

Author(s) retain the copyright of this article.

*Full Length Research Paper*

## Dangers of volatile substances abuse (VSA) and HBV as indicators for their incidence in Sudanese homeless persons in Khartoum State

\*Zeinab C. Wek, Deng K. Omar and Manute Al-Bashir

Immunology in Tropical Medicine, Faculty of Medical Laboratory Science, Neelain University, Khartoum, Sudan.

Accepted 18 October, 2015

The prevalence of HBV among VSA homeless individual in Khartoum state is more than in non VSA individual. The aims of this study are: to identify the possible reasons that homeless individuals get into glue sniffing; to estimate the prevalence of viral hepatitis B disease among volatile substances abusers (VSA); to better understand the relationship between viral hepatitis B infections and the bad habits underlying these outcomes; and to estimate the STDs and sexual behaviors among the study population using reflections to questionnaire. A case control study was designed to address these relationships. The study targeted 30 VSA (Case) and 58 normal individuals (Control) in Khartoum state aged 10-17 years. Using a questionnaire, the data were collected and ELISA test for detection of HBV was carried out. The chi square test and odds ratio were used to obtain the statistical results of this research (the significant level (P value is less than 0.05)). The study found that 13.3% of cases and 8.6% of controls were infected by HBV. The relationships between the glue sniffing and the war, the broken family ties and the peer influence were highly significant ( $P < 0.01$ ). However, the relationship between infection with HBV and glue sniffing were insignificant. Nevertheless, the relationship between infection with HBV and surgeries were significant in case group ( $P < 0.05$ ). This study demonstrated that the main reasons for being homeless and get into glue sniffing are war, family break up and peer influence. We also concluded that the risk factors that lead to infection with STDs are common among the study population, leading to consequent outcomes like infection with HBV.

**Key words:** Shamasa street children in Sudan, volatile substances abuse (VSA), hepatitis B virus (HBV).

### INTRODUCTION

Volatile substance abuse (VSA) is the intentional inhalation of substances which give off a vapor or gas at room temperature for their intoxicating effects. The term 'abuse' helps to distinguish accidental inhalation of fumes by legitimate users such as in industrial settings. While the terms 'solvent abuse' or 'inhalant abuse' are widely used, they tend to narrow the range of substances commonly abused. Other colloquial terms include:

'chroming' (abuse of aerosol paints, particularly chrome paints), 'nagging' (abuse of nitrous oxide from whipping cream bulbs), 'huffing' (from the USA, abuse of volatile substances using a bag) (Rose, 2001).

'Volatile substances', also known as 'inhalants', is the term used to refer to a broad range of common products containing volatile substances (such as toluene and hydrocarbons) that produce chemical vapors at room temperature (Sullivan, 2002).

Alternative terminologies in the literature regarding this topic include 'volatile substance misuse VSM', 'solvent sniffing', 'sniffing', 'huffing', 'inhalant abuse' and 'substance abuse'. 'Chroming' is a term used to mean sniffing chrome based paint, and is a specific form of VSM (Sullivan, 2002).

The core features of VSA definitions across the

research literature are intentionality, the desire to alter one's consciousness and the mechanism is by inhaling a volatile substance. Essentially, volatile substance abuse may be considered as such if it involves a deliberate or intentional inhalation of gases or solvents for the sole purpose of achieving mental excitation. Indeed, there has been much research evidence exploring the occupational exposure to volatile substances, especially among medical professionals working with dangerous and toxic solutions, and which falls out with the remit of VSA, but may present an exaggerated view of the amount of work in the area of inhalant effects (Orr et al., 2006).

Across the research literature, there is also conflict in the terms used to describe volatile substance abuse.

These include 'volatile substance abuse', 'solvent abuse' and 'inhalant abuse', all of which are used interchangeably (Orr et al., 2006).

