Virginia Department of Health

Plan for Healthcare-Associated Infections (HAIs)

Version 08.14.2015

VDH VIRGINIA DEPARTMENT OF HEALTH

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Executive Summary

The overarching goal of Virginia's *Plan for Healthcare-Associated Infections* (HAI) is to provide a framework for preventing healthcare-associated infections in the Commonwealth. Virginia seeks to serve as a national leader in HAI prevention efforts, demonstrating top tier performance in the reduction of HAI rates. The Plan provides HAI prevention strategies from the state perspective. However, it is noted that changes at the institutional level, within healthcare facilities across the state, are needed to reduce the occurrence of HAIs.

Public health involvement in HAI prevention increased in 2005 in Virginia, with the passage of a related bill in the Virginia General Assembly. The bill required acute care hospitals in the Commonwealth to report HAIs to the Centers for Disease Control and Prevention's (CDC) National Healthcare Safety Network (NHSN). Reporting regulations specified the reporting of central-line associated bloodstream infections (CLABSI) in adult intensive care units. The law went into effect July 1, 2008. Additional HAI reporting measures were recently proposed and finalized through the Virginia regulatory process.

Virginia's *Plan for Healthcare-Associated Infections* (HAI) addresses five target areas: (1) Developing and Enhancing HAI Program Infrastructure; (2) Surveillance, Detection, Reporting and Response; (3) Prevention; (4) Evaluation and Communications; and (5) Healthcare Infection Control Assessment and Response. The Plan is consistent with the U.S. Department of Health and Human Services (HHS) Action Plan for HAI and was developed using the HHS template for states. Activities are identified as "Underway" (presently engaged in using currently available resources) or "Items Planned" (future directions, contingent on available resources and competing priorities).

The first target area addressed in the Plan is *Developing and Enhancing HAI Program Infrastructure*. Activities in this area include: supporting and expanding the HAI Advisory Group, which provides oversight and feedback into HAI initiatives; increasing coordination of HAI efforts between organizations; supporting a state HAI program coordinator and other HAI staff; and integrating laboratory activities with HAI efforts. If additional funds become available, Virginia will increase efforts to facilitate the use of standards-based formats by healthcare facilities for the reporting of HAI data.

The second target area addressed in the plan is *Surveillance, Reporting, Detection, and Response.* Activities in this area include: improving outbreak detection, investigation, and communication; identifying HHS prevention targets for surveillance; implementing HAI pilot surveillance projects; adopting national standards to track HAIs; developing standardized data reports; providing HAI-related training; and validating CLABSI data currently reported to NHSN. If additional funds become available, Virginia will work to increase validation efforts, enhance electronic reporting of HAI data, adopt integration and interoperability standards for HAI information systems and data sources, and improve surveillance/detection of HAIs in non-hospital settings.

The third target area addressed in the Plan is *Prevention*. Activities in this area include: implementing HAI collaboratives targeting Healthcare Infection Control Practices Advisory Committee (HICPAC) recommendations; establishing a workgroup to oversee the collaboratives; and developing a HAI training program for healthcare professionals. Collaborative prevention efforts will occur in acute care and long-term care settings. If supplemental funds become available, Virginia plans to address compliance with adherence to HICPAC recommendations and expand collaboratives to target additional clinical settings.

The fourth target area addresses *Evaluation and Communications.* Activities in this area include: developing training programs to address identified needs; developing a HAI communication plan; and continuing to provide consumer access to HAI information, including data. If additional funds become available, Virginia will seek to increase involvement in patient safety initiatives and identify opportunities for additional HAI research.

The fifth target area addresses *Healthcare Infection Control Assessment and Response*. Activities in this area include: conducting on-site assessments of Ebola assessment hospitals to evaluate infection control practices and Ebola readiness; developing a facility inventory; and improving outbreak detection and response. If additional funds become available, Virginia plans to assess infection control practices in other hospitals and/or healthcare settings.

The Virginia Department of Health is working closely with its partners and an Advisory Group, made up of representatives from demographically diverse hospitals and key stakeholders, to implement Virginia's *Plan for Healthcare-Associated Infections.* The Plan will be revised regularly to reflect updated policies and practices.

I. Goal of HAI Prevention

The overarching goal of *Virginia's Plan for Healthcare-Associated Infections* (HAI) is to provide a framework for preventing healthcare-associated infections in the Commonwealth. Virginia seeks to serve as a national leader in HAI prevention efforts, demonstrating top tier performance in the reduction of HAI rates.

II. Background

In response to increasing concerns about the public health impact of healthcare-associated infections (HAIs), the U.S. Department of Health and Human Services (HHS) developed an Action Plan to Prevent Healthcare-Associated Infections (HHS Action Plan). The HHS Action Plan includes recommendations for surveillance, research, communication, and metrics for measuring progress toward national goals. Three overarching priorities include: progress toward 5-year national prevention targets; improving use and quality of the metrics and supporting systems needed to assess progress toward meeting the targets; and prioritization and broad implementation of current evidence-based prevention recommendations.

Virginia has used the HHS Action Plan as a template for the Virginia HAI Plan and to guide HAI efforts in the state. Virginia recognizes the challenge of identifying, responding to, and preventing HAIs across the continuum of settings where healthcare is currently delivered. The public health model's population-based perspective places health departments in a unique and important role in this area, particularly given shifts in healthcare delivery from acute care settings to ambulatory and long-term care settings. In non-hospital settings, infection control and oversight have been lacking which have resulted in outbreaks which can have a wide-ranging and substantial impact on affected communities. At the same time, trends toward mandatory reporting of HAIs from hospitals reflect increased demand for accountability from the public.

The Virginia HAI Plan targets the following areas:

1. Enhance HAI Program Infrastructure
2. Surveillance, Detection, Reporting, and Response
3. Prevention
4. Evaluation, Oversight, and Communication
5. Healthcare Infection Control Assessment and Response

III. Framework and Funding for Prevention of HAIs

The national framework for the prevention of HAIs builds on a coordinated effort of federal, state, and partner organizations and is based on a collaborative public health approach that includes surveillance, outbreak response, infection control, research, training, education, and systematic implementation of prevention practices. Legislation in support of HAI prevention provides a unique opportunity to strengthen existing state capacity for prevention efforts.

