Best infection control practices for intradermal, subcutaneous, and intramuscular needle injections

Yvan Hutin,[1] Anja Hauri,[2] Linda Chiarello,[3] Mary Catlin,[4] Barbara Stilwell,[2] Tesfamicael Ghebrehiwet,[5] Julia Garner,[2] & the Members of the Injection Safety Best Practices Development Group

Objective To draw up evidence-based guidelines to make injections safer.

Methods A development group summarized evidence-based best practices for preventing injection-associated infections in resource-limited settings. The development process included a breakdown of the WHO reference definition of a safe injection into a list of potentially critical steps, a review of the literature for each of these steps, the formulation of best practices, and the submission of the draft document to peer review.

Findings Eliminating unnecessary injections is the highest priority in preventing injection-associated infections. However, when intradermal, subcutaneous, or intramuscular injections are medically indicated, best infection control practices include the use of sterile injection equipment, the prevention of contamination of injection equipment and medication, the prevention of needle-stick injuries to the provider, and the prevention of access to used needles.

Conclusion The availability of best infection control practices for intradermal, subcutaneous, and intramuscular injections will provide a reference for global efforts to achieve the goal of safe and appropriate use of injections. WHO will revise the best practices five years after initial development, i.e. in 2005.

Keywords Injections, Intradermal/adverse effects/standards; Injections, Subcutaneous/adverse effects/standards; Injections, Intramuscular/adverse effects/standards; Needles; Infection control/methods/standards; Benchmarking; Evidence-based medicine (*source: MeSH, NLM*).

Mots clés Injection intradermique/effets indésirables/normes; Injection sous-cutanée/effets indésirables/normes; Injection intramusculaire/effets indésirables/normes; Aiguille; Lutte contre infection/méthodes/normes; Banc mesure performance; Médecine factuelle (*source: MeSH, INSERM*).

Palabras clave Inyecciones intradérmicas/efectos adversos/normas; Inyecciones subcutáneas/efectos adversos/normas; Inyecciones intramusculares/efectos adversos/normas; Agujas; Control de infecciones/normas; Benchmarking; Medicina basada en evidencia (*fuente: DeCS, BIREME*).

الكلمات المفتاحية: الحقن، الحقن الأدمي، التأثيرات الضائرة للحقن الأدمي، معايير الحقن الأدمي، الحقن تحت الجلد، التأثيرات الضائرة للحقن تحت الجلد، معايير الحقن تحت الجلد، الحقن العضلي، التأثيرات الضائرة للحقن العضلي، معايير الحقن العضلي، الإبر، مكافحة العدوى، طرق مكافحة العدوى، معايير مكافحة العدوى، علامات فارقة، الطب المرتكز على البيِّنات (*المصدر: رؤوس الموضوعات الطبية، المكتب الإقليمي لشرق المتوسط*).

Bulletin of the World Health Organization 2003;81:491-500.

Voir page 498 le résumé en français. En la página 498 figura un resumen en español. يمكن الاطلاع على الملخص بالعربية على الصفحة ٤٩٩ .

Introduction

In transitional and developing countries where unnecessary injections are common, the average number of health care injections per person was estimated to be 3.7 per year (this includes all health care injections, including those given to diabetics for administering insulin) (*1*). Many injections, as well as being unnecessary, are also unsafe. Each year, the reuse of injection equipment may cause 20 million infections with hepatitis B virus (HBV), 2 million infections with hepatitis C virus (HCV), and 250 000 infections with human immunodeficiency virus (HIV) worldwide (*1*). These chronic infections lead to a high burden of morbidity and mortality (*1*).

No evidence-based guidelines are available to guide injection providers through the steps they should follow to prevent injection-associated infections. Thus, WHO asked a development group and a steering group to develop best practices for the use of safe injections (Box 1) using WHO-recommended processes to formulate evidence-based guidelines, as outlined below.

Methods

Intended users

The primary audience for the guidelines on best practice for safe injections includes public health professionals, clinicians,

[1] Medical Officer, Department of Blood Safety and Clinical Technology, Health Technology and Pharmaceuticals, World Health Organization, 1211 Geneva 27, Switzerland (email: sign@who.int). Correspondence should be addressed to this author.

[2] Department of Blood Safety and Clinical Technology, Health Technology and Pharmaceuticals, World Health Organization, Geneva, Switzerland.

[3] Centers for Disease Control and Prevention, Atlanta, GA, USA.

[4] University of Arizona Cancer Center, Tucson, AZ, USA.

[5] International Council of Nurses, Geneva, Switzerland.