The range of products that could possibly be abused is those containing volatile substances and could be categorized into the following groups: Semi-solids (Glues – contact adhesives, model glue, plastic cement), liquids (Petrol, Thinners, Paint, Cleaning fluids, Industrial solvents / degreasers, Nail polish remover, typist correction fluid), gases(Aerosols (Deodorant, pain relief spray, air freshener, hair spray, cleaning products, insect spray, paint spray, aerosol glue, other aerosols), gas fuels (Lighter fuel refill canisters, bottled domestic gas, cylinder propane gas, other butane gas), anaesthetic gas (e.g. Nitrous oxide).

While some products such as toluene contain an almost pure volatile substance, many others such as glues contain a combination of volatile substances as a component of the whole product (Rose, 2001). There are approximately 250 products available which contain volatile substances; many of them are basic household products. The common characteristic of all these products are that they are usually inhaled to achieve intoxication (Sullivan, 2002). Over 30 products that can

be abused could be found within home premises, all readily available, with legitimate uses. The possible reasons that some people abuse these products could be numerous and complex. The main difference is that young people that have used volatile substances can become affected very quickly and experience disturbing hallucinations. Intoxication wears off rapidly, perhaps within 30 min. Such effects can vary from person to person.

Young people may experience a few times with friends or with someone who has used volatile substances before. A small proportion moves on to more frequent abuse, usually with a group of other users. Often these young people stop after a while and move on to other interests. However, a few, often those with personal, family or social difficulties, may be more vulnerable and develop problematic use.

Problematic use starts to affect the life of the individual and becomes a higher priority than other things in life. The problem user is someone whose life has become very chaotic and centres entirely at VSA and the 'next hit (the next dose) ([www.knowthescore.info](http://www.knowthescore.info)) Volatile substance abuse occurs in association with a number of different situations, each of which requires a range of categorically different interventions: Average' young people who experience VSA, VSA associated with delinquent behaviour and low socio-economic status, VSA in urban and rural communities, petrol inhalation in remote Aboriginal communities, VSA amongst disadvantaged and homeless adults, abuse of anaesthetic gases by professional groups, abuse of amyl and butyl nitrites by those in gay community.

Rather than treating VSA per se, understanding the social context and associated behaviours may provide insights into the provision of more holistic interventions (Rose, 2001). Reasons given by young people for misusing volatile substances varied. They include:

To have fun, for excitement, for intoxication, to be part of the group, to shock adults, to deal with problems, to imitate the behavior of adults using alcohol, as an alternative to alcohol, easy accessibility, cheap and affordable, It's not illegal (Sullivan, 2002).

The executive manager of Sabah society for children care and development (Mr. Khalafalla) stated that the homeless children(shamasa) in Sudan are about one hundred and twenty one thousands (121,000), 42% of them are girls. He also stated that the study done by the alliance of Swedish, British, American, Unicef, (Waxfam) of save the children and the Sudanese national council for the child care, revealed that the number of homeless girls is about 15%, 10% of them are partially homeless. However, he insisted that the number of girls is ever increasing, but cannot be compared to the boys, because of the Sudanese traditions that give more shelter to the girls. Mr. Khalafalla summarized the causes of the problem as follows:- Ever growing of poverty, break down of the family link by wars, divorce and multi marriages. All

---

\*Corresponding author. E-mail: zeinab.wek3@yahoo.com

**Abbreviations:** **bDNA**, branched DNA assay; **CMV**, cytomegalovirus; **DNA**, deoxyribonucleic acid; **EIA**, enzyme immunoassay; **ELISA**, enzyme linked immuno sorbent assay; **HAV**, hepatitis A virus; **HBcAg**, hepatitis B core antigen; **HBsAg**, hepatitis B surface antigen; **HBeAg**, hepatitis B e antigen; **HBV**, hepatitis B virus; **HCV**, hepatitis C virus; **HIV**, human immunodeficiency virus; **IgM**, immunoglobulin M; **NANB**, non- A/ non- B hepatitis; **IgG**, immunoglobulin G; **PCR**, polymerase chain reaction; **Q-PCR**, quantitative PCR; **RNA**, ribonucleic acid; **RT-PCR**, reverse transcription polymerase chain reaction; **SSD**, Sudden snuffing death; **STDs**, sexually transmitted diseases; **VSA**, volatile substance abuse; **VSM**, volatile substance misuse.

the aforementioned factors, especially the shortage of money and loss of one of the parents or both leads the children to compensate for this by VSA (Akhirlahza issue 848 Wednesday, 17-12-2008 page 11.)