In 2005, a bill passed in the Virginia General Assembly requiring acute care hospitals in the Commonwealth to report healthcare-associated infections to the Centers for Disease Control and Prevention (CDC) National Healthcare Safety Network (NHSN). The bill specified that the State Board of Health define the reportable infections and populations to be monitored. The Board passed regulations requiring the reporting of central line-associated bloodstream infections (CLABSI) in adult intensive care units to NHSN. The law went into effect July 1, 2008. The first reporting period covered July through December 2008 and reporting has occurred on a quarterly basis thereafter. Virginia Department of Health (VDH) staff review the NHSN data quarterly and create a report identifying CLABSI by hospital; the report is available to stakeholders and the public through the VDH website [http://www.vdh.virginia.gov/Epidemiology/Surveillance/HAI/haireport.htm] or via request.

While no state funding accompanied the HAI reporting requirement, support for HAI prevention in Virginia was enhanced through the American Recovery and Reinvestment Act (ARRA). Virginia received funds in September 2009 to support state efforts to prevent HAIs through December 2011. The grant objectives included: (1) Enhancing state health department capacity for HAI prevention efforts; (2) Developing a state plan for the surveillance and prevention of HAIs in Virginia; (3) Developing training programs to enhance capacity for HAI surveillance and prevention; (4) Validating HAI data currently reported by hospitals; (5) Supporting pilot projects involving additional reporting of HAI data to evaluate the costs and benefits of the expanded reporting; and (6) Implementing HAI prevention collaboratives targeting acute care and long-term care facilities. Partner organizations involved in the grant efforts included: the Association for Professionals in Infection Control and Epidemiology, Inc, Virginia Chapter (APIC-VA), the Virginia Hospital and Healthcare Association (VHHA), VHQC (Virginia's Quality Improvement Network/Quality Improvement Organization), Virginia Health Care Association (VHCA), LeadingAge Virginia (formerly known as the Virginia Association for Nonprofit Homes for the Aging), the Virginia Assisted Living Association (VALA), and the Virginia Department of Social Services.

Since 2012, Epidemiology and Laboratory Capacity grant funds from CDC have supported HAI program efforts. Ongoing federal resources are vital to ensuring the success and sustainability of HAI efforts in Virginia.

VDH and its partners are working closely with an Advisory Group to implement grant objectives and oversee HAI efforts in Virginia. The HAI Advisory Group includes representation from demographically diverse hospitals and key stakeholders and was formed in early 2008. The group met three times in 2008 and have met quarterly since then (on average) to provide input and feedback on HAI-related activities in the Commonwealth.

Since the Virginia HAI reporting regulations went into effect in July 2008, there has been increasing interest from various groups in expanding the current reporting requirements to include additional HAI measures. Proposed additional measures were presented to the Virginia Board of Health in April 2010 and included: adding the requirement for hospitals to report central line-associated bloodstream infections (CLABSI) outside ICU (one adult medical and one

adult surgical ward), adding *Clostridium difficile* infections (NHSN laboratory-identified events), and obtaining data from Surgical Care Improvement Project (SCIP) reports quarterly. These proposed changes were not well-received by the affected populations and the proposed regulations were revised in response to the comments received. An amended proposal was published in October 2013, open for public comment, and signed by the Governor in August 2015. The final amendment, which will go into effect on September 25, 2015, states that facilities that report data to the NHSN for the Centers for Medicare and Medicaid Services Hospital Inpatient Quality Reporting Program shall share those data, through the NHSN, with the Virginia Department of Health. In this manner, federal and state reporting requirements will be aligned without additional reporting burden on the hospitals.

IV. Enhance HAI Program Infrastructure

Successful HAI prevention requires close integration and collaboration with state and local infection prevention activities and systems. Consistency and compatibility of HAI data collected across facilities will allow for greater success in reaching state and national goals.

Table 1: State Infrastructure Planning for HAI Surveillance, Prevention, and Control

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☒	☐	1. Establish statewide HAI prevention leadership through the formation of multidisciplinary group or state HAI advisory council	Ongoing; The HAI Advisory Group was established in 2008 and meets quarterly to address HAI prevention efforts. Currently, the HAI Advisory Group is co-led by VDH and VHQC (state Quality Improvement Network/Quality Improvement Organization) and contains diverse membership including professional organizations, healthcare providers, and consumers. In 2015, VDH worked with VHQC to expand Advisory Group membership and partners, including representatives with expertise in emergency preparedness and licensure and certification. In 2015, an antimicrobial stewardship subgroup was formed to develop a plan for promoting and improving stewardship efforts in hospital, long-term care facilities, and the community. This may include collecting and analyzing data to describe the problem, conducting needs assessments/surveys, and developing and disseminating educational materials. In 2015, a data subgroup was formed to identify existing HAI
☒	☐	i. Collaborate with local and regional partners (e.g., state hospital associations, professional societies for infection control and healthcare epidemiology, academic organizations, laboratorians and networks of acute care hospitals and long-term care facilities (LTCFs))	
☒	☐	ii. Include hospital preparedness partners (e.g., hospital/healthcare coalitions funded through the ASPR Hospital Preparedness Program). Additional representation from accrediting and/or licensing agency with surveyor authority is ideal. iii. Engage HAI advisory committee in potential roles and activities to improve antibiotic use in the state (antibiotic stewardship)	

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
		iv. Engage HAI advisory committee in activities to increase health department's access to data and subsequently use those data in prevention efforts v. Identify specific HAI prevention targets consistent with HHS priorities	data sources, potential data sources, and collaborate on ways to enhance how HAI data are used to drive programs and projects. In March 2015, the state HAI Advisory Group identified catheter-associated urinary tract infections and *Clostridium difficile* infections as HAI priority prevention targets.
Other activities or descriptions: VDH has partnered with a number of agencies/organizations to address HAI prevention in Virginia, including: the Association for Professionals in Infection Control and Epidemiology, Inc, Virginia Chapter (APIC-VA), the Virginia Hospital and Healthcare Association (VHHA), VHQC (Virginia's Quality Improvement Network/Quality Improvement Organization), Virginia Health Care Association (VHCA), LeadingAge Virginia, Virginia Assisted Living Association (VALA), Virginia Health Information (VHI), the Stewardship Interest Group of Virginia, Mid-Atlantic Renal Coalition, and the Virginia Department of Social Services.			
☒ ☒	☐ ☐	2. Establish an HAI surveillance prevention and control program i. Designate a State HAI Prevention Coordinator ii. Develop dedicated, trained HAI staff with at least one FTE (or contracted equivalent) to oversee the four major HAI activity areas (Integration, Collaboration, and Capacity Building; Reporting, Detection, Response and Surveillance; Prevention; Evaluation, Oversight and Communication, and Infection Control)	VDH has an HAI program located within the Division of Surveillance and Investigation (DSI). The HAI program team includes several dedicated staff. The HAI Program Coordinator position has been filled since 2010 and is responsible for overseeing the five major HAI activity areas. Other members of the HAI team include a Nurse Epidemiologist (wage employee) and HAI Epidemiologist (FTE). Council of State and Territorial Epidemiologists Applied Epidemiology Fellows have provided support to the program from 2009-2011, 2013-2015, and August 2015-present. Additional funding from 2015-2017 will add several other members of the team to improve infection control practices in hospitals: Hospital Assessment Coordinator (full-time

