infection for nurses who complete the vaccination regimen (Yacoub et al., 2010).

Despite this progress, the risk cannot be eliminated, as studies have demonstrated that approximately 4% of nurses fail to seroconvert following vaccination. Furthermore, the duration of immunity among those who do seroconvert remains a topic of debate. Recommendations regarding booster doses and their optimal timing vary among researchers. One recent study found that 38% of hospital employees had anti-HBs levels below the theoretical protective threshold of 10 mIU/mL three years after primary hepatitis B vaccination. These findings underscore the importance of adhering to recommended guidelines for preventing HBV transmission among healthcare personnel (Shiny A et al., 2023).

### **Hepatitis Non-A Non-B**

In addition to HBV, nurses are at risk of contracting hepatitis non-A non-B (HNANB). HNANB accounts for up to 90% of post-transfusion hepatitis cases in facilities where all blood donations are screened for HBsAg. Transmission of HNANB through needlestick injuries has also been reported.

The identification of the hepatitis C virus (HCV), a single-stranded RNA virus, has clarified the etiology of HNANB. An immunoassay for detecting antibodies to HCV (anti-HCV) has been developed. Anti-HCV has been identified in up to 85% of patients with post-transfusion HNANB and 60% of patients with chronic hepatitis or cirrhosis who had a history of blood transfusion.

Among Spanish patients with hepatocellular carcinoma, anti-HCV was detected in 75% of cases, a significantly higher proportion ( $P < 0.001$ ) compared to referents (7.3%). Similarly, an Italian study found a 65% prevalence of anti-HCV among hepatocellular carcinoma patients, regardless of the presence of HBsAg (20). These findings suggest a potential role for HCV in the development of hepatocellular carcinoma. Although no specific studies have been published on the prevalence of anti-HCV among nurses, it is reasonable to hypothesize a significant seroprevalence rate

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among healthcare workers, especially those with frequent blood exposure. Without adherence to guidelines like those for HBV prevention, HCV could emerge as a prominent occupational hazard in the healthcare industry (McDiarmid, 2014).

### **Acquired Immunodeficiency Syndrome (AIDS)**

As of 30 June 1990, 266,098 cases of acquired immunodeficiency syndrome (AIDS) had been reported to WHO from 157 countries worldwide. This modern pandemic, caused by human immunodeficiency viruses (HIV), can be transmitted in healthcare settings through needlestick injuries or exposure of abraded skin or mucous membranes to blood or body fluids containing HIV. Needlestick injuries are considered the most significant mode of HIV transmission to healthcare workers. The primary mechanisms of HIV transmission resemble those of HBV.

Given the growing prevalence of the AIDS pandemic and documented instances of HIV transmission to healthcare workers, nurses have become increasingly concerned about the occupational risks of HIV infection. Fortunately, available data suggest that this risk is relatively low and is lower than the risk of occupational HBV infection. The probability of seroconversion following percutaneous or mucous membrane exposure to HIV-infected blood has been estimated at an upper 95% confidence limit of 0.76%. For parenteral exposure alone, the risk ranges from 1.3 to 3.9 per 1,000 cases.

Despite the relatively low risk, AIDS remains a cause for concern. In the absence of a cure or vaccine, adherence to recommended guidelines is critical. An American study found that 40% of occupational exposures to HIV-infected blood could have been prevented through proper precautions.

### **Tuberculosis**

Tuberculosis (TB) remains a significant public health concern, particularly in developing nations, which are estimated to account for over three-quarters of the approximately 8-10 million new TB cases globally each year. Some evidence suggests that TB incidence in these regions is rising, posing a genuine risk of infection for nurses, especially when dealing with undiagnosed cases of TB (Jesudas & Thangakunam, 2013).

Conversely, in many developed nations, the incidence of TB has declined substantially over the past few decades (28). As a result, the occupational risk of nurses contracting TB in these areas has also significantly decreased. A Canadian study assessing reported cases of active TB in female nurses in British Columbia from 1969 to 1979 found a mean annual incidence rate of 2.6 per 10,000 nurses—a figure comparable to that of other women when adjusted for age and birthplace.

