Chapter 22

Occupational Health Risks for Healthcare Workers

Walter Popp and Candace Friedman

Key Points
• Healthcare workers are exposed to biological, chemical, physical, ergonomic, and psychosocial hazards. • Hepatitis B, hepatitis C, human immunodeficiency virus, and tuberculosis pose the greatest risk of infection to healthcare workers. • Infection with hepatitis B virus is preventable with immunisation; all healthcare workers should be vaccinated against hepatitis B. • Written standard procedures on how to manage needle-stick injuries should be available and known to all staff. • Occupational medicine and infection prevention and control may be performed by the same person in low resource facilities or countries.

Background

Health care facilities around the world employ over 59 million workers[1] who are exposed to many health hazards including:

- Biological: tuberculosis (TB), Hepatitis B and C, human immunodeficiency virus (HIV), multi-resistant bacteria
- Chemical: disinfectants, ethylene oxide, antineoplastic agents, anaesthetic gases, latex (in gloves causing allergies)
- Physical: noise, radiation, falls
- Ergonomic: heavy lifting, musculoskeletal disorders
- Psychosocial: shift work, violence, stress, burn-out

Each year 3 million healthcare workers (HCW) are exposed to bloodborne pathogens through a percutaneous route; 2 million are known to be exposed to hepatitis B, 900,000 to hepatitis C, and 170,000 to HIV. However underreporting of injuries can reach 40-75%, so there may be many more unreported cases. Known exposures result in 15,000, 70,000, and 1,000 infections, respectively, and greater than 90% of these infections occur in developing countries.[2]

Needle-stick injuries, which cause 95% of HIV seroconversions in HCWs, are preventable using practical and low-cost measures. Infection with hepatitis B virus (HBV) is 95% preventable with immunisation, however less than 20% of HCWs in some regions of the world have received all three vaccine doses needed for immunity.[1]

The main focus for occupational health programmes is prevention of exposure through improved work practices, proper use of personal protective equipment (PPE), and implementation of standard precautions/ routine practices. This focus applies even in limited resource settings where availability of PPE might be limited. HCWs should understand all prevention measures (e.g., HBV vaccination).

Prevention

Basic principles

Occupational medicine and infection prevention and control (IPC) may be performed by the same person in low resource facilities or countries, although separate departments are preferred. To reduce occupational risks to HCWs:

- Conduct a written risk assessment for staff regarding physical, chemical, biological, ergonomic, and psychosocial hazards.
- Review the risk assessment annually to determine if the risks have changed or whether there are additional risks.
- Include an estimate of the degree of risk, e.g., low, medium, or high (see Tables 22.1 and 22.3)

Once a risk assessment is performed, reduce the risks to HCWs using the following order of activities:

1. Eliminate the hazard – for example:
    - Reduce the number of injections by providing more oral medication[4-6]
    - Assign a central hospital/location for treating highly infective patients (e.g., TB) – for community.
2. Try to remove or isolate the hazard – for example:
    - Use safety needles (single-use needles designed to retract or cover the sharp end immediately after use).[6]

- Transport blood specimens in leak- and puncture-resistant boxes and use puncture-resistant waste boxes for discarding sharp items and needles.
- Manage healthcare waste properly. For example sharp disposal containers should be in a place easily accessible for staff.

3. Organisational measures - organise work so that the exposure is reduced - for example:
    - Reduce the number of staff members who care for a patient with TB, Carbapenem-resistant Enterobacteriaceae (CRE), or methicillin-resistant *S. aureus* (MRSA).
    - Train staff regularly in safe working condition practices.
    - Establish an occupational safety committee. In small hospitals this committee may be the IPC committee.
    - Consider every patient to be potentially infected with hepatitis B or C or HIV and be prepared – work with strict adherence to Standard Precautions/Routine Practices.
    - Audit compliance periodically focusing on prevention measures.
4. Evaluate use of PPE – for example:
    - Gloves: Discard and change between patients. Use only once whenever possible.
    - Gowns: Use if there is a potential for spills/splashes; change between patients. Single-use gowns are preferred. If gowns are used several times, e.g., during a shift time, put on the gown and remove it without touching the outer, potentially contaminated, side.[7]
    - Eye goggles or face shields: Use if spills/splashes to the face are possible. Disinfect regularly and if visibly soiled. Reusable eye protective equipment can be used (e.g., goggles or face shield), but may pose a risk of cross-infection if not cleaned and decontaminated properly according to the manufacturer's instructions after each use.[7]
    - Masks and respirators: N95/FFP respirators that have a tight face seal should be used if there is a risk of exposure to airborne pathogens. When these items are not available, surgical masks are the best alternative, especially against droplet infection. Self-constructed, washable, and reusable textile masks provide some protection against severe acute respiratory syndrome, and may be better than no protection.[8]

