Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Disease

journal homepage:www.elsevier.com/locate/apjtd

Document heading doi:10.1016/S2222-1808(11)60057-1

Dangers of injections overuse in developing countries with a high HIV/AIDS prevalence: a review on HIV risk hazards, traumatic effects and other blood borne infections

Nsimba SED[1*], Gesase AP[1], Massele AY[2]

[1]*The University of Dodoma, College of Health and Allied Sciences, School of Medicine and Nursing, P. O. Box 259, Dodoma, Tanzania, East Africa*
[2]*The University of Botswana, College of Medicine, Botswana, Southern Africa*

ARTICLE INFO

Article history:
Received 20 February 2011
Received in revised form 29 April 2011
Accepted 18 May 2011
Available online 1 June 2011

Keywords:
Injections
Sterile
Unclean
Needles
Syringes
HIV/AIDS
Health care providers
Facilities
Clients
Patients
Consumers
Drug injectors
Traditional healers/practitioners
Developing countries and Tanzania

ABSTRACT

Use of injections is commonly practiced in both developed and developing countries. However, in developing countries like Tanzania, both public and private health care providers prescribe and administer injections to clients/patients. The private sector in developing countries is on the leading side for several reasons and becomes the main one being economic or financial gains through charging patients who demand or request or need an injection. Injections in Tanzania are believed by clients/patients or consumers to work fast or better or more effective than oral medications/tablets. This belief is based on the pharmacological advantage of the pharmacokinetics and pharmacodynamics of injectables versus oral medications/tablets. Despite the curative advantage injections have in a human body, these injections must be administered by qualified personnel in our health facilities applying both aseptic and sterile techniques in order to minimize/prevent trauma which may lead to paralysis after damaging sciatic nerve to gluteal muscle, nerve to deltoid muscle, continuous bleeding in individuals with bleeding disorders such as haemophilia, or thrombocytopenia, and spread of infections such as HIV, hepatitis B, C, poliomyelitis, osteomyelitis and other abscesses. Thus, there is a need to institute educational interventions targeting all the three levels *i.e.* health care providers (clinicians and nurses) in public and private facilities, clients/patients or consumers of care who attend in these facilities and not forgetting injection drug users and traditional healers/practitioners from the informal health sector in our society.

1. Introduction

Injection is often and most frequently used in medical procedures and can be defined as a skin piercing procedure which is performed during administration of a drug into the body for prophylaxis, curative or recreational purposes. The World Health Organisation (WHO) reports that 12 billion injections are given annually globally and 5% are administered for immunization and 95% for curative purposes[1].

Unsafe injection practices especially needle and syringe re-use are commonplace in developing countries and expose both staff and patients at risk of infection with blood borne diseases. It is further estimated that up to 180 000 human immunodeficiency virus (HIV), 16 million hepatitis B and 4.7 million hepatitis C infections annually are probably caused by these malpractices. These problems are complex as they are fuelled by a mixture of both socio-cultural, economic and structural factors.

The use of clean, sterile disposable needles and syringes for injections is widely advocated especially in Sub-Saharan Africa where the prevalence of HIV/AIDS is high[2]. Unsafe injections have been reported to significantly fuel the spread of HIV/AIDS, hepatitis B, C and other infections like osteomyelitis, and abscesses[3-5]. Apart from patients/

*Corresponding author: Nsimba SED, The University of Dodoma (UDOM), College of Health and Allied Sciences, School of Medicine and Nursing, P. O. Box 259, Dodoma, Tanzania, East Africa.
Tel: 255-713-318113/255-786-318113/0758-539287/255-26-2310001/3
Fax: 255-26-2310011
E-mail: nsimbastephen@yahoo.co.uk

clients or consumers of health care and injection drug users being at risk of contacting HIV and other infections through the use of unsterile needles and syringes, health care providers/workers as well stand an equal chance of getting infected with HIV/AIDS from accidental contaminated needle sticks/pricks[2].

