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An Overview on Unsafe Injection and Its Hazards

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Abstract:

Unsafe injection practices remain a significant public health concern, particularly in low-resource healthcare settings. These practices include the reuse of needles and syringes, improper sterilization, poor handling of injection equipment, and inadequate disposal of sharps. Such unsafe behaviors can lead to the transmission of life-threatening infections, including hepatitis B, hepatitis C, and HIV, as well as localized infections and abscesses. Furthermore, unsafe injections contribute to increased antimicrobial resistance and healthcare-associated outbreaks. This paper explores the causes, prevalence, and health consequences of unsafe injection practices and emphasizes the need for strict adherence to international safety protocols. It also highlights the importance of healthcare worker education, public awareness, and policy enforcement to eliminate unsafe practices and ensure patient and provider safety.

Keywords: Unsafe Injection, Hazards, health.

Introduction:

Unsafe injection practices refer to several harmful practices considered dangerous for patients and/or health workers, such as: Reusing a syringe for more than one patient, accessing a medication vial or container with a syringe that has been used to administer medication to a patient, then using the medication from that container for another patient, reusing single-use medicines for more than one patient and failing to use aseptic technique when preparing and administering injections **(1)**

Although, tremendous efforts have reduced the number of hazardous injections in developing countries, but the number remains high in the WHO Eastern Mediterranean Region (**2**).

Unsafe injection practices are prevalent in a wide range of healthcare institutions in developing countries and are involved in a variety of preventable healthcare-related risks (**3).**

Unsafe injection practices put patients and healthcare providers at risk of infectious and noninfectious adverse events, also carry socio-economic and psychological consequences on the individuals and the health system (**4).**

WHO estimated that unsafe injections caused annually 21 million of hepatitis B virus (HBV) infections, two million of hepatitis C virus (HCV) infections and 260,000 of human immunodeficiency virus (HIV) infections. These infections caused to 49,000, 24,000, and 210,000 deaths, respectively. The 40% of the global burden of HBV and HCV infection among Health Care Workers (HCWs) is attributable to occupational exposure .Unsafe injections are responsible for millions of cases of HBV and HCV infection, and an estimated one-quarter of a million cases of HIV infection annually (**5**).

Unsafe injection practices add to the global burden of blood-borne disease. This accounted for 14% of HIV, 25% HBV, 8% HCV, and 5% of bacterial infections worldwide and for 28 million preventable disabilities **(6)**.

Main risks for unsafe injection:

Root causes of the problem could be summarized into main pillars which incorporate the main risks of the problem, health care providers' risks, and working environment risks (**7).**

Health care providers' risks for unsafe injection:

There is a possibility that the problem could be magnified by health care providers who

- Lack knowledge
- Do not receive the appropriate training
- Fail to adhere strictly to the safe injection practices guidelines for handling injections or their disposal.

These drawbacks, in turn, lead indirectly to an increase in the blood borne transmitted infections to the providers by needle pricks or to the patients and magnify the burden of combating them (**2**).

Working environment risks for unsafe injection:

The unsuitable working place and circumstances, as

- Lack of supplies and related equipment and disposal items, have an obvious effect on hazardous unsafe injections.
- Unavailability of waste management protocols ensuring safety for all or lack of satisfied adherence to them are considered a hazardous risk to the whole community.
- In addition, the irregularity of monitoring the practice and shortage in control measures play also a part **(6)**

Four main potential risks might pose a direct patient hazard:

- Re-use of injection equipment, where administration of about 16 billion injections are encountered worldwide with about 40% of which involves re-use of injection equipment.
- Accidental needle stick injuries (NSIs) for health care provider resulting in a total of 3 million accidental NSIs in a WHO survey
- Overuse of injections.
- Unsafe sharps waste disposal, where inappropriate collection and disposal of sharp wastes put the health care practitioner and the waste handler including the community at risk of sharps injuries with consequential blood-borne infections **(6)**.

Syringe reuse, along with other unsafe injection practices, is a major contributor to a widespread spectrum of adverse effects including the global burden of blood borne diseases **(8)**.

