Reference Manual for
Health Care Facilities with Limited Resources

Infection Prevention and Control.

Module 11: Infection Prevention and Control Program Management

Authors
Melanie S. Curless, MPH, RN, CIC
Meredith A. Gerland, MPH, CIC
Lisa L. Maragakis, MD, MPH

JOHNS HOPKINS
MEDICINE

jhpiego
Johns Hopkins University Affiliate

Jhpiego is a nonprofit global leader in the creation and delivery of transformative health care solutions that save lives.

In partnership with national governments, health experts, and local communities, we build health providers' skills, and we develop systems that save lives now and guarantee healthier futures for women and their families. Our aim is revolutionizing health care for the planet's most disadvantaged people.

Jhpiego is a Johns Hopkins University affiliate.

Jhpiego Corporation
Brown's Wharf
1615 Thames Street
Baltimore, MD 21231-3492, USA
www.jhpiego.org

Editors: Melanie S. Curless, MPH, RN, CIC
Chandrakant S. Ruparelia, MD, MPH
Elizabeth Thompson, MHS
Polly A. Trexler, MS, CIC

Editorial assistance: Karen Kirk
Dana Lewison
Joan Taylor

Design and layout: AJ Furay
Young Kim
Bekah Walsh

Module 11 Jhpiego technical reviewers: Kofi Asare, Ghana

Module 11: Infection Prevention and Control Program Management

Chapter 1. Infection Prevention and Control Program Structure and Oversight

Key Topics

- Attributes of effective infection prevention and control (IPC) programs
- Organizing principles for IPC programs
- Core components of IPC programs
- Roles and responsibilities of health care workers (HCWs) involved in IPC programs
- Major IPC program activities, including risk assessment, goal setting, program evaluation, and implementing evidence-based practices

Key Terms

- **Hazard** is any source of potential damage, harm, or other adverse health effects on something or someone (e.g., patients, HCWs, or community members visiting the health care facility) under certain conditions. For example, blood and body fluids are hazards that can cause infection from bloodborne pathogens (the harm) or insertion of a urinary catheter without following recommended aseptic precautions is a hazard that can cause urinary tract infections (the harm). In general, the types of hazards include: biological, chemical, ergonomic, physical, and safety.
- **Hazard identification** is a process of finding, listing, and characterizing hazards.
- **Infection prevention and control (IPC) committee** is a formally established, interdisciplinary group of health care facility staff appointed to oversee implementation of IPC programs according to the national IPC policy and guidelines to minimize the risk of infections for patients and employees.
- **Infection prevention and control (IPC) task force** is a temporary group of health care facility staff created under one leader for the purpose of accomplishing a definite objective, e.g., improve compliance with hand hygiene, or improve the quality of instrument processing at the hospital.
- **Risk** is the chance or probability that a person will be harmed or experience an adverse health effect if exposed to a hazard. For example, if blood and body fluids are the hazard and infection with bloodborne pathogens is the harm, the chance of harm occurring is the risk.
- **Risk assessment**, from the IPC perspective, is the process of identifying infection hazards, and analyzing and evaluating the risk associated with these hazards with the goal of determining appropriate ways to eliminate or control them. Risk assessment for IPC is conducted periodically and allows the IPC team to make decisions regarding the focus of the IPC program at the health care facility.
- **Quality** is the degree to which health services increase the likelihood of desired health outcomes for individuals and populations and are consistent with current knowledge. In simple terms, it means, at all times, providing patient care according to the standards of care. According to the Institute of Medicine (1999), high-quality health care is safe, effective, patient centered, timely, efficient, and equitable.

Background

Successful IPC programs in health care facilities are based on understanding the facility's problems or needs, prioritizing activities, and using available resources effectively. Resources are always limited, so careful planning, implementation, and evaluation of IPC activities are essential, whether in a small clinic or a busy district hospital. In many settings, infection surveillance systems, microbiology laboratory resources to identify the cause of health care-associated infections (HAIs), and treatment options for infections are limited. Thus, IPC is not only the most cost-effective option, but also the best strategy available to protect patients and limit the spread of disease within health care facilities.

At its best, an IPC program consists of a selected group of trained HCWs who engage and educate staff in all areas and at all levels to play an active role in preventing the spread of infections among patients, fellow workers, and themselves. (WHO 2011)

Fortunately, most HAIs can be prevented with readily available, relatively inexpensive strategies. To make this happen, however, health care administrators, clinic managers, and staff at all levels must be committed to supporting and implementing recommended IPC guidelines and practices and the IPC program must be structured in such a way that it can successfully guide, support, and assess the facility's IPC activities. (APIC 2014a; APIC 2014b; WHO 2016)

Infection Prevention and Control Program Oversight

Key Attributes for Effective Infection Prevention and Control Programs

A successful IPC program must be able to effectively guide, support, and assess IPC at the facility. To achieve this, the program must acquire and retain the following attributes:

- Designated staff member who is responsible and accountable for IPC at the facility
- Competent IPC leaders with appropriate training and education
- Formal authority granted to the IPC program
- Tangible support from facility leadership
- Adequate resources for IPC activities
- Partnerships with key stakeholders and front-line HCWs
- Effective communication about IPC

Some of these attributes will be managed by senior facility leadership and some by those designated as responsible and accountable for the facility's IPC program. In both cases, the following are necessary for an IPC program to succeed:

- **Designated staff member responsible and accountable for IPC at the facility**: Preventing HAIs is the responsibility of all HCWs who provide services in a facility. However, helping health care facilities become safer places for patients and HCWs is largely about effectively managing IPC programs. It also includes monitoring current practices, clinical results, and surveillance data and intervening to provide education and change the culture and behavior when problems and risks are identified. The first step in organizing a successful IPC program is to ensure that one or more individuals are clearly designated as having the responsibility and accountability for overseeing the facility's IPC activities and outcomes. The number of IPC staff and their level of prior experience and training in an IPC program will vary depending upon the size and type of health care setting. Regardless of the size or composition of the program, it is important that facility leadership clearly designate staff who are

responsible for these activities rather than leaving IPC to chance or relying on all HCWs to implement evidence-based best practices without oversight and guidance. (APIC 2014a; APIC 2014b; Friedman et al. 1999; Scheckler et al. 1998; WHO 2002)

- **Competent IPC leaders with appropriate training and education**: Once one or more people are designated as responsible and accountable for a facility's IPC program, it is important for these individuals to pursue and/or maintain some type of IPC training and education. Depending upon the setting and resources, this training can be as simple as reading published literature, guidelines and policies, and manuals and gaining on-the-job experience in IPC during times dedicated for these activities. Box 1-1 presents links to Internet-based, up-to-date resources. In larger and more complex health care settings, IPC staff's training and experience should be more extensive and formalized. Ideally, the IPC program in complex and high-risk settings is led by a trained, certified, and experienced IPC specialist. There are a variety of training programs and educational materials available, both online and in person, for those who are new to IPC. Networking with peers and experts in the IPC community is also a good way to gain the necessary information and guidance when organizing and developing a program. Indeed, even the most experienced IPC staff benefit and continue to learn from daily activities and through interactions with IPC colleagues. (Friedman et al. 1999; Scheckler et al. 1998)

Box 1-1. Internet-Based IPC Training and Education Resources

- Society for Healthcare Epidemiology of America (SHEA): http://www.shea-online.org/
- Centers for Disease Control and Prevention (CDC): http://www.cdc.gov/hai/
- Association for Professionals in Infection Control and Epidemiology (APIC): http://www.apic.org/Education-and-Events/Online-learning
- International Federation of Infection Control (IFIC): http://theific.org/basic-ic-training-course-outline/
- World Health Organization (WHO): http://www.who.int/infection-prevention/en/
- Ministry of Health: Access in-country Ministry of Health websites for IPC related resources.

- **Formal authority granted to the IPC program:** Regulatory authorities should create an IPC infrastructure from the national level down to the health care facility to ensure that there is authority for IPC program activities. The IPC staff are responsible for ensuring that all other health care facility staff follow evidence-based IPC practices, according to national policies, regulations, and guidelines. Ideally, IPC staff can influence the behavior of HCWs by building relationships with their colleagues that consist of trust, communication, and respect. However, given the importance of IPC to patients' safety, administrative statements or orders should be issued to formally recognize the authority of IPC staff to enforce the IPC policies and procedures (WHO 2002). The purpose of such an intervention is to formally support the IPC program when HCWs at the facility question or resist recommended measures or do not willingly follow IPC advice. Such administrative statements may include the following:
  - Official endorsement of the facility's IPC program
  - IPC program organizational structure at the facility level as per national guidelines
  - The roles and authority of the program staff to perform designated duties, for example:

  - Conduct surveillance and respond to outbreaks of epidemiological significance.
  - Implement antimicrobial stewardship programs.
  - Develop, implement, and update facility IPC policies and practices as per the national guidelines.
  - Initiate surveillance of HAIs and prevention and control measures to reduce the risk of HAIs and outbreaks of infections.
  - Notify regulatory authorities of any potential outbreak of infectious disease of public health concern.
  - Provide technical updates and competency-based trainings to HCWs on a regular basis.
- Availability of resources for IPC programs

- **Tangible support from facility leadership**: For reasons similar to those regarding the need for an authority statement, it is important that the facility leadership openly demonstrates support for the IPC program's staff, priorities, and policies. This may include leadership discussions of IPC at staff and leadership meetings, senior leadership support for IPC directives, and other visible ways of demonstrating support. Leadership support lends credibility and importance to IPC initiatives and helps to obtain the cooperation and focused effort of health care staff. (WHO 2002; WHO 2016)
- **Adequate resources for IPC activities (time and budget)**: The IPC program must work with facility leadership to define the facility's priorities and to obtain and allocate resources for IPC activities. Identified priorities and problem areas can guide the allocation of scarce resources. Most HAIs can be prevented with readily available, relatively inexpensive strategies. This means that investment in people, rather than equipment, is the primary resource needed to oversee and optimize IPC practices. (WHO 2016)
- **Partnerships with key stakeholders and front-line HCWs**: No matter how large a program is or how many resources there may be, IPC staff cannot prevent HAIs alone. Effective implementation of IPC in a health care facility requires close partnerships and collaboration between the IPC program staff and a variety of other stakeholders and front-line HCWs in the facility. Ideally, the IPC staff provide guidance, expertise, data, education, encouragement, support, and communication to their colleagues at all levels of the facility. In turn, these stakeholders and HCWs contribute their unique viewpoints and clinical perspectives and work together with the IPC staff to implement and sustain evidence-based IPC practices. The design and management of the IPC program should facilitate these partnerships by integrating IPC staff into the organizational structure, locating their workspace close to the daily clinical activities, and including them in meetings, reports, and activities throughout the facility.
- **Effective communication about IPC**: The importance of good communication between the IPC program and the rest of the health care facility cannot be overstated. Communications should be structured so that the information is readily accessible and understandable. Regular feedback of IPC data is one of the most important communication activities. Visual displays of the data with clearly marked goals and progress are powerful IPC tools, especially if they are structured to promote friendly competition among areas and to reward and celebrate high-performing areas for their work and success. (Visual data displays are covered in detail in Module 9, Chapter 1, Basic Epidemiology and Statistics for Infection Prevention and Control.) Additional communication about educational topics, priorities, progress updates, emerging threats, and special circumstances such as outbreaks is also necessary. Open lines of communication using as many methods as possible (e.g., verbal, written, graphic, posters, notices, electronic) help to maintain communication and engagement throughout the facility and ensure that everyone stays aware and informed about IPC topics.

Key Staff and Groups Involved in Infection Prevention and Control Programs

In addition to the designated program leader, other key staff and groups who play a role in the oversight of a successful IPC program include:

- **Administrative leadership**: The reporting structure for the IPC program varies among health care facilities and can be adapted to fit local culture and needs as long as there is leadership oversight and accountability for the program. Various possible organizational structures are discussed later in the chapter. Ideally, one or more health care administrators will supervise the leader of the IPC program and will take an active role in helping to shape and support the program's priorities and plans.
- **IPC committee**: Partnerships between the IPC staff and others in the health care facility are necessary. In addition to the informal relationships and collaboration that occur with partners, it is important to identify and bring together key hospital staff in formal partnership to form and maintain an active IPC committee or similar administrative group. The purpose of the committee is to guide and support the use of recommended practices and to review and resolve related problems that may arise. Additionally, the committee advocates for resources required for effective implementation of the IPC program. This committee should include representatives from different wards and units, including procurement, laboratory, and sterilization and environmental cleaning. In small facilities (e.g., clinics) where these functions often overlap, the group may consist of only two or three individuals. The IPC committee should meet on a regular basis, usually monthly, to review the available IPC data and any problems or issues that are identified. Available IPC information can be used to plan and implement interventions to address the issues. The IPC committee should also participate in reviewing, developing, and approving the facility's IPC policies as well as the yearly risk assessment, goals, and program evaluation that are described in the next section.
- **Task forces/working groups**: Task forces or working groups, or similar structures that interact with the IPC team, may, at times, be needed. These may be permanent or temporary groups, and may be created as needed to provide input and oversight for a particular issue. Examples include groups focused on disinfection and sterilization, waste management, or emergency preparedness. Task forces/working groups should consist of individuals with multidisciplinary expertise and should be granted authority to make decisions and advise and oversee the IPC leadership and team in addressing the issue. IPC leadership or team members should also be included. (WHO 2016)
- **Organizational oversight from top facility leadership**: IPC programs require input from the leadership of the facility. The actual organizational structure is not as important as the fact that IPC has been set as an organizational priority for the safety of patients. In addition to support for IPC (as described earlier in this chapter), the person or group with organizational authority should periodically review the status of HAIs at the facility and the effectiveness of measures designed to contain them (WHO 2002). This review may take the form of a quarterly report to the board of directors, the director, or the owner(s) of the facility. While it can be difficult and sometimes distressing to review the performance of the program, the process can highlight important areas of risk and opportunities for improvement. Demonstration of these priorities and needs often prompts organizational leadership to provide the necessary support, authority, and resources to meet the facility's IPC needs. (See the Program Evaluation section later in this chapter.)
- **National or regional public health authorities, including the national or regional IPC agency**: Public health authorities work closely with and support the facility-level IPC program, providing expertise, partnership, assistance, guidance documents, support for outbreak investigations, and authority to enforce IPC measures. The facility-level IPC team provides important front-line information to the public health authorities.