Irrational injection prescribing and administration can result in some of these dangerous consequences. The WHO estimates that globally, more than 16 billion injections are prescribed and administered annually and among these about 20%-50% are reported to be unsafe ones[6]. Furthermore, it has been reported that in developing countries 50% of the injections prescribed and administered to patients/clients or consumers annually are unsafe[7].

Global efforts are in place in most developed and developing countries. All these efforts aim at reducing the number of unsafe injections prescribed and administered to patients at the same time educating / training health workers to take care of themselves when handling needles, syringes and other sharp objects. This will help them to avoid accidental needle stick/pricks during drug administration or when they have been used by patients including proper disposal after use. Furthermore, health workers should take extra care or refrain from administering injections when they have skin cuts or injuries or any kind of skin puncture as this measure might help them from contamination and getting infected during and after unsafe injection administration.

Most of these global efforts have been directed to formal health facilities, whereas, the informal sector have been left unattended or very little attention have been paid to. Some of these global initiatives focusing primarily on the formal health sector include Safe Injection Global Network (SIGN) which works under the WHO. Another initiative is the Injection Safety Programme within the Global Alliance for Vaccine and Immunization (GAVI) and through HIV prevention efforts under the US President's Emergency Plan for AIDS Relief (PEPFAR). So most of these efforts which have been employed in developing countries like Tanzania are mainly interventions aiming at reducing HIV transmission related to unsafe injection prescribed and administered in formal health care facilities (public and private).

2. An overview situation of injection use in Tanzania

Many forms of irrational prescribing and administration of injections have been reported in Tanzania health care facilities (public and private/church owned) where various forms of irrational use of drugs were seen[4,5,8,10]. These same studies also commented that irrational oversuse of injections was a problem in these facilities and could encourage the spread of HIV, hepatitis B, C and infections like osteomyelitis and poliomyelitis[4,5,8]. Despite the curative advantage injections have in a human body, these injections must be administered by qualified personnel in our health facilities applying both aseptic, sterile techniques and knowing properly the anatomical structures and innervations at the site to be injected in order to minimize/prevent infections/blood borne infections[9], and other traumatic effects or injuries caused by needles which are likely to cause paralysis to the patient after damaging or puncturing the sciatic nerve innervating the gluteal muscles and the nerve innervating the deltoid muscles. There will be even more dangerous when an injection is given unknowingly to patients who have bleeding disorders (such as haemophilia or thrombocytopenia). Their consequence may have fatal outcomes like death if no proper immediate interventions are taken as the individual may bleed to death. In such situations, injections or hepatoma herpes virus vaccines should be avoided in haemophilics and thrombocytopenics and those people taking anticoagulants (blood thinners). This can be avoided or prevented through proper history taking from these individuals.

The demand and use of injections in Tanzania come from two schools of thoughts. One is the patient/client or consumer driven motives as some believe that injections work fast or better than oral medications, so they usually request or demand them to be prescribed and administered by clinicians/nurses[4,5,10-12]. The same people/patients even if the clinicians refuses prescribing for them injections, can still get or buy them from drug shops/stores (informal sectors) with or without a doctor's prescription and get injected somewhere else in households by a qualified or untrained health personnel. The second thought is the prescribers/clinicians driven motives especially in the private health care facilities as they gain some money from additional charging of the clients/patients when they prescribe and administer injections on request or without request from patients[1,5,10,13]. A similar report is that additional fee is charged for injection administration from private facilities in Uganda[14]. Thus, it is this vicious circle which keeps the injections practice on going in most developing countries[15].