Ref. No. **02-0285**

Box 1. **Summarized best infection control practices for intradermal, subcutaneous, and intramuscular needle injections**

Eliminating unnecessary injections is the highest priority in preventing injection-associated infections. When injections are medically indicated, they should be administered safely. These best practices are measures that have been determined through scientific evidence or expert consensus most effectively to protect patients, providers, and communities.

1. Use sterile injection equipment

Use a sterile syringe and needle for each injection and to reconstitute each unit of medication.[a]

- Ideally, use a new, single-use syringe and needle.[a] Inspect packaging for breaches in barrier integrity. Discard a needle or syringe if the package has been punctured, torn, or damaged.[b]
- If single-use syringes and needles are not available, use equipment designed for steam sterilization. Sterilize equipment according to WHO recommendations and document the quality of the sterilization process using time, steam, temperature (TST) spot indicators.[b]

2. Prevent contamination of injection equipment and medication

- Prepare each injection in a clean designated area, where contamination from blood or body fluid is unlikely.[c]
- Use single-dose vials rather than multi-dose vials.[c] If multi-dose vials must be used, always pierce the septum with a sterile needle.[a] Avoid leaving a needle in place in the stopper of the vial.[c]
- Select pop-open ampoules rather than ampoules that need to be opened by using a metal file. If an ampoule that requires a metal file is used, protect fingers with a clean barrier (e.g. small gauze pad) when opening the ampoule.[c]
- Inspect for and discard medications with visible contamination or breaches of integrity (e.g. cracks, leaks).[b] Follow product-specific recommendations for use, storage, and handling.[b] Discard a needle that has touched any non-sterile surface.[b]

3. Prevent needle-stick injuries to the provider

- Anticipate and take measures to prevent sudden movement of patient during and after injection.[c]
- Avoid recapping of needles and other hand manipulations of needles. If recapping is necessary, use a single-handed scoop technique.[a]
- Collect used syringes and needles at the point of use in an enclosed sharps container that is puncture-proof and leak-proof and that is sealed before it is completely full.[c]

4. Prevent access to used needles

- Seal sharps containers for transport to a secure area in preparation for disposal. After closing and sealing sharps containers, do not open, empty, reuse, or sell them.[c]
- Manage sharps waste in an efficient, safe, and environment-friendly way to protect people from voluntary and accidental exposure to used injection equipment.[c]

5. Other practice issues[b]

- **Engineered technology.** Whenever possible, use devices that have been designed to prevent needle-stick injury that have been shown to be effective for patients and providers. Auto-disable (AD) syringes are increasingly available to prevent the reuse of injection equipment in selected settings, including immunization services.
- **Hand hygiene and skin integrity of provider.** Perform hand hygiene (i.e. wash or disinfect hands) before preparing injection material and giving injections. The need for hand hygiene between each injection will vary depending on the setting and whether there was contact with soil, blood, or body fluids. Avoid giving injections if skin integrity is compromised by local infection or other skin condition (e.g. weeping dermatitis). Cover any small cuts.
- **Gloves.** Gloves are not needed for injections. Single-use gloves may be indicated if excessive bleeding is anticipated.
- **Swabbing vial tops or ampoules.** Swabbing of clean vial tops or ampoules with an antiseptic or disinfectant is unnecessary. If swabbing with an antiseptic is selected for use, use a clean, single-use swab and maintain product-specific recommended contact time. Do not use cotton balls stored wet in a multi-use container.
- **Skin preparation of patient before injection.** Wash skin that is visibly soiled or dirty. Swabbing of the clean skin before giving an injection is unnecessary. If swabbing with an antiseptic is selected for use, use a clean, single-use swab and maintain product-specific recommended contact time. Do not use cotton balls stored wet in a multi-use container.

[a] Category I: Strongly recommended and strongly supported by well-designed experimental or epidemiological studies.
[b] Category III: recommended on the basis of expert consensus and theoretical rationale.
[c] Category II: recommended on the basis of theoretical rationale and suggestive, descriptive evidence.

and infection control practitioners. The secondary audience includes injection providers reached through training or communications material developed on the basis of these best practices.

Definitions

The development group defined an injection as a procedure that introduces a substance into the body by piercing the skin or a mucosal membrane. Injections may be administered with a needle or with needleless devices, such as jet injectors. However, for the purpose of these best practices, only needle injections were considered. WHO defines a safe injection as one that does not harm the recipient, does not expose the provider to any avoidable risk, and does not result in waste that is dangerous to other people.

Analysis of the reference definition

The steering group separated this reference definition into 24 potentially critical issues (Table 1).

Review of evidence

The steering group searched the English language literature using MEDLINE. The search terms included injection(s), infection, sterilization, disinfection, vial, ampoule, medication, skin (preparation, cleaning, disinfection), hand hygiene, antisepsis, needle-stick(s), recapping, and sharps (container, collection, disposal). Identified articles were used to select additional key and MeSH terms for further searches. Relevant references in identified articles and additional studies made available by members of the development group were also reviewed.