However, recent data from the United States indicate a reversal of this downward trend. This resurgence is partially attributed to the HIV pandemic, with studies demonstrating a strong link between TB and HIV-1 infection. TB has now been recognized as one of the most common opportunistic infections in individuals

seropositive for HIV-1. Consequently, in countries with high rates of HIV-1 infection, nurses may face an elevated risk of TB in the future unless effective preventive measures, such as screening and surveillance programs and Bacillus-Calmette-Guerin (BCG) vaccination for tuberculin-negative health personnel, are implemented (Erawati & Andriany, 2020).

### **Other Infections**

Certain viral infections with teratogenic potential pose a specific occupational risk to nurses of reproductive age, particularly those who are pregnant. Examples include cytomegalovirus (CMV) and rubella infections. In the case of CMV, reviews of medical literature by researchers in Canada and Scotland concluded that CMV infection is not an occupational hazard for nurses caring for infants and young children. However, strict hand hygiene remains essential. For rubella, it is advised that seronegative nurses of childbearing age who are not pregnant receive the rubella vaccine.

Herpetic whitlow, a herpes simplex viral infection of the fingers caused by contact with virus-laden secretions, is another established occupational hazard for health care workers. Additionally, the transmission of *Clostridium difficile* infection from a patient to three nurses has been documented, suggesting this infection may also be a significant occupational risk.

### **Chemical Hazards**

Chemical risks in health care settings stem from certain drugs and sterilizing agents used in medical practice. With the growing introduction of chemical-based substances, the list of potential occupational hazards for nurses is likely to expand over time (Arif & Delclos, 2012).

### **Cytotoxic Drugs**

Concerns regarding the safety of cytotoxic drugs for nurses handling them have been widely debated. Increased mutagenic activity in the urine of nurses exposed to these drugs has prompted caution regarding their potential adverse effects. However, this observation has been challenged, as similar findings were reported in smokers and individuals ingesting specific drugs or dietary items. Moreover, this mutagenic activity was not consistently observed among all exposed personnel (Abbasi et al., 2016).

A separate study detected cyclophosphamide in the urine of two oncology nurses who prepared the drug, suggesting significant absorption may have occurred. This finding implies that mutagenic activity observed in oncology nurses could partly result from cyclophosphamide metabolites. Given the known side effects of cytotoxic drugs, such as secondary malignancies, this warrants concern.

Norppa and colleagues reported increased frequencies of sister chromatid exchanges in the lymphocytes of nurses handling cytostatic drugs. Nikula et al. noted significantly higher chromosome-type breaks in the lymphocytes of nurses exposed long-term to these agents compared to unexposed laboratory workers and hospital clerks. Another study involving 24 oncology nurses and pharmacists and matched referents found significantly higher *in vivo* mutation frequencies in the exposed group,

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which correlated with the duration of exposure. These findings support the notion that cytotoxic drugs might pose carcinogenic risks. However, prospective studies explicitly linking such exposure to neoplastic effects are currently lacking (Bayraktar-Ekincioglu et al., 2018).

A Finnish study of three head nurses with long-term exposure to cytostatic drugs revealed histological signs of portal hepatitis with piecemeal necrosis in one case and hepatic fibrosis in the other two. Follow-up biopsies suggested the possibility of irreversible hepatic fibrosis caused by prolonged exposure. Additionally, occupational exposure to antineoplastic drugs has been associated with adverse reproductive outcomes. A study involving Finnish nurses found a statistically significant link between fetal loss and exposure to these drugs during the first trimester of pregnancy (odds ratio 2.3, 95% CI 1.20-4.39).

To mitigate these risks, strict handling precautions are necessary for cytotoxic drugs and the waste of patients undergoing chemotherapy. Venitt et al. highlighted this need by demonstrating the presence of cisplatin in the urine of treated patients. Authorities like the Health and Safety Executive in Great Britain have issued guidelines for the safe handling of these drugs.