Overuse of injections in most of our health care facilities at all levels (*i.e.* primary, secondary, and tertiary levels) in Tanzania predominantly involves clinicians/prescribers[4,5,10], and in India for example the same cadres have been reported to over-prescribe injections[16]. As stated above on the risks facing both patients and health care workers related to unsafe injection safety practices in Tanzania, reports show that about 9 needle stick or prick injuries per worker occur annually[17]. Furthermore, reports show that about 10-20 injections are prescribed and administered annually per child in paediatric wards in the country[18]. It has also been reported that one in every four patients in our health care facilities-outpatient departments receives an injection and that more than 70% of these injections could be avoided by use of oral medications or in other words these injections prescribed and administered were unnecessary[4,10,15]. Other researchers have suggested that unsafe injection use practices are major concern in Tanzania since they have a direct association with the spread of HIV and other infections[5,19,20].

3. An overview situation in developing countries on injection use

Unsafe injection practice accompanied with popular but sometimes unnecessary prescribing and use of injections in developing countries is a complex public health problem that adds to the burden of HIV, hepatitis B, C and other infections like poliomyelitis, and osteomyelitis[1,4,5,10].

Re-usable needles and glass syringes have been replaced by disposable plastic sterile needles and syringes for each and every injection in an effort to prevent and reduce the spread of HIV and other blood borne infections[2,5,9,11]. Infection control policies, guidelines and practices to increase injection safety of patients and health workers have not widely been implemented and evaluated in most developing countries. Thus, the risk of injection due to unsafe use of injections in developing countries is extremely high[5,6,9,11,21].

In most developing countries, unsafe injections are common practices and these practices place both health care providers and their patients at risk of contacting and spreading HIV and other infections[5,6,9,11,21]. However, patients are always at risk because both single use disposable and re-usable needles and syringes are often re-used. In addition, quite often methods employed to clean and sterlize them before re-use for other patients are usually incomplete or sub-optimal. As a result, both patients and health workers stand at greater risk of acquiring and transmitting infections and more in particular health workers as they handle used injecting equipments in order to clean, sterilize them before re-use for next patients or while disposing them after use[1,5,9,11]. Unsafe disposal of needles and syringes is another major problem in developing countries as facilities lack proper incinerators and this contributes to more risk of infection and environmental degradation as there is no easy way or solution to this.

4. An overview in developed countries of injection use

The unsafe injection practices rarely occur in developed countries but are more common or major public health problems in developing countries. Therapeutic injections in developed countries are always prescribed and administered by qualified trained health workers. Furthermore, occupation safety and sterilization measures are in place including availability of incinerators, infection control guidelines, monitoring and evaluation done on regular basis.

In contrast, the administration of injection in these developing countries takes place in various forms and involves a range of health care providers such as formal (public and private), informal sector such as untrained providers (not institutionalized/unauthorized), traditional healers/practitioners and households/domestic where a relative or a neighbour may administer injections with or with no payment involved[5,22].

Unsafe injection may be defined as "one in which the syringe, needle or both have been re-used without sterilization"[1,11]. Unsafe injections have been reported from several developing countries such as Tanzania[5,8,23], Uganda[14], Zambia[24], Burkina Faso, Senegal and Cote-d'Voire[3], Nigeria[25], Egypt[26,27], Sudan[28], Libya[29], India[30], Pakistan[31], Indonesia[32,33], Nepal[34] and Taiwan[35].

Use of unsafe injection puts not only patients at risk of HIV and other blood borne infections, but also subjected to pain and other traumatic harmful effects such as injury to the sciatic nerve which can lead to paralysis. However, all health workers are then often more exposed to blood borne materials in their course of work and commonly suffer from needle prick/stick injuries if HIV/AIDS is prevalent in their working place and infection control standards are poor[4,5,9-11].

However, occupational safety hazard of health worker in developed countries is a high priority while it is a neglected issue in most developing countries and no compensations are in place[36,37]. Here there is a big problem related to injection use as most unsafe injections can cause or are likely to pass without notice as they are rarely linked to symptoms at the time of infection, or some symptoms may be non-specific. Another problem is the long incubation period from the time of getting an infected needle stick/prick or getting unsafe injection to the development of sequelae (*e.g.* AIDS, liver cirrhosis, *etc*). Thus, the association is not likely to be made especially in developing countries where injections are so commonly preferred and used very often[1,5,11].