Structure and Organization of Infection Prevention and Control Programs

Ideally, IPC at the facility level receives support from the highest-level public health authorities with a planned and effective national IPC structure (WHO 2016). Having a robust structure and capacity in IPC at national and local levels strengthens the ability to plan and implement IPC and respond to communicable disease emergencies (WHO 2016). This is reflected in the World Health Organization's (WHO) Core Components of IPC (2016), in which the first six components have requirements at the national and facility levels.

The WHO Core Components of IPC:

1. IPC programs at national and facility level
2. IPC guidelines at national and facility level
3. IPC education and training at national and facility level
4. Surveillance of HAIs at national and facility level
5. Multimodal strategies for implementing IPC activities at national and facility level
6. Monitoring and evaluations and feedback at national and facility level
7. Workload, staffing, and bed occupancy at the facility level
8. Built environment, materials, and equipment for IPC at facility level

   (WHO 2016)

Table 1-1 describes the composition, roles, and responsibilities of national-level IPC programs. Table 1-2 describes the composition, roles, and responsibilities of facility-level programs.

WHO calls for each country to have a national-level IPC program with appointed staff, clear objectives, and a defined scope of responsibilities. However, a recent survey by WHO reports that less than half of the countries surveyed (54/133; 41%) had a national IPC program in place. (WHO 2016)

While the best strategies for establishing IPC programs in limited-resource settings have not yet been described (WHO 2016), reviewing the experience of others can be a guide for those working toward this goal. For example, Talaat et al. (2006) describe the process of successfully establishing a national and facility-level IPC structure in Egypt, which included:

- Advocating and collaborating to gain high-level buy-in
- Developing a national organizational structure
- Creating national guidelines
- Training HCWs
- Promoting occupational safety
- Establishing a system for monitoring and evaluation

Table 1-1. Composition, Roles, and Responsibilities of National-Level IPC Programs

National-Level Programs
Composition: • At minimum, include a multidisciplinary group/committee to support an appointed technical team of trained IPC staff (including medical and nursing professionals) with protected and dedicated time and budget, decision-making authority, and links to related national-level programs and professional and academic organizations.
Role: • Support facility-level programs in reducing the risk of HAIs and represent the IPC program at the national or regional level.
Responsibilities: • Set objectives and functions of the national IPC program, appoint IPC staff and define scope of their responsibilities, and, at a minimum, set goals to be achieved for endemic and epidemic infections; develop recommendations for IPC processes and practices to prevent HAIs and antimicrobial resistance. • Represent IPC program with other national-level programs and stakeholders. • Develop and update national, evidence-based IPC guidelines and implementation strategies to reduce HAIs and antimicrobial resistance. • Ensure that infrastructure and supplies needed to enable the guidelines are in place. • Develop a national surveillance program to monitor selected HAIs and antimicrobial resistance patterns, including locally appropriate, standardized definitions, reporting channels, data management, laboratory support, and timely data feedback and benchmarking. Coordinate and facilitate the implementation of multimodal IPC strategies on a nationwide or subnational level. • Develop a national monitoring and evaluation system to assess that IPC standards are being met. • Monitor hand hygiene compliance data and feedback as a key performance indicator. • Support and mandate training programs for HCWs on IPC and guideline recommendations. • Collaborate with local academic institutions to develop pre- and post-graduate IPC curricula. • Facilitate access to materials and products essential for hygiene and safety. • Encourage facilities to monitor HAIs with feedback to health care professionals. • Be responsible for IPC aspects of national preparedness planning.

Adapted from: WHO 2002; WHO 2016.

Table 1-2. Composition, Roles, and Responsibilities of Facility-Level IPC Programs

Facility-Level Programs
Composition: • Various possible structures with at least one IPC staff member per maximum of 250 acute care beds (one IPC staff per 100 beds is preferable).
Role: • Provide IPC expertise at the facility to ensure safe and efficient care to all patients by developing guidance, measuring compliance, conducting surveillance for infections, providing education, and intervening directly, when needed, to prevent infections.
Responsibilities: • Conduct risk assessment to develop program objectives based on local epidemiology and facility priorities. • Write, adapt, and adopt evidence-based guidelines based on international and national standards. • Organize, implement, and monitor IPC practices using multimodal strategies guided by a yearly work plan and linked to national quality improvement programs or accreditation. • Conduct active surveillance of HAIs to inform and guide IPC strategies with timely feedback to HCWs and reports to national networks. • Periodically assess surveillance data quality. • Monitor (audit) health care practices against IPC standards with timely feedback to staff for the purpose of behavior change. • Develop a plan to assess the effectiveness of interventions to improve patient safety at the facility (objectives met, goals accomplished, activities performed, aspects that may need improvement). • Conduct training for HCWs in IPC (upon hire and periodically) using team- and task-based strategies that are participatory and include hands-on training. • Evaluate effectiveness of training and staff knowledge periodically. • Prioritize and ensure access to materials and products essential for hygiene and safety within the parameters of available resources. • Advocate for bed occupancy not to exceed facility capacity and for staffing levels to be adequate for the workload to prevent HAIs. • Advocate for provision of a clean and hygienic patient care environment and availability of appropriate IPC materials, including for hand hygiene at point of care. • Represent IPC in relationships with other programs and stakeholders in the facility. • Take responsibility for IPC aspects of facility preparedness planning.

Adapted from: APIC 2014a; APIC 2014b; WHO 2002; WHO 2016.

Facility-Level Programs

The three primary goals for facility-level IPC programs are to:

- Protect patients
- Protect HCWs, visitors, and others in the health care environment
- Achieve this protection in the most cost-effective manner within the constraints of available resources

(APIC 2014b; Friedman et al. 1999; Scheckler et al. 1998)

The structure and organization of the program tasked with achieving these goals can vary and should take into account the unique situation, needs, and resources of each facility and the environment in which it operates. Considerations such as the type of care that is provided and the size of the facility are examples of factors that will influence the organization of the IPC program. There is no set organizational structure that is recommended over another as long as the key attributes and key staff/groups are in place. (APIC 2014b; WHO 2002; WHO 2016)

Some considerations and examples for possible program structure include:

- All responsibilities of the program are carried out by IPC staff and are guided by a health care epidemiologist/infectious disease physician or other physicians with relevant expertise (e.g., a microbiologist or pathologist). A governing structure, like an IPC committee, is important to maintaining multidisciplinary input, support, and oversight. (WHO 2002)
- The IPC team is composed of the IPC staff, chair of the committee, health care epidemiologist/infectious disease physician, or a physician with experience and expertise in infectious disease management. The team works closely with those responsible for occupational health. All responsibilities of the program are carried out by this group, with one person designated as the primary leader. (APIC 2014b; Scheckler et al. 1998)
- An IPC committee is the central decision-making body reporting to the medical staff administration. The IPC committee acts as the advocate for prevention and control of infections in the facility, formulates and monitors patient care policies, educates HCWs, and provides political support that empowers the IPC team as they implement IPC activities. (Cook et al. 2011; Wiblin and Wenzel 1996)
- The IPC team is supported by a structure of intermediaries such as link nurses, audit nurses, or surveillance nurses, IPC patient liaison nurses, IPC staff educators, and IPC champions. These intermediaries partner with the IPC team to disseminate information, provide an IPC presence in the clinical areas, and motivate HCWs to improve IPC practices. This enables even a very small IPC team to expand their reach while concentrating on core strategic activities. The intermediaries are trained and supported by the IPC team. (Dawson 2003; Hale et al. 2015; WHO 2016)
- Multidisciplinary support is obtained via quality improvement teams that meet regularly and are responsible for planning, policy development, interventions, and decision-making rather than via an IPC team. (APIC 2014b)
- IPC staff have designated hours each week (less than full time) to dedicate to IPC. The remainder of their time may be spent in clinical care or another area, such as occupational health or quality improvement. (APIC 2014b; Smith et al. 2008; WHO 2002)
- One IPC staff member attends to IPC for multiple clinics or facilities. In these settings, a structure like an IPC committee is important for maintaining support and oversight. (APIC 2014b; Smith et al. 2008; WHO 2002; WHO 2016)
- The IPC staff report to and are overseen by a separate administrative area, such as microbiology, laboratory, medical or nursing hierarchy, public health services, quality improvement department, patient safety department, or another area. (APIC 2014b; WHO 2002)

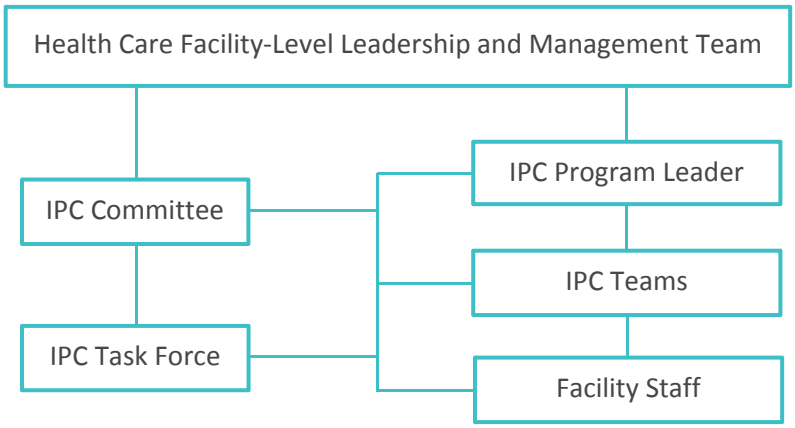
Ratio of IPC professionals to workload

The WHO Core Components for IPC strongly recommend a minimum ratio of one full-time equivalent, adequately trained IPC staff member (nurse or physician) per 250 acute care beds. However, a higher ratio should be considered, for example, one IPC staff member per 100 beds because in many settings patient acuity and complexity are increasing, as well as expectations and responsibilities of the IPC staff. (WHO 2016)

Roles and responsibilities of facility-level program staff

When considering the organization and structure of a facility's IPC program, it is important to have a clear concept of the composition, roles, and responsibilities of important program staff, including the IPC committee, program leader, IPC task forces, and facility staff (see Figure 1-1). The sections below on the IPC committee, program leader, task force/working group, team, and facility staff describe the recommended composition, roles, and responsibilities for each. Facility leadership should adapt the program structure based on the scope of the IPC program and the needs of the facility. Small health care facilities in rural areas may have one staff nurse or a medical officer and a few nurses, midwives, and other HCWs and limited scope of IPC, and may not need a staffing structure like that depicted in Figure 1-1. Most functions related to the IPC program may be looked after and implemented by a very small team. In a medium- to large-size facility, there should be a more organized staffing and program structure.

Figure 1-1. IPC Program Staff Structure at Health Care Facility Level



IPC committee

- **Composition**: Includes a wide representation of stakeholders around the facility, including administrators, leaders of the main clinical departments, physicians, nurses, and support services staff. Support services include central supply, maintenance, clinical microbiology laboratory, pharmacy, housekeeping, environmental services, orderlies, waste management, training, and others.
- **Role**:
  - Provide a forum for multidisciplinary support, input, cooperation, and information sharing and oversight.
  - Meet promptly in the event of an emergency situation.
  - Report directly to administration or medical staff to promote program visibility and effectiveness.
- **Responsibilities**:
  - Meet regularly (monthly or quarterly) and keep a record of the topics discussed and decisions rendered.

- Review and approve the yearly risk assessment and plan of program activities for surveillance and prevention.
- Review surveillance data and identify areas for intervention.
- Assess and promote improved practice at all levels of the facility.
- Ensure appropriate training in IPC.
- Review risks associated with new technologies and monitor infection risks of new devices and products prior to their approval.
- Review and provide input into investigation of epidemics.
- Communicate and cooperate with the other committees of the hospital with common interests (such as pharmacy antimicrobial use committee, biosafety, blood transfusion committee, etc.).

IPC program leader

- **Composition**: Ideally, a health professional (a physician or a nurse/midwife) with training, experience, and, if possible, certification in IPC.
- **Role:** Assumes responsibility for the program activities, including guiding the implementation of the yearly plan, managing the IPC staff, building the team, and providing expertise in and assuring quality of day-to-day IPC activities.
- **Responsibilities:**
  - Represent the team and the program with the higher-level facility administration.
  - Oversee and coordinate the IPC program activities as described below.
  - Build an effective and cohesive IPC team.
- Ensure that a quality improvement approach is applied to IPC activities.