## Hepatitis

Hepatitis simply means an inflammation of the liver without pinpointing a specific cause. Someone with hepatitis may:

1. Have one of several disorders, including viral or bacterial infection of the liver.
2. Have a liver injury caused by a toxin (poison).
2. Have liver damage caused by interruption of the organ's normal blood supply.
3. Always experience an attack by his or her own immune system through an autoimmune disorder.
4. Have experienced trauma to the abdomen in the area of the liver.

Hepatitis is most commonly caused by one of three viruses:

1. The hepatitis A virus.
2. The hepatitis B virus.
3. The hepatitis C virus.

In some rare cases, the Epstein Barr Virus (which causes mononucleosis) can also result in hepatitis because it can cause inflammation of the liver. Other viruses and bacteria that can also cause hepatitis include hepatitis D and E, chickenpox, and cytomegalovirus (CMV) ([http://kids.org/parent/infection/bacterial\\_viral/hepatitis.html](http://kids.org/parent/infection/bacterial_viral/hepatitis.html)).

## Mode of transmission of viral hepatitis

### **The routes of HBV transmission:**

Sexual, percutaneous (Intravenous Drug Use), perinatal, horizontal, transfusion, nosocomial infection (including needle-stick injury), organ transplantation.

## Hepatitis B Virus

This is a complex virus which is very different from HAV. The complete hepatitis B virus is a double stranded DNA spherical particle with a double shell. It measures about 42 nm in diameter. The double shelled particle was discovered by Dane and colleagues in 1970 and is often referred to as the Dane particle.

Antigens which have so far been associated with HBV are as follows:

1. Hepatitis B surface antigen (HBsAg) which is contained in the outer shell of virus.

2. Hepatitis B core antigen (HBcAg).
3. Hepatitis B e antigen (HBeAg).

## **Transmission and pathogenicity**

Infection with HBV is by entry of the virus through the skin or mucous membranes into the blood or body fluids. The general clinical features of viral hepatitis vary from a mild illness without jaundice with little liver cell damage, to acute hepatitis with jaundice and severe liver damage. Hepatitis caused by HBV is often more severe and can lead to chronic hepatitis (about 10% of patients) or post hepatic cirrhosis (Cheesbrough, 1984).

## **Lab diagnosis of HBV**

Since the clinical symptoms of HBV infection are indistinguishable from other forms of viral hepatitis, definitive diagnosis is dependent on serologic testing for HBV infection. A variety of tests are available to make the diagnosis of HBV infection possible.

Acute HBV infection is characterized by the presence of HBsAg in serum and the development of IgM class antibody (IgM anti-HBc). Detection of HBsAg has evolved from immunodiffusion methods to reversed passive hemagglutination assays and to the more sensitive enzyme immunoassays and radioimmunoassays, which can detect HBsAg at concentrations of \$0.1 ng/ml. HBeAg is also detectable during acute infection. During convalescence, HBsAg and HBeAg are cleared, and anti-HBs, anti-HBc, and anti-HBe develop. Anti-HBs is a protective antibody that neutralizes the virus. The presence of anti-HBs following acute infection indicates recovery and immunity from reinfection.

Anti-HBs is also detected among persons who have received hepatitis B vaccine. Immunoassays for the detection of total anti-HBc involve both IgM and IgG class antibody to the core protein and indicate current or past exposure to virus and viral replication. IgG anti-HBc appears shortly after HBsAg among persons with acute disease and generally persists for life; therefore, total anti-HBc is not a good marker for persons with acute disease. The detection of IgM anti-HBc is diagnostic of acute HBV infection.