5. Global problems related to injecting drug users and HIV/AIDS

Millions of people worldwide are injecting drug users, and blood transfer through the sharing of drug taking equipment, particularly infected needles, is an extremely effective way of transmitting HIV[2,4,5,38,39]. Around 30% of global HIV infections outside of sub-Saharan Africa are caused by the use of injecting drugs, and it accounts for an ever growing proportion of those living with the virus[6,9,11,40]. However, it is also questioned whether supervised injecting facilities put in place officially can attract higher injecting drug users for this service[41,42].

The illegal nature of injection drug use can also create barriers to accessing adequate treatment and prevention services can make injecting drug users more vulnerable to HIV and its effects[40,43]. The crossover with prostitution further means they are in positions to transmit the virus between other at-risk populations[38-40]. Thus, proper and effective multifaceted interventions are needed for targeting this vulnerable population whom seem to be neglected especially in most developing countries. It may be because of financial constraints facing these countries.

People take drugs, both legal and illegal, for a variety of reasons that differs from person to person and from drug to drug. Individuals may enjoy the sense of detachment or euphoria that drugs create, their relaxing or energy-inducing properties, the heightened alertness or sensitivity they produce, and their medicinal qualities. Peer pressure or habit may be other reasons, and if they are chemically dependent, addicts will feel they cannot operate without them. These reasons depend on an individual's own

background and socio-economic circumstances. Drugs can be taken in a variety of ways including drinking, smoking, snorting and rubbing, but it is the injection of drugs that creates the biggest risk of HIV transmission[39,40].

The most commonly injected drugs are heroin and other opiates, cocaine and amphetamines, and the prevalence of each is likely to vary according to location and population group. Though heroin is the most common injecting drug in most Western European nations, in France it is buprenorphine[44-47]. In South Korea it is methamphetamine, and across Latin America, with the exception of Mexico, cocaine is the most prevalent injected drug[39,40,43,46].

6. Anti-retroviral (ARV) treatment for drug users

Access to anti-HIV treatment for drug users is surrounded by controversy and stigma in most parts of the world[48-50], with many governments favouring policies that require absolute abstinence from illegal drug use before ARV treatment is provided[47]. There are questions over whether heroin and cocaine/crack users will respond to treatment as well as other patients with studies both affirming and contradicting this view.

The second problem is that drug users face the interaction between recreational drugs and ARV drugs. Recreational drugs can either speed up or slow activity of the liver which break down ARV drugs. This means the HIV suppressing effect of ARV treatment can be exhausted sooner than expected or will not work as rapidly as possible. Unknown impurities in illegal drugs may also interfere with the efficacy of the treatment. Furthermore, injecting drug users and other users of illicit substances including alcohol and tobacco smokers[44-46,50], who are not likely to follow the prescribed dosage schedule of their daily drug intake. Consequently the majority are likely to skip their daily doses[47-49]. This practice not only renders the drug ineffective but also delays and promotes emergence of drug resistance to first line ARVs[48,49].

With injecting drug use accounting for a very significant proportion of people living with HIV, the overwhelming majority in some regions, harm reduction measures including needle exchange schemes, should be implemented widely and sufficiently. Furthermore, stigma and discrimination against drug users need to be tackled so they can gain access to treatment and reduce the risk of being exposed to HIV[9,11,47,48]. This would also lessen the chance of transmitting HIV to other population groups through the overlap with sex work and unsafe sex in general[39,40].

7. Problems facing health workers in developing countries on the issue of unsafe injections

Health workers in developing countries are both professionally and geographically isolated and this becomes difficult for them to learn updated information about safe injection practices. There are problems or lack of accessing educational materials and other ongoing opportunities for their professional development. Furthermore, the health structures in place does not allow effective implementation, monitoring and evaluation of injection practices. Inadequate financial budgets/resources affects capacity to purchase and maintain adequate supplies of injecting equipments and other effective sterilizing equipments (*e.g.* autoclaves).