Table 1. **Potentially critical issues in preventing infection among injection recipients, injection providers, and the community**

Potential source of contamination or exposure	Stage at which contamination or exposure might occur	Potentially critical issues
Preventing infection among injection recipients[a]		
Injection equipment	Sterilization	1. Sterilization of injection equipment
	Storage	2. Duration and conditions of storage
	Handling	3. Handling of injection equipment
Injected substance	Before opening	4. Type of medication
		5. Medication and vial check
	During opening	6. Swabbing of vial stopper/neck
		7. Filing and breaking of ampoules and vials
	After opening	8. Handling of multi-dose vials
Skin of the recipient	Introduction of the needle	9. Site of injection administration
		10. Skin preparation
Environment	Injection preparation	11. Injection preparation area
		12. Aseptic techniques
Hands of the provider	Injection preparation and administration	13. Hand hygiene
Preventing infection among injection providers[b]		
Exposure to the injection recipient's blood through needle-stick injury	During injection administration	14. Preparation and/or restraint of patient
	Handling of injection equipment after use	15. Needle recapping
		16. Needle removal
		17. Needle cutting
		18. Rising and dissembling of sterilizable equipment
	Collection of contaminated equipment	19. Use of sharps containers
		20. Quality of sharps containers
		21. Improper disposal of sharps
	Sharps waste management	22. Removal of containers used to collect sharps
Preventing infection in the community[b]		
Exposure to the injection recipient's blood through needle-stick injury	Sharps waste management	23. Storage of containers used to collect used sharps
		24. Terminal disposition of sharps waste

[a] Contamination.
[b] Exposure.

Formulation of best practices

The steering group formulated best practices for each of the potentially critical issues identified. Best practices strongly supported by well-designed analytical, observational, or intervention studies were characterized as category I (Box 1). Those supported by theoretical rationale and suggestive, descriptive evidence were characterized as category II. Those recommended on the basis of expert consensus and theoretical rationale were characterized as category III. For several other practice issues, best practices were not formulated. However, guidance was formulated on the basis of expert consensus and theoretical rationale. The development group then reviewed a draft and disseminated it for public comment through SIGNpost, the electronic forum of the Safe Injection Global Network (SIGN). All comments obtained from this peer-review process were archived to keep a track of decisions made to modify, or not, the document. Finally, a summary was edited and reorganized so that it would be reader friendly and separate the best practices from the other practice issues.

Results

Analysis of available evidence — preventing infections among injection recipients

Best infection control practices to prevent infections among injection recipients include the use of sterile injection equipment and the prevention of contamination of injection equipment and medication.

Use of sterile injection equipment

The most important infection control measures for preventing infection among injection recipients is the use of a sterile syringe and needle for each injection and to reconstitute each unit of medication (for medications that require a diluent). In many countries, the practice of reusing injection equipment in the absence of sterilization is common, and such practices have been associated with infections (*1*).

Use of a new, single-use syringe and needle provides the highest level of safety to the recipient. However, unreliable and insufficient supplies might lead to the equipment being reused (*2*). Even though boiling injection equipment for 20 min does not sterilize it (*3*), the use of pans to boil single-use injection equipment is common in developing and transitional countries. In many instances these pans are used as containers of tepid water where injection equipment is simply rinsed and soaked between injections (*1*). Although the use of injection equipment taken from damaged packages has not been associated with infection, it is necessary to use injection equipment that has been inspected for breaches in barrier integrity and to discard it if it is punctured, torn, or damaged.

When new single-use injection equipment is not available, equipment designed for sterilization can be used. Sterilizable injection equipment is now made of plastic that can be steam sterilized. A steam sterilization procedure includes initial cleaning, is conducted according to WHO recommendations (*4*), and is controlled using time, steam, and temperature (TST) spot indicators (*3*). Breakdowns in the management of hospitals and clinics lead to breaks in sterilization procedures (*2*). Health care systems that use sterilizable injection equipment have poorer injection safety records than those that use single-use equipment (*5*), and the use of sterilizable injection equipment has been specifically associated with infections (*6, 7*).

