Emergency Preparedness

81

Abstract

Outbreaks of infectious diseases during peacetime or in disaster/war-related conditions, may most often need an effective crisis management in the hospital. The emergency preparedness in hospitals may vary within, and between countries, dependent on endemic and epidemic conditions, capacity, knowledge and economy. Lack of preparedness may result in a high risk of disease burden and death and cause a high economic impact on the health care.

Keywords

High-risk microbes · Lassa/Ebola/SARS/MERS/Nipah/avian influenza and other viruses · Anthrax/pest/cholera/diphtheria and other bacteria · Emergency Preparedness · Crisis management · Infection control · Isolation · Disinfection

81.1 Purpose

- Protect the healthcare institution and the society in general:
  - Against spread of infection during outbreak of unusually infectious and universal very dangerous disease
  - Unusually high number in the society of transmitted contagious disease in peacetime, in disasters, and when the country is in war or when war threatens
- Have an emergency plan for how to act in situations of such outbreaks.

81.2 Comprise

- All persons responsible for the emergency plan and for implementation of the plan
- Determined by epidemic situation and the type of infectious agent

© Springer Nature Switzerland AG 2019

B. M. Andersen, *Prevention and Control of Infections in Hospitals*,
https://doi.org/10.1007/978-3-319-99921-0_81

81.3 Responsibility

The hospital's management/crisis management in cooperation with the emergency response team for infection control supervises the work at the hospital in cooperation *with national health authorities and county governor* [1–7].

The Directorate for Social Security and Preparedness is responsible for the national risk image and for follow-up. (DSB, Norway 2014)

Law on Health and Social Preparedness for Infectious Diseases may be present and implemented in some countries, like in Norway [1].

Emergency Plans, Guidelines and Reports are made for outbreaks of infections like anthrax, SARS, avian influenza, pandemic influenza, MERS, Ebola, etc, see Table 80.1 [1–64], Chap. 80.

- **National**—example Norway [1–15]
- **Local**—example Ullevål University Hospital, Oslo [16–34, 52, 53]
- **International**—WHO, ECDC, CDC, UK, etc. [35–51]

81.4 Practical Measures [23]

Epidemiological conditions—concerning infectious diseases:

81.4.1 "Normal" Conditions

Globally, there are endemic and epidemic conditions that may vary by time, localisation and use of antibiotics and still be perceived as "normal" for this actual country [65–77]. Special infections, like resistant microbes, are increasing in most countries in the world, and WHO made in 2017 a priority list of 12 families of bacteria ("nightmare" bacteria) that agency experts say "pose the greatest threat to human health and kill millions of people every year" (WHO 27 Feb 2017) [67]. In 2017 CDC identified more than 220 samples of these "nightmare" bacteria containing unusual resistance genes in the United States and more than 1400 isolates from clinical samples of 32 states during the first 9 months of 2017 [66–70]. The endemic and epidemic conditions of these resistant bacteria vary between countries and are associated with risk of deaths, a high disease burden and death and an overall economic impact, reducing the gross domestic product (GDP) up to 1.6% [70].

Resistant microbes usually follow patients and personnel with "import status" (from other countries or areas with endemic conditions) and are caught early in the process by good routines and preliminary investigations [52, 53, 73–77]. Import routines (testing for MRSA, ESBL, CRE, CP, VRE, TBC, etc.) work usually well at the hospital, both for patients and for personnel (MRSA and TBC) [52, 53, 71–75]. Resistant microbes create even larger problems in primary care.

Healthcare professionals are generally exposed to infection if relevant precautions are not used. About 5–10% of MRSA-exposed healthcare persons may be infected or carriers with MRSA, and 10–20% of infected may need treatment, long-term sick leave, etc. [74–76] Screening of healthcare contacts of patients infected with carbapenemase-producing, very resistant bacteria with super-resistant genes in the United States found that one in ten was colonized with these bacteria [66].

Annual norovirus epidemics occupy the isolation capacity and lead to high sickness absence among infected healthcare professionals. Winter epidemics of RS virus and rotavirus in infants and flu outbreaks in all age groups occur each year. These are normal epidemiological conditions.

