Chapter 1: Overview of CORHA Principles and Practices

(Preface)

The field of healthcare epidemiology has expanded tremendously in the last few decades. What was once an area of specialty focused primarily within the walls of a hospital has now grown to a network of healthcare and public health professionals working collaboratively across healthcare settings, government agencies, and partner organizations to decrease healthcare-associated infections (HAIs) and antimicrobial resistance (AR).

One part of this partnership is to respond rapidly and efficiently to suspected outbreaks, halting and preventing disease transmission. Guidance for public health agencies and partners to respond to HAI/AR outbreaks, which encompass a wide breadth of infections, pathogens, and associated risk factors, has been needed. We hope this document serves this purpose.

Introduction

Throughout the guidance, we refer to "HAI/AR outbreaks," which include outbreaks that involve infections that meet the definition of an HAI and infections/colonizations with organisms typically associated with receiving healthcare, including AR pathogens. Public health HAI/AR programs often respond to outbreaks that extend beyond traditional HAIs and AR pathogens or exposures solely within healthcare settings. Therefore, this guidance also includes consideration for outbreaks of pathogens that we typically think of as being healthcare-associated but also found in community settings, outbreaks in healthcare settings associated with exposures to noninfectious chemical and other toxic agents, outbreaks that include both healthcare-associated and community cases, and situations that might require investigation even prior to having evidence of cases or an outbreak (e.g., medical product contamination, serious infection control breaches). The term "HAI/AR outbreaks" is used throughout the guidance to be inclusive of these other types of outbreak response.

The primary intended audience of this guidance is public health agencies at the federal, state, and local levels; however, the guidance can also be useful for healthcare professionals, healthcare facilities, and other

partners involved in identifying and responding to HAI/AR outbreaks. It is important to acknowledge that the work involved in responding to and preventing HAI/AR outbreaks occurs across the healthcare-public health continuum. Healthcare institutions, public health and government agencies, and other partners working in this arena comprise a large community of professionals collaborating on the same goal: rapidly detect HAI transmission and intervene to stop outbreaks.

Overview of Chapter 2: Fundamental Concepts of Healthcare-Associated Infections and Antimicrobial Resistant Pathogens Surveillance and Outbreak Response

This chapter focuses on the background and basis for surveillance of healthcare-associated infections (HAIs) and antimicrobial resistant (AR) pathogens, as well as associated outbreak response. It contains information on healthcare settings that public health professionals might interact with as part of HAI/AR outbreak response; changes to healthcare delivery, regulations, funding, and public health capacity over time that have impacted HAI/AR surveillance practices and outbreak response; and trends in surveillance including descriptions of systems used to identify potential outbreaks and the types of outbreaks and other events to which public health routinely responds.

Overview of Topics Covered in Chapter 2		
Section	Subheading	Covered Topics
Introduction (2.0)		• Description of what is covered in Chapter 2 • Definition and prevalence of HAIs • Definition and prevalence of AR pathogens • Types of HAI/AR outbreaks included in the guidance • Primary audience of the guidance
Trends in Healthcare (2.1)	Healthcare Settings (2.1.1)	• Definition of healthcare setting • Types of healthcare settings • Healthcare setting influence on outbreaks • Definitions, characteristics, and staff whom public health will interact by specific healthcare setting
	Healthcare Delivery (2.1.2)	• Trends in healthcare delivery • Influence of healthcare delivery changes on outbreaks

	Regulation and Oversight (2.1.3)	• Trends in regulations related to prevention of healthcare-related infections • Introduction to regulatory partners • Variation in regulation across healthcare settings • Infection prevention and antimicrobial stewardship regulation and resources for HAI rate comparisons
Trends in Surveillance (2.2)	Overview (2.2.1)	• Definition of surveillance • Purposes of disease surveillance • Trends in public health HAI/AR surveillance (2.2.1.1) • Funding for public health HAI/AR initiatives (2.2.1.1) • Reportable diseases and conditions (2.2.1.1.1) • Nationally notifiable diseases and conditions (2.2.1.1.1) • Introduction to HAI reporting via the National Healthcare Safety Network (NHSN) (2.2.1.1.1) • Introduction to healthcare facility surveillance practices (2.2.1.2)
	Public Health Systems (2.2.2)	• Overview of public health surveillance • Description of a surveillance definition • Description of population-based surveillance (2.2.2.1) • Trends in HAI/AR population-based surveillance (2.2.2.1) • Description of pathogen-specific surveillance (2.2.2.1) • Laboratory impact on AR and pathogen-specific surveillance (2.2.2.1) • Introduction to the Antimicrobial Resistance Laboratory Network (AR Lab Network; 2.2.2.1) • Non-AR organisms and community outbreaks of interest to HAI/AR programs (2.2.2.1) • Description of healthcare facility-based surveillance (2.2.2.2) • History and functions of NHSN (2.2.2.2) • Comparison and use of healthcare facility-based surveillance and population-based surveillance (2.2.2.2) • Conditions reported and facility types that report into NHSN (2.2.2.2)