Preventing contamination of injection equipment and medication

Work environment. It is important to prepare injections in a clean designated area, where the risk of contamination by blood or body fluids is low. HBV persists for up to seven days on surfaces (*8*), which can potentially lead to environmental contamination. Environmental contamination is a potential source of HBV infection in settings where chronic haemodialysis is performed (*8*). Factors that might facilitate HBV transmission among patients receiving chronic haemodialysis include a high prevalence of HBV infection among patients, an environmental contamination with blood, a high frequency of percutaneous procedures, and the presence of patients with high levels of viraemia. These factors might also be found in other health care settings because of high HBV endemicity, limited implementation of standard precautions, overuse of injections, and the presence of people in whom the HBV replicates actively (e.g. children). In Romania, for example, where some of these conditions were present, HBV infection was associated with injections in 1998 (*9*). However, a review of injection practices in Romania suggested that single-use syringes and needles were not reused and that HBV transmission was probably related to the preparation of injections in environments that were potentially contaminated with blood or body fluids (*10*). The preparation of injections in contaminated environments might also lead to bacterial infection (*11*) and cause infections among drug users who inject (*12*).

Multi-dose vials. It is important to use single-dose vials rather than multi-dose vials whenever possible. Although preservatives reduce the survival of bacteria (*13*), multi-dose vials remain prone to bacterial contamination (*11*, *14*, *15*) and the use of multi-dose vials has been reported to be a potential source of infections in 19 studies (Table 2) (*11*, *14*, *16–32*). In two episodes, a needle had been left in the septum of the vial (*18*, *23*). Needles left in the septum of multi-dose vials might encourage the use of the same syringe to repeatedly draw medications for one patient, a practice that may lead to vial contamination (*15*) and infections among subsequent patients (*23*). Thus, if multi-dose vials must be used, it is essential that the person administering the injection pierces the septum with a sterile needle and it is important not to leave any needle in place in the stopper.

Breaking vials and ampoules. Injuries to injection providers can be another source of infection. While opening glass ampoules, providers may lacerate their hands (*33*), which can bleed and may cause infections (*34*). Thus, it is important to use pop-open ampoules rather than ampoules that need to be opened using a metal file, and to protect fingers with a clean barrier (e.g. small gauze pad) when opening ampoules that need a metal file to open.

Compromised packaging. Cracks and leaks in vials are a potential source of contamination (*35*). Although it is not known how effective a visual examination of the vial is in preventing infections, it is important to inspect the vial for and discard medications with visible contamination or breaches of integrity (e.g. cracks or leaks) and to follow product-specific recommendations for use, storage, and handling.

Aseptic techniques. Medical devices might become contaminated with bacteria if touched. Thus, a needle that has touched any non-sterile surface must be discarded.

Other practice issues

Provider's hand hygiene and skin integrity. Washing or disinfecting hands is a standard procedure that is carried out before preparing injection material. The need for hand hygiene between each injection will vary depending on the setting and on whether the health care worker has had contact with soil, blood, or body fluids. Injections have been administered in the absence of hand-washing and not caused infection among diabetic patients (*36*). Skin lesions and skin irritation are associated with bacterial contamination (*37*). Thus, it is necessary to avoid giving injections if skin integrity is compromised by local infection or other skin conditions (e.g. weeping dermatitis) and to cover any small cut.

Swabbing vial tops or ampoules. Swabbing vial tops or ampoules with an antiseptic or disinfectant is unnecessary (*11*, *38*). Cotton balls and gauze stored wet in antiseptics might become contaminated and have contributed to infections among patients, particularly when benzalkonium chloride was used (*16*, *39*, *40*). Thus, if swabbing with an antiseptic is selected for use, a clean, single-use swab must be used and the product-specific recommended contact time must be adhered to. Cotton balls stored wet in a multi-use container must not be used.

Skin preparation of patient before injection. Although skin that is visibly soiled or dirty must be washed, swabbing the clean skin of a patient before giving an injection is unnecessary. Studies suggest that there is no increased risk of infection when injections were given in the absence of skin preparation (Table 3) (*36*, *38*, *41–44*). Bacteria from the skin flora might be introduced through skin piercing (*41*). However, most of these bacteria are non-pathogenic and the number introduced is lower than the minimal infectious dose for pus formation (*45*). Skin-preparation protocols traditionally used, including wiping with 70% alcohol, may be insufficient to eliminate the skin flora because of a limited contact time (*43*, *46*). While the benefit of skin preparation is unclear, unsafe skin preparation protocols may be harmful (*39*, *40*). Thus, if swabbing with an antiseptic is selected for use, a clean, single-use swab must be used and the product-specific recommended contact time must be adhered to. Cotton balls stored wet in a multi-use container must not be used.

Analysis of available evidence — preventing infections among injection providers

Injuries from sharp devices have been associated with the transmission of more than 40 pathogens, including HBV, HCV, and HIV (*47*, *48*).