IPC task force/working group

- **Composition**: Individuals with multidisciplinary expertise in the issue at hand. IPC leadership or team members should also be included. The group may be a permanent or pre-existing group or it may be created to provide input and oversight of the IPC program for a particular issue.
- **Role:** Provide input and advice and oversee the IPC program for a particular issue, with authority to make decisions regarding this issue. Examples may be groups focused on disinfection and sterilization, waste management, or emergency preparedness.
- **Responsibilities:**
  - Actively participate in the IPC task force/working group.
  - Advise and oversee the IPC leadership and team in addressing the issue at hand.
  - Meet and report regularly to the IPC committee on progress.

IPC team

- **Composition:** Larger institutions may have full-time IPC teams or the team may have another composition as described in this chapter. The composition and selection criteria for the IPC team should be decided by the IPC committee and department heads.
- **Role:** Serve in a scientific and support role in attending to the day-to-day functions of IPC, acting as consultants, educators, role models, researchers, and change agents.
- **Responsibilities**:
  - Prepare and implement the yearly work plan as per the guidance from the IPC leader.
  - Organize and conduct surveillance for HAIs.
  - Investigate and address outbreaks and provide expert advice, analysis, and leadership in outbreak investigation and control.
  - Oversee the implementation of and compliance with IPC practices.
  - Assist the IPC committee in product and material evaluations.
  - Control and audit methods of disinfection and sterilization and the effectiveness of systems developed to improve hospital cleanliness.
  - Implement departmental training programs.
  - Support and participate in research and assessment programs at national and international levels.
  - Participate in the development and operation of regional and national IPC initiatives.
  - Participate in programs and initiatives to promote rational antimicrobial use.
  - Ensure that patient care practices are appropriate to the level of patient risk.
  - Participate in development and provision of teaching programs for the medical, nursing, and allied health staff, as well as all other categories of HCWs.

Facility staff

- **Composition:** All staff involved in direct and indirect patient care, including physicians, nurses, microbiologists, pharmacists, blood bank, and ancillary services workers.
- **Role:** Implement recommended IPC practices as per the recommended guidelines.
- **Responsibilities:**
  - Use practices that minimize infections when providing direct patient care.
  - Understand and follow recommended IPC practices.
  - Support the IPC team.
  - Serve on or participate in IPC task forces and IPC committees, as requested.
  - Notify the IPC staff about HAIs and infections with potential to spread within the hospital and initiate immediate containment measures.
  - Participate in identifying HAIs in the facility.
  - Process microbiological specimens and identify organisms when infection is suspected.

- Use recommended IPC practices and collect, process, and share results of appropriate samples and make treatment decisions accordingly.
- Use antibiotics rationally.
- Follow clinical guidelines to treat infections.
- Advise and educate patients, visitors, and HCWs on techniques, such as hand hygiene, to prevent infections.
- Follow safe work practices; follow Standard Precautions.
- Ensure that medical equipment, instruments, and the environment are appropriately cleaned, disinfected, and sterilized.
- Obtain, store, and distribute supplies and equipment in a way that prevents infections.
- Participate in outbreak investigations.

  (APIC 2014b; Friedman et al. 1999; Scheckler et al. 1998; WHO 2002; WHO 2016)

Major Infection Prevention and Control Program Activities

As discussed earlier in this chapter, the IPC program provides the facility with specific expertise to ensure that care is provided in a safe and efficient manner. Successful IPC programs are based on understanding the facility's problems and needs, prioritizing activities, and using available resources effectively. To achieve this, there are major activities included within the oversight of the program. The designated program leader should ensure that these activities are carried out:

- Risk assessment
- Program planning
- Implementation strategies for evidence-based practice
- Program evaluation

  (APIC 2014b; WHO 2002; WHO 2016)

Facility Infection Prevention and Control Risk Assessment

A facility-wide IPC risk assessment is the cornerstone for designing, developing, and implementing specific IPC activities at health care facilities. Facility IPC risk assessment helps identify and prioritize surveillance and prevention activities at the facility, based on the risk of acquiring and transmitting infections in the facility. Facility IPC risk assessment helps identify the areas of concern related to patients' risk of infections at the facility with a focus on high-risk, high-volume, or problem-prone procedures. The facility IPC risk assessment should engage key facility staff including IPC committee members. The facility IPC risk assessment form (see Appendix 1-C) can be used by health care facilities to identify and prioritize infection risks in the facility. (WHO 2016)

Program Planning

Clear and detailed goals and objectives make up the annual IPC plan, which guides the team and helps allocate available resources appropriately. Appendix 1-A provides a checklist for large facilities for developing a comprehensive IPC plan including the core components of IPC outlined by WHO. The person filling out the checklist should take the type of facility into consideration; for example, all items will be suitable for acute care hospitals, but some may not be relevant for clinics or smaller facilities. (APIC 2014b; WHO 2016)

IPC Program Planning Goals

The goals and objectives for the IPC program will be determined by:

- Facility IPC risk assessment (described in Appendix 1-C)
- The strategic goals of the facility
- The findings from the previous year's activities

Program goals will be focused on high-risk and problem-prone activities and core responsibilities of the IPC program. In general, goals will include limiting unprotected exposure to pathogens and the transmission of infections associated with procedures, and the use of medical equipment/devices/supplies. (APIC 2014b; WHO 2016)

Goals state what the program is planning to achieve and provide direction to the IPC plan. They should include a clear description of a time frame and specifics needed to achieve them. The health care facility IPC committee and staff should jointly identify the areas to be addressed, based on the results of the risk assessment. If goals are clearly defined, the work plan will focus on achieving the desired achievements. Below are several examples of goals statements:

- Reduce the rate of surgical site infections (SSIs) following cesarean section (C-section) from the current 12% to 6% by the end of the year.
- Initiate quarterly surveillance of catheter-associated urinary tract infections (CAUTI) in three medical wards (one male and two female wards) of the facility.
- Improve compliance with hand hygiene practices to 40% by the end of the year.

  (APIC 2014b; WHO 2016)

Objectives

The plan should include specific objectives for accomplishing the program goals. Objectives are statements of specific activities the team will perform to help achieve the goals. They should be **SMART:**

- **S**pecific
- **M**easureable
- **A**chievable
- **R**ealistic
- **T**ime bound

Objectives should use action verbs and describe the activities to be performed in ways that can be measured (APIC 2014). Examples of objectives include:

- Provide a 1-day technical update on Standard Precautions and Transmission-Based Precautions to 40% of the clinical staff by the end of October 2018.
- Conduct an assessment of staff hand hygiene compliance on each inpatient unit of the health care facility by December 2018.
- Increase on-site manufacturing of alcohol-based handrub by 50% by December 2018.
- Administer single-dose antibiotic prophylaxis within 60 minutes of incision to 100% of women undergoing C-sections per facility guidelines by June 2018.

Appendix 1-B provides an example of program objectives for Hospital A. The objectives show the details of how the plan will be accomplished. They use action verbs like “monitor” and “develop” and include specifics that can be measured such as “weekly” and “40 opportunities.”

Once the work plan has been finalized, the IPC team or hand hygiene task force should prepare an action plan to ensure timely implementation and completion of each activity in the work plan and ensure availability of resources for each activity. It is essential that the team identify the staff or team member who will ultimately be responsible for leading and completing the activities assigned.

The IPC committee members should approve the action plan as well as track the progress of the activity. Also, the committee should list the resources needed for the activity and for approval from the administrative and finance departments.

Infection Prevention and Control Program Evaluation

A process to evaluate the IPC program at the facility should be created. Periodic evaluation of the IPC program should do the following:

- Outline achievements and activities of the IPC program.
- Determine if the activities are being performed according to requirements.
- Assess the extent to which the objectives are met and the goals accomplished.
- Document the impact of the program in terms of defined outcomes.
- Identify aspects that may need improvement.
- Describe support requirements.

  (APIC 2014b; WHO 2016)

A monitoring plan should include defined indicators and tools to collect information in a systematic fashion. Evaluation may address: appropriateness of the program compared with the national goals (outcomes and processes); epidemiological indicators obtained by the surveillance system; efficacy, timeliness, availability, and effectiveness of the program at meeting goals and objectives; results of assessments of compliance with IPC practices; customer satisfaction; and other process indicators, such as training activities and resource allocation obtained through audits and other means. (APIC 2014a; APIC 2014b; WHO 2016)

The focus should be to encourage improvement and promote learning from experience in a blame-free culture, thereby contributing to better patient care and quality outcomes. The value of the IPC program to the organization should be emphasized, along with improved patient outcomes and cost savings. An evaluation report should be created and widely disseminated to high-level facility administration. (APIC 2014a; APIC 2014b; WHO 2011; WHO 2016)

Implementing Quality Improvement Strategies for Infection Prevention and Control

A major function of an IPC program is to decrease patient harm from infections by identifying areas in which improvements in quality of care are needed. IPC program activities (such as surveillance and observations of clinical practice) should identify these areas. As described previously in this chapter, the person responsible for the IPC program oversees the implementation of evidence-based IPC practices at the facility.

Once areas for improvement are identified, IPC and facility staff need to work together to apply evidence-based IPC strategies to reduce infections. This often involves changing the behavior of staff at the facility to incorporate the best practices into day-to-day care. Change includes both technical challenges for which there is knowledge to implement a solution as well as adaptive challenges in which the priorities, beliefs, habits, and loyalties of staff need to be addressed. A knowledge of quality improvement methods is important for those overseeing and implementing IPC programs. (Pronovost 2011)

This can be challenging work. Models have been developed to guide quality improvement efforts in health care facilities. These can be extremely useful to assist IPC teams and HCWs to develop processes to make the changes needed to improve quality of care. The focus of this section is to provide an introduction to quality improvement in health care facilities and examples of quality improvement models to guide IPC staff in the planning and practical application of IPC quality improvement projects.

Quality improvement involves taking systematic and continuous actions that lead to measurable improvement. Principles that assist with this process include:

- Managing processes (i.e., how you perform procedures, provide services) and staff.
- Continuous measurement—if you cannot measure it, you cannot improve it.
- Collecting data—only the right data in the right format, at the right time, and given to the right people.
- Engaging the appropriate HCWs (e.g., nurses, physicians, and laboratory staff) in the process.

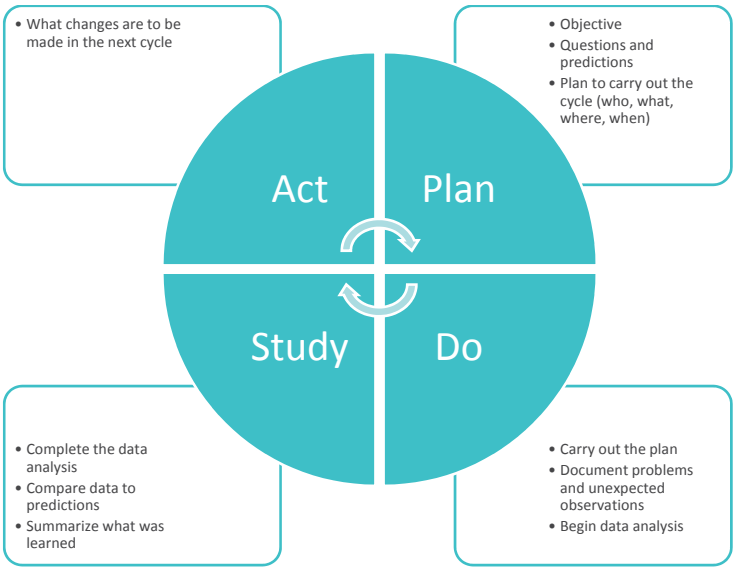
  (Haughom 2017)

Examples of quality improvement models commonly used by IPC programs for quality improvement initiatives include:

- **Plan, Do, Study, Act (PDSA)** was popularized by W. Edward Deming, a leader in total quality management (see Figure 1-2). PDSA outlines a model for the process of continuous quality improvement. This process has been used widely for IPC improvement projects:
  1. Plan—the health care facility staff design interventions to improve an IPC-related process or to address a gap in IPC practices
  2. Do—the health care facility staff implement the intervention
  3. Study—the health care facility staff analyze results of the interventions that were gathered through the timely collection of monitoring data
  4. Act—the health care facility staff institutionalize or reject the intervention based on the results and plan another intervention

     (Moen and Norman 2010)

Figure 1-2. Deming's PDSA Cycle and Key Elements of Each Step



- **Standards-Based Management and Recognition (SBM-R®)**: Jhpiego, a Johns Hopkins University affiliate, developed and champions the SBM-R process, a continuous quality improvement model. It has been used in health care facilities in a number of countries to improve the quality of family planning, HIV/AIDS care and treatment, IPC, and other areas of health care. The four steps of the SBM-R model are:
  - **Setting standards**: The IPC quality working group at the facility or the facility staff develop or adapt objective performance standards based on national IPC guidelines and evidence-based recommendations to perform tasks and procedures (e.g., hand hygiene, use of gloves, cleaning medical instruments). HCWs are involved in the process of developing standards.
  - **Implementing standards**: Carry out an assessment of the current practices compared to the standards and establish baseline performance. Once the baseline performance has been assessed, apply a performance improvement process to identify gaps and address root causes of performance gaps. The steps in the performance improvement process include:
    - Define the gaps identified in the baseline assessment.
    - With IPC quality improvement working groups, perform a root cause analysis of gaps. Use simple methods such as "why-why" analysis, brainstorming, and use of key performance factors.
    - Once root causes of performance gaps are identified, prioritize the gaps that should be addressed first based on the risk, cost, and time available.
    - Design the interventions to address those root causes that have been prioritized.
    - Implement interventions to address the gaps in performance.