In developing countries certain infection control committees, quality assurance systems and other necessary structures are missing/non-existent. In addition, safety standards, patients rights are usually missing or not followed in some health care facilities. Other environmental factors necessary for injection safety such as adequate and reliable water supply and electricity, are not always available in most of our remote rural settings and in most towns or cities in these developing countries, frequent power cuts/interruptions or rationing is the order of the day for example in Tanzania. Thus, you can not expect to achieve optimal sterilization standards in such situations.

It is also obvious that in many developing countries there are wide range of injectable medications over the counter or in the black market which are injected by relatives, friends, neighbours or informal health care providers using unsterile needles and syringes that are often used for more than one patient for example sharing of needles and syringes as commonly practiced by injection drug users[13,14,35].

These practices often facilitate the inappropriate use of medications purchased without doctor's prescription/advice, administered by untrained personnel[10,12,51], and using needles and syringes not properly cleaned/sterilized between users. In fact these needles and syringes are supposed to be used only once for one patient and straight away be disposed off immediately if we are to continue with measures aimed at preventing HIV and other blood borne infections[4,5,9,11]. However, any preventive measures aimed at improving safe injections practices must take into consideration an understanding of the socio-cultural barriers, norms, values and beliefs surrounding those particular individuals to be targeted[52].

8. Promotion of injection safety in developing countries

Few interventions have been undertaken to improve injection safety in Tanzania[4,5,24], Indonesia[34], and Burkina Faso[52]. However, yet no best ways forward have been found or suggested. Injection safety can be improved by switching mind-set of health care providers that patients want injections all the time as this can reduce the numbers of inappropriate injections prescribed and administered including improving sterility of injections and or their injecting equipments[44,53,54].

Thus, planned interventions should target patients beliefs that injections are better or work fast and are efficacious than oral medications and if they comply with this idea, it would reduce so much their demands to be prescribed unnecessary injections[4,5,9,11]. Furthermore, interventions should target health workers with the aim of reducing and improving prescribing practices of injections as well as improving the standards required for injection

administration[44,53,54]. In this case patients have the right and freedom to ask and know about the sterility of injecting equipments being used for them and their associated risk of unsafe injections so that they become more informed as health care consumers.

It is quite possible that by promoting and raising community awareness about injection safety issues, this could result in a decreased demand for injectable medications and an increase in demand for clean and sterile disposable needles and syringes[44,54]. However, it may be argued that both patients and health workers have to establish a sense of mutual trust because it is difficult for illiterate patients to make a distinction between appropriate and inappropriate prescription of injections. Judging whether equipments are sterile or have not been adequately sterilized remains a dilemma to establish this fact.

Thus, in most cases patients tend to believe or trust and comply with what health care providers advise or recommend them to do[55]. Interventions targeting health workers should involve raising prescriber's awareness regarding appropriate prescribing and administration of injectable medications and risks associated with inappropriate prescribing and administering unsafe injections.

Finally, there is a need for improving occupational safety of health care providers at their work places with respect to their own HIV risk they stand to[9,11,53,56]. This approach will very much benefit not only health care providers but also their patients/health consumers they attend to. Interventions aiming at making health care providers safer (*i.e.* free from infections) will also guarantee that their patients they attend to are also safer (*i.e.* no iatrogenic infections transfer) [56,57]. Injection safety information and messages need to be continuous and must be incorporated into the existing HIV/AIDS awareness and educational prevention programmes/campaigns in these developing countries.

In conclusion, there is an urgent need to put in place multi-faceted interventions measures in most developing countries like Tanzania in order to raise both patients and health care providers awareness of the unsafe injection issues. There is also a need for putting in place strategies for promoting injection safety messages amongst both consumers and health care providers in these developing countries within the African continent.

Conflict of interest statement

We declare that we have no conflict of interest.