Table 2. **Epidemiological studies reporting an association between infections and use of multi-dose vials**

Study (ref.)	Pathogen	Infection	No. of patients infected	Type of study	Positive vial culture	Reported practices
Inman (*20*)	*Mycobacterium abscessus*	Abscess	12	Descriptive	NA[a]	Reuse of syringes among different patients Decanting of drug solution
Kothari (*28*)	*Pseudomonas* sp.	Septic arthritis	1	Descriptive	Yes	NA
Black (*26*)	*Streptococcus* sp.	Abscess	1	Descriptive	Yes	NA
Borghans (*18*)	*Mycobacterium chelonei*	Abscess	47	Descriptive	NA	Permanent insertion of a needle Reuse of aspiration needle Reuse of injection needles after boiling Storage of residual vaccine for successive sessions Use of petroleum ether for skin preparation
Cabrera (*21*)	*Pseudomonas* sp.	Bloodstream infection	5	Descriptive	Yes	Use of multi-dose vials of saline for preparation of injectable medications
Katzenstein (*24*)	HIV[b]	HIV infection[b]	1	Descriptive	NA	Use of multi-dose vials, changed daily Repeated aspiration of medication for one patient followed by discarding of vial Aspiration needles discarded after use for individual patients
Kidd-Lungren (*23*)	HBV[c]	HBV[c] infection	2	Descriptive	NA	Permanent insertion of a needle Reuse of syringe to draw medication
Philipps (*14*)	*Streptococcus* sp.	Peritonitis	1	Descriptive	Yes	Stopper wiped with antiseptic
Widell (*25*)	HCV[d]	HCV infection[d]	10	Descriptive	NA	NA
Widell (*25*)	HCV[d]	HCV infection[d]	9	Descriptive	NA	NA
Massari (*26*)	HCV[d]	HCV infection[d]	4	Descriptive	NA	Administration of medications in an IV line without an anti-reflux valve
Greaves (*22*)	*Streptococcus* sp.	Abscess	7	Analytical	Yes	Skin preparation with cotton balls soaked in alcohol
Alter (*29*)	HBV[c]	HBV infection[c]	10	Analytical	NA	Vials shared among patients[e] Medications prepared by patients Multi-dose vials not discarded at end of day
Archibald (*17*)	*Enterococcus* sp.	Bloodstream infection	6	Analytical	NA	Stoppers wiped with povidone-iodine Introduction of needles before drying of povidone-iodine No hand hygiene Cluttered work surfaces
Grohskopf (*32*)	*Serratia* sp.	Bloodstream infection	20	Analytical	Yes	Pooling of residual medications for reuse
Krause (*31*)	HCV[d]	HCV infection[d]	4	Analytical	NA	NA
Nakashima (*16*)	*Serratia* sp.	Arthritis	8	Analytical	Yes	Storage of filled syringes for use during next day Stoppers and skin wiped with cotton balls soaked in benzalkonium chloride Rinsing of storage canisters with tap water No hand hygiene No use of gloves
Oren (*18*)	HBV[c]	HBV infection[c]	5	Analytical	NA	Preparation of multi-dose heparin and saline solution, changed daily
Simon (*11*)	*Streptococcus* sp.	Abscess	8	Analytical	NA	Handling in contaminated areas Stopper wiped with sterile cotton soaked in alcohol Use of sterile single use needles and syringes
Stelter (*30*)	*Streptococcus* sp.	Abscess	12	Analytical	NA	Stopper and skin wiped with cotton balls soaked in alcohol
Stelter (*30*)	*Streptococcus* sp.	Abscess	7	Analytical	Yes	Stopper and skin wiped with disposable alcohol swabs

[a] NA = not available.
[b] HIV = human immunodeficiency virus.
[c] HBV = hepatitis B virus.
[d] HCV = hepatitis C virus.
[e] In a haemodialysis unit.

Table 3. **Studies reporting insulin injections given to diabetic patients with or without skin preparation**[a]

Study (ref.)	Time of observation	Study type	Physical examination of injection sites	No. of patients	Skin preparation protocol	No. of injections without skin preparation	No. of injections with skin preparation	No. of infections at injection site
Fleming (*41*)	0.5–59 years	Retrospective	No	21	NA[b]	66 807[c]	NA[b]	0
Fleming (*41*)	20 weeks	Prospective	Yes	42	Alcohol	7275[c]	6445	0
McCarthy (*42*)	NA	Prospective	Yes	50	Alcohol Tap water	600[d] 600[d]	600[d] 600[d]	0 0
Borders (*36*)	1 week	Retrospective	Yes	47	NA	NA	NA[b]	0
Stepanas (*44*)	⩾1 week	Prospective	No	3	NA	NA	NA[b]	0
Koivisto (*43*)	3–5 months	Prospective	Yes	13	70% alcohol	Over 1700	Over 1700	0

[a] Assuming that 0.01% of injections with skin preparation would lead to infection, a power calculation suggests that the pooled data would allow the detection of a relative risk of 12.5 or higher with a power of 80% and an alpha risk of 5%.
[b] NA = not available.
[c] Injections given through clothing.
[d] Individual patients reused their own injection equipment.