Table 22.1. Classification of biological agents into 4 groups according to their level of risk of infection[3]

Risk group	Description	Examples
1	Biological agent unlikely to cause human disease	Bacteria in yoghurt Yeast in beer
2	Biological agent that can cause human disease and might be a hazard to workers; it is unlikely to spread to the community; there is usually effective prophylaxis or treatment available	Most bacteria Nearly all moulds Most viruses
3	Biological agent that can cause severe human disease and present a serious hazard to workers; it may present a risk of spreading to the community, however there is usually effective prophylaxis or treatment available	Hepatitis B Hepatitis C Human immunodeficiency virus Tuberculosis
4	Biological agent that causes severe human disease and is a serious hazard to workers; it may present a high risk of spreading to the community; there is usually no effective prophylaxis or treatment available	Lassa virus Ebola virus Middle East Respiratory Syndrome Severe Acute Respiratory Syndrome?

Develop written standard operating procedures for medium and high-risk activities. These may be identical to infection prevention and control procedures; however they should include staff protection and vaccination recommendations. Provide a medical examination for all HCWs:

- The examination should include a physical examination and medical history for all new staff performed by an experienced physician.
- Results of the examination should be documented.
- HCW examination records and other health information should be kept confidential and stored in a secure place.
- Provide vaccinations for all staff. The following vaccinations are strongly recommended for all non-immune HCWs:
    - Hepatitis B
    - Influenza
    - Mumps/Measles/Rubella/Varicella/Pertussis (specially for staff working with children)
    - Poliovirus
    - Tetanus, Diphtheria
- Consider TB screening for staff
- All injuries should be documented in the respective staff member's medical record.
- Repeat the examination periodically, e.g., every 3 years.

Low Resource Issues

In low resource countries, special interest should be focused on preventing needlestick injuries. The two most important causes of these injuries are recapping of needles and unsafe handling of sharps waste. Other causes include:

- Overuse of injections
- Lack of supplies (disposable syringes, safer needle devices, sharps-disposal containers)
- Failure to place needles in sharps containers immediately after injection
- Passing instruments from hand to hand, e.g., in operating theatres
- Lack of awareness of the problem and lack of training for staff

Hepatitis B, hepatitis C, HIV, and TB pose the greatest risks of infection to HCWs in low resource countries. The risk of transmission from an infected patient to a HCW by a needlestick injury is around:[5,6,9-11]

- 30% for hepatitis B
- 3% for hepatitis C
- 0.3% for HIV

Surveillance of needle-stick or sharp injuries may help identify problem areas/devices and be used in educating staff. After each needle-stick or sharp injury:

- Ideally, any skin wound should be disinfected using alcohol or alcohol-based hand rub (use of alcohol will cause pain). If alcohol is not available, wash extensively with soap and water.
- For mucous membrane exposure, only water douching/washing may be realistic (alternatives: iodine, chlorhexidine, or octenidin preparations).

- After disinfection, the risk of transmission should be assessed. The risk may be increased with deep wounds, visible blood on the device, a blood-filled needle, or a high viral load status of the index/source patient (if known).

Specific prevention practices

Hepatitis B

The risk of infection with hepatitis B virus (HBV) can be avoided by decreasing exposure to blood and body fluids and through vaccination. Post-exposure prophylaxis (PEP) varies with the immune status of the HCW. See Table 22.2. If PEP is required it should be administered as soon as possible (preferably within 24 hours).[12]

Table 22.2. Recommended post-exposure prophylaxis for exposure to hepatitis B virus[9]

Vaccination and antibody response status of exposed workers*	Treatment		
	Source HBsAg† positive	**Source HBsAg† negative**	**Source unknown or not available for testing**
Unvaccinated	HBIG§ x1 and initiate HB vaccine series¶	Initiate HB vaccine series	Initiate HB vaccine series
Previously vaccinated			
Known responder**	No treatment	No treatment	No treatment Known
nonresponder††	HBIG x1 and initiate HBIG x 1 and revaccination or HBIG x2§§ one month apart	No treatment	If known high-risk source, treat as if source were HBsAg positive
Antibody response unknown	Test exposed person for anti-HBs¶¶	No treatment	Test exposed person for anti-HBs¶¶
	1. If adequate,** no treatment is necessary		1. If adequate,¶ no treatment is necessary
	2. If adequate,†† administer HBIG X1 and vaccine booster		2. If inadequate,¶ administer vaccine booster and recheck titer in 1–2 months

* Persons who have previously been infected with HBV are immune to reinfection and do not require post-exposure prophylaxis.