Healthcare workers (HCWs), including doctors, nurses, technicians, and assistants, are at risk of being exposed to infectious diseases through continuous contact with the patients' blood and body fluids during clinical work in medical institutions **(9).**

The common viral infections associated with unsafe injection.

1-HBV exposure:

Hepatitis B is an infection of the liver caused by the hepatitis B virus. The infection can be acute (short and severe) or chronic (long term). Hepatitis B can cause a chronic infection and puts people at high risk of death from cirrhosis and liver cancer**. (10)**

Hepatitis B is a major global health problem. Hepatitis B virus (HBV) infection remains one of the most important infections affecting people in sub-Saharan Africa. Data from 187 countries shows that viral hepatitis is a major public health challenge of this decade. An estimated 1.3 million people died from chronic

viral hepatitis B and C in 2022 i.e 3500 deaths per day. An estimated **254** million people are living with hepatitis B and 50 million people are living with hepatitis C worldwide, and 6000 people are newly infected with viral hepatitis each day. Many people remain undiagnosed in many countries, and even when hepatitis is diagnosed, the number of people receiving treatment remains incredibly low **(10).**

It is estimated that approximately two billion people worldwide have evidence of past or present infection with HBV, and 296 million individuals are chronic carriers (i.e., positive for hepatitis B surface antigen). The overall prevalence of HBsAg is reported to be 3.5 percent; however, it varies depending on the geographic area. The prevalence is highest in the Western Pacific, accounting for 116 million infections, followed by the African region, accounting for 81 million, and then the Eastern Mediterranean region and Southeast Asia, each accounting for 60 million infections. Europe and the Americas account for 14 and 5 million, respectively **(10)**.

Frequent exposure of Egyptian healthcare workers to hepatitis B virus infection is significantly high. This high predisposition is mainly due to needle stick injuries and accidental exposure to infected blood and other body fluids. In the absence of proper preventive measures, infected healthcare workers could be an eminent source of HBV infection transmission to their patients. A prevalence rate of 1.5% was recorded among Egyptian healthcare workers. Moreover, a significant number of HCWs have an occult hepatitis B infection (**11).**

The prevalence of HBV in Egypt showed a progressive decline over time as an effect of introducing the HBV vaccine to the list of compulsory vaccinations for infants. Healthcare workers had a fourfold higher risk of HBV infection compared to the general population. This could be attributed to noncompliance with recognized guidelines for infection control, such as those set by the Centers for Disease Control and Prevention (CDC). Adhering to the CDC's guidelines, practicing hand hygiene, utilizing gloves, and properly disposing of sharp tools are all essential measures to avoid the transmission of HBV **(12).**

In developing countries, occupational infections are common due to the high prevalence rates of blood-borne pathogens and the increased risk of injury. A study that investigated occupational exposure to needle sticks and sharp medical device injuries and HBV in Egypt (the Nile Delta and Upper Egypt regions) revealed that around 8617 cases of HBV infections are reported annually among HCWs. Another study conducted among HCWs in a national liver disease referral center in Egypt found that 16.6% of HCWs tested positive for HCV-Ab, 1.5% tested positive for HBs-Ag, and 0.2% tested positive for coinfection. Additionally, an Egyptian study revealed that the rates of anti-HBs varied among different occupational groups, with nonprofessional personnel having the highest frequency (60%), followed by graduated nurses (33%) and physicians (29%) **(12).**

2-HCV exposure:

Hepatitis C is a liver disease caused by the hepatitis C virus (HCV): that virus can cause both acute and chronic hepatitis, ranging in severity from a mild illness lasting a few weeks to a serious, lifelong illness. Hepatitis C is a major cause of liver cancer. Antiviral medicines can cure more than 95% of persons with hepatitis C infection, thereby reducing the risk of death from cirrhosis and liver cancer, but access to diagnosis and treatment is low. There is currently no effective vaccine against hepatitis C; however, research in this area is ongoing **(13).**

Hepatitis C virus causes both acute and chronic infection. New HCV infections are usually asymptomatic. Some persons get acute hepatitis which does not lead to a life-threatening disease. Around 30% (15–45%) of infected persons spontaneously clear the virus within 6 months of infection without any treatment. The remaining 70% (55–85%) of persons will develop chronic HCV infection. Of those with chronic HCV infection, the risk of cirrhosis ranges between 15% and 30% within 20 years **(13).**