See also pre-examinations of patients, Chap. 47 and different isolation procedures, Chaps. 14–19.

81.4.2 Sporadic Outbreak of Serious Infectious Disease: Import Disease

Preparedness measures depend on the agent, extent and rate of development. As a rule, such infections are far from most countries in Europe, such as SARS, bird flu and Ebola, and are usually taken care of where they occur. It may rarely lead to import, for example, Ebola-infected healthcare personnel transported to actual homeland for treatment, in 2014.

81.4.3 Disasters: Natural or Inflicted—and Bioterrorism

The hospital emergency preparedness plan/disaster plan must be available and followed after adaptation to the current situation.

A number of natural disasters lead to increased risk of outbreaks of serious epidemics in society such as earthquakes; floods; tsunami in holiday paradises; earth, stone or clay landslides; snow avalanches; extreme heat; radiation damage; hurricane/tornado; fire over large areas; volcanic eruptions; explosions; etc. The disasters may cause a heavy load on the healthcare system in general [54]. This may happen in own country or harm own citizens abroad [1, 3, 4, 12].

War-related or disaster-related measures at terrorist attacks against the population often cause major damage and spread of infections due to a paralysed infrastructure. Bioterrorism, for example, by anthrax can cause uncontrolled epidemic outbreaks in the population; *see separate chapter.*

The result could be a massive destruction or paralysis of infrastructure such as water and sewage, energy supply, transport system, access to food and water, healthcare systems, broken hospitals and communications networks, etc.

In such statements it is important to have both disaster plans and infection control plans in place, like the examples published from CDC [54–64, 78–82].

Proposal for a mandate for the emergency response group for infection control/crises team [23]:

- The director at the hospital has overall responsibility and determining authority and leads the emergency group.
- The emergency group shall advise on unusually large outbreaks, particularly dangerous microbes, in an uncontrollable epidemic and in disasters/state of war/suspected biological sabotage.
- The emergency group shall be adviser before, during and after the situation described above and shall propose preventive measures and guidelines in the current situation.
- Infection control leader coordinate the infection protection according to what is determined, in the same way as under normal conditions.
- Under normal circumstances, the emergency group meets once a year with ongoing updating of the action plan. The director summon for the meeting.
- In case of epidemic outbreak, particularly dangerous microbe or uncontrollable situation, the director summons the hospital's disaster leader in cooperation with the infection control leader for emergency group meetings. The group meets so often it is necessary to come up with updated recommendations and measures.

81.4.4 Suggestions to Members of the Emergency Response Group

81.4.4.1 Permanent Members

- The director (manager)
- Assistant hospital director
- Head of disaster committee or equivalent (deputy head)
- Emergency chief
- Information officer
- Head of Infection Control Department (coordinator for disease prevention) [82]
- Head of the Department of Infectious Diseases
- Head of the Department of Medical Microbiology
- Head of the Department for Internal Service, prehospital service (ambulances), etc.
- Hospital medical officer

81.4.4.2 Situational Members

Head of the department(s) with the problem(s), external participants from the state and municipal health authorities, safety overseer, HR representative.

81.4.5 Work Tasks at Situation of Increased Preparedness

The emergency preparedness group assesses the situation on a continuous basis and checks that:

- Competent infection control personnel (hygiene nurses, infection control doctor, epidemiologist, etc.) are available and can provide advice and guidance as well as carry out preparatory control measures regarding:

  - Isolation regime and routines for the actual patient group
  - Written infection control procedures for patients, personnel and visitors
  - Personnel access to and use of personal protection equipment (PPE)
  - Control of isolates (air pressure and function)
  - Triage—practical plan
  - Patient logistics, to avoid spreading to other patients
  - General infection control at the hospital, including cleaning and disinfection
  - Other prophylactic measures such as vaccines and drugs
  - Special measures for infection-exposed persons and especially susceptible persons (patients, personnel and visitors)
- *Infection isolates*: A written updated overview must be available for all types of isolates and single rooms at the hospital. The required number and quality must be calculated. The isolates must be routinely checked for ventilation and negative pressure—by the technically responsible at the hospital.
- *Cohort treatment and mobilization*: There should be a feasible plan for cohort treatment of patients that have the same diagnostic type of infection, mobilization and relocation of other patients and an escalation plan for more beds in cooperation with other hospitals, health institutions, etc.
- *Competent hospital staff* (doctors, nurses, cleaners, porters, ambulance staff, service units, etc.) must be available for the appropriate infection control work, in addition to treatment staff. Resources must be considered.
- *Infection control equipment* should be available and sufficient (respirators, tight-fitting goggles, double gloves, infection gown, cap/hood, coverings of the head/neck, room-bound shoes/shoe coverings, decontamination equipment/machines and chemical disinfectants, including hand disinfectants) and in accordance with the actual infectious agent (see isolation procedures).
- *Vaccines* that are currently preventive should be made available from defined stocks within a certain time limit (flu, rabies, anthrax, plague, smallpox, diphtheria, tetanus, polio, BCG, haemorrhagic viruses, etc.).
- *Drugs and specific immunoglobulins* should be made available from defined stocks as needed.
- *The escalation plan* must be available for further treatment and isolation of patients and exposed personnel, including healthcare professionals.

81.4.6 Intentional Infection: Bioterror and High-Risk Science Laboratories [79–83]

The Norwegian biotechnology community has warned about inadequate preparedness—easy to spread disease and hazardous agents in drinking water, air or food [83]. This is a well-known phenomenon for many other countries. Biosafety level 4 is the strictest level of safety where dangerous infection is identified and worked on. Nonetheless, infection occurs, and biologically dangerous and living agents have—by misunderstanding—been sent from such laboratories [84]. Work in high-risk laboratories is complicated and not everyone is equally well-trained [85].

There is a great variety in Europe in terms of quality of how high risk-infected patients become isolated [86, 87]. Checklists for infection control at high-level isolation have been designed and tested for five special units in Europe: in France, Germany, Italy, England (London) and Sweden (Linköping) [88]. The isolation unit was checked for separate entry for healthcare personnel and infected patient, safety control and security personnel, constant power and throughput autoclaves. The isolation room was checked for internal communication system, negative air pressure indicators, self-closing doors and separate/private bathroom/toilet. It is also checked for medical technical devices for intensive treatment and diagnostics and infection control procedures such as the use of PPE, hand hygiene, disinfection and waste management, external and internal transport, training in infection control and post-mortem treatment [88].

Guidance for outbreak response and incident management is recently made for acute care hospitals in the United States [89].

References

1. Law on Health and Social Preparedness 23 June 2000, No. 56. Oslo: Royal Health and Social Affairs; 2000.
2. Ministry of Social Affairs and Health. National emergency plan for pandemic flu. Oslo: 1999, 2001, 2006, 2009.
3. Ministry of Health and Care Services. Superior national health and social preparedness plan. Norway; 2007.
4. Regional plan for health and social preparedness in health region east, Norway; 2005.
5. Norwegian Health Directorate. Pandemic planning in municipal health services. Organization, Processing, Logistics. Draft 26 April 2009.
6. Norwegian Health Directorate. Pandemic planning in the specialist health service. Organization, Patient Reception and Treatment Draft 27 April 2009.
7. Directorate for Civil Protection and Emergency. Continuity planning—pandemic flu. *DSB* 5.6.2009.
8. National Institute for Public Health. Plan for mass vaccination against pandemic influenza in healthcare enterprises. Oslo 1.11.2008.
9. National Institute for Public Health. Report on recommended order for vaccination against new influenza A (H1N1), September 2009.
10. Norwegian Medicines Agency. Adverse reaction reported at Pandemrix—week 11; 03/18/2010.
11. Norwegian Medicines Agency. Annual report 2012. Vaccine effects. Reported side effects of vaccine against pandemic flu; 2012. p. 12–3.
12. Directorate for Civil Protection and Emergency. National risk image 2014. *DSB* 15 December 2014.
13. Blystad H. Preparedness/infection control plans and asylum reception. National Institute for Public Health, 2014.
14. Guldvåg B, Stoltenberg C. National Emergency Plan against Ebola. Interim plan. December 2014. Norwegian Directorate of Health/National Institute of Public Health December 2014.
15. Ebola guideline—from the Norwegian Institute of Public Health. November 2014.
16. Dalgard R, Espinoza R, Levy F, Rustung Jemtland AL, Røed R, Andersen BM. Emergency preparedness for outbreaks of serious, common infectious disease—import infection. In: Handbook in hygiene and infection control. Oslo: Ullevål Hospital; 1996. p. 170–80.
17. Dalgard R, Brubakk O, Levy F, Rustung Jemtland AL, Røed R, Andersen BM. Emergency preparedness for outbreaks of serious, common infectious disease—import infection. In: Handbook in hygiene and infection control. Oslo: Ullevål Hospital; 1999. p. 254–64.