### **Anesthetic Agents**

Occupational exposure to anesthetic agents has been linked to adverse reproductive outcomes, liver and kidney diseases, and vitamin B12 metabolism interference. Many studies investigating these effects rely on retrospective questionnaire surveys, which are susceptible to recall bias and low response rates. Despite these limitations, Vessey and Nunn estimated a 40% increased risk of spontaneous abortion among exposed women.

Layzer described a neurological condition resembling subacute combined degeneration of the spinal cord in 15 patients exposed to nitrous oxide for extended periods. This observation suggested nitrous oxide might affect vitamin B12 metabolism. Another study found evidence of bone marrow toxicity in three of 20 dentists exposed to nitrous oxide at levels like those found in British operating rooms. Consequently, nurses exposed to these concentrations might risk disrupted vitamin B12 metabolism. The National Institute for Occupational Safety and Health has recommended maximum exposure levels of 2 ppm for halothane and 25 ppm for nitrous oxide.

While evidence for other suspected hazards, such as malignancy, teratogenic effects, low birthweight, and infertility, remains unconvincing, ensuring anesthetic gas levels remain below recommended limits is essential. Installing effective scavenging systems may be necessary to achieve this goal.

### **Antibiotics**

Nurses frequently experience sensitization to antibiotics, particularly penicillins, which has been well documented. A study using interviewer-administered

questionnaires in Sri Lanka revealed that sensitivity to penicillin and other substances was significantly more prevalent among hospital staff nurses (33.7%) compared to a reference group of teachers (6.4%). Notably, nearly one-third of the allergic nurses were solely sensitive to penicillin. Among those allergic to penicillin, 51% reported developing the allergy within the first ten years of their nursing service.

### **Ethylene Oxide**

Ethylene oxide is a sterilizing agent commonly used for heat-sensitive medical equipment in health care facilities. However, its safety has been a concern, as it is suspected to be carcinogenic, with bone marrow being identified as the most vulnerable site. Research in Finland has suggested that exposure to ethylene oxide might increase the risk of spontaneous abortion among sterilizing staff. One study reported a spontaneous abortion rate of 16.7% for pregnancies involving exposed individuals compared to 5.6% among unexposed pregnancies. This difference remained statistically significant after adjusting for factors such as age, parity, pregnancy decade, smoking habits, and alcohol and coffee consumption (Coggon et al., 2004).

### **Formaldehyde**

Formaldehyde is known to irritate mucous membranes and impair the mucociliary mechanism. Acute massive exposures can even result in pulmonary edema. Among nurses, formaldehyde is a leading cause of occupational dermatitis among disinfectants. Additionally, occupational asthma caused by formaldehyde exposure has been documented. Although a report from the Council on Scientific Affairs of the American Medical Association found no significant impairment in pulmonary function in the studies reviewed, brief exposures could provoke nonspecific airway hyperresponsiveness.

The carcinogenic potential of formaldehyde in humans remains controversial, with some studies reporting elevated incidences of specific tumors among exposed workers, while others present contradictory findings. Despite this, formaldehyde is classified as a possible human carcinogen by the Environmental Protection Agency and the National Institute for Occupational Safety and Health in the United States (Vaughan et al., 2000).

### **Glutaraldehyde**

In medical settings, glutaraldehyde is widely used for cold sterilization, particularly for endoscopes. However, its use poses health risks, as it can act as both an irritant and an allergen. Documented health conditions associated with glutaraldehyde exposure include rhinitis, asthma, and contact dermatitis.

### **Other Chemical Hazards**

Chlorhexidine has been identified as a cause of irritant contact dermatitis among nurses. Moreover, cases of occupational asthma triggered by chlorhexidine and alcohol aerosols have been reported in a practical nurse and a midwife. Acrylic cement vapor has been implicated in an instance of corneal ulceration in an operating room nurse. Additionally, methyl methacrylate, a component of acrylic cement, has been associated with a case of occupational asthma in an orthopedic nurse.

