Original Article

Knowledge and Practice on Injection Safety among Primary Health Care Workers in Kaski District, Western Nepal

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Abstract

Background: **Unsafe injection practice can transmit various blood borne infections. The aim of this study was to assess the knowledge and practice of injection safety among injection providers, to obtain information about disposal of injectable devices, and to compare the knowledge and practices of urban and rural injection providers.**

Methods: **The study was conducted with injection providers working at primary health care facilities within Kaski district, Nepal. Ninety-six health care workers from 69 primary health care facilities were studied and 132 injection events observed. A semi-structured checklist was used for observing injection practice and a questionnaire for the survey. Respondents were interviewed to complete the questionnaire and obtain possible explanations for certain observed behaviors.**

Results: **All injection providers knew of at least one pathogen transmitted through use/re-use of unsterile syringes. Proportion of injection providers naming hepatitis/jaundice as one of the diseases transmitted by unsafe injection practice was significantly higher in urban (75.6%) than in rural (39.2%) area. However, compared to urban respondents (13.3%), a significantly higher proportion of rural respondents (37.3%) named Hepatitis B specifically as one of the diseases transmitted. Median (inter-quartile range) number of therapeutic injection and injectable vaccine administered per day by the injection providers were 2 (1) and 1 (1), respectively. Two handed recapping by injection providers was significantly higher in urban area (33.3%) than in rural areas (21.6%). Most providers were not aware of the post exposure prophylaxis guideline.**

Conclusion: **The knowledge of the injection providers about safe injection practice was acceptable. The use of safe injection practice by providers in urban and rural health care facilities was almost similar. The deficiencies noted in the practice must be addressed.**

Keywords: *health personnel, injection, injection safety, needle stick injury, Nepal*

Introduction

The injection is one of the key health care procedures used globally for administration of medicines. However, unsafe and over-use of injections is a common characteristic of health care systems in developing countries (1). Injection prescribers and providers in these countries perceive that injection use help to prove their professional credibility which ultimately elevates their status and helps them to compete in the competitive health market (2).

Globally, injections are provided by various personnel (1) with differing qualifications and training. These personnel, can be grouped into formal providers, informal providers, and quacks, and differ with place and time. The formal providers, such as, nurses, medical doctors, and

other health care workers (HCWs), are trained for providing injections and have legal authority to do so. Informal providers (e.g. traditional healers, ayurvedic HCWs, pharmacist/ medical dispensers etc) are trained and qualified for other health care services but not for injection administration. Quacks are illegal injection (medical) providers and provide injections for financial benefits only. They are mostly self-taught or have learned the procedure by working under another person (1).

Safe Injection Global Network (SIGN) defines a safe injection as, "the injection that does no harm to the recipient, does not expose the health worker to any risk and does not result in waste that is dangerous for the community" (3). Therefore, the safety of injection recipients, injection providers and the community should be considered for safe practice.

A needle stick injury (NSI) is a commonly encountered occupational hazard which may harm the injection provider by transmitting various viral infections, most importantly, hepatitis B virus (HBV), hepatitis C virus (HCV), and Human Immunodeficiency virus (HIV) (3). The global burden of HBV, HCV and HIV infections due to NSI among HCWs were calculated to be approximately 66,000, 16,000 and 1,000 respectively per annum for the year 2000 (4).

NSI among injection providers can be avoided by following these procedures: anticipating sudden movements of patients during the injection procedure; avoiding recapping of used needles; and collecting contaminated sharps in puncture-proof and leak-proof safety boxes (5). Immunization against Hepatitis B is also essential to ensure the safety of injection providers (3).

Nepal is a landlocked South Asian country with a gross per capita income of US$ 717 (6). Although vital health indicators have recently improved, disparities remain between rural and urban populations (6). The Government of Nepal (GoN) manages and delivers health care service through the Department of Health Services and the Ministry of Health and Population. A Sub Health Post (SHP) is the first contact point for basic health care services. Through a SHP, patients can be referred to Health Posts (HP), Primary Health Care Centers (PHCC), and various hospitals. Additionally, medical services are provided by private clinics and private hospitals. Traditional medicine, mainly Ayurveda, also caters to a significant proportion of the population (7).