After a needle stick injury, most people do not have symptoms of hepatitis C, or if they do develop symptoms, they are vague and may resemble a flu-like syndrome. Unlike hepatitis B virus, where less than 6% of adults develop a chronic infection, with hepatitis C more than 75% of adults will develop a chronic infection. About three-quarters of patients will develop acute liver disease, and of these, about 20% will go on to develop

end-stage liver disease or cirrhosis. About 1% to 5% of them will develop hepatocellular cancer over the next 2 to 3 decades. While there is no post-exposure treatment for hepatitis C, there are some newer drugs that have shown promise in preventing the progression of liver damage and lowering the rates of liver cancer (**14).**

Precise estimates of the global prevalence of HCV are difficult to establish because of underdiagnosis, underreporting, and a lack of systematic surveillance in most countries. In 2022, the World Health Organization (WHO) reported that approximately 58 million people had chronic HCV infection, and approximately 1.5 million new infections occurred each year **(15)**.

The burden of chronic HCV infection among each of the WHO geographic regions was estimated at:

- Western Pacific region – 12.7 million (0.6 percent prevalence)
- European region – 11 million (1.2 percent prevalence)
- Eastern Mediterranean region – 10.2 million (1.4 percent prevalence)
- Southeast Asia region – 9.5 million (0.5 percent prevalence)
- African region – 7.8 million (0.7 percent prevalence)
- Americas region – 5.7 million (0.6 percent prevalence) (**16).**

Within these regions, there are differences in the prevalence of HCV by country; for example, prevalence is higher in Eastern Europe compared with Western or Central Europe and is higher in Western Africa compared with Central or Eastern Africa. The four countries with the highest burden of cases are China, Pakistan, India, and Russia because of high overall population, high prevalence, or both. Egypt previously had a very high prevalence related to healthcare-associated transmission, but its national treatment program was associated with a reduction in prevalence to 0.5 percent in 2020 (**16).**

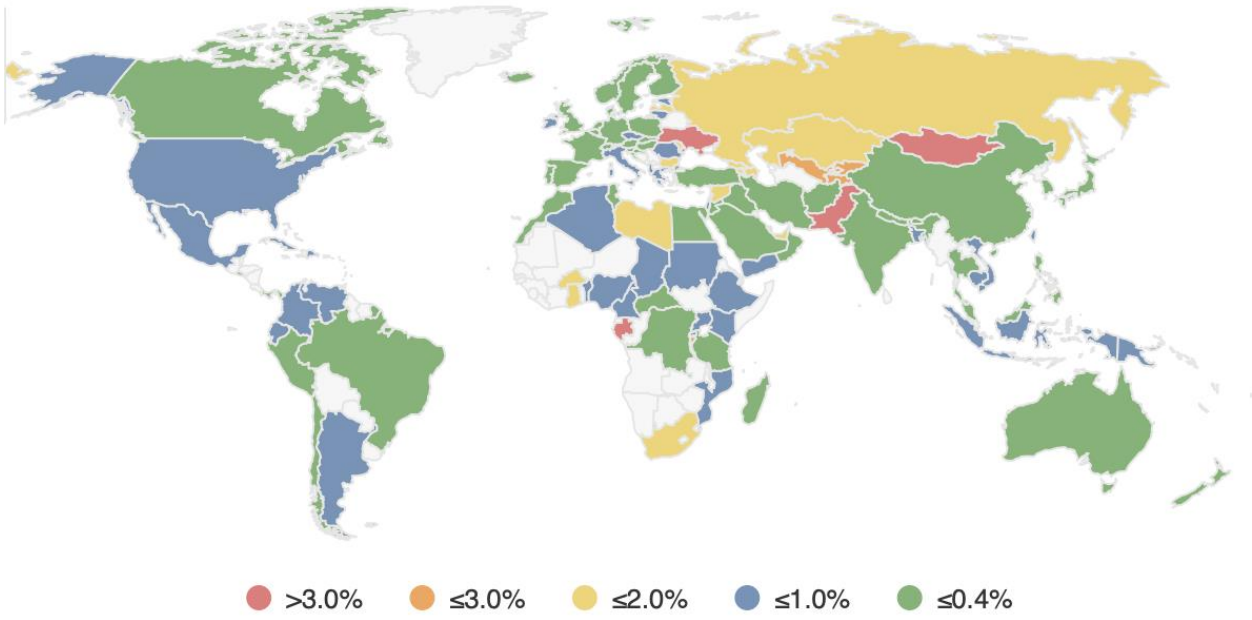

Figure I: Hepatitis C Viremic Prevalence – 2024. **(17**)