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			contractor), Infection Preventionist (part-time contractor), and Assistant HAI Program Coordinator (part-time contractor). The DSI Director, the DSI Epidemiology Consultant, and the HAI Advisory Group provide oversight and guidance to the VDH HAI program.
☒	☒	3. Integrate laboratory activities with HAI surveillance, prevention and control efforts. i. Improve laboratory capacity to confirm emerging resistance in HAI pathogens and perform typing where appropriate (e.g., outbreak investigation support, HL7 messaging of laboratory results)	Ongoing; VDH currently partners with the state public health lab (Virginia Division of Consolidated Laboratory Services, or DCLS) to perform molecular typing of pathogens during the investigation of HAI outbreaks. VDH will continue to seek funding through other sources to support DCLS capacity to identify and type HAI pathogens. VDH will seek funding through other sources to support HL7 messaging of laboratory results from hospitals to the Virginia Electronic Disease Surveillance System and ultimately to NHSN.
☒	☐	4. Improve coordination among government agencies or organizations that share responsibility for assuring or overseeing HAI surveillance, prevention and control (e.g., State Survey agencies, Communicable Disease Control, state licensing boards)	Ongoing; VDH Division of Surveillance and Investigation (general communicable disease control) is coordinating HAI efforts for VDH. VDH is working closely with partners and the statewide HAI Advisory Group to implement HAI grant objectives. In 2015, membership was expanded to include representation from the VDH Office of Licensure and Certification and Office of Emergency Preparedness as well as the Virginia Department of Social Services (DSS).
☐	☒	5. Facilitate use of standards-based formats (e.g., Clinical Document Architecture, electronic messages) by healthcare facilities for purposes of electronic reporting of HAI data. Providing	In 2011, VDH and VHHA conducted a SSI mini-grant program to award funds to 22 hospitals to assist with implementation of the NHSN Procedure-Associated Module in preparation for reporting SSIs to NHSN. Funds were used for equipment and

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
		technical assistance or other incentives for implementations of standards-based reporting can help develop capacity for HAI surveillance and other types of public health surveillance, such as for conditions deemed reportable to state and local health agencies using electronic laboratory reporting (ELR). Facilitating use of standards-based solutions for external reporting also can strengthen relationships between healthcare facilities and regional nodes of healthcare information, such as Regional Health Information Organizations. (RHIOs) and Health Information Exchanges (HIEs). These relationships, in turn, can yield broader benefits for public health by consolidating electronic reporting through regional nodes.	services, training and education, consultative and technical assistance, and/or administrative support. Timeline for further progress toward this activity is undetermined at this time. VDH will continue to seek additional sources of funding to support electronic reporting and enhancement of information technology capacity.
Additional Activities: From 2009 to 2014, a steering group of HAI stakeholders was established and met monthly to assess progress toward HAI prevention goals and provide guidance to the implementation of VDH grant objectives. The group included representation from VDH, VHHA, VHQC, APIC-VA, VHCA, and LeadingAge Virginia. In 2015, the steering group was replaced by the state HAI Advisory Group.			

V. Surveillance, Detection, Reporting, and Response

Timely and accurate monitoring remains necessary to gauge progress toward HAI elimination. Public health surveillance has been defined as the ongoing, systematic collection, analysis, and interpretation of data essential to the planning, implementation, and evaluation of public health practice, and timely dissemination to those responsible for prevention and control.[1] Increased participation in systems such as the National Healthcare Safety Network (NHSN), improvements to simplify and enhance data

[1] Thacker SB, Berkelman RL. Public health surveillance in the United States. Epidemiol Rev 1988;10:164-90.

collection, and improved dissemination of results to healthcare providers and the public are essential steps toward increasing HAI prevention capacity in Virginia.

The HHS Action Plan identified targets and metrics for five categories of HAIs and identified Ventilator-associated Pneumonia as an HAI under development for metrics and targets (Appendix 1). The categories include:

- Central Line-Associated Bloodstream Infections (CLABSI)
- *Clostridium difficile* Infections (CDI)
- Catheter-Associated Urinary Tract Infections (CAUTI)
- Methicillin-resistant *Staphylococcus aureus* (MRSA) Infections
- Surgical Site Infections (SSI)
- Ventilator-Associated Pneumonia (VAP)

State capacity for investigating and responding to outbreaks and emerging infections among patients and healthcare providers is central to HAI prevention. Investigation of outbreaks helps identify preventable causes of infections including issues with the improper use or handling of medical devices; contamination of medical products; and unsafe clinical practices.

Table 2: State Planning for Surveillance, Detection, Reporting, and Response for HAIs

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☒	☐	1. Improve HAI outbreak detection and investigation i. Work with partners including CSTE, CDC, state legislatures, and providers across the healthcare continuum to improve outbreak reporting to state health departments	Ongoing; VDH requires the reporting of all outbreaks (including HAI) to local health departments by the most rapid means available. Local health department (LHD) staff work with infection preventionists and other healthcare providers to increase knowledge about the reporting requirement and improve outbreak reporting; LHD staff regularly attend hospital infection control committee meetings to improve communication around HAIs and other reportable disease issues.

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☒	☐	ii. Establish protocols and provide training for health department staff to investigate outbreaks, clusters or unusual cases of HAIs.	LHD staff have received information on HAI surveillance and prevention strategies in various forums including new employee orientation, annual meetings of epidemiologists, and monthly statewide conference calls. Protocols and resources are available in the Virginia Disease Control Manual (DCM). Examples of resources include protocols for investigating infection control breaches associated with blood glucose monitoring, tools for observing infection control practices during facility site visits, and infection-specific chapters on organisms such as carbapenem-resistant Enterobacteriaceae and group A Streptococcus. DCM chapters will be revised or added in response to identified needs.
☒	☐	iii. Develop mechanisms to protect facility/provider/patient identity when investigating incidents and potential outbreaks during the initial evaluation phase where possible to promote reporting of outbreaks	VDH has an agency wide administrative policy in place that protects facility identity; Section 32.1-41 of the *Virginia Code* specifies that the anonymity of patients and practitioners is protected.
☒	☐	iv. Improve overall use of surveillance data to identify and prevent HAI outbreaks or transmission in HC settings (e.g., hepatitis B, hepatitis C, multi-drug resistant organisms (MDRO), and other reportable HAIs)	The HAI Program will work with the DSI Reportable Disease Surveillance Team to develop strategies to review surveillance data to identify possible clusters of HAI.
☒		2. Enhance laboratory capacity for state and local detection and response to new and emerging HAI	Ongoing; DCLS partners with VDH to provide testing in support of HAI outbreaks. DCLS has provided