The government provides free health care service and immunisation through primary health care facilities mostly managed by HCWs like health assistants (HA), community medicine auxiliaries (CMA), Auxiliary nursing midwifes (ANM), and community health workers (CHW) (7). The HA, CMA, and ANM are HCWs who have completed 10 years of schooling and undergone basic medical training (between 18 to 36 months). They are trained to diagnose and treat common illnesses, prescribe a few essential medicines and refer patients for more specialized care if required (8).

In Nepal, there is no clear guideline, policy or required qualification for injection providers (9). Studies (8–10) have reported that injections are administered by various injection providers and unsafe injection practice (including improper sharps management) is a major public health concern. Similarly, studies (10,11) have reported that, the GoN has undertaken certain initiatives at the primary health care level to promote rational and safe use of injections. Hence, this study was conducted with the following aims: a) to assess knowledge and practice of injection safety among injection providers, b) to obtain information about the disposal of injectable devices and c) to compare knowledge and practices in injection providers working at urban and rural primary health care facilities in Kaski district of Western Nepal.

Materials and Methods

Study design

The present study conducted in Kaski district from September 2012 to January 2013 was a descriptive, cross sectional study. It consisted of observation of health care facilities and injection events, and interview with all the injection providers (including supervisors) of the primary health care facilities. The interview was done to complete the questionnaire and explore reasons for observed behaviors and practices. Injection practice, including disposal of used injection equipment at selected health care facilities were also surveyed.

Sampling method

The district (total population 490 429) (12) was divided into two strata e.g. urban and rural. Lekhnath municipality and Pokhara sub-metropolitan city were stratified as urban while 43 Village Development Committees (VDCs) of Kaski district were stratified as rural. The VDCs and municipalities are divided into wards with clear geographical boundaries. There are 420 wards in Kaski district from which 50 wards (25 from urban and 25 from rural) were selected by probability proportionate sampling method. In each ward, one house was selected randomly

and the successive 12 households were included. The household head of the selected houses were asked to name the health care facilities visited (preferred) by them for their basic health care needs. The present study was a continuation of the community study which had been published previously (13). The health care facilities indicated by them were visited for the study. In Kaski district there are 3 Primary Health Care Centers (PHCC), 21 Health Posts (HP), 27 Sub-Health Posts (SHP), 5 ayurvedic centers, and 350 medical dispensaries (pharmacies) out of which 2 (67%) PHCC, 6 (28.6%) HP, 14 (51.85%) SHP, 3 (60%) ayurvedic centers and 42 (12%) medical dispensaries were included in the study. Out of the 69 total health care facilities, 24 were government run facilities.

HCWs (all types) working at the selected primary health care facilities for at least six months were included in the study and the injections provided by them were observed. For the purpose of the study, an injection was defined as "A skin-piercing event performed with a syringe and/or needle with the purpose of introducing a curative substance or vaccine into a patient by various routes" (3). Therefore, injections carried out for phlebotomy, blood transfusion and other purposes were excluded from the study.

Study tools

Two data collection tools were used in the study: A semi-structured questionnaire and an observation checklist.

The questionnaire contained a mix of structured close-ended and semi-structured open-ended questions was adapted from the tools used to assess and evaluate injection practices proposed by the World Health Organization (WHO) (14). The WHO questionnaire was adapted to the Nepalese context following discussions between authors and experts in the field. These tools were tested during a pilot study in Baglung district (a district adjacent to Kaski district) (11) and finalised. Some of the important changes were: the names of diseases transmitted by unsafe injection practice included in the standard WHO questionnaire were removed, the term "unsafe injection practice" was replaced with "sharing same disposable syringe between patients"; questions pertaining to sterilisable syringes were removed from our questionnaire; questions about how many doses of Hepatitis B vaccine was received by the injection providers and when were added; in the question relating to NSI event, the time-frame enquired into was changed from 1 year to 6 months; and questions regarding safe injection practice training were added.

The pilot study was conducted among supervisors of 10 health care facilities and key findings from this study have previously been published (11). The finalised version of the questionnaire was forward translated into Nepali (local language) and back translated into English by two different groups of people not involved in the study and fluent in both the languages. The back translated questionnaires were compared with the original questionnaires. As the questionnaires were standardised and the changes made were minimal, the questionnaires' reliability and construct validity were not studied.