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The use of rubber gloves poses sensitization risks, causing contact urticaria in some cases. A Finnish study found a 6.4% prevalence of rubber glove allergy among doctors and nurses working in operating units. Furthermore, a case of asthma linked to vapors emitted by general-purpose rubber gloves has been reported. These findings underscore the importance of careful handling of rubber gloves, particularly as their usage has increased due to the ongoing HIV pandemic.

Occupational exposure to psyllium, a constituent of bulk laxatives, has been shown to cause sensitization among nurses. This exposure can lead to allergic reactions such as rhinitis and asthma.

### **Physical Hazards**

Nurses face a range of physical hazards while performing their duties. According to Feldman, common injuries among hospital employees include needle punctures, sprains, and back injuries. Other notable physical hazards include assaults and radiation exposure.

### **Needlestick Injury**

Needlestick injuries are among the most frequent occupational accidents experienced by nurses. McCormick and Maki reported that needlestick injuries accounted for one-third of all occupational accidents among hospital staff at the University of Wisconsin. Nurses comprised nearly two-thirds of all reported needlestick incidents in two studies conducted in the United States. Annual incidence rates identified by McCormick and Maki included 92.6 needlestick injuries per 1,000 registered nurses, 127.0 per 1,000 housekeeping staff, and 104.7 per 1,000 laboratory personnel. Ruben et al. noted an average annual incidence rate of 23 injuries per 100 nurses.

Underreporting is a significant issue in documenting needlestick injuries, especially among nurses who often self-assess the severity of such incidents. As a result, the true extent of these injuries is likely much higher than recorded figures. A self-administered questionnaire survey conducted in a regional hospital in Hong Kong revealed that 95% of nurses had experienced needlestick injuries during their careers, with 15% sustaining such injuries in the week prior to the survey. However, the low response rate (31%) in this study poses limitations to interpreting the findings.

Although the immediate consequence of a needlestick injury is usually temporary disability, the risk of long-term repercussions, including permanent disability, is considerable. These injuries pose risks of transmitting viral hepatitis, HIV, malaria, tuberculosis, and cryptococcosis. Additionally, a case report detailed the accidental injection of human colonic adenocarcinoma cells, resulting in tumor growth at the injection site. Needlestick injuries also carry risks of sepsis (Yacoub et al., 2010).

Efforts to mitigate needlestick injuries have focused on identifying associated factors, including work activities and device types. Key activities linked to these injuries include recapping used needles, disposing of needles, performing

venipunctures, and administering intravenous therapy, accounting for nearly three-fourths of all reported cases. These findings highlight the potential to significantly reduce needlestick injuries by following recommended precautions.

In another study, Jagger et al. identified disposable syringes, intravenous tubing and needle assemblies, and prefilled cartridge syringes as the three most implicated devices in needlestick injuries, accounting for 35%, 26%, and 12% of cases, respectively. Recapping of needles was responsible for one-third of these incidents, with competing hazards cited as a justification for the practice. Jagger et al. emphasized the importance of redesigning needle-containing devices to enhance safety while also advocating for adherence to safe handling practices. Both strategies are deemed essential in addressing the issue of needlestick injuries effectively.

### **Back Pain and Back Injuries**

Back pain is a predominant complaint among the working population, affecting more than half of workers at some point in their careers. Health industry workers, particularly nurses, are especially vulnerable to developing back pain during their professional duties. A survey conducted in Israel across eight occupational groups found that only workers in heavy industries experienced higher rates of back pain than nurses (76). High prevalence rates of back pain have also been documented among nurses in various other countries (Davis & Kotowski, 2015).

In the United States, a questionnaire survey investigating occupational low-back pain among nurses revealed attack rates of 52% and 37% for six-month and two-week recall periods, respectively. These rates were significantly higher ( $P < 0.01$ ) than those reported by a comparison group of unit service coordinators engaged in clerical work within nursing units. Finnish researchers noted that 79% of qualified nurses and 85% of nursing assistants reported at least one episode of low-back pain prior to their survey, with figures for the month preceding the study being 41% and 50%, respectively.