† Hepatitis B surface antigen.

§ Hepatitis B immune globulin; dose is 0.06 mL/kg intramuscularly.

¶ Hepatitis B vaccine.

** A responder is a person with adequate levels of serum antibody to HBsAg (i.e., anti-HBs ≥10 mIU/mL).

†† A non-responder is a person with inadequate response to vaccination (i.e., serum anti-HBs < 10 mIU/mL).

§§ The option of giving one dose of HBIG and reinitiating the vaccine series is preferred for non-responders who have not completed a second 3-dose vaccine series. For persons who previously completed a second vaccine series but failed to respond, two doses of HBIG are preferred.

¶¶ Antibody to HBsAg.

Hepatitis C

There is currently no recommended PEP for hepatitis C virus (HCV). Perform baseline and follow-up testing for anti-HCV and alanine aminotransferase (ALT) up to six months after exposure. Perform HCV RNA testing at 4-6 weeks if an earlier diagnosis of HCV infection is desired. Staff members who develop hepatitis C should be treated after seroconversion.

Human immunodeficiency virus

PEP against HIV should be started as soon as possible, preferably within 2-24 hours, not after 72 hours.[13] Problems with HIV PEP include:

- Proof of HIV transmission is only possible using PCR testing, which is only available in highly developed laboratories.
- PEP must be given within hours of exposure. Do not wait for test results.
- Contraindications (e.g., pregnancy) should be considered. None of the current drug regimens recommended for post-exposure prophylaxis is contraindicated for pregnant women. Breastfeeding should not contraindicate post-exposure prophylaxis, however the risks and benefits of continuing breastfeeding while HIV transmission risk is unknown and should be discussed with the mother.[13]
- There is a high rate of side effects (and a high rate of dropouts in taking the drugs).
- Medication must be taken for at least 4 weeks.

HIV PEP may not be available in some countries; therefore, attention should be given to using PPE and safe practices to avoid injuries. Seek expert consultation if viral resistance is suspected. In case no PEP is available:

- Perform HIV antibody testing for at least six months post-exposure (e.g., at baseline, six weeks, three months, and six months).
- Perform HIV antibody testing if an illness compatible with an acute retroviral syndrome occurs.
- Advise exposed persons to use precautions to prevent secondary transmission during the follow-up period.

Multi-resistant bacteria

Multi-resistant bacteria, such as MRSA, vancomycin-resistant enterococcus (VRE), and extended-spectrum beta lactamase bacteria (ESBL), may pose harm to staff if they become carriers. It is known that MRSA carriers have a higher risk of getting an infection and dying of it than non-carriers. Most MRSA carriers can be decolonised so that it makes sense to find MRSA carriers in staff, decolonise them and reduce their individual risk – and additionally the risk of patients to get infected from staff. The situation with ESBL, CRE, or VRE carriers is different because most of them are carriers in the gut and there is no proven means to decolonise them.

Tuberculosis

Some measures to control healthcare-associated TB transmission (ventilation systems, isolation rooms, personal protective equipment) may be beyond the resources of low-income countries.[14-16] The following measures may reduce the risk of transmission:

- Establish a TB control committee/programme.
- Place patients with suspected TB or with an abnormal chest radiograph in an isolation room with door closed and a special ventilation system (natural or artificial).[15,17]

- Restrict sputum induction procedures and aerosolised pentamidine treatments to TB isolation rooms.
- Assign an adequate number of trained staff to perform routine and urgent acid-fast bacilli smears on a daily basis.
- Initial anti-TB treatment regimens should include four drugs. Treatment regimens may need to be altered for MDR-TB or XDR-TB.[18]
- Patients in TB isolation rooms should only be allowed to leave their rooms when medically necessary and *must* always wear a surgical mask when outside the room.
- Place automatic closing devices on all TB isolation room doors.
- Continue isolation of TB patients until at least three negative acid-fast bacilli sputum smears are obtained.
- Forbid immunocompromised staff from contact with, or caring for, patients with TB.
- Ensure that all HCWs entering a TB isolation room wear a N95/FFP mask (or – if not available - at least a surgical mask).
- Perform routine tuberculin testing for tuberculin negative staff. In case of tuberculin conversion: Rule out active tuberculosis and treat HCW for latent TB infection. Newly available Interferon Gamma Release Assays are more specific than tuberculin skin tests and are not affected by prior Bacille Calmette-Guerin vaccinations.[15]
- Each HCW has to inform a designated person on the TB control committee (or occupational health staff) if a cough for longer than 3 weeks has not responded to a course of antibiotics.
- Treat HCWs as soon as active TB is confirmed.