The finalised questionnaire could be divided into two parts: 1) Part one collected the demographic data of respondents including age, post, gender and years of experience. 2) Part two collected data pertaining to use of injection, use and availability of needle destroyer and safety box, disposal technique for used injection equipment, incidence of NSI, guidelines about post- exposure prophylaxis (PEP), Hepatitis B vaccination, and availability of disposable syringes. Some of the questions were intentionally repeated during the observation and survey for triangulation of the results.

The observation checklist was developed, taking into consideration the study's objectives after a thorough review of the literature by the authors. The revised injection safety assessment tool (15) was consulted while constructing the checklist. This was then circulated to pre-selected people working in the field, and feedback gathered. As per the checklist, safe injection indicators (presented in Table 1) were observed. Within the checklist, types of syringes, their trade name and country of manufacture were noted as well as the presence or absence of posters promoting safe injection at the injection venue.

Study procedure

The selected health care facilities were visited during office working hours. The observation checklist was completed by observing the injection events and health care waste management practices in the facility. Interviews with all the injection providers present at the time of the visit were conducted in Nepali at the health care facilities by the corresponding author using the questionnaire. This was carried out during working hours, particularly in the afternoon when there were likely to be fewer patients. This interview was conducted to complete the questionnaire and understand the reasons and rationale for the answers provided by respondents to part two of the questionnaire. During the interview, use of

injection, technique for disposal of used injection equipment, knowledge and practice regarding NSI, preventive measures (including PEP) for NSI, and knowledge of safe injection practice were discussed. Important points were noted in Nepali. Respondents were shown the notes, asked to confirm that these were accurate and to add any points, if required. Each respondent was interviewed only once.

Ethical issues

The protocol was approved by the Nepal Health Research Council (Reference no 1233), Kathmandu, Nepal. All injection providers were informed that participation was completely voluntary and that they were free to withdraw at any time during the study without needing to provide reason. The participants were assured about the confidentiality of information given by them and were included in the study following a verbal consent. Prior permission was obtained from respective health care facility supervisors to observe the health care facilities, their waste disposal method, and injection events at their health care facilities.

Data analysis

Data was analysed using IBM Statistical Package for Social Sciences (SPSS) version 20 for Windows. Pearson chi-square test and Fisher's exact test were used to compare the urban and rural results. A *P* value < 0.05 was considered to be statistically significant. Interview responses were analysed and common responses highlighted.

Table 1: Indicators of injection safety which were observed during the study

Indicators (Observational data)		Urban	Rural	Total	Chi-square	*P* value
		Frequency (%)	Frequency (%)			
Sharps near providers, n = 96 (U = 45 & R = 51)		2 (4.4)	5 (9.8)	7 (7.3)	1.016	0.314
Swabbed multi-dose vial before use, n = 46 (U = 11 & R = 35)		6 (54.5)	18 (51.4)	24 (52.2)	0.033	0.857
Left needle on rubber of multi-dose vial after use, n = 46 (U = 11 & R = 35)		0 (0.0)	2 (5.7)	2 (4.4)	0.638	0.424
Cotton/gauge used while breaking ampoule, n = 86 (U = 44 & R = 42)		14 (31.8)	22 (52.4)	36 (41.9)	8.236	0.016
Wrapping plastic of the syringe used to break ampoule, n = 86 (U = 44 & R = 42)		3 (6.8)	7 (16.7)	10 (11.6)		
Needle destroyer used after injection event, n = 96 (U = 45 & R = 51)		2 (4.4)	0 (0.0)	2 (2.1)	2.315	0.128
Needle recapping practice, n = 96 (U = 45 & R = 51)	One handed	17 (37.8)	4 (7.8)	21 (21.9)	19.159	<0.001
	Two handed	15 (33.3)	11 (21.6)	26 (27.1)		
	No recapping	13 (28.9)	36 (70.6)	49 (51.0)		
Safety box near providers, n = 53 (U = 11 & R = 42)		10 (90.9)	31 (73.8)	41 (77.4)	1.455	0.228
Sharp scattered around healthcare facilities, n = 69 (U = 39 & R = 30)		0 (0.0)	6 (20.0)	6 (8.7)	5.647	0.017

U= Urban and R = Rural.