    The root cause analysis may also reveal that HCWs are not able to perform due to the lack of resources or motivation. If so, the facility team should design interventions to ensure availability of appropriate resources and incentives to motivate staff.
  - Measuring progress: Once the interventions for addressing performance gaps have been put in place, use the original set of standards to measure performance to ensure that the interventions

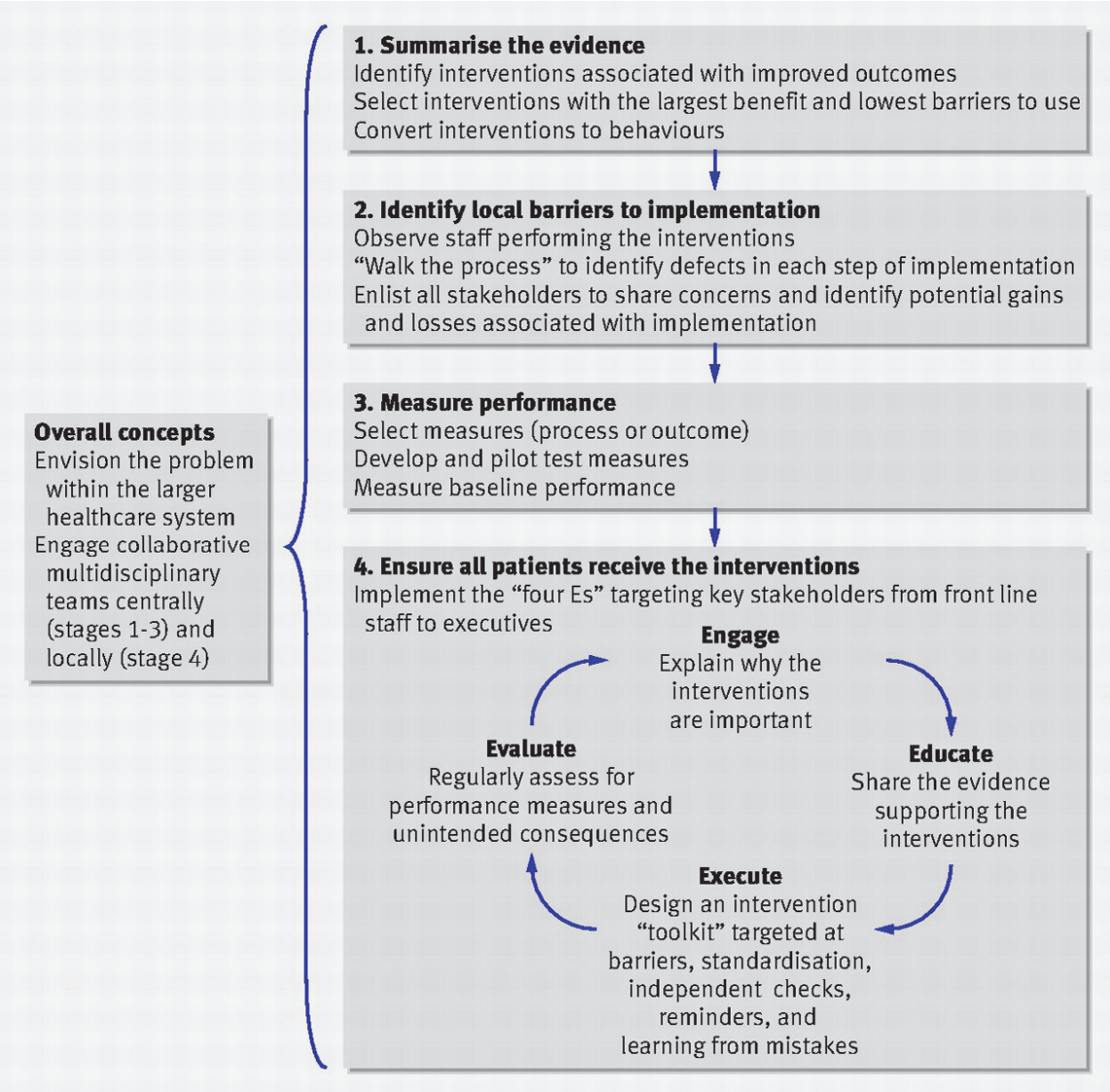
were effective in addressing the gaps. Identify additional gaps in the performance that affect the quality of care and address them.

- Rewarding achievement: To motivate HCWs to continue to participate in the quality improvement processes, it is essential to motivate them to make progress. Public recognition is an effective way to motivate staff. From time to time, recognize HCWs and the teams for achieving their goals.

- **Translating Evidence into Practice model:** The Johns Hopkins Medicine's Armstrong Institute for Patient Safety and Quality developed the Translating Evidence into Practice model to support hospital-wide IPC interventions (see Figure 1-3). The model focuses on changing behaviors of the health care team within a larger hospital system. The approach has five key components:
  - A focus on systems (how work is organized) rather than care of individual patients
  - Engagement of local interdisciplinary teams to assume ownership of the improvement project
  - Creation of centralized support for the technical work
  - Encouraging local adaptation of the interventions
  - Creating a collaborative culture within the local unit and larger system

  (Pronovost 2008)

Figure 1-3. The Armstrong Institute's Translating Evidence into Practice Model



Source: Pronovost 2008.

Health care facilities should follow their Ministry of Health's guidelines for quality improvement. If no guidelines are available, choose a method that is easy to implement and does not require much external assistance for improvement. Key facility staff should be trained in implementation of quality improvement interventions in the facility. (Necochea and Bossemeyer 2005)

"The most important single condition for success in quality in healthcare is the determination to make it work. If we are truly committed to quality, almost any mechanism will work. If we are not, the most elegantly constructed mechanisms will fail."

—Avedis Donabedian (1996)
Professor of Public Health, School of Public Health, Harvard University

Summary

An IPC program should be structured in such a way that it can successfully guide, support, and assess the facility's IPC activities. Successful programs are based on understanding the problems/needs, prioritizing activities, and using available resources effectively. Program attributes that are integral to an effective program include responsibility and accountability; IPC leaders with appropriate training and education, authority, and administrative and management leadership support; resources; partnerships; and communication. In addition to the designated IPC program leader, there are other key HCWs and groups who play a role in the oversight of a successful IPC program. They all have important roles for promoting IPC at the facility. The structure and organization of the program tasked with achieving the goals of protecting patients and others at the facility can vary and should take into account the unique situation, needs, and resources of each facility and the environment in which it operates. Risk assessment, goal setting, program evaluation, and a focus on patient safety and quality are among the essential programmatic activities for program oversight. Finally, a knowledge of quality improvement methods is important for those overseeing and implementing IPC programs.

Appendix 1-A. IPC Plan Checklist for Large Health Care Facilities

IPC Plan Checklist	
Administrative	☐ Authority statement ☐ Vision/mission statement ☐ Budget ☐ Staffing ratio ☐ IPC committee or equivalent ☐ Administrative support (secretary, IT equipment, Internet access) ☐ Risk assessment ☐ Program responsibilities, goals, and objectives ☐ Technical guidelines ☐ Program monitoring and evaluation
Staff	☐ Program leader ☐ IPC team ☐ Link nurses ☐ Other staff ☐ Job descriptions ☐ Training for IPC staff ☐ Information technology and data support
Core components of IPC activities	☐ Surveillance of HAIs and antimicrobial resistance ☐ IPC activities related to patients', visitors', and HCWs' safety and the prevention of antimicrobial resistance ☐ Development or adaptation of guidelines and standardization of effective preventive practices (standard operating procedures) and their implementation ☐ Outbreak prevention and response, including triage, screening, and risk assessment, including during community outbreaks of communicable disease ☐ HCW education and practical training ☐ Maintenance of effective aseptic techniques for health care practices ☐ Assessment and feedback of compliance with IPC practices ☐ Assurance of continuous procurement of adequate supplies relevant for IPC practices, including innovative equipment when necessary, as well as functioning WASH services that include water and sanitation facilities and a health care waste disposal infrastructure ☐ Assurance that patient care activities are undertaken in a clean and hygienic environment and supported by adequate infrastructures

IPC Plan Checklist	
Investigations	☐ Assessment of IPC practices ☐ Surveillance for HAIs ☐ HAI outbreak management ☐ Assessment of rational use of antibiotics
General organizational policies	☐ Standard Precautions (hand hygiene, personal protective equipment [PPE], respiratory hygiene, reuse of medical devices, sharps safety, prevention/management of sharps injuries, waste management, laundry, environmental cleaning) ☐ Cleaning, disinfection, and sterilization ☐ Isolation Precautions (Contact, Droplet, Airborne Precautions) ☐ Prevention of HAIs (surgical site, bloodstream, urinary tract infections, lower respiratory tract infections, HAI of gastrointestinal tract) ☐ Occupational health activities ☐ Emergency preparedness ☐ Rational use of antibiotics ☐ Remodeling and construction in clinical areas
Collaboration	☐ Medical leadership ☐ Nursing leadership ☐ Microbiology laboratory ☐ Pharmacy ☐ Public health services ☐ Other programs (e.g., HIV, TB) ☐ Antimicrobial stewardship ☐ Occupational health

Adapted from: Hoffmann 2000; WHO 2016.

Appendix 1-B. Example of Template for an Action Plan and Objectives

Goal	Objectives	Activity	End Date	Responsible Persons	Resources Needed
Hand hygiene compliance on all wards will improve 25% from baseline by the end of the year.	1. Form a hand hygiene task force consisting of a representative from each ward. 2. Obtain baseline hand hygiene compliance data for each ward by observing 20 hand hygiene opportunities each week for 1 month, using ward staff as secret, trained observers. 3. Analyze and share hand hygiene compliance data weekly with hospital administration and the HCWs on each ward. 4. Review and update the hospital policy on hand hygiene. 5. Provide hand hygiene education to staff on any wards with baseline hand hygiene compliance less than 90%; include demonstration, practice, and workplace reminders. 6. Guide and encourage the safety team on each ward to identify and address two barriers to hand hygiene compliance. 7. Monitor hand hygiene compliance on all units by observing 40 hand hygiene opportunities each week for 1 month, using ward staff as secret, trained observers. 8. Analyze and share ongoing hand hygiene compliance data weekly with hospital administration and HCWs on each ward. 9. Create a hand hygiene competition to reward the wards with the best hand hygiene. 10. Plan a hospital-wide hand hygiene awareness and promotion event on World Hand Hygiene Day. 11. Evaluate the intervention every 3 months to measure progress toward the goal of 25% improvement.				

Appendix 1-C. Facility Infection Prevention and Control Risk Assessment Tool

The IPC program provides the facility with specialized expertise to ensure care is provided in a safe and efficient manner. Successful IPC programs are based on understanding the facility's problems and needs, prioritizing activities, and using available resources effectively. An IPC risk assessment helps identify the areas of greatest infection/patient safety risk at the facility from high-risk, high-volume, or problem-prone procedures. A case study of fictional Hospital A is provided below, followed by a blank form for use in your facility.

Facility IPC Risk Assessment

An IPC risk assessment should be conducted periodically and involve key people at your facility. Members of the assessment team should include the members of the IPC committee, if there is one, staff with IPC responsibilities, leaders of the main clinical departments, nursing services, support services (e.g., central supply, microbiology laboratory), administration, housekeeping, sanitation, and environmental services).

Case Study: Facility IPC Risk Assessment for Hospital A

Facility IPC Risk Assessment: Part 1

1. Become familiar with the state of IPC at your facility to prioritize IPC activities.
2. Fill out the Facility IPC Risk Assessment Form, Part 1:
    a. Indicate the date and the groups involved in the process.
    b. Insert information about factors and characteristics that increase risks using local population and epidemiological information and data from your facility, local sources, and local knowledge.
    c. Review health care epidemiology and IPC data available at your facility and impressions from the team obtained during direct observation and discussion with HCWs.

Facility IPC Risk Assessment Form, Part 1

Date: _____

This assessment was developed by:

- ☐ IPC committee
- ☐ Safety committee
- ☐ Legal team
- ☐ Occupational health committee
- ☐ Quality team
- ☐ Leadership
- ☐ Others:

This IPC risk assessment provides guidance on the priority focus areas for the IPC program. The risk assessment should be reviewed periodically, at least annually or whenever significant changes occur in elements that affect risk.