18. Emergency preparedness at Ullevål University Hospital in connection with biological weapons. http://www.ulleval.sykehus.oslo.kommune.no/default.asp?page=/News&Id=23370. Accessed 25 Oct 2001.
19. Andersen BM. Anthrax and emergency routines at Ullevål University Hospital. Tidsskr Nor Legeforen. 2002;122:852–5.
20. Kjersem H, Lereim I. Emergency preparedness group at Ullevål University Hospital. Outbreaks of particularly infectious diseases during peacetime and in disasters/war related conditions. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2003. p. 325–7.
21. Hafstad AM, Brubakk O, Madsen P, Rustung Jemtland AL, Levy F, Hochlin K, Andersen BM. Emergency preparedness plan for outbreak of serious infectious diseases—import disease. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2003. p. 310–23.
22. Lereim I, Madsen P, Hylen Ranhoff A, Brubakk O, Melby K, Andersen BM. Preparedness for Ullevål University Hospital in connection with biological weapons. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2003. p. 328–30.
23. Lereim I, Andersen BM. Emergency Response Group. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 550–2.
24. Andersen BM, Lereim I, Hochlin K. Serious, public infection scenarios. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 553–62.
25. Andersen BM, Hochlin K, Lereim I. Serious infections. Isolation. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 563–6.
26. Andersen BM. Severe infection. Use of personal protective equipment—PPE. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 567–8.
27. Andersen BM, Lereim I. General information and advice. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 569–70.
28. Andersen BM, Lereim I. Triage-treatment. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 571–2.
29. Andersen BM, Hochlin K, Lereim I. Patient management—logistics for serious infectious disease. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 569–70.
30. Andersen BM, Hochlin K, Rasch M. Viral haemorrhagic fever (VHF) and other serious viral diseases. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 575–82.
31. Andersen BM, Lereim I. Suspected use of biological weapons—for example anthrax. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 583–5.
32. Andersen BM, Lereim I. Preparedness for biological weapons. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 586–7.
33. Andersen BM, Lereim I. Contamination of dangerous agents/chemical substances. In: Handbook in hygiene and infection control for hospitals. Oslo: Ullevål University Hospital; 2008. p. 588–91.
34. Andersen BM. Pandemic preparedness 2010—evaluation of the pandemic 2009 at OUS-Ullevål. 20/12/2010. Attachment to the evaluation report to HSØ from OUS.
35. WHO. Hospital infection control guidance for severe acute respiratory syndrome (SARS) revised 24 April 2003.
36. WHO. Avian influenza, including influenza A (H5N1) in humans: WHO interim infection control guidelines of health care facilities, 2006.
37. WHO Infection prevention and control of epidemic—and pandemic- prone acute respiratory disease in healthcare. WHO/CDS/EPR/2007.6.
38. WHO. Infection prevention and control in health care for confirmed or suspected cases of pandemic (H1N1) 2009 and influenza-like conditions. WHO 25 June 2009.
39. WHO. Human infection with pandemic (H1N1) 2009 virus: updated interim WHO guidance on global surveillance. WHO 10 July 2009.