		• Other systems that support HAI/AR surveillance (2.2.2.3) • Overview of the Emerging Infections Program: Healthcare-Associated Infections Community Interface (2.2.2.3.1) • Description of the AR Lab Network and its function in surveillance activities (2.2.2.3.2) • Description of sentinel surveillance and its use in HAI/AR surveillance activities (2.2.2.3.3) • Description of syndromic surveillance (2.2.2.3.4) • Description of regulatory monitoring systems and their potential to support surveillance activities (2.2.2.3.5) • Description of administrative databases and their use in supporting surveillance activities (2.2.2.3.6)
	Impact of Advances in Laboratory Methods on HAI/AR Surveillance (2.2.3)	• Trends in microbiological and molecular testing and the impact on HAI/AR surveillance • Introduction to the impact of polymerase chain reaction (PCR) and whole genome sequencing (WGS) on surveillance and outbreak detection • Culture-independent diagnostic testing (CIDT) and the impact on public health surveillance • CDC laboratory protocol resource
	Quality and Usefulness of Surveillance Data (2.2.4)	• Uses of surveillance data (2.2.4.1) • Reasons for incomplete surveillance data (2.2.4.2) • Methods to improve surveillance data quality (2.2.4.2) • NHSN validation (2.2.4.2)
Trends in Outbreak Detection and Response (2.3)		• Overview of outbreak detection and response • Changes to public health HAI/AR programs leading to improvements in outbreak detection and response • Other factors contributing to improvements in outbreak detection and response • Overview of potential variety of outbreaks
	Modes of Transmission (2.3.1)	• Overview and examples of point-source and person-to-person spread • Relationship of pathogens to mode of transmission

	Outbreak Types Based on Etiology (2.3.2)	• Importance of outbreak types • Outbreak detection and response based on pathogen, including when to suspect an outbreak and the importance of laboratory (2.3.2.1) • Outbreak detection and response based on infection type, including frequency and considerations (2.3.2.2) • Non-infectious causes of HAI/AR-related outbreaks (2.3.2.3)
	Outbreak Types Based on Setting (2.3.3)	• Impact of healthcare setting on the type of outbreak • Examples of types of outbreaks based on healthcare setting • Single-facility outbreaks including typical causes (2.3.3.1) • Introduction to multi-facility outbreaks, including typical causes and detection (2.3.3.2) • Local multi-facility outbreaks (2.3.3.2.1) • Widespread multi-facility outbreaks (2.3.3.2.2) • Outbreaks related to international travel (2.3.3.2.3) • Healthcare facility role in detection of outbreaks outside their facility and in the community (2.3.3.3)
	Investigation of Serious Infection Control Breaches (2.3.4)	• Introduction to serious infection control breaches • Centers for Medicare and Medicaid Services (CMS) requirement to report serious infection control breaches • Core infection control practices
Tables, Boxes, Figures, and Keys to Success		• Table 2.1 Selected Healthcare Setting Types: Definitions, Characteristics, and Staff with whom Public Health Might Interact • Box 2.1 Reporting into the National Healthcare Safety Network (NHSN): Conditions and Healthcare Settings • Table 2.2 Outbreak Examples Based on Healthcare Setting

Overview of Chapter 3: Planning and Preparation for Healthcare-Associated Infection and Antimicrobial Resistant Pathogen Outbreak Response

In this chapter, strategies for planning and preparation before an outbreak occurs are discussed. Background information on agencies and partners that might be involved in an outbreak response, and their respective roles and responsibilities, are described, including considerations for the coordinating agency and the composition of outbreak response teams. Other topics include planning and preparation for resource identification and record management, communication considerations, understanding legal authorities, and preparation for escalation, recovery, follow-up, including potential implementation of an incident command system (ICS).