In Great Britain, a questionnaire survey on back pain among nurses documented an annual prevalence (person) of 431 per 1,000 nurses and an annual incidence (person) of 77 per 1,000 nurses. For back pain attributed to specific patient-handling incidents, the corresponding rates were 159 and 29 per 1,000 nurses, respectively. Back pain and related injuries are significant contributors to morbidity among nurses, often leading to incapacity and ill-health retirement. Harber et al. reported that 29% of nurses used analgesics for back pain relief in the preceding six months. Additionally, a five-year prospective survey on low-back injuries resulting from patient-handling incidents, which led to work absences, revealed that 27% of injured nurses had evidence of prolapsed intervertebral lumbar disc lesions.

In Finland, 18% of qualified nurses and 29% of nursing assistants reported low-back pain that rendered them unfit for daily tasks within the previous five years. In Ontario, Canada, back injuries accounted for over 40% of all time-lost claims among hospital nursing personnel. Stubbs et al. estimated that back pain caused an annual loss of 750,000 workdays among nurses in Great Britain. Furthermore, Heap noted that 12% of nurses with low-back injuries terminated employment prematurely.

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Given the current global shortage of nursing staff, such high morbidity levels represent a critical challenge for the health care industry.

Efforts to identify factors associated with back pain among nurses have highlighted the significance of prior back pain history, work activities, and job category. A history of back pain has consistently been shown to be a significant predictor of subsequent episodes. The recurrent nature of back pain in nurses is evidenced by findings that 84.7% of nurses experiencing back pain reported more than one episode (Vieira et al., 2016).

Certain work activities have been strongly associated with back pain in nurses. Lifting patients is the activity most frequently cited as contributing to back pain and back injuries. Videman et al. identified inadequate patient-handling skills as a major risk factor for back pain and injuries among nurses. Research from the United States suggests that non-patient-contact activities, such as moving hospital furniture or equipment, are more closely associated with occupational back pain than patient-handling tasks. Moreover, these non-patient-contact activities were found to be performed more frequently by nurses.

Within the nursing profession, nursing assistants appear to be at greater risk of occupational back pain and injuries compared to registered nurses. This association may be confounded by differences in work activities, as nursing assistants are typically involved in more frequent lifting, bending, and rotating movements and tend to handle heavier loads than registered nurses. The study by Venning et al. provided strong evidence supporting the role of job category in back injuries, with logistic regression analysis revealing job category as a significant predictor ( $P < 0.01$ ). The adjusted odds ratio for back injuries was 1.77 for nursing assistants compared to registered nurses and supervisory staff (Epstein et al., 2018).

Given that lifting is a primary factor linked to back pain, it is reasonable to hypothesize that proper training in lifting techniques could reduce the risk. However, evidence regarding the effectiveness of such training is mixed. Some researchers have noted that training in safe lifting procedures has not significantly reduced back pain rates among nurses. Advocates for lifting training argue that the lack of positive outcomes may result from employees neglecting instructions. Additionally, it has been suggested that poorly designed training programs might exacerbate the problem instead of mitigating it.

Heap reported that retraining nurses in the use of kinetic principles, combined with regular reinforcement, significantly contributed to reducing low-back pain. An interventional study demonstrated an improvement in patient-handling skills following training, with significantly lower back injury rates among nurses rated as having good or excellent skills (2%) compared to those with poor skills (24%). These findings suggest that adequate patient-handling skills offer some protection against back injuries. From a biomechanical perspective, this assumption is plausible. The lack of definitive evidence for training effectiveness may stem from variations in the quality, duration, and frequency of training.

## **Radiation**

Radiation exposure in the nursing profession can be broadly categorized into ionizing and non-ionizing forms. The adverse effects of ionizing radiation are well-established and include malignancies, genetic damage, negative reproductive outcomes, and radiation sickness. Sources of ionizing radiation in medical settings include diagnostic and therapeutic radiology equipment as well as radiopharmaceuticals. Consequently, nurses working in units directly handling these sources, as well as those accompanying patients undergoing such procedures, are at risk if protective guidelines are not followed.