40. WHO. Patient care checklist. New influenza A (H1N1) 15 May 2009.
41. CDC. H1N1 Flu. Interim recommendations for facemask and respiratory use in certain community settings where H1N1 influenza virus transmission has been detected, 27 April 2009.
42. CDC. H1N1 Flu. Interim guidance for emergency medical services (EMS) systems and 9-1-1 Public Safety Response Points (PSAPs) for management of patients with confirmed or suspected swine-origin influenza A (H1N1) infection, 29 April 2009.
43. CDC. H1N1 Flu. Interim guidance for infection control for care of patients with confirmed or suspected swine influenza A (H1N1). Virus infection in a healthcare setting, 3 May 2009.
44. CDC. Vaccine safety. CDC statement on narcolepsy following Pandemrix influenza vaccination in Europe. CDC 27 March 2013.
45. Council of Europe: influenza vaccination a scandal. *Aftenposten* 27 Jan 2010.
46. ECDC. New ECDC technical report on "Narcolepsy in association with pandemic influenza vaccination—a multi-country European epidemiological investigation ", 20 Sep 2012.
47. WHO. Global alert and response. Middle East respiratory syndrome coronavirus (MERS-CoV)—update. 11 March 2014.
48. WHO. Interim-infection prevention and control guidance for care of patients with suspected or confirmed filovirus haemorrhagic fever in health-care settings, with focus on Ebola, Sep 2014.
49. CDC. Infection prevention and control recommendations for hospitalized patients with known or suspected Ebola haemorrhagic fever in US hospitals, Aug 2014.
50. UK, Department of Health. Management of hazard group 4 viral haemorrhagic fevers and similar human infectious diseases of high consequences, Sept 2014.
51. CDC. Guidance on personal protective equipment to be used by healthcare workers during management of patients with Ebola virus disease in US hospitals, including procedures for putting on (donning) and removing (doffing), 20 Oct 2014.
52. Andersen BM. Preliminary examination of patients. In: Handbook in hygiene and infection control for hospitals. Osla: Ullevål University Hospital; 2008. p. 405.
53. Andersen BM. Prevention of import infection and unknown infection. In: Handbook in hygiene and infection control for hospitals. Osla: Ullevål University Hospital; 2008. p. 406–15.
54. CDC. Health and safety concerns for all disasters/natural disasters and severe weather.
55. CDC. Preparation and planning.
56. CDC. Be ready! Earthquakes.
57. CDC. Prevent illness after a disaster, 8 Aug 2014.
58. CDC. Medical management of ill disaster evacuees, 20 June 2014.
59. CDC. Infection control guidance for community evacuation centres following disasters, 20 June 2014.
60. CDC. Infectious diseases after a disaster, 21 Aug 2014.
61. CDC. Remedication and infection control considerations for reopening healthcare facilities closed due to extensive water and wind damage, 20 June 2014.
62. CDC, Brandt M, Brown C, Burkhart J, et al. Mould-preventing strategies and possible health effects in the aftermath of hurricanes and major floods. MMWR. 2006;55:1–27.
63. Sehulster LM, Chinn RYW, Ardunio MJ, et al. Guidelines for environmental infection control in health-care facilities. CDC MMWR. 2003;52:1–42.
64. Rutala WA, Weber DJ. Disinfection, sterilization, and control of hospital waste. In: Mandell, Douglas, and Bennets principles and practice of infectious diseases. 8th ed. vol. 2. Philadelphia: Elsevier Churchill Livingstone; 2015. p. 3294–309.
65. CDC. Antibiotic resistance threats in the United States, 2013.
66. CDC Vital signs report, 3 Apr 2018.
67. Promed-mail 27 Febr 2017. Antibiotic resistance: WHO, priority pathogens.
68. Promed-mail 3 April 2018. Antibiotic resistance: USA, CDC coordinated containment strategy.
69. Woodworth KR, Walters MS, Weiner LM, Edwards J, Brown AC, Huang JY, et al. Vital signs: containment of novel multidrug-resistant organisms and resistance mechanisms—United States, 2006-2017. Morbid Mort Wkly Rep. 2018;67:1–7.
70. WHO. Antimicrobial resistance global report on surveillance, 2014.