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
		issues.	laboratory support for testing for recent HAI outbreaks due to influenza, norovirus, *Staphylococcus aureus* and hepatitis. VDH will continue to partner with DCLS on an ongoing basis to provide testing and/or coordinate testing at CDC for HAI outbreaks that are reported.
☒	☐	3. Improve communication of HAI outbreaks and infection control breaches i. Develop standard reporting criteria including, number, size and type of HAI outbreak for health departments and CDC	Ongoing; the *Regulations for Disease Reporting and Control* in Virginia require the rapid reporting of outbreaks (including healthcare-associated outbreaks) to local health departments, which then report to the state health department. Educational documents on outbreak reporting in nursing homes and assisted living facilities were shared with providers in 2011 as part of a long-term care infection prevention toolkit.
☒	☐	ii. Establish mechanisms or protocols for exchanging information about outbreaks or breaches among state and local governmental partners (e.g., State Survey agencies, Communicable Disease Control, state licensing boards)	VDH routinely shares outbreak information between the Division of Surveillance and Investigation (responsible for investigating most HAI outbreaks) and the VDH Office of Licensure and Certification. VDH DSI also maintains good communication with the Department of Social Services regarding outbreaks in assisted living facilities and has a standardized protocol for reporting and investigating infection control breaches associated with blood glucose monitoring.
☒	☐	4. Identify at least 2 priority prevention targets for surveillance in support of the HHS HAI Action Plan i. Central Line-Associated Bloodstream Infections (CLABSI) ii. *Clostridium difficile* Infections (CDI)	In March 2015, the state HAI Advisory Group identified catheter-associated urinary tract infections and *Clostridium difficile* infections as HAI priority prevention targets.

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
		iii. Catheter-Associated Urinary Tract Infections (CAUTI) iv. Methicillin-resistant Staphylococcus aureus (MRSA) Infections v. Surgical Site Infections (SSI) vi. Ventilator-Associated Pneumonia (VAP)	
☒ ☒	☐ ☐	5. Adopt national standards for data and technology to track HAIs (e.g., NHSN). i. Develop metrics to measure progress towards national goals (align with targeted state goals). (See Appendix 1). ii. Establish baseline measurements for prevention targets	Virginia currently uses NHSN for reporting of CLABSI in adult ICUs. In 2011, VDH epidemiologists began using the standardized infection ratio (SIR) to analyze HAI data from NHSN. The VDH HAI Program monitors facility performance against national baseline data, current national performance (per the latest CDC National and State-Specific Progress Report) as well as the target goals of the HHS HAI Action Plan. The VDH team has also recently begun using the Targeted Assessment for Prevention (TAP) reports in NHSN to track facility performance.
☒	☐	6. Develop state surveillance training competencies i. Conduct local training for appropriate use of surveillance systems (e.g., NHSN) including facility and group enrollment, data collection, management, and analysis	VDH has partnered with other organizations such as APIC-VA, VHQC, and VHHA to provide training to hospitals on NHSN enrollment, data collection, data management, and analysis functions. Most recently, VDH partnered with VHQC on a training to educate hospitals about the new 2015 NHSN surveillance definitions. Trainings are developed in response to needs identified through needs

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			assessments, informal surveys, or communication with partner organizations. VDH staff work one-on-one with hospitals to provide technical assistance on the use and optimization of NHSN, including conferring rights and analyzing data. VDH also actively promotes surveillance training opportunities sponsored by partner organizations.
☒	☒	7. Develop tailored reports of data analyses for state or region prepared by state personnel	CLABSI data by hospital are currently analyzed quarterly and made available to healthcare providers or the public upon request. VDH is part of a national workgroup that is producing a toolkit of strategies to effectively analyze and present HAI data. In 2015-2016, VDH will implement the strategies outlined in the toolkit and produce HAI reports targeted to consumers and healthcare professionals.
☒ ☐ ☐ ☐	☐ ☒ ☒ ☒	8. Validate data entered into HAI surveillance (e.g., through healthcare records review, parallel database comparison) to measure accuracy and reliability of HAI data collection i. Develop a validation plan ii. Pilot test validation methods in a sample of healthcare facilities iii. Modify validation plan and methods in accordance with findings from pilot project	In 2010, VDH partnered with VHHA to conduct an external validation of CLABSI data in 37 hospitals. Results from the validation study were shared with hospitals via a webinar and summary report. As funding becomes available, VDH will undergo additional validation projects to ensure the quality of the reported data using standardized methodology established by the CDC. On an ongoing basis, the VDH HAI Program reviews

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☐ ☐ ☐	☒ ☒ ☒	iv. Implement validation plan and methods in all healthcare facilities participating in HAI surveillance v. Analyze and report validation findings vi. Use validation findings to provide operational guidance for healthcare facilities that targets any data shortcomings detected	CLABSI data for missing and outlier values and follows up with facilities to address these issues.
☒	☐	9. Develop preparedness plans for improved response to HAI i. Define processes and tiered response criteria to handle increased reports of serious infection control breaches (e.g., syringe reuse), suspect cases/clusters, and outbreaks	HAI investigation resources are available to local, state, and regional communicable disease staff in the Virginia Disease Control Manual (DCM) to assist with response efforts. Examples of resources include protocols for investigating infection control breaches associated with blood glucose monitoring, tools for observing infection control practices during facility site visits, and infection-specific chapters on organisms such as carbapenem-resistant Enterobacteriaceae and group A Streptococcus. The Department of Social Services uses a standardized form to report to VDH when infection control breaches associated with blood glucose monitoring practices are identified.
☒	☐	10. Collaborate with professional licensing organizations to identify and investigate complaints related to provider infection control practice in non-hospital settings, and to set standards for continuing education and training	The HAI program shares information with the VDH Office of Licensure and Certification when patient or family member complaints related to improper infection control practices in non-hospital settings are reported to the Office of Epidemiology.