However, a study monitoring nursing staff in a coronary care unit over a three-year period found no significant evidence of occupational hazards associated with ionizing radiation when standard safety measures were observed. The author emphasized that adherence to protective protocols could mitigate most risks associated with machine-produced radiation.

Among non-ionizing radiation sources in healthcare, laser beams are prominent. The medical application of lasers is extensive and continues to grow. The primary risk associated with laser use is retinal damage, which can occur through direct exposure or indirectly via reflections from shiny surfaces.

## **Psychosocial Hazards**

### **Stress**

Caring for the sick, disabled, and dying presents significant stressors for nurses. Health industry workers are particularly susceptible to "burnout," characterized by emotional exhaustion, depersonalization, and reduced productivity, often accompanied by feelings of diminished achievement. Psychological burnout is notably prevalent among those caring for patients with terminal illnesses, such as AIDS. Compared to cancer care, AIDS-related care often imposes greater emotional demands, particularly as many AIDS patients are in the prime of life, intensifying the stress experienced by healthcare providers.

Comparative studies have shown that nurses report higher levels of stress than physicians and pharmacists. This observation was supported by findings from the Health Professions Stress Inventory (HPSI), which measured stress levels among these groups (98). Additional research has revealed significant variations in occupational stress across different hospital units (Mumbwe et al., 2020).

### **Shift Work**

The demands of nursing necessitate shift work, which is implemented in various patterns across healthcare facilities. However, shift work is associated with several adverse effects, including disruption of social and family life and the desynchronization of circadian rhythms. This disruption can result in sleep disturbances, fatigue, reduced work performance, and impaired safety awareness. Moreover, nurses with pre-existing medical conditions such as diabetes, asthma, or epilepsy may experience exacerbations of their illnesses due to circadian misalignment (Phillips, 2016).

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## Conclusion

Nurses, as the largest group of healthcare professionals, face diverse occupational hazards that span biological, chemical, physical, and psychosocial domains. Biological risks, such as exposure to hepatitis B, tuberculosis, and HIV, remain prominent due to frequent patient contact and needlestick injuries. Chemical exposures, including cytotoxic drugs, anesthetic gases, and sterilizing agents, pose significant health concerns, ranging from carcinogenic risks to reproductive health effects.

Physical hazards, including back injuries and needlestick incidents, contribute extensively to morbidity and early retirement within the profession. High-risk environments such as emergency and psychiatric units further expose nurses to assaults, while radiation hazards persist in units utilizing ionizing and non-ionizing sources. Psychosocial challenges, encompassing stress, burnout, and mental health risks, amplify the demand for effective interventions, with nursing professionals demonstrating higher stress and suicide rates than many other occupational groups.

Addressing these hazards necessitates a comprehensive approach that integrates adherence to safety protocols, enhanced training, ergonomic interventions, and robust psychological support systems. Only through such targeted measures can the healthcare industry ensure the safety, well-being, and productivity of its essential nursing workforce.