References

1. Health worker occupational health. World Health Organization. http://www.who.int/occupational_health/topics/hcworkers/en/ [Accessed 5 January 2016]
2. AIDE-MEMOIRE for a strategy to protect health workers from infection with bloodborne viruses. World Health Organization. 2011. (http://www.who.int/injection_safety/toolbox/en/AM_HCW_Safety_EN.pdf [Accessed 5 January 2016]
3. Directive 2000/54/EC of the European Parliament and of the Council of 18 September 2000 on the protection of workers from risks related to exposure to biological agents at work (seventh individual directive within the meaning of Article 16(1) of Directive 89/391/EEC) http://europa.eu/legislation_summaries/employment_and_social_policy/health_hygiene_safety_at_work/c11113_en.htm [Accessed 5 January 2016]
4. Popp W, Rasslan O, Unahalekhaka A, et al. What is the use? An international look at reuse of single-use medical devices. *Int J Hyg Environ Health* 2010; 213: 302-307.
5. Simonsen L, Kane A, Lloyd J, Zaffran M, Kane M. Unsafe injections in the developing world and transmission of bloodborne pathogens: a review. *Bull WHO* 1999; 77: 789-800. http://www.who.int/bulletin/archives/77(10)789.pdf [Accessed 5 January 2016]
6. WHO guideline on the use of safety-engineered syringes for intramuscular, intradermal and subcutaneous injections in health-care settings, 2015. http://www.who.int/injection_safety/global-campaign/injection-safety_guidline.pdf?ua=1 [Accessed 5 January 2016]
7. Infection prevention and control of epidemic-and pandemic prone acute respiratory infections in health care. WHO guidelines 2014. http://who.int/csr/bioriskreduction/infection_control/publication/en/ [Accessed 5 January 2016]
8. van der Sande M, Teunis P, Sabel R. Professional and homemade face masks reduce exposure to respira-

tory infections among the general population. PLoS ONE 2008; 3:e2618. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0002618

9. Kuhar DT, Henderson DK, Struble KA, et al. Updated US Public Health Service Guidelines for the Management of Occupational Exposures to Human Immunodeficiency Virus and Recommendations for Postexposure Prophylaxis. *Inf Control Hosp Epidemiol* 2013; 34: 875-892. http://stacks.cdc.gov/view/cdc/20711 [Accessed 5 January 2016]
10. CDC: Recommendations for Postexposure Interventions to Prevent Infection with Hepatitis B Virus, Hepatitis C Virus, or Human Immunodeficiency Virus, and Tetanus in Persons Wounded During Bombings and Similar Mass-Casualty Events — United States, 2008. *MMWR* 2008; 57 (RR-6). http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5706a1.htm [Accessed 5 January 2016]
11. Wilburn, SQ, Eijkemans G. Preventing Needlestick Injuries among Healthcare Workers: A WHO–ICN Collaboration. *Int J Occup Environ Health* 2004; 10: 451–456.
12. Postexposure Prophylaxis to Prevent Hepatitis B Virus Infection. *MMWR* 2006; 55 (RR16); 30-31. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5516a3.htm?s_cid=rr5516a3_e [Accessed 5 January 2016
13. WHO Guidelines on Post-Exposure Prophylaxis for HIV and the Use of Co-Trimoxazole Prophylaxis for HIV -Related Infections among Adults, Adolescents and Children: Recommendations for a Public Health Approach, 2014. http://apps.who.int/iris/bitstream/10665/145719/1/9789241508193_eng.pdf?ua=1&ua=1 [Accessed 5 January 2016]
14. Harries, AD, Maher D, Nunn P. Practical and affordable measures for the protection of health care workers from tuberculosis in low-income countries. *Bull WHO* 1997; 75: 477-489.
15. Implementing the WHO Policy on TB Infection Control in Health-Care Facilities, Congregate Settings and Households.
16. Guidelines for the prevention of tuberculosis in health care facilities in resource-limited settings, 1999. http://www.who.int/tb/publications/who_tb_99_269/en/ [Accessed 5 January 2016]
17. Escombe, AR, Oeser CC, Gilman RH, et al. Natural Ventilation for the Prevention of Airborne Contagion. *PLoS Med* 2007; 4(2): e68. doi:10.1371/journal.pmed.0040068. http://www.plosmedicine.org/article/info%3Adoi%2F10.1371%2Fjournal.pmed.0040068 [Accessed 5 January 2016]
18. WHO Management of MDR-TB: A field guide, 2009. http://apps.who.int/iris/bitstream/10665/44163/1/9789241547765_eng.pdf?ua=1&ua=1 [Accessed 5 January 2016]