Overview of Topics Covered in Chapter 3		
Section	Subheading	Covered Topics
Introduction (3.0)		• Description of what is covered in Chapter 3 • Advantages of advanced preparation • High-level enumeration of tasks for public health agencies prior to an outbreak
Agency Roles (3.1)	Overview (3.1.1)	• Overview of importance of understanding roles and responsibilities • Centralized and decentralized governance and relationship to public health agencies
	Local, State, and Federal Agencies (3.1.2)	• Description of local public health agency experience and capacity (3.1.2.1) • The local public health agency role in planning for HAI/AR outbreaks (3.1.2.1) • Local public health agency roles, responsibilities, and resources (3.1.2.1) • Description of state public health agency experience and capacity (3.1.2.2) • The state public health agency role in planning for HAI/AR outbreaks (3.1.2.2) • State public health agency roles, responsibilities, and resources (3.1.2.2)

		• Role of the state survey and facility licensing agency and strategies for coordination (3.1.2.3) • Role of the state provider licensing agency and strategies for coordination (3.1.2.4) • Role of the Centers for Disease Control and Prevention (CDC) and coordination with state and local public health agencies and healthcare facilities (3.1.2.5) • Role of the Food and Drug Administration (FDA) in HAI/AR outbreak investigations (3.1.2.6)
	Healthcare Facilities (3.1.3)	• Roles and responsibilities of healthcare facilities • Role of the team tasked with preventing infections, including infection preventionist and medical epidemiologist within healthcare facilities • General information about facility planning for an outbreak • Variation of resources among healthcare facility types
	Other Agencies and Partners (3.1.4)	• Professional member organizations for healthcare professionals and healthcare facilities (3.1.4.1) • Tribal entities and the Indian Health Service (IHS) (3.1.4.2) • Law enforcement (3.1.4.3)
Outbreak Response Team (3.2)	Overview (3.2.1)	• Basic composition of an outbreak response team • Introduction to roles and responsibilities of outbreak response team members
	Roles of Team Members (3.2.2)	• Introduction to the coordinating agency • Roles of the public health outbreak response team members • Role and responsibilities of the public health team leader (3.2.2.1) • Roles and responsibilities of the epidemiologist(s) on the public health team (3.2.2.2) • Role and responsibilities of the infection preventionist on the public health team (3.2.2.3)

		• Roles and responsibilities of the public health laboratorians (3.2.2.4) • Other team members, which might include administrative staff, statisticians, public health information officers, legal staff, and emergency preparedness staff (3.2.2.5)
	Outbreak Response Team Model Practices (3.2.3)	• Pre-identified dedicated outbreak response teams (3.2.3.1) • Scaling up additional support (3.2.3.2) • Establishing outbreak response plans and protocols (3.2.3.3) • Training for outbreak response team members (3.2.3.4)
Resources (3.3)		• Introduction to resource components needed during the response to an outbreak
	Equipment and Supplies (3.3.1)	• List of equipment and supplies to consider in preparation for an outbreak response
	Outbreak Investigation Documents and Toolkits (3.3.2)	• Investigation document, tools, and protocols to consider preparing ahead of an outbreak
	Reference Materials (3.3.3)	• Reference materials to consider compiling ahead of an outbreak
	Tracking Time and Resources (3.3.4)	• Advantage of setting up processes to track time and resources during large-scale investigations
Records Management (3.4)	Overview (3.4.1)	• Overview of systematic information management during an outbreak response
	Records Management Model Practices (3.4.2)	• Standardized information collection (3.4.2.1) • Considerations for sharing information across agencies (3.4.2.1) • Tracking data during an outbreak investigation, including situations to track and data system considerations (3.4.2.2)
Communication (3.5)		• Importance of communication across all partners • Considerations for communication preparation ahead of an outbreak