Direct quotes were also translated from Nepali to English and were contextualised, rendered readable and presented in the habitual language of the interviewees. The questionnaire findings were triangulated with the findings of observational study.

Results

From the community (household) survey, it was found that most people in rural areas consult HCWs of government health care facilities for their basic health care needs either at their respective facilities or at private dispensaries (clinics). Although the number of tertiary level hospitals and nursing homes was greater in urban areas compared to rural areas, people in urban areas reported a preference for medical dispensaries for their basic health care needs and certain injections (e.g. Tetanus toxoid, injectable contraceptives etc). Medical dispensaries are medicine shops which are mostly run by Professionalists. Professionalists are people who have received short (48 hours) orientation training that includes basic knowledge about drugs but does not include injection administration (8).

Out of 69 health care facilities, only 4 government health care facility in-charges (5.8%) claimed that they had guidelines for safe injection practice but none were able to produce this to the researchers.

Observation of injection practice

One hundred and thirty two injections administered by 96 injection providers (45 from urban and 51 from rural) of 69 health care facilities were observed. The providers were aware of the observation which may have led them to modify their practices or responses (Hawthorn effect). To minimise the Hawthorn effect, the checklist used for the observation was not shown to the providers.

Types of syringe used

All injection providers administered injectable therapeutic medicines using single use disposable syringes taken from sealed packages. Single use disposable syringes manufactured in Nepal were most commonly used, followed by those made in China and India.

Routine vaccines were administered by 39 and 9 HCWs in rural and urban areas, respectively. Auto-disable syringes were used in all cases of vaccination. Auto-disable syringes manufactured in Germany and China were commonly used for vaccination.

Safe injection practice

Used needles and syringes were found littered on the floors and tables of the injection rooms (outside the safety box) in seven injection providing sites (first indicator of table 1). Table 1 shows various indicators which determine injection safety.

Cotton balls soaked in disinfectant were used to sterilize the skin before injection. Almost one half of the injection providers used their bare hands to open glass ampoule. In two cases, the glass pieces caused minor injury to the providers. The wounds were then cleaned with the soaked cotton ball from the same container.

Needle destroyers, used to burn the tip of the needle and/or cut the tip of the syringe, were not present and were not used by most (97.9%) injection providers. In two government health care centers (out of 24) electrically operated needle destroyer donated by non-governmental organisations (NGOs) were observed to be available. However, these health care facilities lacked access to electricity so the devices were not in use. Safety boxes were available in all government health care facilities (100% availability) in sufficient quantity. Out of 53 injection providers who had an option to dispose of the used syringe in safety boxes, 12 (22.6%) did not have the safety box near them.

Forty nine (51%) injection providers avoided needle recapping after injection administration. Recapping was mostly avoided by HCWs working in government health care facilities. Surprisingly, many did not know the correct reason for avoiding recapping. Some typical responses were:

> *"... recapping of the needle could not be done due to lack of time."* **P (Participant)-50**

> *"Sir (supervisor) has asked me to avoid recapping... but I do needle recapping. Now tell me, what should be done and why?....."* **P-45**

Two handed recapping was done by 26 (27.1%) providers out of 96 (seventh response of Table. 1) and the recapping practice was more common at non-government health care facilities.

In some government health care facilities, some recapped needles of used syringes were visible in safety boxes and even in a pit designated for disposal of biomedical waste. Despite this, the injection providers insisted that they do not recap. Safety boxes were not available at non-government health care facilities and open cartons, plastic buckets or other plastic containers

were often used to collect syringes and other sharps. Recapped syringes were commonly seen in those containers. Posters advocating safe injection practice were not observed at any of the injection providing venues.

Injection providers' survey

Ninety six (male 65) injection providers were included in the study. The mean (SD) and median age of the injection providers were 38.81 (9.66) [range 20-62 years] and 38 years, respectively. Mean (SD) experience of the injection providers was 16.04 (9.45) years. Median (interquartile range) number of therapeutic injection and injectable vaccine administered per day by the injection providers were 2 (1) and 1 (1), respectively. Table 2 shows the qualifications of the injection providers.