## References

- Abbasi, K., Hazrati, M., Mohammadbeigi, A., Ansari, J., Sajadi, M., Hosseinnazzhad, A., & Moshiri, E. (2016). Protection behaviors for cytotoxic drugs in oncology nurses of chemotherapy centers in Shiraz hospitals, South of Iran. *Indian Journal of Medical and Paediatric Oncology: Official Journal of Indian Society of Medical & Paediatric Oncology*, 37(4), 227–231. <https://doi.org/10.4103/0971-5851.195748>
- Arif, A. A., & Delclos, G. L. (2012). Association between cleaning-related chemicals and work-related asthma and asthma symptoms among healthcare professionals. *Occupational and Environmental Medicine*, 69(1), 35–40. <https://doi.org/10.1136/oem.2011.064865>
- Bayraktar-Ekincioglu, A., Korubük, G., & Demirkan, K. (2018). An evaluation of chemotherapy drug preparation process in hospitals in Turkey—A pilot study. *Journal of Oncology Pharmacy Practice: Official Publication of the International Society of Oncology Pharmacy Practitioners*, 24(8), 563–573. <https://doi.org/10.1177/1078155217720007>
- Coggon, D., Harris, E. C., Poole, J., & Palmer, K. T. (2004). Mortality of workers exposed to ethylene oxide: Extended follow up of a British cohort. *Occupational and Environmental Medicine*, 61(4), 358–362. <https://doi.org/10.1136/oem.2003.008268>
- Davis, K. G., & Kotowski, S. E. (2015). Prevalence of Musculoskeletal Disorders for Nurses in Hospitals, Long-Term Care Facilities, and Home Health Care: A Comprehensive Review. *Human Factors*, 57(5), 754–792. <https://doi.org/10.1177/0018720815581933>
- Epstein, S., Sparer, E. H., Tran, B. N., Ruan, Q. Z., Dennerlein, J. T., Singhal, D., & Lee, B. T. (2018). Prevalence of Work-Related Musculoskeletal Disorders Among Surgeons and Interventionalists: A Systematic Review and Meta-analysis. *JAMA Surgery*, 153(2), e174947. <https://doi.org/10.1001/jamasurg.2017.4947>
- Erawati, M., & Andriany, M. (2020). The Prevalence and Demographic Risk Factors for Latent Tuberculosis Infection (LTBI) Among Healthcare Workers in Semarang, Indonesia. *Journal of Multidisciplinary Healthcare*, 13, 197–206. <https://doi.org/10.2147/JMDH.S241972>
- Jesudas, C. D., & Thangakunam, B. (2013). Tuberculosis risk in health care workers. *The Indian Journal of Chest Diseases & Allied Sciences*, 55(3), 149–154.

- McDiarmid, M. A. (2014). Hazards of the health care sector: Looking beyond infectious disease. *Annals of Global Health, 80*(4), 315–319. <https://doi.org/10.1016/j.aogh.2014.08.001>
- Mumbwe, M. C., McIsaac, D., Jarman, A., & Bould, M. D. (2020). A Cross-Sectional Survey to Determine the Prevalence of Burnout Syndrome Among Anesthesia Providers in Zambian Hospitals. *Anesthesia and Analgesia, 130*(2), 310–317. <https://doi.org/10.1213/ANE.0000000000004464>
- Phillips, J. P. (2016). Workplace Violence against Health Care Workers in the United States. *The New England Journal of Medicine, 374*(17), 1661–1669. <https://doi.org/10.1056/NEJMr1501998>
- Shiny A, K., Amirthalingam, B., & Kathiresan, S. (2023). Assessing the Risk of Occupational Hazard Using the FMEA Tool Among Hospital Staff at Multispecialty Hospital. *International Journal of Experimental Research and Review, 35*, 43–53. <https://doi.org/10.52756/ijerr.2023.v35spl.005>
- Vaughan, T. L., Stewart, P. A., Teschke, K., Lynch, C. F., Swanson, G. M., Lyon, J. L., & Berwick, M. (2000). Occupational exposure to formaldehyde and wood dust and nasopharyngeal carcinoma. *Occupational and Environmental Medicine, 57*(6), 376–384. <https://doi.org/10.1136/oem.57.6.376>
- Vecchio, D., Sasco, A. J., & Cann, C. I. (2003). Occupational risk in health care and research. *American Journal of Industrial Medicine, 43*(4), 369–397. <https://doi.org/10.1002/ajim.10191>
- Vieira, E. R., Schneider, P., Guidera, C., Gadotti, I. C., & Brunt, D. (2016). Work-related musculoskeletal disorders among physical therapists: A systematic review. *Journal of Back and Musculoskeletal Rehabilitation, 29*(3), 417–428. <https://doi.org/10.3233/BMR-150649>
- Yacoub, R., Al Ali, R., Moukeh, G., Lahdo, A., Mouhammad, Y., & Nasser, M. (2010). Hepatitis B vaccination status and needlestick injuries among healthcare workers in syria. *Journal of Global Infectious Diseases, 2*(1), 28–34. <https://doi.org/10.4103/0974-777X.59247>