Escalation (3.6)	Overview (3.6.1)	• Notifying leadership within your agency • Getting help within your agency • Considerations for transferring coordination responsibilities to another agency
	When to Ask for Help (3.6.2)	• Considerations for when to ask for help from another agency
	How to Obtain Help (3.6.3)	• Who to ask for help • Contact information for CDC
Incident Command System (3.7)		• History and description of the incident command system (ICS) • ICS in government agencies • ICS in healthcare organizations • Considerations for ICS activation
Other Aspects of Preparation (3.8)	Legal Preparedness and Authority (3.8.1)	• Understanding legal authority • Anticipating legal situations and preparing in advance
	Ethics (3.8.2)	• Considerations for potential ethical dilemmas in advance
	Privacy (3.8.3)	• Understanding privacy laws and regulation • Maintaining confidential information • Preparing for protection versus disclosure of information
	Permissions and Approvals (3.8.4)	• Considerations for the need for permission or approval • Preparation for accessing medical records
Planning for Recovery and Follow-up (3.9)	Overview (3.9.1)	• Planning ahead for recovery and follow-up
	Recovery and Follow-Up Model Practices (3.9.2)	• Model practices to assist in planning for recovery and follow-up
Tables, Boxes, Figures, and Keys to Success		• Table 3.1 Additional Agencies and Partners that Public Health Agencies Interact with During Outbreak Response • Table 3.2 Partners to Consider Involving by Type of Event • Box 3.1 Selected Training Resources • Box 3.2 Selected Resources from Federal Regulatory Agencies • Box 3.3 Types of Facilities Required by CMS to Develop Emergency Preparedness Plans

		• CORHA Keys to Success: Key Planning and Preparation Steps • CORHA Keys to Success: Developing Relationships Prior to an Outbreak

Overview of Chapter 4: Healthcare-Associated Infections and Antimicrobial Resistance Outbreak Detection and Reporting

Detection and reporting of outbreaks to public health is the focus of this chapter, including detection by reporting of suspected outbreaks, and through use of surveillance data. Additionally, definitions of clusters and outbreaks are described. The section on reporting of outbreaks includes information on reporting within a healthcare facility and reporting to public health, entities that might report to public health, and types of events that might be reported. This is followed by an overview of detection using surveillance data which includes information about the process for cluster and outbreak detection using this method. Strengths and limitations, key determinants of successful detection, and model practices are described for both types of detection methods.

Overview of Topics Covered in Chapter 4		
Section	Subheading	Covered Topics
Introduction (4.0)		• Description of what is covered in Chapter 4 • Purpose of detecting clusters and outbreaks • Benefits of detecting outbreaks
Overview (4.1)		• Overview of methods of detection
	Outbreak Detection Pathways (4.1.1)	• Introduction to outbreak reporting • Introduction to detection of clusters and outbreaks using surveillance data • Other activities that might lead to outbreak detection
	Cluster and Outbreak Definitions (4.1.2)	• Definition of a cluster • Considerations for defining a suspected outbreak • Threshold levels and outbreak definitions • General principles for determining when a situation is an outbreak

Reporting of Suspected Outbreaks (4.2)	Purpose (4.2.1)	• Importance of reporting as a methodology to detect outbreaks
	Background (4.2.2)	• Reporting suspected outbreaks within healthcare facilities (4.2.2.1) • Reporting suspected outbreaks to public health (4.2.2.2) • Public health processes to receive reports of suspected outbreaks (4.2.2.2) • Requirements for reporting to public health (4.2.2.2) • Strategies to encourage reporting suspected outbreaks to public health and perceived barriers to reporting (4.2.2.2) • Perceived barriers for reporting suspected outbreaks (4.2.2.2)
	Reporting Entities (4.2.3)	• Sources of outbreak reports • Healthcare facility and provider reports (4.2.3.1) • Clinical and public health laboratory reports (4.2.3.2) • Public, patients, and media reports (4.2.3.3) • Other government agencies that might report, including state facility licensing agencies (4.2.3.4) • Other partners that might report (4.2.3.5)
	Epidemiology Process (4.2.4)	• Importance of a pre-established process • Determining if clusters and suspected outbreaks are linked
	Laboratory Process (4.2.5)	• Importance of communication between epidemiology and laboratory staff upon report of a suspected outbreak
	Strengths and Limitations of Outbreak Reporting Systems (4.2.6)	• Strengths of outbreak reporting systems (4.2.6.1) • Limitations of outbreak reporting systems (4.2.6.2)
	Key Determinants of Successful Outbreak Reporting Systems (4.2.7)	• Successful outbreak reporting system, defined • Factors impacting the sensitivity of outbreak detection (4.2.7.1) • Impact of the prevalence of disease on outbreak detection (4.2.7.2)