Local epidemiological studies in 2008 and 2015 revealed high hepatitis C virus (HCV) prevalence rates, with national estimates ranging from 10% to 15% of the population being seropositive for HCV antibodies and 10% chronically infected (about 6 million people viremic) and accounting for 7.6% of the country's mortality. In rural Egypt, the prevalence of HCV was higher, reaching 24%, which is 10–20 fold higher than in the United States **(18)**.

The HCV incidence rates were estimated at 2.4 per 1000 person-years, with nearly 165,000 new infections annually in 2010. Until 2015, Egypt had the highest prevalence rate of hepatitis C in the world. According to World Bank estimates, more than 1 in 5 Egyptians aged 50–59 had hepatitis C, leading to a decline in productivity by 7.5% among infected people **(19).**

The main cause for the high prevalence of HCV infection in Egypt was the parenteral anti-schistosomal therapy, which was used to treat schistosomiasis from the 1950s to the early 1980s in national mass therapy campaigns, mostly with poorly sterilized reusable glass syringes, thus spreading the infection to a huge cohort. Although this was replaced by oral schistosomal therapy in the 1980s, poor infection control, equipment sterilization, and blood safety procedures in the healthcare setting at the time led to the continued spreading of the disease **(19).**

Egypt had recognized the enormous health, social and economic burden of hepatitis infection, which was the driver to establish national response to fight the disease. It has become clearer that the root causes, as well as catalysts of transmission of HCV and hepatitis B (HBV), are strongly associated with healthcare-related malpractices. There was an ever-growing need to establish a comprehensive Infection Prevention and Control programme in the Egyptian Ministry of Health and Population (MoHP). Such a programme was successfully launched in 2001 and has succeeded in improving adherence to infection prevention and control practices and developing the national infection control guidelines **(20)**

The national treatment program that started in 2014 and the national screening and treatment program of 2018–2019 resulted in the treatment of more than 4 million HCV patients **(18)**.

HCV prevalence is estimated to have decreased from 6% of the population in 2015 to less than 0.5% of the population in 2021 (decrease from 5 million patients to less than 400,000 patients). Egypt achieved all the WHO elimination targets from the diagnosis of more than 90% of its HCV-infected population, offering treatment for more than 90% of them and a cure for more than 95% of them **(13)**.

3-HIV Exposure:

HIV/AIDS is a serious public health problem costing the lives of many people including health care workers. By the end of the year 2002, the world health organization estimated that 42 million people had been infected with the Human Immunodeficiency Viruses. In that year alone, 5 million new infections occurred with 75% of these new infections occurring in sub Saharan Africa. Therefore HIV/AIDS is probably the most serious disease and causes the highest level of anxiety amongst health care workers (HCWs) in many countries **(21).**

The estimated number of people living with HIV/AIDS is 36.7 million worldwide at 2016. In the United States, a critical risk factor for the HIV propagation among young people is the use of drugs before having sex including marijuana, alkyl nitrites ("poppers"), cocaine, and Ecstasy. Other risk factors associated with a risk of acquiring HIV infection include men who have sex with men, unsafe sexual practices, the use of intravenous drugs, and unsafe blood transfusions or blood products, needle stick injury is an important route of transmission among health care workers **(22).**

Since its recognition in 1981, the HIV pandemic has reached every country and nearly all populations throughout the world. The HIV epidemic in the Middle East and North Africa is growing. The estimated 17,000 new infections in 2022 represented a 61 percent increase since 2010. The epidemic in the region is highly concentrated among key populations and their sexual partners. People who inject drugs accounted for 43 percent of new HIV infections in 2022, and homosexuals for another 23 percent **(23).**