Further Reading

1. CDC: Immunization of Health-Care Workers. Recommendations of the Advisory Committee on Immunization Practices (ACIP) and the Hospital Infection Control Practices Advisory Committee (HICPAC). *MMWR* 2011; 60 (RR07): 1-45. http://www.cdc.gov/mmwr/preview/mmwrhtml/rr6007a1.htm [Accessed 5 January 2016]
2. Joint WHO-ILO-UNAIDS policy guidelines on improving health workers' access to HIV and TB prevention, treatment, care and support services, 2005. http://www.who.int/occupational_health/publications/hiv_tb_guidelines/en/ [Accessed 5 January 2016]
3. A guidance note (2010). http://www.ilo.org/aids/Publications/WCMS_149714/lang--en/index.htm [Accessed 5 January 2016]
4. Joshi, R, Reingold AL, Menzies D, Pai M. Tuberculosis among Health-Care Workers in Low- and Middle-Income Countries: A Systematic Review. *PLoS Med* 2006; 3(12): e494. doi:10.1371/journal.pmed.0030494. http://www.plosmedicine.org/article/info:doi/10.1371/journal.pmed.0030494 [Accessed 5 January 2016]
5. National Institute for Occupational Safety and Health (US): Health care workers. http://www.cdc.gov/niosh/topics/healthcare/ [Accessed 5 January 2016]

6. Weber DJ, Rutala WA, Schaffner W. Lessons learned: protection of healthcare workers from infectious disease risks. *Crit Care Med* 2010; 38: S306-314.

7. Health and Safety (Sharp Instruments in Healthcare) Regulations 2013. http://www.hse.gov.uk/pubns/hsis7.htm [Accessed 5 January 2016]

8. Needlestick Safety & Prevention Act (2000) USA. https://www.osha.gov/needlesticks/needlefaq.html [Accessed 16 November 2015]

9. Injection Safety – World Health Organization. http://www.who.int/patientsafety/activities/technical/injection_safety/en/ [Accessed 5 January 2016]

Published by the International Federation Of Infection Control
47 Wentworth Green
Portadown, BT62 3WG, N Ireland, UK
www.theific.org

Table 22.3. Risk evaluation for infectious agents in health care settings

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents[3]	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
		Staff to patient	Patient to staff				
Cholera	Faecal-oral, contaminated water	Rare	Rare	2	Stool contact	Yes	
Conjuntivitis, viral (e.g., adenovirus)	Contact with eye secretions and contaminated objects	High	High	2	Hand contact and touching eye	No	No
Cytomegalovirus (CMV)	Contact with urine, saliva, breast milk, cervical secretions, or semen from infected person who is actively shedding virus	Rare	Rare	2	Contact with body fluids, especially saliva, blood, or urine	No	No
Diphtheria	Droplets, also by contact	No data	Rare	2	Close face to face exposure, cough	Yes	PEP with antibiotic should be discussed
Ebola virus	Blood-borne; contact transmission	Negligible	Moderate	4	Blood splash on mucous membrane, needle-stick injury	No	Antivirals should be discussed
Haemorrhagic fever (Marburg, Lassa virus)	Blood-borne; some question of contact transmission	Negligible	Moderate	4	Blood splash on mucous mem-brane	No	Antivirals should be discussed
Hepatitis A	Person-to-person by faecal-oral route; infected food handlers with poor personal hygiene can contaminate food	Rare	Rare	2	Stool contact	Yes	Immune globulin
Hepatitis B	Percutaneous, mucosal, or non-intact skin contact with blood, semen, vaginal secretions, or bloody fluids	Low	Moderate	3	Needle-stick injury	Yes	Hepatitis B immune globulin (HBIG)