		• Impact of relationships among reporting entities and public health agencies (4.2.7.3)
	Model Practices for Outbreak Reporting Systems (4.2.8)	• Establishing requirements for reporting (4.2.8.1) • Ensuring timeliness of reporting (4.2.8.2) • Establishing a clearly defined reporting process methodology (4.2.8.3) • Useful tools to apply to outbreak reporting systems (4.2.8.4) • Importance of tracking outbreaks (4.2.8.5)
Detecting Clusters and Outbreaks through Surveillance (4.3)	Purpose (4.3.1)	• Importance of use of surveillance data as a methodology to detect outbreaks
	Background (4.3.2)	• Basic surveillance principles impacting detection of clusters and outbreaks • Techniques to assist with detecting patterns in surveillance data • Detection of clusters and outbreaks within a healthcare facility using surveillance data (4.3.2.1) • Surveillance data typically collected by public health that can be used to detect clusters and outbreaks (4.3.2.2)
	Types of Surveillance Data (4.3.3)	• Types of surveillance data used for cluster detection
	Epidemiology Process (4.3.4)	• General epidemiology process for collection of surveillance data • Manual review of surveillance data for cluster detection • Automated processes for cluster detection using surveillance data
	Laboratory Process (4.3.5)	• General laboratory process for conditions under surveillance • Methods for support of cluster detection using laboratory data
	Strengths and Limitations of Surveillance for	• Strengths of outbreak reporting systems (4.3.6.1) • Limitations of outbreak reporting systems (4.3.6.2)

	Outbreak Detection (4.3.6)	
	Key Determinants of Successful Outbreak Detection via Surveillance Systems (4.3.7)	• Surveillance system components that support outbreak detection • Factors impacting complete reporting of conditions under surveillance (4.3.7.1) • The effect of sensitivity of surveillance on cluster detection (4.3.7.2) • Impact of the prevalence of disease on cluster detection (4.3.7.3) • Influence of the speed of reporting diseases and conditions under surveillance on cluster detection (4.3.7.4)
	Model Practices for Detecting Outbreaks through Surveillance (4.3.8)	• Strategies for rapid case detection (4.3.8.1) • Advantages of submission and characterization of isolates (4.3.8.2) • Standardized processes for cluster detection using surveillance data (4.3.8.3) • Communication practices supporting cluster detection (4.3.8.4) • Tools that can be used for cluster detection using surveillance data (4.3.8.5) • Importance of tracking outbreaks (4.3.8.6)
Multi-Facility and Multi-Jurisdictional Considerations (4.4)		• Importance of complete reporting to identify multi-facility and multi-jurisdictional outbreaks • Factors influencing multi-facility and multi-jurisdictional cluster and outbreak detection
Tables, Boxes, Figures, and Keys to Success		• Table 4.1 Potential Methods of Outbreak Detection by Healthcare Facilities and Public Health Agencies • CORHA Keys to Success: Maximizing Outbreak Detection

Overview of Chapter 5: Investigation and Control of Healthcare-Associated Infection and Antimicrobial Resistant Pathogen Outbreaks

This chapter reviews the key elements and steps involved in the investigation of and response to outbreaks of HAIs and AR pathogens. The information within the chapter can also be applied to investigations of toxin or chemical exposures in healthcare settings, infection control breaches, and sentinel cases of novel or emerging pathogens. The chapter is arranged to follow the steps typically followed in an outbreak investigation, recognizing that the steps might occur in a nonlinear order and will depend on the precise nature and needs of the response.