References

[1] WHO. *Unsafe injections practices and transmission of blood borne pathogens*. Geneva: WHO; 1999.
[2] Wilburn SG, Eijkemans G. Preventing needle stick injuries among health care workers. *Int J Occup Health* 2004; **10**: 451-456.
[3] Dicko M, Oni AQ, Ganivet S, Kone S, Pierre L, Jacquet B. Safety of immunization injections in Africa: not simply a problem of logistics. *Bull World Health Organ* 2000; **78**: 163-169.
[4] Massele AY, Nsimba SE, Fulgence J. A survey of prescribing practices of health care workers in Kibaha district in Tanzania. *Tanzan Med J* 2008; **22**: 31-33.
[5] Nsimba SE, Massele AY, Kayombo EJ. Reducing injection overuse through consumers/patients-prescribers' interaction group discussions (IGDs) at public and private facilities in Dar Es Salaam region, Tanzania. *J Future Med Ther* 2011; **8**(2): 179-187.
[6] WHO. *The world health report 2002. Reducing risks, promoting healthy life*. Geneva: WHO; 2002. [Online] Available from: http://www.who.int/whr/2002/en.
[7] Kotwal A, Priya R, Thakur R, Gupta V, Kotwal J, Seth T. Injection practices in a metropolis of North India; perceptions, determinants and issues of safety. *Indian J Med Sci* 2004; **58**: 334-344.
[8] Massele AY, Nsimba, SE, Rimoy G. Prescribing habits in church owned primary health care facilities in Dar Es Salaam and other Tanzanian coast regions. *East Afr Med J* 2001; **78**(11): 510-514.
[9] Sparks C. Killer blood transfusions targeted in the fight against HIV. Medial global voice of the global south; 2010. [Online] Available from: www.medialglobal.org.
[10] Nsimba SE. Assessing prescribing patterns and patient care indicators for children underfive years old with malaria and other disease conditions in public primary health care facilities in Tanzania. *Southeast Asian J Trop Med Public Health* 2006; **37**(1): 206-214.
[11] World Health Organization. *Safe injection global network (SIGN). Toolbox to assess and evaluate injection practices*. Geneva: WHO; 2000, p. 18.
[12] Nsimba SE. Assessing malaria case management of under-five children in homes and primary health care institutions: a review article based on studies carried out from 1997-2002 in Kibaha district-Tanzania. *BioSoc Soc J Biol Hum Aff* 2005; **70**: 3-22.
[13] Reeler AV. Anthropological perspectives on injections: a review. *Bull World Health Organ* 2000; **78**: 135-143.
[14] Birungi H. Injections and self help: risk and trust in Ugandan health care. *Soc Sci Med* 1998; **47**: 1455-1462.
[15] Sciortino R. The myth of injections: providers and patients in rural central Java. In: Wolffers I, Bloem M. (eds.) *The impact of injections on daily medical practice*. Amsterdam: VU University Press; 1993.
[16] Greenhalgh T. Drug prescription and self-medication in India: an exploratory survey. *Soc Sci Med* 1997; **25**: 307-318.
[17] Larsen GA. *An assessment of injection safety practices in Tanzania health facilities*. Geneva: WHO; 2000.
[18] Ayo E, Lema M. Universal precautions in infection control and prevention: emphasis on HIV/AIDS prevention. Presentation at the national planning workshop on injection safety (unpublished report). 2004.
[19] Killewo J, Nyamuryekunge K, Sandström A, Bredberg-Rådén U, Wall S, Mhalu F, et al. Prevalence of HIV-1 infection in Kagera region of Tanzania: a population-based study. *AIDS* 1990; **4**: 1081-1085.
[20] Hoelscher M, Riedner G, Hemed Y, Wagner H, Korte R, von Sonnenburg F. Estimating the number of HIV transmissions through re-used syringes and needles in Mbeya region-Tanzania. *AIDS* 1994; **8**: 1609-1615.
[21] Hutin Y, Chen RT. Injection safety: a global challenge. *Bull World Health Organ* 1999; **77**: 787-788.
[22] Reeler AV. Anthropological perspectives on injections: a review. *Bull World Health Organ* 2000; **78**: 135-143.