71. ECDC. Summary of the latest data on antibiotic consumption in the European Union. ESAC-Net surveillance data, November 2017.
72. ECDC. Summary of the latest data on antibiotic resistance in the European Union. EARS-Net surveillance data, November 2017.
73. Andersen BM, Sørlie D, Hotvedt D, Almdahl SM, Olafsen K, George RC, Gilfillian A. Multiply beta-lactam resistant *Enterbacter cloacae* infections linked to the environmental flora in a unit of cardiothoracic and vascular surgery. Scand J Infect Dis. 1989;21:181–19.
74. Andersen BM, Bergh K, Steinbakk M, Syversen G, Magnæs B, Dalen H, Bruun JN. A Norwegian nosocomial outbreak of methicillin-resistant *Staphylococcus aureus* resistant to fusidic acid and susceptible to other anti-staphylococcal agents. J Hosp Infect. 1999;41:123–32.
75. Andersen BM, Lindemann R, Bergh K, Nesheim B-I, Syversen G, Solheim N, Laugerud F. Spread of methicillin-resistant *Staphylococcus aureus* in a neonatal intensive unit associated with understaffing, overcrowding and mixing of patients. J Hosp Infect. 2002;1:1–7.
76. Andersen BM, Tollefsen T, Seljordslia B, Hochlin K, Syversen G, Jonassen Ø, Rasch M. Rapid MRSA test in exposed persons: costs and savings in hospitals. J Infect. 2010;60:293–9.
77. Andersen BM, Seljordslia B, Hochlin K, Rasch M, Syveren G. A predicted outbreak in an overcrowded, administratively neglected and run-down haemo-dialysis unit as an offer of "New Public Management" in Norwegian hospitals. J Hosp Admin. 2013;2:15–24.
78. American Nurses Association. Adapting standards of care under extreme conditions. ANA, March 2008.
79. Rebman T. Infection prevention and emergency management. Institute for Biosecurity, Saint Louis University School of Public Health. (slides).
80. Rebman T. Infectious disease disaster: bioterrorism, emerging infections, and pandemics. APIC text of infection control and epidemiology 2014, chapter 120: 1–22.
81. English JF, Cundiff MY, Malone JD et al. Bioterrorism readiness plan: a template for healthcare facilities. APIC, CDC, 4/13/99.
82. Rebman T, the 2008 APIC Emergency Preparedness Committee, St. Louis, Missouri. APIC state-of-the-art report: the role of the infection preventionist in emergency management. Am J Infect Control. 2009;37:271–81.
83. Gjerding ML. Warns against bio terrorism in Norway. VG net, 23.10.2012.
84. CDC Lab incident: Anthrax. CDC. Updated 19 July 2014.
85. LeDuc JW, Anderson K, Bloom ME, et al. Framework for leadership and training of biosafety level 4 Laboratory workers. Emerg Infect Dis. 2008;14:1685–8.
86. Merens A, Cavallo JD, Thibault F, et al. Assessment of the bio-preparedness and of the training of the French hospital laboratories in the event of biological threat. Eurosurveillance. 2012;17:20312.
87. Maltezou HC, Fusco FM, Schilling S, et al. Infection control practices in facilities for highly infectious diseases across Europe. J Hosp Infect. 2012;81:184–91.
88. Fusco FM, Schilling S, Puro V, et al. EuroNHID checklists for the assessment of high-level isolation units and reference centers for highly infectious diseases: results from the pilot phase of a European survey. Clin Microbiol Infect. 2009;15:711–9.
89. Banach DB, Johnston BL, Al-Zubeidi D, Bartlett AH, Bleasdale SC, Deloney VM, et al. Outbreak response and incident management: SHEA Guidance and resources for healthcare epidemiologists in United States acute-care hospitals. Infect Control Hosp Epidemiol. 2017;38