In persons with chronic HBV infection, HBsAg remains persistently detectable, generally for life. HBeAg is variably present, and IgM anti-HBc generally becomes undetectable 6 months after acute infection.

Detection of HBV DNA has limited usefulness for diagnostic purposes. HBV DNA is detectable in the serum of persons with acute and chronic HBV infection. Most slot or dot blot hybridization assays can detect HBV DNA levels as low as 5 pg/ml, which corresponds to 1.5 3 106 genomes per ml. A commercial liquid hybridization assay (Abbott) detects 1.5 pg of HBV DNA per ml (4.0 3 105 genomes per ml), and the branched-DNA hybridization assay detects 2.5 pg of HBV DNA per ml.

PCR is much more sensitive than direct hybridization and detects HBV DNA levels of 1023 pg/ml (approximately 100 to 1,000 genomes); however, PCR assays are prone to false-positive results.

The clinical significance of detecting HBV DNA by hybridization and by PCR is quite different. Generally, detection by PCR has the same significance as detection of HBsAg and indicates current HBV infection. In contrast, detection by hybridization indicates significant viral replication and a high probability of active liver disease (similar to HBeAg). Monitoring HBV DNA levels is useful in determining the response of chronic HBV infection to treatment. Nucleic acid sequence analysis has been used to identify genetic variants of the virus and to investigate common-source outbreaks of HBV infection (Mahoney, 1999).

## MATERIALS AND METHODS

### Study population

A group of thirty Sudanese individuals (both sex) aged between 10 and 17 years, who are volatile substances abuser (VSA) in Khartoum state were assigned as cases. Control group were fifty eight Sudanese individuals (both sex) matched with the cases in terms of age, socioeconomic status and ethnic background, but they were not volatile substances abuse (VSA) in Khartoum state.

### Study design

Case control study was designed to collect data using a questionnaire. Blood samples from VSA, and control subjects in community and the blood bank of Khartoum hospital.

### Ethical consideration

The data of questionnaire and blood samples of the cases included in this study were officially collected with the help of the governmental and health authorities of all partners of this study (case and control). All participants were informed about the purpose and willingly agreed to participate.

### Data and sample collection

The data were collected in a questionnaire and designed to obtain general information about the VSA and the control subjects (name, age, race, etc), the substances abused and the reasons that lead to be VSA, the others substances used by VSA and control subjects (cigarette, tobacco, etc), the habits that leads to transmission of viral hepatitis B, and also to investigate the possibility that VSA individuals revert to begin a new life. Using 5 ml syringes, cotton soaked in 70% alcohol and a tourniquet,

the samples of blood (3cc or more) were collected from VSA, and control subjects in a plain container for later separation of serum, serum samples are kept deeply frozen until the moment of the analysis.

### Data and sample analysis

All data were subjected to analysis by SPSS using chi square test, relative risk and / or odds ratio (the null hypothesis was used the significant level is less than 0.05).

All samples were subjected to an immunological test (ELISA test) for hepatitis B virus.

### **ELISA test for the detection of hepatitis B surface antigen (HBsAg) in human serum or plasma in clinical laboratories**

#### *Principle*

Bioelisa HBsAg 3.0 is a direct immunoenzymatic method of the «sandwich» type in which guinea pig anti-HBs antibodies coated to microplate wells act as the capture antibody and goat anti-HBs antibodies marked with peroxidase serve as conjugate antibodies. The sample to be analyzed is incubated in one of the antibody-coated wells. If the sample contains HBsAg, the antigen will bind to the antibody on the plate. After washing to eliminate any unbound material, goat anti-HBs conjugate to peroxidase is added to the well and allowed to react with the antigen-antibody complex formed in the first incubation. After a second incubation and subsequent washing, an enzyme substrate containing a chromogen is added. The substrate will develop a blue colour if the sample is positive for HBsAg. The blue colour changes to yellow after blocking the reaction with sulphuric acid. The intensity of the colour is proportional to the amount of HBsAg in the test specimens.