Human immunodeficiency virus (HIV) infection and the development of acquired immunodeficiency syndrome (AIDS) pose severe threats to public health across the world. At the end of the year 2021, the Joint United Nations Program on HIV/AIDS (UNAIDS) estimated that the worldwide prevalence of HIV among adults was 0.7%, with 650,000 AIDS-related deaths. Sub-Saharan Africa (SSA) is the region that continues to be the most severely impacted by HIV, with almost 1 in 25 adults living with the virus. SSA accounts for two-thirds of all people living with HIV (PLHIV) in the world; 25.6 million of the 38.4 million PLHIV are based in SSA. It is worth noting that despite a notable decrease in new infections since mid-2010 (new cases reduced by

32%), there were still approximately 1.5 million new infections in 2021, equating to an average of 4,000 new infections per day (**24)**.

Egypt has a low HIV prevalence (< 0.01), however, there is evidence of a concentrated epidemic among two groups: Intravenous drug users and men who have sex with men. Although the estimated number of PLHIV in Egypt is modest, the incidence of HIV infections in Egypt is rising rapidly relative to other Middle East and North African countries, with a 25–30% annual increase in the number of new confirmed cases over the last 10 years **(25)**.

The management of health care personnel (HCP) immediately after a significant exposure to blood or body fluids from HIV-infected patients is critically important in reducing the likelihood of transmission **(26)**.

Several prospective studies on healthcare workers who have suffered occupational HIV exposure have been done. The data reveal that the risk of transmission from a single percutaneous needle stick or cut with a scalpel from an HIV-infected individual is about 0.3% or 3 out of every 1000 healthcare workers. However, there are several other studies that indicate that the risk of HIV actuating after a needle stick injury is a lot higher, especially in individuals who have been exposed to a higher quantity of blood and struck with a large-bore needle. Others who are at a higher risk are when they are exposed to patients with high viral titers or those patients who have just seroconverted at the time of the needle stick injury **(27).**

In addition to blood-borne viral infections, which have traditionally been the major focus of infection prevention efforts, recent data suggest that the incidence of bacterial endocarditis among people who inject drugs increased >12-fold over 5 years (**28)**.

Safe injection techniques can reduce the incidence of infectious endocarditis by over 90%, significantly higher than is achievable with a reduction in injection frequency alone (**28)**. Syringe service programs reduce disease transmission by decreasing the rate of needle and syringe sharing, reducing needle reuse, and the length of time that injection materials are in circulation(**30).**

By introducing organisms from the skin microbiome into the bloodstream, injection drug use can lead to bacterial and fungal infections such as infective endocarditis, epidural abscess, skin and soft tissue infections, osteomyelitis, bacteremia and fungemia, and septic arthritis. The occurrence of these infections is growing, particularly in younger adults, with cases of severe infection increasing and often requiring prolonged treatment and hospitalization (**31, 32)**. The most common organisms include *Staphylococcus aureus* (including methicillin-resistant *S. aureus*), group A *Streptococcus*, and *Candida* species (**33).**

Cellulitis, an acute infection of the dermis and subcutaneous tissues, is a clinical diagnosis when uncomplicated and is treated with antibiotics and supportive measures. It occurs as a result of direct introduction of pathogens into the dermis. Imaging primarily plays a role where a complication of cellulitis, such as a soft tissue abscess or deep venous thrombosis, is suspected. Necrotizing fasciitis is a progressive, rapidly spreading infection of the deep fascia, fat, and muscle with resultant secondary necrosis of subcutaneous soft tissues and carries a significant mortality rate **(34).**

Vascular complications are common in people who inject drugs, can occur locally at the injection site or a distant location, and may be arterial or venous. Vascular complications may manifest as injury to the vessel wall, interruption of blood flow in the lumen with resultant ischemia, or hematogenous spread of a pathogen from the injection site. Arterial complications result from inadvertent and often repeated arterial punctures during attempted venous access and can lead to acute vascular emergencies. Arterial pseudoaneurysms occur when the vessel wall is directly disrupted at the injection site. This leads to the formation of an extravascular hematoma within the surrounding tissues, which retains communication with the artery's lumen **(35).**

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