[23] Vos J, Gumodoka B, van Asten H, Berege ZA, Dolmans WM, Borgdorff MW. Improved injection practices after the introduction of treatment and sterility guidelines in Tanzania. *Trop Med Int Health* 1998; **3**: 291-296.

[24] Costen E, van Lanschot J, Henny P, Tinnemans J, van der Mear J. A prospective study on the risks of exposure to HIV during surgery in Zambia. *AIDS* 1995; **9**: 585-588.

[25] Adegboye AA, Moss GB, Soyika F, Kreiss JK. The epidemiology of needle stick and sharp instruments accidents in a Nigerian hospital. *Infect Control Hosp Epidemiol* 1994; **15**: 27-31.

[26] Nafeh MA, Medhat A, Shehata M, Mikhaib NN, Swifee Y, Abdel-Hamad M, et al. Hepatitis C in a community in upper Egypt. 1-Cross sectional survey. *Am J Trop Med Hyg* 2000; **63**: 236-241.

[27] Darwish MA, Faris R, Darwish N, Shouman A, Gadalled M, El-Sharkawy M, et al. Hepatitis C and cirrhotic liver disease in the Nile delta of Egypt: a community based study. *Am J Trop Med Hyg* 2001; **64**: 147-153.

[28] McCarthy MC, Hyans KC, el-Tiganiel-Hag A, elDabi M, el-Sadiq el-Tayeb M, Khalid IO, et al. HIV -1 and hepatitis B transmission in Sudan. *AIDS* 1989; **3**: 725-729.

[29] Yerly S, Quadri R, Negro F, Barbe KP, Cheseaux JJ, Burgisser P, et al. Nosocomial outbreak of multiple blood borne viral infections. *J Infect Dis* 2001; **184**: 369-372.

[30] Lakshman M, Nichter M. Contamination of medicine injection paraphemalia used by registered medical practitioners in South India: an ethnographic study. *Soc Sci Med* 2000; **51**: 11-28.

[31] Khan AJ, Luby SP, Fikree F, Karim A, Obaid S, Della Walla S, et al. Unsafe injections and the transmission of hepatitis B and C in peri-urban community in Pakistan. *Bull World Health Organ* 2000; **78**: 956-963.

[32] Hogenboon van Buggenum I, Kistemaker A, Ronner E. Injections in Indonesia. In: Wolffers I, Bloem M. (eds.) *The impact of injections on daily medical practice*. Amsterdam: Vu University Press; 1993.

[33] Hadiyono JP, Suryawati S, Prawitasari H, Danu S, Sunartono D, Santoso B. Interactional group discussions: results of a controlled trial using behavioural intervention to reduce the use of injections in public health care facilities. *Soc Sci Med* 1996; **42**: 1177-1183.

[34] Bhattarai MD, Wittet S. Perceptions about injections and private sector injection practices in Central Nepal. General Welfare Praisthan and Gates Children's Vaccine Program; 2000. [Online] Available form: http://www.path.org/files/Nepal-Inject-Practices-RA.pdf.

[35] Wang CS, Cheng TT, Chou P. Differences in the risk factors for being either a hepatitis B carrier or anti hepatitis C+ in a hepatoma-hyperendemic area in rural Taiwan. *J Clin Epidemiol* 1998; **51**: 733-738.

[36] Sagoe-Moser C, Pearson RD, Perry J, Jagger J. Risks to health care workers in developing countries. *New Engl J Med* 2001; **345**: 538-541.

[37] Kermode M. Unsafe injections in low income country health settings: need for injection safety promotion to prevent the spread of blood borne viruses. *Health Promot Int* 2004; **19**: 95-103.

[38] National Center for AIDS and STD Control, Ministry of Health & Population. *National HIV/AIDS strategy 2006-2011*. Nepal: Ministry of Health Sage Publication; 2007, p. 198-210.