Factors	Characteristics that increase risks
Geographic location and community environment: • Sub-Saharan Africa • Urban hospital • Near slum area	• Highly populated city • Crowded housing conditions • Variable access to sanitation
Care, treatment, and services provided: • Referral hospital • Full surgical services provided	• High volume of surgical cases • Routine and complex procedures • High volume of ICU beds • Complex medical devices
Population characteristics: • Mix of low- and middle-income patients • Frequent movement of population	• High incidences of TB and other communicable diseases • 55% of population under 15 • High birth rate
Analysis of Health Care Epidemiology and Infection Prevention and Control Data	
High-risk areas/issues: • Use of medical devices in ICUs • GI endoscopy • Bloodstream infection (sepsis) in newborn nursery	**Problem-prone areas/issues**: • Spread of TB in facility
High-volume procedures and infections: • C-section • Colorectal surgery	**Improvement needed:** • Hand hygiene non-compliance • Postpartum endometritis

Facility IPC Risk Assessment: Part 2

1. Use information provided in Part 1 to list IPC hazards in the left-hand column of the table. The type of hazards listed may include items such as the following but should be specific and relevant to your facility:
   - Specific HAIs
   - Non-compliance with measures that prevent HAI (such as hand hygiene)
   - Infection risks common in the community that can spread to patients or staff in the hospital (such as TB)
   - IPC measures that are required to be reported to health authorities or to the public

2. Discuss each hazard with the IPC committee (or key people) one by one to determine:

   a. **Probability of Occurring:** How likely is it to occur based on previous surveillance, other data, experience, or local knowledge? In many cases this may be an educated guess. Probability ranges from High = 3 to Low = 0.

   b. **Outcome Severity:** If the hazard occurs, how serious is the outcome or disruption (i.e., will the person die, experience serious illness/disability, be difficult or expensive to treat versus experience an easily rectifiable illness with only a few extra days of hospitalization)? In many cases this may be an educated guess. Severity ranges from Very High = 4 to None = 0.

   c. **Make the calculations**: Probability of Occurring x Outcome Severity = Assessment Score.

   d. **Obtain the Level of Preparedness Needed:** What is the level of work needed to prevent the hazard from occurring? Use the Assessment Score to determine the level of preparedness needed. Levels range from High = 3 to Low = 1.

      * **Level of Preparedness Needed**:

Assessment Score	Level of Preparedness
≤ 2	Low
3 to 5	Medium
≥ 6	High

      Note: All HAI are scored a minimum of 2 on Level of Preparedness Needed

   e. **Level of Preparedness Achieved:** How much work has already been done successfully to prevent the hazard from occurring? Achievement ranges from High = 1 to Low = 3.

   f. **Calculate the Preparedness Score:** Level of Preparedness Needed x Level of Preparedness Achieved = Preparedness Score; enter in the final column.

Facility IPC Risk Assessment Form, Part 2

Hospital A selected the following IPC hazards based on Part 1 and entered them into the **Infection Prevention and Control Hazards** column.

Hazard Identification	IPC Risk Assessment											Assessment Score	Level of Preparedness								Preparedness Score
	Probability of Occurring					Outcome Severity							Needed*				Achieved				
	High	Med	Low	None		Very High Disrup-tion	High Disrup-tion	Mod Disrup-tion	Low Disrup-tion	None			High	Med	Low		High	Med	Low		
Score	3	2	1	0	**X**	4	3	2	1	0	**=**		3	2	1	**X**	1	2	3	=	
Infection Prevention and Control Hazards																					
C-section SSI		2			x		3					6	3			x	1				3
Hand hygiene non-compliance	3				x			2				6	3			x			3		9
BSI (Sepsis) in newborn nursery		2			x	4						8	3			x		2			6
Postpartum endometritis			1		x		3					3		2		x		2			4
Spread of TB in the facility			1		x			2				2			1	x			3		3

Facility IPC Risk Assessment Review: Part 2

The Facility IPC Risk Assessment team used information they gathered from Part 1 of the Facility IPC Risk Assessment to complete Part 2:

- **Hand hygiene compliance:** Hospital A has never done hand hygiene surveillance or held an intervention. The team used their observations from walking around the hospital to determine that hand hygiene non-compliance has a high probability (3) of occurring at Hospital A and the outcome of poor hand hygiene is known to cause HAIs, therefore it can be moderately disruptive (2) to patients. Hand hygiene had an Assessment Score of 3 x 2 = 6, which is high and produces a Level of Preparedness Needed of 3. Because the hospital has never done hand hygiene promotion, the team felt that the Level of Preparedness Achieved was low (3). So the Preparedness Score for hand hygiene compliance is 3 x 3 = 9.
- **C-section surgical site infection (SSI):** Hospital A began a C-section SSI prevention intervention last year using a small donation. SSI rates from 3 months of surveillance completed prior to the SSI intervention were a little below those found in the rest of the country. The team used their local knowledge and the SSI data to determine that C-section SSIs have a medium probability (2) of occurring at Hospital A and can be highly disruptive to the patient (3), which produced an Assessment Score of 2 x 3 = 6, which is high (Level of Preparedness Needed = 3). The team felt that with the intervention to prevent C-section SSIs, Hospital A attained a high Level of Preparedness Achieved (1). So the Preparedness Score for C-section SSIs is 3 x 1 = 3.
- **Bloodstream infection (BSI/sepsis) in the newborn nursery:** Hospital A has a small newborn nursery. The team used hospital records to determine that BSI in the nursery has a medium probability (2) of occurring but the outcome is devastating to the patients and they often die. Therefore, they give an outcome severity of 4, which produced an Assessment Score of 2 x 4 = 8, which is high (Level of Preparedness Needed = 3). The hospital had sent several nurses to a WHO training to prevent sepsis, and they proposed several changes. Because the WHO recommendations were not yet in place, the Level of Preparedness Achieved was low (3). So the Preparedness Score for BSI in the newborn nursery is 3 x 2 = 6.
- **Postpartum endometritis:** Hospital A performs a moderate number of deliveries each year. The team used data collected from the health department to determine that postpartum endometritis at Hospital A has a low probability (3) of occurring, but when it does, the outcome is highly disruptive to the patients, who become very sick, cease lactating, and often need to be transferred to another facility (3). This produced an Assessment Score of 1 x 3 = 3; which is moderate (Level of Preparedness Needed = 2). The doctor in charge of the delivery ward has been working to put best practices for delivery in place for the past 6 months and thus the Level of Preparedness Achieved was determined to be medium (2). So the Preparedness Score for postpartum endometritis is 2 x 2 = 4.
- **Spread of TB in the facility:** Hospital A occasionally sees patients with active TB. The wards are well ventilated and they have isolation rooms for TB patients. The team used regional data on TB, hospital data on diagnosis of TB, and local knowledge to determine that at Hospital A, TB has a low probability (1) of occurring. TB is a serious disease but the local morbidity is not high as it can be treated and there is a good local TB screening and treatment program funded by an NGO. Therefore, the team felt that spread of TB in the facility would be moderately disruptive to patients (2). This produced an Assessment Score of 1 x 2 = 2, which is low (Level of Preparedness Needed = 1). Although there are few patients and the isolation rooms are well used for TB patients, there is not adequate PPE for staff to use; thus the team determined the Level of Preparedness Achieved to be low (3). So the Preparedness Score for Spread of TB in the facility is 1 x 3 = 3.

Facility IPC Risk Assessment: Part 3

Based on the risk assessment (Part 2), the facility IPC risk assessment team ranked the risks they listed in the Infection Prevention and Control Hazards column of Part 2 from highest to lowest preparedness score. Items scoring 6 or greater in Preparedness Score should be IPC priority focus areas.

Facility IPC Risk Assessment Form, Part 3

Risk Prioritization: Based on the risk assessment, prioritize the risks from high Preparedness Scores to low, with 1 having the highest priority. Items scoring 6 or greater in Preparedness Score in the risk assessment are IPC priority focus areas.

Priority	Risk
1	Hand hygiene compliance (Preparedness Score = 9)
2	BSI (sepsis) in the newborn nursery (Preparedness Score = 6)
3	Postpartum endometritis (Preparedness Score = 4)
4	C-section SSI (Preparedness Score = 3)
5	Spread of TB in the facility (Preparedness Score = 3)

For Hospital A, comparison of the preparedness scores for noncompliance with hand hygiene and C-section SSIs shows that improving hand hygiene compliance at Hospital A should be the first priority.

Facility Infection Prevention and Control Risk Assessment Form

Year: _____

An annual risk assessment to prioritize infection prevention and control activities with a focus on high risk, high volume procedures, and problem-prone areas is recommended. Conduct the risk assessment using the attached tool. Page 1 is a description of the facility in terms of geography, patient population, and types of treatment and services provided, including a listing of high risk, high volume, and problem-prone procedures and areas. Pages 2–3 are the assessment itself and show how the preparedness score is calculated for each item. Items with a preparedness score of 6 or greater may be considered priority areas.

Date: _____

This assessment was developed by:

- ☐ IPC committee
- ☐ Safety committee
- ☐ Legal team
- ☐ Occupational health committee
- ☐ Quality team
- ☐ Leadership
- ☐ Others:

This IPC risk assessment provides guidance on the priority focus areas for the IPC program. The risk assessment should be reviewed periodically, at least annually or whenever significant changes occur in elements that affect risk.

Factors	Characteristics that increase risks
Geographic location and community environment: •	•
Care, treatment, and services provided: •	•
Population characteristics: •	•

Analysis of Health Care Epidemiology and Infection Prevention and Control Data	
High-risk areas/issues: •	**Problem-prone areas/issues**: •
High-volume procedures and infections: •	**Improvement needed:** •

Infection Prevention and Control Risk Assessment: Part 2														Review date:								
														Reviewed by:								
	Risk Assessment											Assessment Score		Level of Preparedness								Preparedness Score
Hazard Identification	Probability of occurring					Outcome Severity								Needed*				Achieved				
	High	Med	Low	None		Very High	High Disrup	Mod Disrup	Low Disrup	None				High	Med	Low		High	Med	Low		
Score	3	2	1	0	X	4	3	2	1	0	=			3	2	1	X	1	2	3	=	
Infection Prevention and Control Hazards																						
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					
					x												x					

* **Level of Preparedness Needed**: Based on the **Assessment Score** determine the level of preparedness needed utilizing the following guidelines:

Score =	Rating =
≤2	Low
3 to 5	Med
≥6	High

Note: All HAI are scored a minimum of 2 on **Level of Preparedness Needed**

Infection Prevention and Control Risk Assessment: Part 3

Priority Risks: Based on the risk assessment, this hospital has identified those items scoring **6** or greater in **Preparedness Score** in the risk assessment as priority focus areas for infection control. Please rank them from 1 to 25 (1 having the highest priority).

Priority	Risk
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

References

Armstrong Institute for Patient Safety and Quality, Johns Hopkins Medicine. n.d. https://www.hopkinsmedicine.org/armstrong_institute/index.html.

Association for Professionals in Infection Control and Epidemiology (APIC). 2014a. Education and training (Chapter 3). In: *APIC Text of Infection Control and Epidemiology*, 4th ed. Washington, DC: APIC.

APIC. 2014b. Infection prevention and control programs (Chapter 1). In: *APIC Text of Infection Control and Epidemiology.* 4th ed. Washington, DC: APIC.

Bryant KA, Harris AD, Gould CV, et al. 2015. Necessary infrastructure of infection prevention and healthcare epidemiology programs: a review. *Infect Control Hosp Epidemiol*. 37(4):371–380.

Canadian Centre for Occupational Health and Safety (CCOHS). 2017. OSH Answers Fact Sheets. Risk Assessment. http://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html.

Centers for Disease Control and Prevention (CDC). National Center for Emerging and Zoonotic Infectious Diseases. 2016. *Guide to Infection Prevention for Outpatient Settings: Minimum Expectations for Safe Care.* https://www.cdc.gov/infectioncontrol/pdf/outpatient/guide.pdf.

CDC. National Institute for Occupational Safety and Health (NIOSH). 2015. Veterinary Safety and Health. Hazard Prevention and Infection Control. https://www.cdc.gov/niosh/topics/veterinary/hazard.html.

CDC. NIOSH. 2016. Workplace Safety & Health: Hierarchy of Controls. https://www.cdc.gov/niosh/topics/hierarchy/default.html.

Cook E, Marchaim D, Kaye KS. 2011. Building a successful infection prevention program: key components, processes, and economics. *Infect Dis Clin N Am*. 25:1–19.

Dawson SJ. 2003. The role of the infection control link nurse. *J Hosp Infect.* 54(4):251–257.

Donabedian A. 1996. The effectiveness of quality assurance. *Int J Qual Health Care*. 8(4):401–407.

Doran G, Miller A, Cunningham J. 1981. There's a S.M.A.R.T. way to write management goals and objectives. *Management Review*. 70:30–36.

European Environment Agency. 2016. Environmental Risk Assessment Approaches, Experiences and Information Sources: Introduction to Risk Assessment Concepts. http://www.eea.europa.eu/publications/GH-07-97-595-EN-C2/chapter1h.html.

Friedman C, Barnette M, Buck AS, et al. 1999. Requirements for infrastructure and essential activities of infection control and epidemiology in out-of-hospital settings: a consensus panel report. *Am J Infect Control.* 27:418–430.

Fukuda H, Imanaka Y, Hirose M, et al. 2009. Factors associated with system-level activities for patient safety and infection control. *Health Policy*. 89:26–36.

Hale R, Powell T, Drey NS, Gould DJ. 2015. Working practices and success of infection prevention and control teams: a scoping study. *J Hosp Infect*. 89(2):77–81.

Haughom J. 2017. Five Deming Principles That Help Healthcare Process Improvement. Salt Lake City, UT: Health Catalyst. https://www.healthcatalyst.com/wp-content/uploads/2014/11/Five-Deming-Principles-That-Help-Healthcare-Process-Improvement.pdf.