Injection equipment

Almost all (99.0%) the injection providers reported that they administer injectable therapeutic medicines using single use disposable syringes and that they had a sufficient supply of syringes. All injection providers from government health care facilities (fifty) reported that they use single use auto-disable syringes for administration of vaccines. Injection providers with the exception of government employees reported that they do not provide vaccines.

Safety of injection providers

Most providers (96.9%) were not trained for safe injection practice and reported that there was no PEP guideline in their health care facilities. Washing hand with soap water and/ or using antiseptic were the most commonly practiced PEP. Some common comments by the

Table 2: Injection providers' qualification and their knowledge about the diseases transmitted by unsafe injection practice

	Urban, n = 45 Frequency (%)	Rural, n = 51 Frequency (%)	Total (%), n = 96	*P* value (Fisher's exact test)
Qualification of injection providers[a]				
Community medicine auxiliary (CMA)	21 (46.7)	23 (45.1)	44 (45.8)	
Health assistant (HA)	8 (17.8)	5 (9.8)	13 (13.5)	
Community health worker (CHW)	2 (4.4)	9 (17.7)	11 (11.5)	
Auxiliary nursing midwife (ANM)	3 (6.7)	11 (21.6)	14 (14.6)	
Diploma in Pharmacy	3 (6.7)	0 (0.0)	3 (3.1)	
Bachelor of medicine, Bachelor of Surgery (MBBS)	1 (2.2)	0 (0.0)	1 (1.0)	
Intermediate Nursing	1 (2.2)	0 (0.0)	1 (1.0)	
Ayurvedic health assistant	1 (2.2)	2 (3.9)	3 (3.1)	
Others (Professionalist)	5 (11.1)	1 (2.0)	6 (6.3)	
Diseases that may be transmitted through unsafe injection practice[b]				
HIV/ AIDS	44 (97.8)	51 (100.0)	95 (99.0)	0.469
Hepatitis/ Jaundice	34 (75.6)	20 (39.2)	54 (56.3)	<0.001
Hepatitis B	6 (13.3)	19 (37.3)	25 (26.0)	0.010
Syphilis	1 (2.2)	3 (5.9)	4 (4.2)	0.620
Tuberculosis	2 (4.4)	2 (3.9)	4 (4.2)	1.000
Hepatitis C	2 (4.4)	1 (2.0)	3 (3.1)	0.598
Other infections	6 (13.3)	13 (25.5)	19 (19.8)	0.199

[a]The knowledge was not compared among injection providers with different qualifications due to the diverse nature of the qualifications and the providers. bThe question was multiple response.

respondents about PEP were:

> *"……if injury (NSI) occurs we press our fingers to ooze out the contaminated blood and use antiseptic… nothing else."* **P-62**

> *"…… we wash our hands with soap water and use antiseptics… Sir (supervisor) [has] said that it should be done for our safety."* **P-37**

> *"…… I wash my hands with soap water and swab the wound using spirit…"* **P-39**

Table 3 shows the proportion of various factors indicating the status of safety of injection providers. Six of the 96 injection providers (6.3%) reported NSI in the last six months. Four providers had one incidence each, while two had two incidences each, making a total of 8 incidences in six months. The average number of NSI per person per annum was therefore calculated to be 2.67.

Out of 57 injection providers who had received vaccines against HBV (Table 3), only 50 had (87.7%) received the full dose of the vaccine (Table 4). Furthermore, approximately half of them had received the last dose of vaccine at least 5 years ago.

Knowledge of safe injection practice

All injection providers were aware that the use of unsterile syringe or reuse of single use disposable syringes could transmit diseases. When they were asked to name diseases transmitted by such practice, most of them named at least two correct diseases. The number (percentage) of injection providers naming one, two, three, and four correct diseases transmitted by unsafe injection practice are 14 (14.6%), 60 (62.5%), 19 (19.8%), and 3 (3.1%), respectively. Furthermore,