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			The HAI program conducted infection prevention trainings for inspectors from VDH OLC and DSS in 2011 and has partnered with DSS inspectors on infection prevention trainings for assisted living facility administrators.
		11. Adopt integration and interoperability standards for HAI information systems and data sources	
☐	☒	i. Improve overall use of surveillance data to identify and prevent HAI outbreaks or transmission in HC settings (e.g., hepatitis B, hepatitis C, multi-drug resistant organisms (MDRO), and other reportable HAIs) across the spectrum of inpatient and outpatient healthcare settings	The HAI Program will work with the DSI Reportable Disease Surveillance Team to develop strategies to review surveillance data to identify possible HAI outbreaks or transmission in healthcare settings.
☐	☒	ii. Promote definitional alignment and data element standardization needed to link HAI data across the nation.	Virginia will plan for implementation in the future, pending the identification of additional funding sources.
		12. Enhance electronic reporting and information technology for healthcare facilities to reduce reporting burden and increase timeliness, efficiency, comprehensiveness, and reliability of the data	In 2011, VDH and VHHA conducted a SSI mini-grant program to award funds to 22 hospitals to assist with implementation of the NHSN Procedure-Associated Module in preparation for reporting SSIs to NHSN. Funds were used for equipment and services, training and education, consultative and technical assistance, and/or administrative support. Timeline for further progress toward this activity is undetermined at this time. Virginia has not received funding to support HL7 messaging of HAIs

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☒	☒	i. Report HAI data to the public	from hospitals to the Virginia Electronic Disease Surveillance System and to NHSN. VDH currently produces reports of CLABSI data reported to NHSN from Virginia hospitals upon request. After VDH receives access to additional measures following the implementation of the revised HAI reporting regulations, annual data reports using national analysis and presentation standards will be published.
☒	☒	13. Make available risk-adjusted HAI data that enables state agencies to make comparisons between hospitals.	VDH staff use the standardized infection ratio (SIR), a risk-adjusted measure, when reporting HAI data. Following the implementation of the revised reporting regulations to include additional reporting measures, VDH will continue to report HAI data using risk-adjusted measures
☒	☐	14. Enhance surveillance and detection of HAIs in nonhospital settings	Ongoing; nursing homes and assisted living facilities are required by the Virginia *Regulations for Disease Reporting and Control* to rapidly report all outbreaks to local health departments, which report to the state health department. Local health department staff routinely work with nursing home staff to improve communication about reportable diseases and outbreaks. In 2011, the VDH HAI program developed and disseminated educational resources on infection prevention and surveillance with assisted living facilities and nursing homes via toolkits and trainings. Other prevention projects targeted toward long-term care facilities include a urinary tract infection prevention collaborative in 2011 and a *Clostridium difficile* prevention

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			collaborative in 2012-2013. The Mid-Atlantic Renal Coalition works with dialysis facilities to conduct surveillance using NHSN and prevent infections in dialysis settings.

VI. Prevention

State implementation of HHS Healthcare Infection Control Practices Advisory Committee (HICPAC) recommendations is a critical step toward the elimination of HAIs. CDC with HICPAC has developed evidence-based HAI prevention guidelines cited in the HHS Action Plan for implementation. These guidelines are translated into practice and implemented by multiple groups in hospital settings for the prevention of HAIs. CDC guidelines have also served as the basis for the Centers for Medicare and Medicaid Services (CMS) Surgical Care Improvement Project (SCIP). These evidence-based recommendations have also been incorporated into Joint Commission standards for accreditation of U.S. hospitals and have been endorsed by the National Quality Forum.

Table 3: State Planning for HAI Prevention Activities

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☐	☒	1. Implement HICPAC recommendations. i. Develop strategies for implementation of HICPAC recommendations for at least 2 prevention targets specified by the state multidisciplinary group.	The HAI Advisory Group will help identify strategies for preventing the two priority infection targets (catheter-associated urinary tract infections and *C. difficile*).
☒	☐	2. Establish prevention working group under the state HAI advisory council to coordinate state HAI collaboratives i. Assemble expertise to consult, advise, and coach inpatient healthcare facilities involved in HAI prevention collaboratives	VDH and program partners have served as consultants and advisors to participants of several past collaboratives including: data presentation collaborative (acute care, 2011), urinary tract infections (long-term care, 2011), *C. difficile* collaborative (acute and long-term care, 2012-2013). Non-VDH led collaboratives include several cohorts of a CUSP collaborative addressing CLABSI (2009-2012), Hospital Engagement Network initiatives (2012-2014), VHQC QIN/QIO initiatives targeting CLABSI, CAUTI, *C. difficile*, ventilator-associated events (2009-ongoing), Mid-Atlantic Renal Coalition

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			quality improvement collaboratives in dialysis settings (2013-ongoing), and a CUSP collaborative addressing CAUTI (2014-2015). The HAI Advisory Group will work together to organize projects and prevention collaboratives to address priority infection targets and other identified needs.
☒ ☒ ☒	☐ ☐ ☐	3. Establish HAI collaboratives with at least 10 hospitals (i.e. this may require a multi-state or regional collaborative in low population density regions) i. Identify staff trained in project coordination, infection control, and collaborative coordination ii. Develop a communication strategy to facilitate peer-to-peer learning and sharing of best practices iii. Establish and adhere to feedback of a clear and standardized outcome data to track progress	In 2014-2015, VHHA enrolled 24 hospitals (27 units) to participate in a CAUTI prevention collaborative, involving peer-to-peer education, sharing of successes and challenges, and individualized coaching/consultation. In 2015, VHQC enrolled 36 Virginia hospitals to participate in their prevention projects, which include peer-to-peer learning, sharing of best practices, and data feedback.
☒	☐	4. Develop state HAI prevention training competencies i. Consider establishing requirements for education and training of healthcare professionals in HAI prevention (e.g., certification requirements, public education campaigns and targeted provider education) or work with healthcare partners to establish best practices for training and certification	In 2011, VDH developed and disseminated an infection prevention toolkit of educational resources for assisted living facilities and nursing homes that serve as templates for provider education in those settings. VDH has worked with DSS to propose amendments to assisted living facility regulations that would increase the training requirements of ALF administrators and direct care staff.