Health and Safety Authority. 2006. *Guidelines on Risk Assessments and Safety Statements.* Dublin, Ireland: Health and Safety Authority. http://www.hsa.ie/eng/Small_Business/Getting_Started/Risk_Assessments_Made_Easy/Guidelines_on_Risk_Assessments_and_Safety_Statements.pdf.

Hoffmann C. 2000. Developing an infection control program. *Infect Control Today.* (November 30). http://www.infectioncontroltoday.com/articles/2000/12/developing-an-infection-control-program.aspx.

Institute of Medicine. 1999. Measuring the Quality of Health Care. Washington, DC: The National Academies Press. https://doi.org/10.17226/6418.

Japan International Cooperation Agency (JICA). 2013. Africa: With JICA's Help, 'Kaizen' Is Being Widely Adopted in Africa. https://www.jica.go.jp/english/news/field/2013/130529_01.html.

Mehrjerdi YZ. 2011. Six-Sigma: methodology, tools, and its future. *Assembly Automation*. 31(1):79–88.

Moen RE, Norman CL. 2010. Circling back: clearing up myths about the Deming cycle and seeing how it keeps evolving. *Quality Progress*. (November). http://www.apiweb.org/circling-back.pdf.

Necochea E, Bossemeyer D. 2005. *Standards-Based Management and Recognition: A Field Guide.* Baltimore, MD: Jhpiego.

Pronovost PJ. 2008. Translating evidence into practice: a model for large scale knowledge translation. *BMJ.* 337:a1714.

Pronovost P. 2011. Navigating adaptive challenges in quality improvement. *BMJ Qual Saf*. 20:560–563.

Saint S, Kowalski CP, Banaszak, et al. 2010. The Importance of leadership in preventing healthcare-associated infection: results of a multisite qualitative study. *Infect Control Hosp Epidemiol*. 31:901–907.

Scheckler WE, Brimhall D, Buck AS, et al. 1998. Requirements for infrastructure and essential activities of infection control and epidemiology in hospitals: a consensus panel report. *Am J Infect Control*. 26:47–60.

Smith PW, Bennett G, Bradley S, et al. 2008. SHEA/APIC guideline: infection prevention and control in the long-term care facility. *Am J Infect Control*. 36:504–535.

Strengthening Pharmaceutical Systems. 2009. *Infection Control Assessment Tool*, 2nd ed. Submitted to the US Agency for International Development by the Strengthening Pharmaceutical Systems Program. Arlington, VA: Management Sciences for Health. http://siapsprogram.org/wp-content/uploads/2012/05/ICAT-composite_FINAL_May-2009.pdf.

Talaat M, Kandeel A, Rasslan O, et al. 2006. Evolution of infection control in Egypt: achievements and challenges. *Am J Infect Control*. 34(4):193-200.

United States Occupational Safety and Health Administration (OSHA). n.d. Recommended Practices for Safety and Health Programs, Hazard Identification and Assessment. https://www.osha.gov/shpguidelines/hazard-Identification.html.

Vuori H. 1989. Research needs in quality assurance. *Int J Qual Health Care*. 1(2–3):147–159.

Wiblin RT, Wenzel RP. 1996. The infection control committee. *Infect Control Hosp Epidemiol*. 17(1):44–46.

World Health Organization (WHO). 2002. *Prevention of Hospital-Acquired Infections: A Practical Guide*, 2nd ed. Geneva, Switzerland: WHO.

WHO. 2011. *Report of the Burden of Endemic Health Care-Associated Infection Worldwide: Clean Care Is Safer Care*. Geneva, Switzerland: WHO http://apps.who.int/iris/bitstream/10665/80135/1/9789241501507_eng.pdf.

WHO. 2016. *Guidelines on Core Components of Infection Prevention and Control Programmes at the National and Acute Health Care Facility Level*. Geneva, Switzerland: WHO. http://www.who.int/gpsc/core-components.pdf.

Wright SB, Ostrowsky B, Fishman N, et al. 2010. Expanding roles of healthcare epidemiology and infection control in spite of limited resources and compensation. *Infect Control Hosp Epidemiol.* 31:127–132.

Chapter 2. Principles of Public Health Emergency Preparedness and Outbreak Management for Health Care Facilities

Key Topics

- Infection control in public health emergencies
- Principles of emergency management: mitigation, preparedness, response, and recovery
- The role of the health care facility in data collection and epidemiological investigation during an emergency or outbreak
- Information sharing and communication during a public health emergency

Key Terms

- **Case definition** is a set of uniform criteria used to define a disease for public health surveillance.
- **Emergency management** is the process by which an individual, facility, and/or community uses mitigation strategies to better prepare for, respond to, and recover from a disaster or emergency.
- **Endemic** refers to the baseline level of disease occurrence in a community; in technical terms, it refers to the usual prevalence of cases of a disease or infectious agent in a population (group of people) within a geographic area.
- An **epidemic** is the occurrence of more cases of a disease than expected in a defined population, geographic area, or season.
- **Isolation** is the separation of persons who have a communicable disease from others.
- **Mitigation** is the actions taken before and during an outbreak or epidemic to decrease the potential impact of the situation.
- **Outbreak** is the occurrence of more cases of a disease or infectious agent than expected in a defined population (group of people), geographic area, or season. This is the same definition as “epidemic,” but an outbreak usually refers to disease events occurring in a more limited geographic area than an epidemic.
- A **pandemic** is an epidemic that has spread over several countries or continents, usually affecting a large number of people.
- **Quarantine** is the separation and restriction of movement of persons who may have been exposed to a communicable disease but are not yet ill. It is used to stop the spread of a disease.
- **Surveillance** is the systematic collection, analysis, and interpretation of data on the frequency of disease. It is essential to the planning, implementation, and evaluation of public health practices and the timely dissemination of this information for public health action.
- **Zoonotic disease** is a disease that can be passed between animals and humans.

Background

Disease outbreaks and other public health emergencies may be considered major disasters. Thus, planning ahead for these emergencies is critical for all organizations, including health care facilities. With proper planning and preparedness, a health care facility is able to respond more quickly and thoughtfully to a public health emergency.

Public health emergencies bring many challenges, including an urgent need for response, proper case identification, use of basic and enhanced infection prevention and control (IPC) practices, data collection, and communication, all while essential health services must still be maintained. The more a facility can prepare in advance, the better the ability to respond and adapt to a public health emergency. (APIC 2014; WHO 2005b)

"Outbreaks are urgent emergencies accompanied by rapid efforts to care for cases, prevent further spread, and bring the outbreak under control. Decisions, often with life-saving potential, need to be made rapidly and actions need to be followed promptly."

—World Health Organization 2005a

The Nature of Public Health Emergencies

Public health emergencies can be classified in various ways. One way is to differentiate between infectious and non-infectious emergencies. Infectious disease emergencies include all events that involve a biological agent (e.g., bioterrorism event) or a disease (a pandemic or an outbreak of an emerging pathogen) and impact a large number of individuals, such as in a pandemic (e.g., avian influenza) or an outbreak of an emerging infectious disease (e.g., Middle East Respiratory Syndrome-Corona Virus [MERS-CoV]). Non-infectious disease emergencies include all natural and manmade events that do not include an infectious agent as the source of the incident.

Infectious disease outbreaks can be triggered by other emergencies, such as natural disasters. These are usually the result of population displacement, poor sanitation, lack of clean water, breakdown of health care services and prevention efforts, endemic pathogens, zoonotic diseases, and foodborne illness. After a natural disaster, animals and humans may face displacement, which can lead to an increase in zoonotic diseases. (APIC 2014)

As an example, there was an outbreak of cholera following the 2010 earthquake in Haiti. Prior to the outbreak, Haiti had been free from cholera for over 100 years. Displacement of more than 1 million people, destruction of water and sanitation systems, poor sanitation, and improper hygiene resulted in contamination of drinking water with the *Vibrio cholerae* bacteria and an outbreak of cholera. (CDC 2011a; WHO 2015b)

Infection Prevention and Control and Public Health Emergencies

Outbreaks and public health emergencies tend to bring IPC infrastructure into the spotlight as routes of disease transmission are investigated. Many outbreaks in the past have revealed breakdowns in IPC practices, even in institutions and countries that were assumed to have strong practices.

With the increased attention comes an effort to strengthen the systems already in place. For example, during the 2014–2015 Ebola Virus Disease outbreak, a Centers for Disease Control and Prevention (CDC) team found many lapses in basic IPC practices during a rapid needs assessment in Sierra Leone. The team identified a lack of dedicated IPC personnel and standard operating procedures related to many IPC practices, including screening, triage, and isolation. In addition, the investigation into the causes of Ebola Virus Disease transmission within a health care facility in Texas in the United States revealed staff skills in the appropriate use of personal protective equipment (PPE) were lacking in many instances. The findings of these reports triggered resources for developing basic IPC practices. (Chevalier et al. 2014; Pathmanathan et al. 2014)

Four Principles of Emergency Management

Public health emergencies should be planned for and responded to using the primary principles of emergency management (see Figure 2-1): mitigation, preparedness, response, and recovery.

Figure 2-1. The Four Principles of Emergency Management

Mitigation

Mitigation strategies can help a health care facility decrease the devastating impact of a potential public health emergency. The exact mitigation strategy used will depend on the type of event. The strategy should include activities that would prevent or reduce the chance of an emergency, or reduce vulnerability of high-risk groups. For example, offering timely vaccination if an effective vaccine is available against the disease, such as influenza, polio, measles, or yellow fever, can prevent or mitigate an outbreak of these diseases. (APIC 2014; FEMA 2015)

Preparedness

Health care organizations, facilities, and communities that are most successful at handling public health emergencies begin preparations long before any cases of disease or other emergencies occur. Preparedness actions, which take place before an emergency, increase a facility's ability to respond when an emergency occurs. They include planning, organizing, training, equipping, practicing, evaluating, and taking corrective actions. IPC aspects of preparedness include stockpiling IPC supplies, training staff, and increasing compliance with recommended IPC practices during mitigation.

However, preparedness is more than writing a plan down on paper. It is essential to test the system and make sure the facility is clear about who is expected to do what.

Preparedness assessment

Facilities should perform a facility preparedness assessment during the early preparedness stages to determine if the facility is prepared and where actions and resources for handling a public health emergency are most needed. (See Appendix 2-A for an example of a facility emergency preparedness checklist.)

In addition to performing a facility assessment, other key steps in the pre-emergency preparedness phase include:

- Creating a strong disease surveillance system
- Reinforcing IPC practices
- Coordinating with health ministries or other public health authorities
- Partnering with the community for education, involvement, and communication
- Performing drills and tests of the system

These steps are described in detail in the following sections.

Create a strong disease surveillance system

Facilities and communities should be able to identify when a disease rises above normal levels in a specific facility or area. Outbreaks, epidemics, and pandemics, by definition, occur when there is an increase in the endemic level of a disease in a certain area. A strong disease surveillance system should assist a facility in identifying cases of disease that are of concern. (See Module 9, Surveillance of Health Care-Associated Infections, for more detailed information on how to create surveillance systems for health care-associated infections.) Partnering with the public health authorities will assist a health care facility in increasing its awareness concerning diseases in neighboring communities or countries.

Case definitions

During an outbreak situation, it is important that a facility have clear procedures for identifying, investigating, and evaluating possible cases of disease. Successful case identification depends on clear and easy-to-use case definitions. Case definitions in community outbreak situations are generally developed or adapted by national or international public health authorities. Case definitions describe the characteristics and signs or symptoms of a disease so that those who might have the disease can be recognized early and followed up by health care facilities or public health authorities. Table 2-1 provides an example of a case definition. It can be challenging to create a case definition during an outbreak of a new infectious disease, especially in the early stages of the outbreak when there is not a lot of information available. (CDC 2015)

Case definitions should be specific enough to identify true cases of disease that are part of an outbreak, and at the same time they should be sensitive enough to capture all potential cases. During an outbreak, case definitions are used to classify the likelihood of a particular case being a part of the outbreak. Case definitions can be separated into three categories: confirmed, probable, and possible cases.

- **Confirmed cases** are typically laboratory-confirmed cases.
- **Probable cases** usually have characteristics and clinical features of the disease but do not have laboratory confirmation.
- **Possible cases or suspect cases** usually have some, but not all, of the characteristics and clinical features of the disease and do not have laboratory confirmation.

As an outbreak evolves and more information becomes available, it is common for case definitions to be adapted and change.

MERS-CoV is a viral respiratory illness that affects the lungs. The first known cases of MERS-CoV occurred in Jordan in April 2012. Table 2-1 lists the World Health Organization (WHO) case definitions for confirmed and probable cases of MERS-CoV. (WHO 2014a)

Table 2-1. Case Definition of Middle East Respiratory Syndrome Coronavirus

Case Type	Definition
Confirmed Case	A person with laboratory confirmation of MERS-CoV infection, irrespective of clinical signs and symptoms
Probable Case	A febrile, acute respiratory illness with clinical, radiological, or histopathological evidence of pulmonary parenchymal disease (e.g., pneumonia or acute respiratory distress syndrome) **AND** A direct epidemiologic link with a confirmed MERS-CoV case **AND** Testing for MERS-CoV is unavailable, negative on a single inadequate specimen, or inconclusive
	A febrile, acute respiratory illness with clinical, radiological, or histopathological evidence of pulmonary parenchymal disease (e.g., pneumonia or acute respiratory distress syndrome) **AND** Testing for MERS-CoV is inconclusive
	An acute, febrile respiratory illness of any severity **AND** Direct epidemiological link with a confirmed MERS-CoV case **AND** Testing for MERS-CoV is inconclusive

A direct epidemiological link with a confirmed MERS-CoV patient may include:

- Health care-associated exposure, including providing direct care for MERS-CoV patients, working with HCWs infected with MERS-CoV, or visiting patients or staying in the same close environment of individuals infected with MERS-CoV.
- Working together in close proximity or sharing the same classroom environment with individuals infected with MERS-CoV.
- Traveling together with individuals infected with MERS-CoV in any kind of conveyance.
- Living in the same household as individuals infected with MERS-CoV.
- The epidemiological link may have occurred within a 14-day period before or after the onset of illness in the case under consideration.