Prevention of needle-stick injuries to the provider

Best infection control practices for preventing infections among injection providers address the prevention of movements of patients, the prevention of unsafe recapping of needles, and the collection of contaminated sharps in puncture-proof and liquid-proof containers.

Movement of patients. Needle-stick injuries to providers when administering injections are usually attributable to the abrupt movement of patients during the procedure (*48*, *49*). Thus, it is important that providers anticipate and take measures to prevent sudden patient movement during and after injection. In some instances, physical assistance from other health care workers or family members might help to ensure that the procedure is carried out under appropriate circumstances.

Recapping. Avoiding recapping of needles and other hand manipulations of used needles is essential for preventing needle-stick injuries. A high proportion of needle-stick injuries are attributable to two-handed recapping (*48*). Teaching the one-handed, scooping–resheathing–recapping technique was effective in reducing the risk of recapping-related needle-stick injuries in one study (*50*). Thus, it is essential to use the single-handed scoop technique if recapping is necessary (e.g. in circumstances where a sharps container is not available).

Sharps collection. It is important to collect and properly contain syringes and needles at the point of use in a sharps container that is puncture- and leak-proof and that is sealed before it is completely full. Unsafe sharps waste collection causes between 5% and 28% of needle-stick injuries (*49*, *51*). Puncture- and liquid-proof containers designed for the collection of contaminated sharps are associated with a lower risk of needle-stick injuries than regular cardboard boxes (*52*). The presence of sharps containers close to the point of use reduces the incidence of recapping (*53*, *54*) and of recapping-related needle-stick injuries (*55*, *56*). Interventions that combine the provision of sharps containers and risk communications reduce the total number of needle-stick injuries (*49*, *57*).

Other practice issues

Engineered technologies. Current hypodermic needles and syringes with safety features for preventing needle-stick injuries require a provider-dependent activation step. Their effectiveness is unclear (*58–60*). None are able to protect the provider when giving an injection because the safety feature is only activated after use. Reports on the effectiveness of other, safer needle-bearing devices (e.g. intravenous catheters, phlebotomy needles) to protect health care personnel from needle-sticks are encouraging (*61–64*). Thus, whenever possible, devices designed to prevent needle-stick injury that have been shown to be effective for patients and providers are preferable.

Analysis of available evidence — preventing infections in the community

Contaminated sharps are a potential source of biohazard to the community at large. To prevent people being exposed to contaminated sharps, it is important to seal sharps containers for transport to a secure area in preparation for disposal (*65*). After closing and sealing, sharps containers must not be opened, emptied, reused, or sold. In South Asia, used injection equipment is sought for recycling, mostly for the plastic-ware industry (*66*). Such practices might lead to needle-stick injuries among waste pickers and can lead to illegal repackaging of syringes for reuse in hospitals and clinics. Finally, it is important to manage sharps waste in an efficient, safe, and environment-friendly way. Contaminated sharps were observed in the immediate surroundings of a high proportion of health care facilities in developing countries (*5*). Such unsafe sharps waste management exposes the community to needle-stick injuries (*67*).

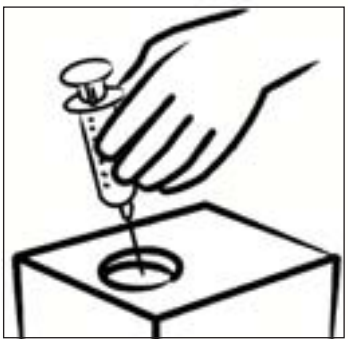
Discussion

We used WHO-recommended processes to formulate best infection control practices for intradermal, subcutaneous, and intramuscular injections and to address the use of sterile injection equipment, the prevention of contamination of injection equipment and medication, the prevention of needle-stick injuries to the provider, and the prevention of access to used needles. In addition, we addressed other practical issues that are relevant to injection providers. Although we addressed the safety of injections from the

Fig. 1. **Selected best practices in using injection equipment**

a) Use of new single-use equipment

b) Collection of dirty sharps in safety boxes



c) Safe sharps waste management

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perspectives of injection recipients, injection providers and communities, the burden of disease associated with unsafe injections is of a different magnitude among these three groups. In 2000, WHO estimated that contaminated injections might have caused 250 000 HIV infections among injection recipients, whereas needle-stick injuries might have caused 1000 HIV infections among injection providers. No estimates are available regarding the burden of disease among the general population associated with unsafe sharps waste disposal; however, the low frequency of needle-stick injuries in this group indicates that it would be of an even lower magnitude (*68*). Overall, making injection safe to the injection recipients should be the first priority from a public health point of view. Sharps waste management addresses a smaller burden of disease and may require the setting up of an infrastructure. Careful planning and integration throughout the health sector will limit costs and ensure sustainability.