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
			In addition, the VDH HAI program worked with the Board of Nursing to revise the curriculum for registered medication aides to reduce the risk of transmitting bloodborne pathogens in the settings where these healthcare providers practice. VDH routinely partners with other organizations and agencies on educational campaigns (e.g., Infection Prevention Week, promoting safe injection practices) and will work within the HAI Advisory Group to identify other public or provider education needs.
☐ ☒ ☐	☒ ☐ ☒	5. Implement strategies for compliance to promote adherence to HICPAC recommendations i. Consider developing statutory or regulatory standards for healthcare infection control and prevention or work with healthcare partners to establish best practices to ensure adherence ii. Coordinate/liaise with regulation and oversight activities such as inpatient or outpatient facility licensing/accrediting bodies and professional licensing organizations to prevent HAIs iii. Improve regulatory oversight of hospitals, enhancing surveyor training and tools, and adding sources and uses of infection control data	In 2015-2016, the VDH HAI Program will be conducting a mapping initiative to catalog all healthcare facilities in Virginia, their regulatory oversight, available HAI data, and infection prevention contact. The HAI Program will work with the HAI Advisory Group and regulatory agencies to explore ways to improve regulatory oversight of these settings, including enhancing surveyor training and tools. VDH has worked with DSS to propose amendments to assisted living facility regulations that would increase the training requirements of ALF administrators and direct care staff. Similarly, the VDH HAI Program works with VDH OLC staff to suggest improvements to infection control regulations in other settings (e.g., hospitals, nursing homes).

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☐	☒	iv. Consider expanding regulation and oversight activities to currently unregulated settings where healthcare is delivered or work with healthcare partners to establish best practices to ensure adherence	
☒	☐	6. Enhance prevention infrastructure by increasing joint collaboratives with at least 20 hospitals (i.e. this may require a multi-state or regional collaborative in low population density regions)	In 2014-2015, VHHA enrolled 24 hospitals (27 units) to participate in a CAUTI prevention collaborative, involving peer-to-peer education, sharing of successes and challenges, and individualized coaching/consultation. In 2015, VHQC enrolled 36 Virginia hospitals to participate in their prevention projects, which include peer-to-peer learning, sharing of best practices, and data feedback.
☐	☒	7. Establish collaborative to prevent HAIs in nonhospital settings (e.g., long-term care, dialysis)	Past collaboratives in nonhospital settings have included projects on urinary tract infections (long-term care, 2011), *C. difficile* (long-term care, 2012-2013), and infection prevention in dialysis settings (2013-ongoing). The Virginia HAI Advisory Group will provide input into targeting and establishing future collaborative efforts in nonhospital settings.

VII. Evaluation and Communications

Program evaluation is an essential organizational practice in public health. Continuous evaluation and communication of practice findings integrates science as a basis for decision-making and action for the prevention of HAIs. Evaluation and communication allows for learning and ongoing improvement to occur. Routine, practical evaluations can inform strategies for the prevention and control of HAIs.

Table 4: State HAI Communication and Evaluation Planning

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☒ ☒	☐ ☐	1. Conduct needs assessment and/or evaluation of the state HAI program to learn how to increase impact i. Establish evaluation activity to measure progress towards targets ii. Establish systems for refining approaches based on data gathered	The VDH HAI Team designed and administered an extensive needs assessment to hospital infection preventionists, quality improvement staff, and hospital administrators in early 2010 and has done periodic surveys of IP educational needs since then to inform the development of educational resources and trainings. Assisted living facilities and nursing homes were surveyed about their infection prevention training needs in 2011. All collaborative projects have an evaluation component (e.g., pre-survey, post-survey) to measure improvement and identify successful components of the projects.
☒	☐	2. Develop and implement a communication plan about the state's HAI program and progress to meet public and private stakeholders needs i. Disseminate state priorities for HAI prevention to healthcare organizations, professional provider organizations, governmental	Since 2010, VDH has published a monthly HAI newsletter on its website and distributed the information to infection preventionists, professional provider organizations, and public health colleagues. The VDH HAI website was updated extensively in 2011, including resources for the general public and healthcare providers. The website continues to be updated on a

		agencies, non-profit public health organizations, and the public	regular basis to share up-to-date resources that are tailored to specific healthcare settings (e.g., acute care, long-term care, ambulatory care).
☒	☐	3. Provide consumers access to useful healthcare quality measures	Ongoing; VDH currently has an HAI website that addresses reporting requirements, data, and prevention information. There is also a specific section for consumers that includes links to healthcare quality data and prevention resources. As additional reporting requirements are implemented in Virginia, data and educational materials about each measure, including how to prevent the reported outcomes, will be made available on the website. Special consideration will be taken when describing data on the website to ensure that the general public can easily interpret relevant HAI process and outcome measures.
☒	☐	4. Guide patient safety initiatives. i. Identify priorities and provide input to partners to help guide patient safety initiatives and research aimed at reducing HAIs	The members of the Virginia HAI Advisory Group will work together to identify priorities and provide input to our partner organizations when designing and implementing prevention projects and research initiatives. VDH is currently partnering with Virginia Commonwealth University on an initiative to improve patient and provider *C. difficile* education. VDH has also collaborated with the University of Virginia on initiatives regarding CRE surveillance and prevention.

VIII. Healthcare Infection Control and Response (Ebola-associated activities)

The techniques and practice on which infection control protocols are based form the backbone of infectious disease containment for pathogens that are otherwise amplified and accelerated in healthcare settings. Investments in a more robust infection control infrastructure will prevent many HAIs transmitted to, and among, patients and health care workers.

Table 5: Infection Control Assessment and Response

Check Items Underway	Check Items Planned	Items Planned for Implementation (or currently underway)	Target Dates for Implementation
☐ ☐	☒ ☒	1. Create an inventory of all healthcare settings in state. List must include at least one infection control point of contact at the facility 2. Identify current regulatory/licensing oversight authorities for each healthcare facility and explore ways to expand oversight	In 2015-2016, the VDH HAI Program will be conducting a mapping initiative to catalog all healthcare facilities in Virginia, their regulatory oversight, available HAI data, and infection prevention contact. The HAI Program will work with the HAI Advisory Group and regulatory agencies to explore ways to improve regulatory oversight of these settings, including enhancing surveyor training and tools.
☒ ☒ ☐	☐ ☐ ☒	3. Assess readiness of Ebola-designated facilities within the state i. Use CDC readiness assessment tool and determine gaps in infection control ii. Address gaps (mitigate gaps) iii. Conduct follow-up assessments	Virginia has composed a team of hospital assessors to perform targeted assessments of general infection control competency in core domains in Ebola-designated assessment hospitals and other selected hospitals using a standardized CDC readiness assessment tool. The team works with each hospital to identify gaps in readiness in infection control or other domains and suggest strategies to mitigate those gaps, which may involve training and/or the development of additional resources.

☐ ☐ ☒	☒ ☒ ☐	4. Assess outbreak reporting and response in healthcare facilities i. Use standard assessment tool and determine gaps in outbreak reporting and response ii. Address gaps (mitigate gaps) iii. Track HAI outbreak response and outcome	Outbreaks are reportable from all healthcare facilities. HAI program staff are routinely involved with providing guidance, consultation, or on-site assistance with outbreak investigations and with monitoring outbreak trends. The VDH HAI Program routinely tracks the number of outbreaks that they provide guidance on, and the extent of the program's involvement. When a standard assessment tool becomes available from CDC, the HAI team will use the tool to determine gaps in outbreak reporting and response. Subsequently, a plan to mitigate those gaps will be created.