Screening and triage systems

Preparation should include setting up a screening and triage system. The goal of screening patients is to quickly identify potential cases before they receive care in the health care facility, thus minimizing the risk of disease transmission within the facility.

After a patient arrives at a facility, screening should occur as soon as possible, ideally before any direct patient care begins. It is not necessary for the person conducting the screening to be a clinician but

everyone involved in screening and triage should be appropriately trained. It is helpful to have print copies of screening forms as job aids. The person conducting screening may be required to wear some PPE or maintain a distance of at least 2 meters (6 feet) from the patients, depending on the disease and its mode of transmission.

In addition to having case definitions for screening, HCWs should know what to do with any patients who meet the case definition criteria. There should be a designated workflow that moves patients from screening to isolation and triage, as indicated. Staff engaged in screening and triage should follow the recommendations for reporting a positive case and follow the specific instructions on reporting frequency.

Any patients identified by screening should be isolated immediately. Isolation refers to the physical separation of these patients from other patients. Potential cases should be moved to an area away from other patients and staff, and appropriate PPE should be worn by all staff. The designated area for these patients should be decided ahead of time. The type of isolation and PPE required will depend on the characteristics of the disease and the possible mode of disease transmission. (More information on the types of PPE can be found in Module 3, Chapter 1, Personal Protective Equipment, and Chapter 2, Use of Personal Protective Equipment during Outbreaks of Viral Hemorrhagic Fever.)

Reinforce infection prevention and control practices

IPC practices should be followed every day with every patient in a health care facility. However, during an outbreak or other public health emergency, complying with IPC principles becomes more critical. Basic IPC measures, such as Standard Precautions, including hand hygiene, cleaning and disinfection, and Transmission-Based Precautions, are key practices that help prevent disease transmission in health care facilities at all times, including during an outbreak.

A facility must have strong IPC principles in place before the outbreak occurs in order to rapidly prevent any further spread. A component of preparedness is training HCWs and other facility staff on the basics of IPC. Box 2-1 lists topics related to IPC to be prioritized for education as part of a preparedness plan.

Box 2-1. IPC Topics for Staff Education during the Preparedness Phase

- Self-screening for illness
- Screening and triage of patients
- Internal and external reporting of communicable diseases
- Surveillance
- Emergency management plan and procedures
- Modes of disease transmission
- Standard precautions
- Transmission-Based Precautions
- Respiratory etiquette
- Use and reuse of PPE
- Hand hygiene
- Handling contaminated linens
- Obtaining and handling specimens
- Environmental cleaning and disinfection
- Cleaning, disinfection, and sterilization of medical equipment and devices
- Waste management procedures
- Decontamination procedures
- Postmortem care
- Vaccination

Adapted from: Rebmann 2009.

Most outbreaks involve organisms that require Transmission-Based Precautions, in addition to Standard Precautions. Availability and proper use of PPE are critical in an outbreak situation. The types and combinations of PPE worn during an outbreak will depend on the mode of transmission of the organism. If worn correctly, PPE is an effective physical barrier between infectious agents and the HCW.

The greatest risk of contamination to HCWs is during the removal of PPE. Emergency preparedness activities for HCWs should include competency-based training and adequate practice on the use of PPE. PPE training and competency assessment should occur during the pre-emergency preparedness stages. Practice with immediate visual feedback of contamination can help staff to see where contamination is likely to occur. This can be accomplished using red paint, jam, tomato ketchup, fluorescent dye, or other brightly colored materials (Tomas et. al 2015). See Module 3, Chapter 1, Personal Protective Equipment, and Chapter 2, Use of Personal Protective Equipment during Outbreaks of Viral Hemorrhagic Fever, for more information.

As part of the preparedness, a health care facility should make sure that there is enough PPE for an outbreak or emergency situation. It is challenging to determine how much PPE to stockpile, especially because the type of PPE varies depending on the pathogen. The amount to be stockpiled can be based on the number of HCWs, the number of PPE sets required for each HCW per day, and the estimated length of time of the outbreak using the following calculation:

(Number of HCWs x number of PPE sets per HCW per day) x estimated number of days in outbreak = Estimated number of PPE sets needed for stockpile

The estimated cost of the PPE stockpile can be calculated by multiplying this number by the average cost of one set of PPE. (Hashikura and Kizu 2009; NAMRU3 and USAID Egypt 2011) See Appendix 2-B for an example of calculating a PPE stockpile.
IPC practices must also be followed when collecting, transporting, and handling laboratory specimens to prevent disease transmission to HCWs and lab workers. (See Module 1, Chapter 3, Basic Microbiology for Infection Prevention and Control, for details on safe specimen collection and handling.) Safe work practices by laboratory workers including biosafety precautions appropriate for the pathogen must be in place. (See Module 8, Chapter 1, Clinical Laboratory Biosafety, for more details on safe work practices in the laboratory and appropriate safety considerations for each biosafety level.)

Coordinate with health ministries or other public health authorities

As recent outbreaks have demonstrated, disease cases can spread over large geographic areas in just a few days or weeks. With constant international travel and many portals of entry and exit across porous borders, the likelihood of an infectious disease spreading across multiple countries, and even continents, has increased. Ministries of health play a critical role in understanding the bigger picture of disease distribution, and these authorities can be very valuable in helping to identify disease threats that may be moving toward a facility or country. Open communication with public health authorities will help a facility remain vigilant for emerging pathogens.

Partner with the community for education, involvement, and communication

The community presents a unique challenge during an outbreak or emergency situation. It may be easily alarmed and skeptical of the information coming from the authorities during an emergency (WHO 2005a). Mistrust within a community can escalate during emergency situations. Open communication with the community can reduce the potential for feelings of mistrust if an outbreak occurs. Community members can help disseminate information and follow recommendations from public health authorities, including recommendations on isolation and quarantine. By developing a good relationship with the

community before an emergency occurs, the community and health care facility are better able to come together during times of public health emergency.

Perform drills and tests of the system

With effective disease surveillance systems, strong IPC practices, and good partnerships with the local public health authorities and the local community in place, a health care facility is much more likely to be able to respond well to a public health emergency. However, health care facilities should test their systems to ensure that plans unfold as intended and roles and responsibilities are clear. Each test of the system is a learning process and enables emergency preparedness plans to be further refined.

Response

Response to public health emergencies includes activities in reaction to a known or suspected event. This is when emergency plans are operationalized. Depending upon the nature of the emergency, response activities may be restricted to the health care facility itself or may include local, community, regional, and national actions and may continue for a short, intermediate, or long time. Response functions and tasks are divided into three time frames: **immediate, intermediate, and extended** (see Table 2-2).

Response to any public health emergency is a dynamic process; activities may be repeated at various stages of the response. Immediate and intermediate interventions are implemented during the first 24 hours, and the extended response activities are implemented until the emergency is over. (CDC 2011b)

Many facilities use the formal Incident Command System (ICS) when responding to an emergency. ICS is a management system aimed at using a common organizational structure to respond to an incident. ICS can be used across many different disciplines and in many types of incidents, including public health emergencies. ICS usually takes into account activities involving command, operations, planning, logistics, and finance and administration. (FEMA)

Table 2-2. Public Health Emergency Response by Time Frame

Immediate Response (0–2 hours)	Intermediate Response (2–6 hours)
• Assess the situation. • Contact key government health personnel. • Develop immediate response objectives and establish plan of action. • Establish emergency operation center if indicated and engage public health professionals. • Ensure that the site health and safety plans to protect response personnel are followed. • Establish communication with key health and medical organizations. • Assign and deploy resources and assets for initial health response objectives (including health care needs of those affected). • Address requests for assistance and information. • Initiate risk communication activities. • Engage legal counsel, if available. • Document all response activities.	• Continue activities already initiated. • Verify that surveillance activities are operationalized. • Ensure that laboratories are operational for confirmation of cases. • Address the needs of special populations (e.g., children, pregnant women, elderly). • Communicate with community about need for health-related volunteers and donations. • Update risk communication messages as new information becomes available.

Intermediate Response 6–12 hours	Extended Response 12–24 hours
• Continue activities already initiated, as appropriate. • Collect and analyze disease surveillance and laboratory data. • Update information and make changes to objectives and plans, as needed. • Prepare for onsite assistance from public health authorities. • Assess and acquire supplies and other resources.	• Address mental and behavioral health support needs. • Prepare for transition to extended operations.

Extended Response: Ongoing Public Health Emergency Response Functions and Tasks from 24 Hours Onward		
• Identify environmental hazards. • Assess potential hazards. • Assess epidemiological services. • Assess health and medical needs. • Identify and treat affected individuals. • Control contamination. • Conduct surveillance, include laboratory. • Manage wastes. • Quarantine and isolate affected individuals.	• Provide public health information. • Communicate with facility staff and community. • Assess responder safety and health. • Assess overall health and medical personnel resources. • Check health and medical equipment availability. • Organize health-related volunteers and donations. • Review in-hospital care. • Plan evacuation and sheltering in place.	• Manage trauma and fatalities. • Assess morgue services and disposal of human remains. • Initiate mental health and social services. • Ensure water and food safety. • Control vectors. • Review sanitation and hygiene practices. • Maintain routine services. • Coordinate with veterinary services. • Plan long-term community recovery.

Adapted from: CDC 2011b.

Recovery

Once an emergency is declared "over," the recovery efforts begin. Although specific recovery activities will vary depending on the type of event that has occurred, there are the six general principles for recovery actions:

- Establish short- and long-term goals to return a facility or community to the pre-event baseline.
- Evaluate how the emergency management plan was carried out and identify gaps that occurred during the response.
- Determine potential solutions to the gaps identified in the emergency management plan.
- Update the emergency management plan to reflect lessons learned.
- Educate staff on changes in the emergency management plan.
- Practice the new emergency management plan.

(APIC 2014)

Restoring normal life in a community or facility is an important way to make staff feel safe and comfortable. There is no defined time period for how long recovery actions will take place.

Post-event evaluation is a critical piece of the emergency management framework. The goal of the post-event evaluation is to improve the system and to further increase the preparedness level of a facility. There are areas for improvement in every emergency response. It should be noted that identifying improvements is not a sign of weakness or failure. Questions to consider during the post-event evaluation include:

- Was the facility response appropriate for the emergency?
- Were the emergency preparedness plans implemented as they were intended to be implemented?
- Were the emergency preparedness plans timely and effective?
- Were the facility's patients, staff, and HCWs safe?
- Could risks have been further reduced for patients, staff, and the community?
- Were there any gaps in the system?
- What was done well?
- What could have been done better?

Recovery efforts should be multidisciplinary and include individuals with different backgrounds and expertise. Findings of the post-event evaluation can be compiled into an after-action report. Putting the findings into one document will easily allow the facility to identify strengths and opportunities for improvement.

Once an assessment of the response to the event has been performed, changes and adjustments to the emergency plans should be made to reflect the post-event discussions. Staff should be educated about these changes to make sure they understand their roles and responsibilies in an emergency. Lastly, the whole cycle should begin again, with mitigation and preparedness. The new response system should be tested, especially the new portions of the system that were added after the emergency occurred.

Role of the Health Care Facility in Data Collection and Epidemiological Outbreak Investigation during an Emergency

Outbreak investigation requires cooperation and collaboration between many groups, including health care providers, epidemiologists, IPC staff, public health authorities, and the community. The health care facility has a role in assisting public health authorities with data collection and outbreak investigation during outbreak situations.

The ultimate goal of any outbreak investigation[1] is to implement measures that stop or reduce the risk of continued spread and future occurrences of disease, and to methodically identify the factors that may have contributed to the outbreak. This is not always an easy task due to the many factors contributing to an outbreak. In addition, it is not always easy to collect data and information during an outbreak. However, data collection helps identify the scope of the outbreak, assists with refining and changing the case definition to be more accurate, identifies where to focus resources, and leads to a better

[1] The steps of an outbreak investigation are similar for community- and health care-associated outbreaks. (See Module 9, Chapter 3, Investigation of Outbreaks of Health Care-Associated Infections, for these steps although the details in this chapter are specific to health care-associated outbreaks.)

understanding of risk factors. By tracking risk factors and exposures, outbreak investigators can better understand how to prevent exposures in healthy individuals. The WHO Ebola Situation Reports that were issued weekly during the 2014–2015 Ebola Virus Disease outbreak in West Africa provide an example of excellent data collection during an outbreak. (WHO 2015a)

Outbreak Communication and Information Dissemination

Public health emergencies and outbreaks present many challenges for a health care facility, including how best to communicate with the public and the community. A public health emergency or outbreak brings its own unique set of communication difficulties that are defined by the pathogen, its mode of transmission, and the political, economic, and cultural context in which the outbreak occurs. WHO has identified five best practices for outbreak communication (also called "risk communication"):

- Build trust
- Announce early
- Be transparent
- Respect public concerns
- Plan in advance

The goal of using these principles is to promote rapid containment of the outbreak with minimal social and economic disruption to the community. (WHO 2005a)

Build Trust

Building and maintaining trust with the community is the foundation for successful emergency communication. The public needs to trust that the health authorities are honest, competent, and in control throughout the outbreak. A foundation of trust in the investigators will reduce public anxiety during times of uncertainty, lead to greater compliance with recommendations from the authorities, and help prevent reactions that exacerbate an outbreak's social and economic impact.