Table 3: Indicators about safety of injection providers

Indicators	Urban, n = 45	Rural, n = 51	Total, n = 96	Chi-square	*P* value
	Frequency (%)				
Have used needle destroyer in last 6 months	2(4.4)	0 (0.0)	3 (3.1)	2.315	0.128
Had NSI in last 6 months	3 (6.7)	3 (5.9)	6 (6.3)	0.025	0.988
Have guideline for PEP	1 (2.2)	0 (0.0)	1 (1.0)	1.145	0.285
Had a training for safe injection practice in last 2 years	1 (2.2)	2 (3.9)	3 (3.1)	0.228	0.633
Received Hepatitis B vaccine	26 (57.8)	31 (60.8)	57 (59.4)	0.090	0.765
Reporting sufficient supply of syringes	44 (97.8)	51 (100.0)	95 (99.0)	1.145	0.285
Reporting sufficient supply of safety box*	7 (77.8)	41 (100.0)	48 (96.0)	9.491	0.002

*As the safety box were only available to the injection providers (n=50) at governmental health facilities, the sample size in urban, rural and total were 9, 41, and 50 respectively.

Table 4: Hepatitis B vaccination among injection providers

Hepatitis B vaccination		Urban, n = 26	Rural, n = 31	Total, n = 57 (%)	Chi-square	*P* value
		Frequency (%)				
Dose	< 3	2 (7.7)	5 (16.1)	7 (12.3)	5.673	0.059
	3	20 (77.0)	26 (83.9)	46 (80.7)		
	> 3	4 (15.4)	0 (0.0)	4 (7.0)		
Duration from last vaccination (in years)	< 5	10 (38.5)	18 (58.0)	28 (49.1)	2.174	0.140
	≥ 5	16 (61.5)	13 (42.0)	29 (50.9)		

there was no significant difference in knowledge of injection providers working in urban area or rural area (Pearson Chi-square = 5.988, P = 0.112). Almost all (95 out of 96) injection providers named HIV/AIDS as one of the common diseases transmitted by unsafe injection practice (Table 2).

Waste disposal techniques

Seventeen (24.6%) supervisors claimed that there are separate employees for biomedical waste (including used syringes) management; however, the employees referred to were general office workers or peons who carry out waste management as a part of their normal duty. Table 5 shows different waste disposal techniques used for disposal of injection equipment.

Discussion

For their basic health care needs, most people in rural areas visited government health care facilities while those in urban areas visited medical dispensaries. As a result, in our study, a greater number of government health care facilities from rural area and a greater number of medical dispensaries from urban area were included.

A few supervisors (6%) claimed to have guidelines for safe injection practice but were not able to produce this when requested. Similar results were presented in a study from Bangladesh, where none of the health facilities (n = 24) observed, had injection safety and waste disposal policy or guidelines available for viewing (2). However, in India, 14.2% of health facilities observed had guidelines for waste disposal (16).

Injection equipment

The use of sterilisable injection equipment has been associated with infections (17,18) and the health care facilities that use single-use disposal equipment have better injection safety record than those using sterilisable syringes (19). In our study we found that all therapeutic injection and injectable vaccine were administered using a new single use disposable syringe and an auto-disable syringe, respectively, which were taken from sealed packages. The syringes were available in sufficient quantity in all the selected health care facilities. Continued availability of sufficient quantity of injection devices ensures safe injection practice while shortages lead to reuse of devices (20).

In our study, only about 60% of used disposable syringes were manufactured nationally, and the rest was imported from other countries. For our study, injection equipment in a sealed pack was considered as sterile and of good quality which may not always be true. There is no legally authorized body in Nepal to ensure the quality of this equipment so there is reason to question the quality of syringes available in the national market. Health policy makers' survey from Nepal (10), reported that GoN was preparing a draft on "Guidelines of Regulation of Health Related Products" which will authorise a body for quality monitoring of health related products including injection equipment.

Use of ampoules and vials

As multi-dose vials are prone to bacterial contamination and its use may be a potential source of infection, use of ampoules or single-dose vials is preferable to multi-dose vials (5). If multi-dose vials must be used, the use should be limited to single person (5,15). Multi dose vials of vaccines and Tetanus Toxoid (TT) supplied by GoN were used in government health care facilities and may not have been limited to single patient. However, use of multi-dose vials of those medicines is promoted by the government to minimize wastage of the medicines (7).