Overview of Topics Covered in Chapter 5		
Section	Subheading	Covered Topics
Introduction (5.0)		• Description of what is covered in Chapter 5 • Overall function of public health in an outbreak investigation • Collaboration between public health and healthcare • Importance of a systematic approach
Outbreak Investigation and Response Steps (5.1)		• Review of outbreak detection and initial steps of investigation • Overview of application of outbreak steps
	Perform an Initial Assessment (5.1.1)	• Initial information to be gathered when an outbreak is detected via reporting or use of surveillance data (5.1.1.1) • Considerations for determining the level of response: full investigation and response, following facility investigation, or receipt of report (5.1.1.2) • Initial control measures at the time of outbreak detection (5.1.1.3) • Developing an initial hypothesis (5.1.1.4)
	Verify the Diagnosis (5.1.2)	• Information review to aid in diagnosis verification • Importance of the laboratory in diagnosis verification
	Assemble and Brief the Outbreak Response Team (5.1.3)	• Composition of the outbreak response team • Introduction to team roles • Introduction of the concept of a coordinating agency

		• Partners' outbreak response teams, including healthcare facilities and regulatory partners (5.1.3.1) • Escalation of response and partner roles (5.1.3.1) • Public health team communication (5.1.3.2) • Communication among partners (5.1.3.3) • Coordination among public health and regulatory agencies (5.1.3.3)
	Establish a Plan and Prepare for Fieldwork (5.1.4)	• Determination of missing information and steps to gather that information • Importance of gathering information on similar outbreaks, including pathogen or type of infection • Considerations for utility and burden of planned steps during preparations • Considerations for on-site investigations • Onsite preparation steps, including gaining access to medical records, preparing for data collection including tool development, and infection control preparation
	Confirm the Presence of an Outbreak (5.1.5)	• Factors involved in verifying outbreaks • Pseudo-outbreaks
	Establish Case Definition and Classification Criteria (5.1.6)	• Components of a case definition • Creating a useful case definition • Stratified case definitions and classification criteria
	Identify and Count Cases (5.1.7)	• Retrospective and prospective case counting • Methods to retrospectively identify cases • Methods to prospectively identify cases • Consideration for cases in healthcare workers, visitors, and community residents • Importance of systematic case counting and application of case definitions and classifications
	Collect, Organize, and Analyze Data (5.1.8)	• Data sources for collection of data (5.1.8.1) • Importance of and components of a standardized data collection tool (5.1.8.1) • Protecting private information (5.1.8.1)

		• Organizing data into a line list (5.1.8.2) • Descriptive epidemiologic analysis (5.1.8.2) • Other data organization tools, including maps, timelines, and epidemic curves (5.1.8.2) • Refining the hypothesis (5.1.8.3) • Considerations for use of analytic epidemiology (5.1.8.4) • How to conduct an analytic study (5.1.8.4 and Appendix A)
	Perform an Infection Control Assessment (5.1.9)	• Considerations for performing on-site infection control assessments • Areas of focus during infection control assessments • Considerations for staff interviews
	Consider an Environmental Assessment (5.1.10)	• Determining possible environmental factors that might have contributed to an outbreak • Environmental assessment as part of the infection control assessment • Determining when environmental sampling is appropriate • Laboratory considerations for environmental testing
	Recommend Control Measures (5.1.11)	• Recommendations for infection control measures throughout the investigation • Providing written recommendations • Importance of follow-up after recommendations • What to do when there is imminent potential harm to patients
	Interpret Results (5.1.12)	• Considerations for interpretation of results following investigation
	Monitor the Outbreak Until Completion (5.1.13)	• Monitoring the outbreak (5.1.13.1) • Re-evaluation of hypotheses and case definitions during the monitoring phase (5.1.13.2) • Determining when to end an investigation (5.1.13.3) • Post-outbreak and after-action meetings as a strategy for improvements (5.1.13.3)
	Other Follow-Up Activities (5.1.14)	• Writing a final report (5.1.14.1) • Distribution of the final report (5.1.14.2)

		• Policy action that might result from an outbreak investigation (5.1.14.3)
Tables, Boxes, Figures, and Keys to Success		• Box 5.1 HAI/AR Outbreak Investigation Resources • Box 5.2 Goals of an Outbreak Investigation • Table 5.1 Investigation Activities for Outbreak Response Objectives • CORHA Keys to Success: Initial Steps in the Investigation of Outbreaks • Box 5.3 Steps of an Outbreak Investigation • CORHA Keys to Success: Communication During an Investigation • Box 5.4 Example Case Definitions • Box 5.5 Healthcare Facility Records to Consider Reviewing during an Outbreak Investigation • Figure 5.1 Sample Timeline • Appendix A: Cohort and Case-Control Studies

The Council for Outbreak Response: Healthcare-Associated Infections and Antimicrobial-Resistant Pathogens

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