Announce early

Announcing information early in the outbreak sets the tone for the entire outbreak. By sharing information early, expectations are set that information will be shared as it is learned and will not be concealed from the public. Early announcement is especially important for diseases that spread rapidly from one community to another and from one country to another. The very first communication about an outbreak can set the tone for all of the communications throughout the outbreak, adding to the importance of announcing early.

Be transparent

Transparent information is honest, easily understood, complete, and accurate. The more transparent communication is, the more trust the public will have in it. However, there are limits to transparency, especially when dealing with confidential and sensitive patient data.

Respect public concern

It is important for health officials to listen to the concerns and fears of the public, even if they seem like overreactions or irrational. Being respectful of the concerns of the public will help to maintain trust.

Plan in advance

A communication plan is essential for good communications during an emergency or an outbreak. Emergencies can be chaotic, stressful, and emotional. It is best to develop a plan for communicating with the public before the outbreak even begins.

Summary

History has shown that basic IPC practices play an important role during outbreaks and public health emergencies. This role highlights the need for resources for strengthening basic IPC practices to prepare for the next public health emergency or outbreak. The four main principles of emergency management—mitigation, preparedness, response, and recovery—help determine how a health care facility will respond to an emergency or outbreak. Key steps in preparing facilities for an emergency include: creating a strong disease surveillance system; reinforcing basic and enhanced IPC principles; partnering with health ministries and the community for education, involvement, and communication; and testing the system. Although some public health emergencies cannot be prevented, the amount of time invested by a health care facility in preparing will help determine how successful the facility will be in responding to an emergency.

Appendix 2-A. Preparing for a Public Health Emergency: A Facility Preparedness Checklist

The following is a sample facility preparedness checklist. Assessing how prepared your facility is to handle a public health emergency or outbreak is the first step in the preparedness process.

Getting Started

- ☐ Dedicate adequate resources to emergency preparedness planning efforts.
- ☐ Secure facility leadership support for emergency preparedness plans.
- ☐ Designate individuals responsible for making the facility's emergency preparedness plans.
- ☐ Involve individuals and representatives from various backgrounds in the emergency preparedness plans.
- ☐ Ensure that everyone involved in the emergency preparedness plan knows what their roles and responsibilities are during a public health emergency.
- ☐ Perform a facility risk assessment of emergency preparedness.
- ☐ Establish relationships with local ministries of health.
- ☐ Develop standard operating procedures for essential functions, including:
  - ☐ Procedures for outbreak alert and outbreak verification
  - ☐ The flow of information
  - ☐ The development and distribution of information to the public
  - ☐ Staffing management
  - ☐ Designated roles and responsibilities

Communication

- ☐ Designate a spokesperson who is responsible for communications during an outbreak.
- ☐ Develop a plan for how to communicate key messages to various groups during an outbreak, including:
  - ☐ Facility staff
  - ☐ The community
  - ☐ Public health authorities

Surveillance

- ☐ Ensure that mechanisms are in place to detect unusual disease events or clusters.
- ☐ Check that a system is in place to create and revise case definitions.
- ☐ Designate staff who are able to perform enhanced surveillance during an outbreak, including:
  - ☐ Monitoring hospital admissions for cases of the disease

- Monitoring deaths in suspected or confirmed cases
- Monitoring staff absenteeism
- Monitoring vaccine usage if a vaccine is being administered during an outbreak
- Collecting data on vaccine and antiviral usage

Laboratory Considerations

- Designate an area to store specimens in case there are too many specimens collected to process during an outbreak.
- Locate WHO protocols for specimen collection and transportation.
- Identify a local laboratory in the country with biosafety security levels 3 or 4 (BSL3 or BSL4) capability. (WHO has a national inventory of laboratories with BSL3 and BSL4 capability.)
- Ensure that your facility has access to a designated reference laboratory.

Infection Control Considerations

- Basic IPC procedures are followed within the facility.
- Staff are trained and assessed for competency on basic IPC procedures.
- Equipment is available to implement infection control measures, including soap, water, alcohol-based handrub, and PPE.
- Areas within the facility are designated for patient screening, triage, and patient care during an outbreak.
- Overflow areas are designated for screening, triage, and patient care in case there is an influx of patients.
- Supply needs (including PPE) have been calculated and ways to stockpile supplies has been explored.
- A system has been developed for the distribution of stockpiled supplies.

Staffing Considerations

- Ensure that staff are aware of the emergency preparedness plans within the facility.
- Estimate the number of health care workers at the facility who may need PPE.
- Determine sources from which additional health care workers could be recruited in instances where staff absenteeism is high.
- Consider how psychosocial support will be given to your staff during and after an emergency.

Vaccines and Antivirals

- Determine how vaccine or antivirals can be obtained during an outbreak.
- Develop contingency plans for storage, distribution, and safe administration of vaccines and antivirals.
- Plan how to distribute available vaccines or antivirals during an outbreak based on priority groups in case there is a limited supply.
- Develop a process to monitor adverse reactions to antivirals or vaccines.

Management of the Deceased

- Identify the emergency capacity for storage of corpses before culturally acceptable burial.
- Develop protocols for the safe handling of corpses, making sure to consider cultural and religious beliefs.
- Determine the maximum capacity for the disposal of corpses during an outbreak using culturally acceptable burial methods.

Implementing and Updating the Plan

- Assess the effectiveness of the emergency preparedness plan.
- Perform drills using the emergency preparedness plan, targeting specific areas of the plan.
- Revise emergency preparedness plans based on true emergency events or drills.
- Determine a set interval of time to revise the emergency preparedness plans (e.g., yearly, every 2 years).

Adapted from: WHO 2005b.

Appendix 2-B. Preparing for a Public Health Emergency: Calculating PPE Needs

A Case Study on PPE Stockpiling

The Healthy Hospital wants to obtain a stockpile of PPE so it is prepared for an outbreak of novel influenza. The hospital has asked the Emergency Preparedness Planning Team to calculate an approximate number of PPE sets to be obtained for the stockpile. The Healthy Hospital decides that one PPE set should include a respirator, goggles, gloves, and a gown.

What key pieces of information does the Emergency Preparedness Planning Team need to know in order to calculate the number of PPE sets needed for the stockpile?

The Emergency Preparedness Planning Team needs to know the number of HCWs in the facility who will need PPE, the number of PPE sets per HCW per day, and the estimated number of days in the outbreak period. The Emergency Preparedness Planning Team gathers the following information:

- The average number of HCWs is 50.
- The number of PPE sets (respirator, goggles, gloves, and gown) per HCW per day is 3.
- The estimated number of days in the outbreak period is 8 weeks, or 56 days.

How should the Emergency Preparedness Planning Team calculate the number of PPE sets to stockpile?

- Number of HCW x number of PPE sets x estimated days in outbreak = estimated number of PPE sets needed for stockpile
- 50 x 3 x 56 = estimated number of PPE sets needed for stockpile
- = 8,400 estimated number of PPE sets needed for stockpile

What should the Emergency Preparedness Planning Team recommend for the PPE stockpile?

The Emergency Preparedness Planning Team should recommend an estimated 8,400 sets of PPE for the PPE stockpile at The Healthy Hospital.

(Hashikura and Kizu 2009; NAMRU3 and USAID Egypt 2011)

References

Association for Professionals in Infection Control and Epidemiology (APIC). 2014. *APIC Text of Infection Control and Epidemiology*, 4th ed. Washington, DC: APIC.

Centers for Disease Control and Prevention (CDC). 2009. An Introduction to applied epidemiology and biostatistics. In: *Principles of Epidemiology in Public Health Practice,* 3rd ed. http://www.cdc.gov/ophss/csels/dsepd/ss1978/lesson1/section11.html.

CDC. 2011a. Cholera in Haiti: One Year Later. https://www.cdc.gov/cholera/haiti/haiti-one-year-later.html.

CDC. 2011b. *Public Health Emergency Response Guide for State, Local and Tribal Public Health Directors*, Version 2.0 (HHS-CDC 2011). http://emergency.cdc.gov/planning/pdf/cdcresponseguide.pdf.

CDC. 2013. Zoonotic Diseases. http://www.cdc.gov/onehealth/zoonotic-diseases.html.

CDC. 2015. National Notifiable Disease Surveillance System (NNDSS): Case Definitions. http://wwwn.cdc.gov/nndss/case-definitions.html.

CDC. 2016. Middle East Respiratory Syndrome (MERS): About MERS. http://www.cdc.gov/coronavirus/mers/about/index.html.

Chevalier MS, Chung W, Smith J, et al. 2014. Ebola virus disease cluster in the United States – Dallas Country, Texas, 2014. *MMWR*. 63(early release):1–3. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm63e1114a5.htm.

Federal Emergency Management Agency (FEMA). 2015. The four phases of emergency management. In: *Animals in Disasters*: *Awareness and Preparedness.* http://www.training.fema.gov/emiweb/downloads/is10_unit3.doc.

FEMA. n.d. ICS [Incident Command System] Resource Center. http://training.fema.gov/EMIWeb/IS/ICSResource/index.htm.

Hashikura M, Kizu J. 2009. Stockpile of personal protective equipment in hospital settings: preparedness for influenza pandemics. *Am J Infect Control*. 37:703–707.

Naval Medical Research Unit 3 (NAMRU3) and USAID Egypt. 2011. Module 2: Principles of product selection and evaluation, stock planning of essential IC supplies. *Program to Improve Quality and Safety of Healthcare in Egypt, Basic Infection Control Training Course.*

Pathmanathan I, O'Connor KA, Adams ML, et al. 2014. Rapid assessment of Ebola infection prevention and control needs – six districts, Sierra Leone, October 2014. *MMWR*. 63(49):1172–1174. http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6349a7.htm.

Rebmann T. 2009. Assessing hospital emergency management plans: a guide for infection preventionists. *Am J Infect Control.* 37:708–714.

Tomas ME, Kundrapu S, Thota P, et al. 2015. Contamination of health care personnel during removal of personal protective equipment. *JAMA Intern Med*. 175(12):1904–1910. http://archinte.jamanetwork.com/article.aspx?articleid=2457400.

U.S. Department of Health & Human Services (HHS). 2009. What Is the Difference between Isolation and Quarantine? http://www.hhs.gov/answers/public-health-and-safety/what-is-the-difference-between-isolation-and-quarantine/index.html#.

World Health Organization (WHO). 2005a. *Outbreak Communication: Best Practices for Communicating with the Public during an Outbreak*. http://www.who.int/csr/resources/publications/WHO_CDS_2005_32web.pdf.

WHO. 2005b. *WHO Checklist for Influenza Pandemic Preparedness Planning*. Geneva, Switzerland: WHO. http://www.who.int/influenza/resources/documents/FluCheck6web.pdf?ua=1.

WHO. 2008. *Foodborne Disease Outbreaks: Guidelines for Investigation and Control.* Geneva, Switzerland: WHO. http://apps.who.int/iris/bitstream/10665/43771/1/9789241547222_eng.pdf.

WHO. 2009. *WHO Guidelines on Hand Hygiene in Health Care: First Global Patient Safety Challenge. Clean Care Is Safer Care.* Geneva, Switzerland: WHO. http://apps.who.int/iris/bitstream/10665/44102/1/9789241597906_eng.pdf.

WHO. 2011a. Disaster Risk Management for Health: Mass Casualty Management. http://www.who.int/hac/events/drm_fact_sheet_mass_casualty_management.pdf.

WHO. 2011b. Disaster Risk Management for Health: Safe Hospitals. Prepared for Emergencies and Disasters. http://www.who.int/hac/events/drm_fact_sheet_safe_hospitals.pdf.

WHO. 2014a. Case Definition for Reporting to WHO: Middle East Respiratory Syndrome Coronavirus. Interim Case Definition. http://www.who.int/csr/disease/coronavirus_infections/case_definition_jul2014/en/.

WHO. 2014b. *Ebola and Marburg Virus Disease Epidemics: Preparedness, Alert, Control, and Evaluation*. Geneva, Switzerland: WHO. http://www.who.int/csr/disease/ebola/manual_EVD/en/.

WHO. 2015a. Ebola Situation Report – 9 September 2015. http://apps.who.int/ebola/current-situation/ebola-situation-report-9-september-2015.

WHO. 2015b. Weekly Epidemiological Record (WER): 2 October 2015, vol. 90, 40 (pp. 517–544). http://www.who.int/wer/2015/wer9040/en/.

WHO. 2016a. Disease Outbreaks. http://www.who.int/topics/disease_outbreaks/en/.

WHO. 2016b. 2014 West African Ebola Outbreak: Feature Map. http://www.who.int/features/ebola/storymap/en/.