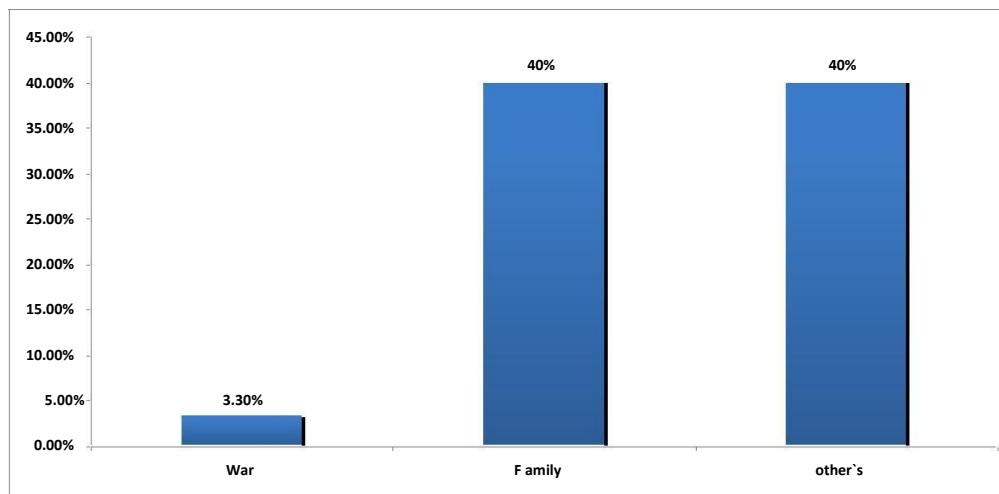
## RESULTS

The majority of both group (case and control) were males 76.7% in case group and 81% in control group, most cases and controls are from center of Sudan (63.3 and 51.7%, respectively). According to the statistical analysis using chi square test and odds ratio, the obtained results showed that this case control study covered individuals in the age group of 10 to 17 years (case and control). As shown in Table 1, 66.7% of the case group were glue sniffing, while all members of control group were not sniffing glue. The majority of the VSA started using glue due to family problems and also due to other reasons (sniffing with friends) and this is shown in Figure 1.

The relationship between the glue sniffing and the wars, family and peers influence were highly significant ( $P < 0.001$ ). The study showed that 43.3% of the case group use cigarette and 36.2% of control group use

**Table 1.** Distribution of glue sniffing.

Status		Frequency	Percent
Case	Glue sniffing	20	66.7
	Not use	10	33.3
	Total	30	100
Control	Not use	58	100

**Figure 1.** Reasons for using glue.

cigarette, 56.7% of case group were tobacco users and 20.7% of control group use tobacco, 46.7% of case group were alcohol users and 6.9% of control group use alcohol, 10% of case group were drug users and only 1.7% of control group were so. Watching of dissoluteness video among case group is high (60%) as it compared with control group (8.6%). The majority of individuals in case (86.7%) and control group (96.6%) were not using any sharpened equipments with others. Those who have been operated in the case group (73.3%) were more than those in control group (20.7%). About 63.3% of the glue sniffing users consider it as a bad habit, most of them (56.7%) expressed their willingness to quit glue sniffing habit and are ready to go back to normal ( $P > 0.001$ ). These are shown in Figure 2.