The best practices do not constitute a standard for regulatory purposes or prescriptive guidelines. Rather, they distil critical steps believed to prevent injection-associated infections for resource-limited environments. Although this approach removes some elements that could make them directly applicable to a particular setting, it enables them to be adapted by specific programmes or countries on the basis of practicality, feasibility, or cost-effectiveness issues. For example, the recommendation to avoid multi-dose vials is not applicable in immunization services that make extensive use of them in developing countries. However, when multi-dose vials are used in immunization services, specific messages to providers will ensure their safe use.

These best practices did not address the use of specific safety devices, enabling the development group to avoid issues that could lead to actual or perceived conflicts of interest. Newer technologies supporting a safer use of injections have been developed. Auto-disable (AD) syringes inactivate after one use. Other safety mechanisms have been engineered to prevent needle-stick injuries. Policy decisions to recommend the use of these devices need to analyse in a cost-effectiveness evaluation the probability of achieving safe practices in the absence of the device, the effectiveness of the device in the setting where use is being considered, and the incremental cost involved.

These best practices do not include a recommendation to prepare the skin with an antiseptic. Skin-preparation protocols have an influence on the risk of infection for intravenous catheters (*69*). However, in this case, baseline rates of infections are higher and most infections are presumed to result from inward migration of bacteria from the insertion site (*69*). Among injecting drug users, skin cleaning may be associated with a lower risk of bacterial infections (*41*).

These best practices have several limitations. First, the scope of the best practice document was limited to intradermal, subcutaneous, and intramuscular injections that constitute the majority of injections and that are homogeneous in terms of infection control requirements. Second, because infections constitute the most common adverse effect associated with injections, the scope of these best practices was restricted to infection control and did not address other recommended practices (e.g. ensuring that the right dose of injection is given to the right patient, at the right time, etc.). Third, the quality of medications and equipment was not addressed, as it depends on national regulatory authorities rather than on injection providers. Fourth, in the absence of data, the practice of removing needles after injections to collect sharps waste separately was not addressed. Disassembling injection equipment might cause needle-stick injuries (*48*). In addition, it is unclear whether removing needles might produce splatters and aerosols as needle cutters do (*70*). Thus, safety evaluations are needed before this practice can be recommended. Fifth, although they call for a reduction in injection overuse, our best practices do not provide details regarding the strategies proven to be effective in reducing the use of injections. Additional details regarding the rational use of injections may be obtained from the WHO Department of Essential Drugs and Medicine Policy.

WHO will promote the use of these best practices to prevent injection-associated infections. Pictogrammes (Fig.1) were developed to illustrate each of the steps and are available for download from the following URL:

www.injectionsafety.org. The best practices are also used as a reference for a set of WHO education tools and for a tool to assess injection safety in health care facilities. To ensure that these best practices continue to be useful, users should continue reviewing scientific literature for new information and WHO will plan for revisions using the same methodology five years after the initial development, i.e. in 2005. ■

Acknowledgements

These best practices were approved by the steering group (who are the authors of this article), and the development group: Baheeja Abdulla (Infection Control Officer, Salaminya Medical Complex, Bahrain), Naima Al-Gasseer (Nursing and Midwife Services, WHO), Aranya Chaowalit (Dean, Faculty of Nursing, Prince of Songkla University, Thailand), Cynthia Chasokela (Director of Nursing Services, Ministry of Health and Child Welfare, Zimbabwe), John Nicolas Crofts (Deputy Director, Macfarlane Burnet Centre for Medical Research, Australia), Philippe Duclos (Immunization Safety, WHO), Pilar Gavinio (Hepatitis C Prevention, WHO), Catherine MacCaulay (Senior Quality Assurance Advisor, The Quality Assurance Project, USA), Henry Francis, Director, (Center on AIDS and Other Medical Consequences of Drug Abuse, National Institute on Drug Abuse, USA), Annette Pruess (Health Care Waste Management, WHO), and Arnaud Tarantola (Medical Officer, Groupe d'Etude sur le Risque d'Exposition des Soignants aux Agents infectieux (GERES), France).

Funding for the development of these best practices was provided by the United States Agency for International Development (USAID).

Conflicts of interest: none declared.

Résumé

Meilleures pratiques pour prévenir les infections liées aux injections intradermiques, sous-cutanées et intramusculaires

Objectif Elaborer des lignes directrices à partir des meilleures données disponibles pour améliorer la sécurité des injections.