[39] Edwinvan T, Padam S, Julier R. Issues and challenges of HIV/AIDS prevention and treatment in Nepal. *Glob J Health Sci* 2009; **1**(2): 62-72.

[40] Davies G. A critical evaluation of the effects of safe injection facilities. *J Glob Drug Policy Pract* 2007; **1**: 1-15.

[41] Wood E, Tyndall MW, Li K, Lloyd-Smith E, Small W, Montaner JSG, et al. Do supervised injecting facilities attract higher-risk injection drug users? *Am J Prev Med* 2005; **29**(2): 126-130.

[42] Wood E, Tyndall MW, Zhenguo Q, Zhang R, Montaner JSG, Kerr T. Service uptake and characteristics of injection drug users utilizing North America's first medically supervised safer injecting facility. *Am J Public Health* 2006; **96**: 770-773.

[43] WHO. *Young people and HIV/AIDS*. Geneva: WHO press. [Online] Available from: www.searo.who. Int/linkfiles/EFS 2006 Nepal.Pdf. 2007.

[44] Nsimba SE, Sussman S. Tobacco advertisements and promotion industry on smoking in Tanzania: a review of negative public health implications for current and future generations. *Tob Induc Dis J* 2007; **3**: 41-43.

[45] Nsimba SE. Outpatient treatment programs: a review article on substances of abuse outpatient treatment outcomes in the United States. *J Addict Disord Their Treat* 2007; **6**(3): 91-99.

[46] Nsimba SE. Potential preventive programs for marijuana use among Hispanic: a review article on the impact of various health related prevention programs targeting adolescents in the US. *J Addict Disord Their Treat* 2007; **6**(4): 181-186.

[47] Nsimba SED. Anti-retroviral (ARV) rationing schemes in developing countries: a review article on strategies and ethical issues related to the successes and failures of ARV programmes. *East Afr J Public Health* 2009; **6**: 219-222.

[48] Irunde H, Nsimba SE, Comoro CK. The need to improve quality of operating structures and processes for better ARV drug of adherence in Tanzania. *Asian Pac J Trop Med* 2009; **2**: 67-74.

[49] Nsimba SE, Irunde H, Comoro C. Barriers to ARV adherence among HIV/AIDS positive persons taking anti-retroviral therapy in two Tanzanian regions 8-12 months after program initiation. *J AIDS Clin Res* 2010; **1**(3): 1000-1011.

[50] Nsimba SE. Methadone maintenance therapy: a review paper of the summary of evidence based approach for long patient waiting time for this service in the United States. *East Afr J Public Health* 2010.

[51] Nsimba SE. Assessing the performance, practices and roles of drug sellers/dispensers and mothers/guardians behaviour for common childhood conditions in Kibaha district, Tanzania. *Trop Dr* 2007; **37**: 197-201.

[52] Nsimba SE, Kayombo EJ. Socio-cultural barriers, norms, values, beliefs and practices can affect health care programmes in Tanzania. *Eval Health Prof* 2008; **31**: 318-322.

[53] Logez S. *Increasing access to injection equipment in Burkina Faso*. New Delhi: SIGN Annual Meeting; 2001.

[54] Kerr T, Tyndall MW, Li K, Montaner J, Wood E. Safer injection facility use and syringe sharing in injection drug users. *Lancet* 2005; **366**: 316-318.

[55] Wood E, Tyndall MW, Lai C, Montaner JSG, Kerr T. Impact of a medically supervised safer injecting facility on drug dealing and other drug-related crime. *Subst Abuse Treat Prev Policy* 2006; **1**: 13-16.

[56] Reeler AV, Simonsen L. *Unsafe injections, fatal infections*. Seattle: Bill and Belinda Gates Children's Vaccine Program; 2000.

[57] Tyndall MW, Kerr T, Zhang R, King E, Montaner JG, Wood E. Attendance, drug use patterns, and referrals made to North America's first supervised injection facility. *Drug Alcohol Depend* 2005; **83**(3): 193-198.