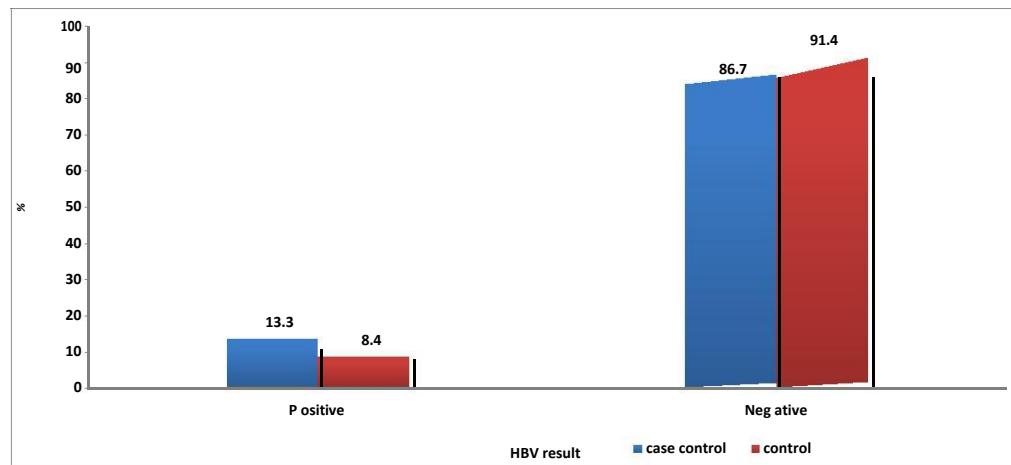
The relationship between the infection with HBV watching and imitation of dissoluteness video were insignificant in both groups case and control ( $P$ .value  $>0.05$ ). The relationship between infection with HBV and sharing the use of sharpened equipments were found to be insignificant in both groups case and control ( $P >0.05$ ), and also the relationship between infection with HBV and surgeries were significant in case group ( $P <0.05$ ) while it were insignificant in control group ( $P >0.05$ ).

## DISCUSSION

The present study addresses one of the important issues

that has both health and social impacts among vital sectors of the community. The findings obtained from questionnaire targeted thirty Sudanese street individuals and fifty eight normal Sudanese individuals. The findings showed that there is a significant relationship between the glue sniffing and war, break of family link and other related reasons like peer influence and using VSA. This agrees with the findings of Rai et al as cited in Nepal (2002) that about 51.7% of street children are using dendrites and about 36% of the street children left home due to domestic violence, and 14% were due to peer pressure.

This study covered VSA individuals in the age group 10 - 17 years, 66.7% of them belonged to 10- 17 age groups, and 76.7% of VSA are males. This again is in agreement with Rai et al. (2002) where they found that about 88.2% of glue sniffing individuals belong to 10-16 age groups. This present study found that about 63.3% of glue sniffing individuals admitted that it is a bad habit; about 56.7% of glue sniffing individuals showed their readiness to quit and go back to normal. This willingness to revert to normal seemed highly significant ( $P < 0.05$ ). 16.7% of the case group seemed to have started glue sniffing less than one year ago, 10% of them only one year, and 36.7% have been using VSA for more than two years. This is in accordance with Rai et al. (2002) where they found that 19.7% started sniffing 2 years ago, 34.4% started sniffing 1 year ago, and 27.9% started sniffing



**Figure 2.** Distribution of HBV infection.

only one month ago. This study also found that 43.3% of cases regularly smoke, 56.7% are using tobacco and 46.7% are taking alcohol, this again agrees with Rai et al. (2002) where they found that about 73% of street children are taking cigarette, 19% are taking tobacco and 31% are taking alcohol.

About 60% of cases in our study population used to watch the dissoluteness video and about 60% of them imitate what they saw, this agrees with Joseph et al. (1999) where they proved that people who abuse alcohol or use drugs may have personalities more prone to taking risks, and making them more likely to go into sexual activities without any precautions, this will most likely attract STD including HIV and hepatitis. Among a sample of gay and bisexual men, having a "sensation-seeking" personality was the strongest indicator of having multiple sexual partners and using alcohol and drugs before engaging in sex. This present study found that 13.3% of case and 8.6% of control are infected by HBV; these findings disagree with Qirbi and Hall (2001) where they reported in a study targeting the Middle East region that the prevalence of HBs Ag ranged from 16 to 20% in Sudan.

Based on the prevalence of HBV chronic carriers (individuals positive for hepatitis B surface antigen, HBsAg) amongst adults in the general population, countries are classified as having low endemicity (< 2%), intermediate endemicity (2%–5%), or high endemicity (> 5%) of infection (Qirbi and Hall, 2001). According to this classification the prevalence of HBV infection among partners is considered to be highly endemic (> 5%).