Table 5: Waste disposal techniques for disposal of used injection equipment in Kaski

Disposal Techniques	Urban, n = 45	Rural, n = 51	Total (%) n = 96
	Frequency (%)		
Burning in open place	13 (28.9)	3 (5.9)	16 (16.7)
Burning in pit	10 (22.2)	42 (82.4)	52 (54.2)
Incineration	2 (4.4)	0 (0.0)	2 (2.1)
Burying	6 (13.3)	3 (5.9)	9 (9.4)
Municipality waste	8 (17.8)	0 (0.0)	8 (8.3)
Dispose in hospital waste system	2 (4.4)	3 (5.9)	5 (5.2)
Sell to Kabadi (Scrap purchaser)	4 (8.9)	0 (0.0)	4 (4.2)

Swabbing of vial tops with an antiseptic or disinfectant is unnecessary (5,15) but almost half of the providers were observed doing this, mostly using dry cotton. The septum of the vial must be pierced with a sterile needle and the needle should not be left in place in the septum (5). It was observed in our study, that the vial's septum was pierced with sterile needles but some providers left needle on the rubber of multi-dose vial after use. The needle left in the septum of the vial might encourage reuse of the same syringe to repeatedly draw medication, which may lead to contamination of medicament present in the vial (21,22) and transmission of pathogens.

While opening glass ampoules, injuries to injection providers can occur which may cause infections (5). Almost half of the injection providers observed used only cotton/gauge while breaking an ampoule to protect their finger.

Safety of injection providers

Five to 28% of NSI are attributed to unsafe sharps waste collection (22,23) and use of safety boxes at the point of sharp generation lowers the risk of NSI (15,24) compared to use of regular cardboard boxes (25). Out of 96 injection providers observed, 53 providers from government health care facilities had the option to dispose of the used syringe in safety box but only 41 (42.7%) providers did so immediately after use. The providers from non-governmental health care facilities, in our study, were using open cardboard boxes for the collection of sharps. More than half of the injection providers (regardless of availability of safety box) did not use the safety box; this percentage was less than that reported from Bangladesh (81.5%) (2).

Safety boxes at government health care facilities were delivered along with immunization equipment and the left-over boxes were retained in the facilities. These were sufficient to dispose of the used therapeutic syringes in the facilities. This was contrary to the information shared by the health policy makers of Nepal (10) who stated that the injection and injection equipment (including safety box) were matched and supplied to government run health care facilities. As government employees were trained for immunization safety and safety boxes were provided for disposal of sharp waste, safety of the injection providers were ensured, at least partly, in governmental health facilities.

In primary health care facilities there is a smaller chance of NSI compared to secondary and tertiary care hospitals as fewer surgical procedures are carried out in primary health care facilities. In our study where only the HCWs working in primary health care facilities were included, the calculated NSI was 2.67 injuries per HCW per annum. This is higher than the estimated incidence (2.27 injuries per HCW per annum) in South East Asia region D in which all types of health care facilities (primary, secondary and tertiary care) were included (4). Hence, the incidence of NSI reported in our study should not be under estimated or neglected.

A high proportion of NSIs are attributable to two-handed recapping (26,27) and therefore, avoiding this could prevent NSI (27). Even a single handed scoop technique recapping (when essential) was found to be effective in reducing NSI (28). Unfortunately, more than a quarter of the injection providers in our study reported performing two handed needle recapping. After administration of injection, the used syringes should be disposed of immediately in a sharps container (safety box) without recapping the needle so the container should be within one arm's distance to injection providers (15). Tendency to recap the needle (5,24) increases when safety boxes are kept far from the injection site (venue). In our study, the boxes were not near to 22.6% of the injection providers at government health care facilities. This may also explain why recapped syringes were found in the disposal pit. Proper training and supervision for use of the safety box was therefore found to be necessary to change HCWs' behavior. Interventions that combine the provision of sharps containers and risk communications are important to reduce the total number of NSIs (22).

Almost all selected health care facilities of Kaski district lacked a guideline for PEP, leaving the providers to manage NSI on their own. PEP practice included washing hand with soap water and/or using antiseptic which is recommended by WHO. Squeezing injury sites by pressing the pricked finger and making blood ooze out should be avoided (29), however this practice was reported in our study.