Méthodes Un groupe d'étude a recensé, à partir de données probantes, les meilleures pratiques permettant de prévenir les infections liées aux injections dans les situations de ressources limitées. Son travail a consisté à traduire la définition de référence de la sécurité des injections adoptée par l'OMS en une série d'étapes essentielles, à passer en revue l'ensemble des publications consacrées à chacune de ces étapes, à élaborer un projet de document sur les meilleures pratiques d'injection et à le soumettre à un examen collégial.

Résultats La première chose à faire pour prévenir les infections associées aux injections est d'éliminer toutes les injections inutiles. Pour les injections intradermiques, sous-cutanées ou intramusculaires médicalement justifiées, il est recommandé d'utiliser du matériel d'injection stérile, de prévenir toute contamination du matériel d'injection et des produits injectés, d'éviter que le personnel ne se blesse en manipulant les aiguilles et d'empêcher l'accès aux aiguilles usagées.

Conclusion Les meilleures pratiques pour la sécurité des injections intradermiques, sous-cutanées et intramusculaires serviront de référence pour les efforts mondiaux visant à garantir un usage sûr et approprié des injections. Ces meilleures pratiques seront révisées par l'OMS cinq ans après leur élaboration, soit en 2005.

Resumen

Prácticas óptimas contra las infecciones para las inyecciones intradérmicas, subcutáneas e intramusculares

Objetivo Formular directrices basadas en la evidencia para aumentar la seguridad de las inyecciones.

Métodos Un grupo de desarrollo resumió las prácticas óptimas basadas en la evidencia para prevenir las infecciones asociadas a inyecciones en los entornos con recursos limitados. El proceso de desarrollo incluía un desglose de la definición de referencia de la OMS de lo que constituye una inyección segura en una lista de pasos potencialmente críticos, un examen de la literatura para cada uno de esos pasos, la formulación de las prácticas óptimas, y el examen por homólogos del documento preliminar.

Resultados La eliminación de las inyecciones innecesarias constituye la máxima prioridad para prevenir las infecciones asociadas a inyecciones. En el caso de las inyecciones intradérmicas, subcutáneas o intramusculares efectuadas por indicación médica, las mejores prácticas de control de las infecciones incluyen el uso de instrumental de inyección estéril, la prevención de la contaminación de dicho instrumental y de la medicación, la prevención de los pinchazos del dispensador, y la prevención del acceso a las agujas usadas.

Conclusión Las prácticas óptimas de control de las infecciones para las inyecciones intradérmicas, subcutáneas e intramusculares constituirán una referencia para los esfuerzos mundiales desplegados hacia la meta de la utilización segura y apropiada de las inyecciones. La OMS revisará las prácticas óptimas a los cinco años de iniciado su desarrollo, esto es, en 2005.

ملخص

أفضل الممارسات لمكافحة العدوى بإبر الحقن العضلي والأدمي وتحت الجلد

الهدف: وضع دلائل إرشادية مرتكزة على البيِّنات لجعل الحقن أكثر أماناً.

الطريقة: قامت مجموعة مَغْنِيَّة بإعداد موجز لأفضل الممارسات المُرْتَكزة على البيِّنات للوقاية من العدوى التي ترافق ممارسات الحقن في المواقع ذات الموارد المحدودة. وقد تضمَّنت عملية الإعداد مراحل تفصيلية لتعريف مرجعي لمنظمة الصحة العالمية للحقن المأمون على شكل قائمة من المراحل والخطوات الأساسية، وإعداد وثيقة مبدئية، وعرضها على الزملاء للمراجعة.

الموجودات: إن التخلُّص من الحقن غير الضرورية هو الإجراء الذي يحظى بالأولوية المطلقة للوقاية من العدوى التي ترافق الحقن؛ أما إذا كان هناك ما يستدعي الحقن العضلي أو الأدمي أو تحت الجلد، فإن أفضل الممارسات لمكافحة العدوى تشتمل على استخدام معدات حقن معقَّمة، والوقاية من تلوُّث معدات الحقن والأدوية، واتِّقاء الأذيات بوخز الإبر لمن يقوم بحقن الدواء، ومنع إتاحة الإبر المستعملة.

الاستنتاج: إن توفُّر أفضل ممارسات مكافحة العدوى بالحقن العضلي أو الأدمي أو تحت الجلد سيوفر مرجعاً للجهود العالمية لتحقيق المرمى بالاستخدام الملائم والمأمون للحقن. وستقوم منظمة الصحة العالمية بمراجعة أفضل الممارسات بعد خمس سنوات من إعدادها، أي في عام ٢٠٠٥.

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