Appendix 1.

The HHS Action Plan identifies metrics and 5-year national prevention targets. These metrics and prevention targets were developed by representatives from various federal agencies, the Healthcare Infection Control Practices Advisory Committee (HICPAC), professional and scientific organizations, researchers, and other stakeholders. The group of experts was charged with identifying potential targets and metrics for six categories of healthcare-associated infections:

- Central Line-Associated Bloodstream Infections (CLABSI)
- *Clostridium difficile* Infections (CDI)
- Catheter-Associated Urinary Tract Infections (CAUTI)
- Methicillin-resistant *Staphylococcus aureus* (MRSA) Infections
- Surgical Site Infections (SSI)
- Ventilator-Associated Pneumonia (VAP)

Following the development of draft metrics as part of the HHS Action Plan in January 2009, HHS solicited comments from stakeholders for review.

Stakeholder feedback and revisions to the original draft metrics

Comments on the initial draft metrics published as part of the HHS Action Plan in January 2009 were reviewed and incorporated into revised metrics. While comments ranged from high level strategic observations to technical measurement details, commenters encouraged established baselines, both at the national and local level, use of standardized definitions and methods, engagement with the National Quality Forum, raised concerns regarding the use of a national targets for payment or accreditation purposes and of the validity of proposed measures, and would like to have both a target rate and a percent reduction for all metrics. Furthermore, commenters emphasized the need for flexibility in the metrics, to accommodate advances in electronic reporting and information technology and for advances in prevention of HAIs, in particular ventilator-associated pneumonia.

To address comments received on the Action Plan Metrics and Targets, proposed metrics have been updated to include source of metric data, baselines, and which agency would coordinate the measure. To respond to the requests for percentage reduction in HAIs in addition to HAI rates, a new type of metric, the standardized infection ratio (SIR), is being proposed. Below is a detailed technical description of the SIR.

To address concerns regarding validity, HHS is providing funding, utilizing Recovery Act of 2009 funds, to CDC to support states in validating NHSN-related measures and to support reporting on HHS metrics through NHSN. Also, most of the reporting metrics outlined here have already been endorsed by NQF and for population-based national measures on MRSA and *C. difficile*, work to develop hospital level measures will be conducted in the next year utilizing HHS support to CDC through funds available in the Recovery Act.

Finally, to address concerns regarding flexibility in accommodating new measures, reviewing progress on current measures, and incorporating new sources of measure data (e.g., electronic data, administrative data) or new measures, HHS and its constituent agencies will commit to an annual review and update of the HHS Action Plan Targets and Metrics.

Below is a table of the revised metrics described in the HHS Action Plan.

Metric Number and Label	Original HAI Elimination Metric	HAI Comparison Metric	Measurement System	National Baseline Established (State Baselines Established)	National 5-Year Prevention Target	Coordinator of Measurement System	Is the metric NQF endorsed?
1. CLABSI 1	CLABSIs per 1000 device days by ICU and other locations	CLABSI SIR	CDC NHSN Device-Associated Module	2006-2008 (proposed 2009, in consultation with states)	Reduce the CLABSI SIR by at least 50% from baseline or to zero in ICU and other locations	CDC	Yes*
2. CLIP 1 (formerly CLABSI 4)	Central line bundle compliance	CLIP Adherence percentage	CDC NHSN CLIP in Device-Associated Module	2009 (proposed 2009, in consultation with states)	100% adherence with central line bundle	CDC	Yes†
3a. C diff 1	Case rate per patient days; administrative/discharge data for ICD-9 CM coded *Clostridium difficile* Infections	Hospitalizations with *C. difficile* per 1000 patient discharges	Hospital discharge data	2008 (proposed 2008, in consultation with states)	At least 30% reduction in hospitalizations with *C. difficile* per 1000 patient discharges	AHRQ	No

Metric Number and Label	Original HAI Elimination Metric	HAI Comparison Metric	Measurement System	National Baseline Established (State Baselines Established)	National 5-Year Prevention Target	Coordinator of Measurement System	Is the metric NQF endorsed?
3b. C diff 2 (new)		*C. difficile* SIR	CDC NHSN MDRO/CDAD Module LabID‡	2009-2010	Reduce the facility-wide healthcare facility-onset *C. difficile* LabID event SIR by at least 30% from baseline or to zero	CDC	No
4. CAUTI 2	# of symptomatic UTI per 1,000 urinary catheter days	CAUTI SIR	CDC NHSN Device-Associated Module	2009 for ICUs and other locations 2009 for other hospital units (proposed 2009, in consultation with states)	Reduce the CAUTI SIR by at least 25% from baseline or to zero in ICU and other locations	CDC	Yes*
5a. MRSA 1	Incidence rate (number per 100,000 persons) of invasive MRSA infections	MRSA Incidence rate	CDC EIP/ABCs	2007-2008 (for non-EIP states, MRSA metric to be developed in collaboration with EIP states)	At least a 50% reduction in incidence of healthcare-associated invasive MRSA infections	CDC	No
5b. MRSA 2 (new)		MRSA bacteremia SIR	CDC NHSN MDRO/CDAD Module LabID‡	2009-2010	Reduce the facility-wide healthcare facility-onset MRSA bacteremia LabID event SIR by at least 25% from baseline or to zero	CDC	No
6. SSI 1	Deep incision and organ space infection rates using NHSN definitions (SCIP procedures)	SSI SIR	CDC NHSN Procedure-Associated Module	2006-2008 (proposed 2009, in consultation with states)	Reduce the admission and readmission SSI§ SIR by at least 25% from baseline or to zero	CDC	Yes¶
7. SCIP 1 (formerly SSI	Adherence to SCIP/NQF infection	SCIP Adherence percentage	CMS SCIP	To be determined by CMS	At least 95% adherence to process measures to prevent	CMS	Yes

Metric Number and Label	Original HAI Elimination Metric	HAI Comparison Metric	Measurement System	National Baseline Established (State Baselines Established)	National 5-Year Prevention Target	Coordinator of Measurement System	Is the metric NQF endorsed?
2)	process measures				surgical site infections		

* NHSN SIR metric is derived from NQF-endorsed metric data

† NHSN does not collect information on daily review of line necessity, which is part of the NQF

‡ LabID, events reported through laboratory detection methods that produce proxy measures for infection surveillance

§ Inclusion of SSI events detected on admission and readmission reduces potential bias introduced by variability in post-discharge surveillance efforts

¶ The NQF-endorsed metric includes deep wound and organ space SSIs only which are included the target.