Immunisation of HCWs for HBV, proper use and disposal of safety boxes, and providing training to HCWs to increase awareness and encourage behavioral change, are simple but effective interventions that could prevent NSI and its consequences (4,30). Unfortunately, in our study only half of the injection providers had been vaccinated against hepatitis B with full (three) doses. Globally 18–85% (4), in United Kingdom 90% (31), and in India 55.4% (32) of HCWs are vaccinated against hepatitis B; these figures are all greater than those found in our

study. Furthermore, half of the HCWs who were vaccinated against HBV had received the vaccine five or more than five years ago so a booster dose should have been administered.

The injection providers and their knowledge of safe injection

Almost a quarter of the injection providers interviewed were not qualified or trained to provide injections. The CHW working in government health care facilities were trained for immunisation during in-service trainings specifically before a national immunisation campaign but they were prescribing and administrating therapeutic injections as well. Approximately 13% of injection providers with short orientation training (Professionalists), pharmacy degree, or ayurvedic degree, were neither trained nor qualified for injection administration but they were also providing injection to the community. Although they reported using sterile devices for injection, the injection administered by them may not be safe (33). The risk of unsafe injections administered by them (informal sector) was over one and a half times more when compared to qualified & trained providers (formal sectors) (16).

All injection providers were knowledgeable about at least one pathogen transmitted through use or re-use of unsterile syringes. A study from Pakistan reported that 66.67%, 11.11% and 0% (Nil) of primary HCWs could name HIV/AIDS, HBV and HCV, respectively, as infections transmitted though unsterile practice (34) while in our study the proportions were greater (Table 2). Hence, it could be said that there is a higher awareness among primary HCWs regarding the risk of disease transmission by unsterile/reuse of syringe.

Disposal of used injection equipment

Although the quantity of biomedical waste generated in primary health care facilities is small, the hazards associated with them should not be overlooked (35). Waste disposal practice in primary health care facilities in Kaski was not satisfactory. The disposal was more haphazard in urban area compared to rural area. This was entirely different to reports from India where disposal of injection related waste at health facility level was significantly better in urban areas as compared to their rural counterparts (16).

Open burning of health care waste carries risk to staff, communities and the environment (36). Unfortunately, open burning practice was evident in our study. Like in other South Asian countries (16,37), selling of used plastic (disposable) syringes to scrap purchasers (Kabadi) was also evident. The selling of used disposable syringe was more prevalent in private health care facilities than in government facilities in urban area which is similar to the findings from a study of community pharmacies in Pokhara city (8). This study (8) reported that urban private health care facilities lack space and infrastructure for waste disposal which may be why the syringes are sold. Selling of used syringes could lead to illegal repackaging of syringes for reuse in hospitals and clinics (37). The illegal commercialization of syringes in Nepal has been reported in a study (10).

Burning in pit was the most commonly practiced waste disposal technique in rural areas. Even though the technique is safe, it is a temporary method (36). Therefore, a suitable, sustainable and environment friendly disposal method is required. In Nepal, there are policies and strategies which address general waste and workers (not specifically HCWs) safety. However, the implementation of these guidelines and acts is poor (38).

Limitations

Due to the sensitive nature of some of the questions, answers given by the respondents may not be consistent with actual practice. Furthermore, as the injection providers knew that they were being observed, this might have influenced their practice. The influence was minimized and validity of the findings enhanced using a combination of observation and interview. This study carried out in one of the hill districts, may not represent other regions (especially Terai and Mountain regions) of Nepal.

Conclusion

The injection providers' knowledge about safe injection practice was acceptable. Safe injection practices in urban and rural health care facilities were very similar. Government efforts to make injections safer were evident in the study area but were mostly limited to immunisation services and to government health care facilities so this needs to be expanded to the private sector as well. Use of single use (disposable) equipment, and awareness of diseases transmitted by unsafe injection practices were the positive aspects of safe injection practice observed in almost all facilities. Breaks in infection control practices, poor health care worker protection, training of injection providers on safe injection practice, and the absence of a proper waste management

infrastructure, are the grey areas found in the study which need to be addressed as soon as possible to improve injection practice.

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Conflicts of Interest

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Authors' Contributions

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Final approval of the article: SG, DSR, PRS, NJHA, DS
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