This study also found that there is no significant association between infections with HBV and glue sniffing ( $P > 0.05$ ), this agrees with Omer and Ezzat (1999) where they found that the relationship between HBsAg positive and substances abuser is not significant. The relationship between HBV infection and three of the four investigated risk factors in this study did not show significant associa-

tion in both case and control groups, as it shows significance in case group when taking surgery as a risk factor. When analyzing the data using the odds ratio, this study proved that in both groups, there is a significant association between watching of dissoluteness video and HBV infection. There is also an association between using sharpened equipments with others and HBV infection. As such, these findings agrees with what was reported by Abou et al. (2009), where they found that unprotected sexual activities (20%) was the most apparent predisposing risk factor for both HBV and HCV seroreactors, followed by razor sharing (13.3%), parenteral drug injections (10%), tattooing and surgical procedures (3.3%) for each.

## Conclusion

From this study, it can be said that the main reasons for Sudanese homeless individuals to get into glue sniffing are war, family and friends influence. We also conclude that the risk factors that lead to infection with STDs are common among the study population, and also the infection with HBV was very high among them. The majority of glue sniffing individuals has readiness to quit and go back from this habit if they found a better and decent life.

## RECOMMENDATION

1. Based on the findings, we urge provision of care, social, and health support to this lost sector of the community.
2. Solving conflicts that lead to civil unrest, strengthen family ties will greatly help to provide better living conditions and avoid these kind of phenomena.
3. Increase the awareness among these target groups in order to minimize the bad peer influence and different bad behavior and conducts.

4. Raise the awareness about the devastating consequences of illegal sexual behavior.

## REFERENCES

- Rose J (2001). Volatile Substance Abuse Background Paper, WA Solvents Abuse Working Party Department of Health & Drug Alcohol Office, This publication is available online at <http://www.dao.health.wa.gov.au>.
- Sullivan R (2002)., Volatile Substance Misuse in Queensland, Commission for Children and Young People.
- Orr K, Shewan D (2006). Substance Misuse Research: Review of Evidence Relating to Volatile Substance Abuse in Scotland, Scottish Executive Substance Misuse Research Programme, Glasgow Caledonian University.  
[www.knowthescore.info](http://www.knowthescore.info).
- Akhirlahza (17-12-2008) issue 848 Wednesday, page 11.,  
[http://kidshealth.org/parent/infection/bacterial\\_viral/hepatitis.html](http://kidshealth.org/parent/infection/bacterial_viral/hepatitis.html)
- Cheesbrough M (1984). Medical Laboratory Manual for Tropical Countries, Volume II: Microbiology.
- Mahoney FJ (1999). Update on Diagnosis, Management, and Prevention of Hepatitis B Virus Infection, Office of the Director, National Centers for Infectious Diseases, Centers for Disease Control and Prevention, U.S. Naval Medical Research Unit no. 3, Cairo, Egypt. Clin. Microbiol. Rev., 12(2): 351-366.
- Rai A, Ghimire K, Shrestha P, Tuladhar S (2002). Glue Sniffing among street children In the Kathmandu valley, Child Workers in Nepal Concerned Centre.
- Joseph AC, Kenneth I, Chenault, Dimon J, Fisher M, Douglas AF, Kelmenson L, Donald RK, David AK, LaSalle D, Leffall, Manuel TP, Joseph JP, Reagan N, E. John R, George R, Michael PS, Luis WS, Michael AW (1999). Dangerous Liaisons: Substance Abuse and Sex, December (1999).
- Qirbi N, Hall A (2001). Epidemiology of hepatitis B virus infection in the Middle East. Eastern Mediterr. Health J., 7( 6): 1034-1045.
- Omer A, Ezzat B (1999). Volatile Substance Abuse: Experience from Al Amal Hospital, Jeddah.
- Abou M, Eltahir Y, Ali A (2009) Seroprevalence of Hepatitis B virus and Hepatitis C virus among blood donors in Nyala, South Dar Fur, Sudan. Virol. J., Volume 6.