Understanding the Relationship between HAI Rate and SIR Comparison Metrics

The original HAI elimination metrics listed above are very useful for performing evaluations. Several of these metrics are based on the science employed in the NHSN. For example, metric #1 (CLABSI 1) for CLABSI events measures the number of CLABSI events per 1000 device (central line) days by ICU and other locations. While national aggregate CLABSI data are published in the annual NHSN Reports these rates must be stratified by types of locations to be risk-adjusted. This scientifically sound risk-adjustment strategy creates a practical challenge to summarizing this information nationally, regionally or even for an individual healthcare facility. For instance, when comparing CLABSI rates, there may be quite a number of different types of locations for which a CLABSI rate could be reported. Given CLABSI rates among 15 different types of locations, one may observe many different combinations of patterns of temporal changes. This raises the need for a way to combine CLABSI rate data across location types.

A standardized infection ratio (SIR) is identical in concept to a standardized mortality ratio and can be used as an indirect standardization method for summarizing HAI experience across any number of stratified groups of data. To illustrate the method for calculating an SIR and understand how it could be used as an HAI comparison metric, the following example data are displayed below:

Risk Group Stratifier	**Observed CLABSI Rates**			**NHSN CLABSI Rates for 2008 (Standard Population)**		
Location Type	**#CLABSI**	**#Central line-days**	**CLABSI rate***	**#CLABSI**	**#Central line-days**	**CLABSI rate***
ICU	170	100,000	1.7	1200	600,000	2.0
WARD	58	58,000	1.0	600	400,000	1.5

$$\text{SIR} = \frac{\text{observed}}{\text{expected}} = \frac{170+58}{100000\times\left(\frac{2}{1000}\right)+58{,}000\times\left(\frac{1.5}{1000}\right)} = \frac{228}{200+87} = \frac{228}{287} = 0.79$$

95%CI = (0.628,0.989)

*defined as the number of CLABSIs per 1000 central line-days

In the table above, there are two strata to illustrate risk-adjustment by location type for which national data exist from NHSN. The SIR calculation is based on dividing the total number of observed CLABSI events by an "expected" number using the CLABSI rates from the standard population. This "expected" number is calculated by multiplying the national CLABSI rate from the standard population by the observed number of central line-days for each stratum which can also be understood as a prediction or projection. If the observed data represented a follow-up period such as 2009 one would state that an SIR of 0.79 implies that there was a 21% reduction in CLABSIs overall for the nation, region or facility.

The SIR concept and calculation is completely based on the underlying CLABSI rate data that exist across a potentially large group of strata. Thus, the SIR provides a single metric for performing comparisons rather than attempting to perform multiple comparisons across many strata which makes the task cumbersome. Given the underlying CLABSI rate data, one retains the option to perform comparisons within a particular set of strata where observed rates may differ significantly from the standard populations. These types of more detailed comparisons could be very useful and necessary for identifying areas for more focused prevention efforts.

The National 5-year prevention target for metric #1 could be implemented using the concept of an SIR equal to 0.25 as the goal. That is, an SIR value based on the observed CLABSI rate data at the 5-year mark could be calculated using NHSN CLABSI rate data stratified by location type as the baseline to assess whether the 75% reduction goal was met. There are statistical methods that allow for calculation of confidence intervals, hypothesis testing and graphical presentation using this HAI summary comparison metric called the SIR.

The SIR concept and calculation can be applied equitably to other HAI metrics list above. This is especially true for HAI metrics for which national data are available and reasonably precise using a measurement system such as the NHSN. The SIR calculation methods differ in the risk group stratification only. To better understand metric #6 (SSI 1) see the following example data and SIR calculation:

Risk Group Stratifiers		**Observed SSI Rates**			**NHSN SSI Rates for 2008 (Standard Population)**		
Procedure Code	**Risk Index Category**	**#SSI†**	**#procedures**	**SSI rate***	**#SSI†**	**#procedures**	**SSI rate***
CBGB	1	315	12,600	2.5	2100	70,000	3.0
CBGB	2,3	210	7000	3.0	1000	20,000	5.0
HPRO	1	111	7400	1.5	1020	60,000	1.7

$$\text{SIR} = \frac{\text{observed}}{\text{expected}} = \frac{315+210+111}{12600\times\left(\frac{3.0}{100}\right)+7000\times\left(\frac{5.0}{100}\right)+7400\left(\frac{1.7}{100}\right)} = \frac{636}{378+350+125.8} = \frac{636}{853.8} = 0.74$$

95% CI = (0.649,0.851)

† SSI, surgical site infection

* defined as the number of deep incision or organ space SSIs per 100 procedures

This example uses SSI rate data stratified by procedure and risk index category. Nevertheless, an SIR can be calculated using the same calculation process as for CLABSI data except using different risk group stratifiers for these example data. The SIR for this set of observed data is 0.74 which indicates there's a 26% reduction in the number of SSI events based on the baseline NHSN SSI rates as representing the standard population. Once again, these data can reflect the national picture at the 5-year mark and the SIR can serve as metric that summarizes the SSI experience into a single comparison.

There are clear advantages to reporting and comparing a single number for prevention assessment. However, since the SIR calculations are based on standard HAI rates among individual risk groups there is the ability to perform more detailed comparisons within any individual risk group should the need arise. Furthermore, the process for determining the best risk-adjustment for any HAI rate data is flexible and always based on more detailed risk factor analyses that provide ample scientific rigor supporting any SIR calculations. The extent to which any HAI rate data can be risk-adjusted is obviously related to the detail and volume of data that exist in a given measurement system.

In addition to the simplicity of the SIR concept and the advantages listed above, it's important to note another benefit of using an SIR comparison metric for HAI data. If there was need at any level of aggregation (national, regional, facility-wide, etc.) to combine the SIR values across mutually-exclusive data one could do so. The below table demonstrates how the example data from the previous two metric settings could be summarized.

	Observed HAIs			**Expected HAIs**		
HAI Metric	**#CLABSI**	**#SSI†**	**#Combined HAI**	**#CLABSI**	**#SSI†**	**#Combined HAI**
CLABSI 1	228			287		
SSI 1		636			853.8	
Combined HAI			228 + 636 = 864			287+853.8 = 1140.8

$$\text{SIR} = \frac{\text{observed}}{\text{expected}} = \frac{228+636}{287+853.8} = \frac{864}{1140.8} = 0.76$$ 95% CI = (0.673,0.849)

† SSI, surgical site infection