Table 22.3. Risk evaluation for infectious agents in health care settings

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents[3]	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
		Staff to patient	Patient to staff				
Hepatitis C	Percutaneous, mucosal, or non-intact skin contact with blood, semen, vaginal secretions, or bloody fluids	Low	Moderate	3	Needle-stick injury	No	No
Herpes simplex	Contact with virus in saliva of carriers; contact with vesicle fluid	Rare	Low	2	Contact with infected site	No	No
Human immunodeficiency virus (HIV)	Primarily percutaneous contact with blood; mucosal or non-intact skin contact with blood; semen, vaginal secretions, or bloody body fluids less likely to transmit	Rare	Low	3	Needle-stick injury		Antivirals must be provided within hours!
Influenza	Droplet; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients	Moderate	Moderate	2	Close contact with patient (Within 3 feet from coughing/ sneezing)	Yes	Antivirals normally not recommended
Measles (Rubeola)	Airborne; direct airborne transmission or airborne to contact transmission of respiratory secretions of infected person	High	High	2	Inhaling or contact with the patient's respiratory secretions	Yes	Immune globulin
Meningococcal infection	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients		Rare	2	Close contact; face to face	Yes (tetravalent A, C, W135, and Y)	Antibiotic after close contact

Table 22.3. Risk evaluation for infectious agents in health care settings

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents[3]	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
		Staff to patient	Patient to staff				
Middle East respiratory syndrome coronavirus (MERS-CoV)	Contact or droplet spread	Rare	Rare	4	Close contact	No	No
Multi-resistant bacteria (MRSA, ESBL, VRE)	Direct and indirect contact	rare	Rare	2	Close contact; face to face; contact with faeces	no	no
Mumps	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients	Moderate	Moderate	2	Close contact with patient (Within 3 feet from coughing/ sneezing)	Yes	
Norovirus	Faecal-oral (direct or indirect contact with patient's stool)	High	High	2	Stool contact	No	No
Pertussis	Droplet spread; direct droplet transmission or droplet to contact transmission of respiratory secretions of infected patients	Moderate	Moderate	2	Cough	Yes	Macrolides
Polio	Faecal-oral	Rare	Rare	2	Close contact with patient	Yes	
Rabies	Animal bite	Rare	Rare	3	Bites	Yes	Yes

Table 22.3. Risk evaluation for infectious agents in health care settings

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents[3]	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
		Staff to patient	Patient to staff				
Respiratory syncytial virus (RSV)	Droplet contact or direct contact with respiratory secretions	Moderate	Moderate		Close contact with patient (Within 3 feet from coughing/ sneezing)	No	
Rotavirus	Faecal-oral	Moderate	Moderate	2	Stool contact		
Rubella	Droplet contact or direct contact with respiratory secretions; airborne transmission not demonstrated.	Moderate	Moderate	2	Close contact with patient (Within 3 feet from coughing/ sneezing)	Yes	
Salmonella or Shigella	Faecal-oral route; via contaminated food or water; food handlers with poor personal hygiene can contaminate food	Low	Low	2	Stool contact		
Severe acute respiratory syndrome (SARS)	Droplets, contact	Medium	Medium	3	Cough	No	No
Scabies	Direct skin-to-skin contact with infested person	Low	Low		Skin contact		
Streptococcus, Group A	Droplet contact or direct contact with oral secretions or drainage from infected wounds	Rare	No data	2			

Table 22.3. Risk evaluation for infectious agents in health care settings

Infection	Transmission in general	Risk of transmission evaluation		Risk classification of biological agents[3]	Main risk	Vaccine available	Post-exposure prophylaxis (PEP)
		Staff to patient	Patient to staff				
Syphilis	Direct contact with lesions of primary or secondary syphilis	No data	Rare	2	Direct contact with skin or mucous membrane lesions		Antibiotics possible
Tetanus	Bites, skin wounds	No data	No data	2		Yes	Immune globulin
Tuberculosis (TB)	Airborne transmission from sources with active pulmonary or laryngeal tuberculosis; susceptible person must inhale airborne droplet nuclei to become infected	Low to high	Low to high	3	Cough, sneeze	BCG - Bacille Calmette Guérin (Not given to healthcare workers)	Isoniazid (INH) for treatment of latent TB infection; 4 drug regimen for active TB
Typhus	Faecal-oral	Low	Low	3	Stool contact	Yes	
Varicella, Chickenpox, disseminated zoster	Contact with vesicles; droplet or airborne spread from respiratory tract of acute cases and perhaps from disseminated zoster	High	High	2		Yes	Varicella-zoster immune globulin (VZIG)
Localised varicella-zoster (shingles)	Contact with vesicles	Moderate	Moderate				
Yellow fever	Mosquito bites	Negligible	Rare			Yes	No