

July 2019

**Final Technical Expert Panel Summary
Report:
Development of a Healthcare-Associated
Infections Quality Measure for the
Skilled Nursing Facility Quality
Reporting Program**

Deliverables 6, 10, 11, and 14

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FINAL TECHNICAL EXPERT PANEL SUMMARY REPORT:
DEVELOPMENT OF A HEALTHCARE-ASSOCIATED INFECTIONS QUALITY
MEASURE FOR THE SKILLED NURSING FACILITY QUALITY REPORTING PROGRAM

DELIVERABLES 6, 10, 11, and 14

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SECTION 1. INTRODUCTION AND OVERVIEW

1.1 Introduction

On May 9, 2019, RTI International convened an in-person Technical Expert Panel (TEP) meeting to obtain expert input on the development of a healthcare-associated infection (HAI) measure for the Centers for the Medicare & Medicaid Services (CMS) Skilled Nursing Facility Quality Reporting Program (SNF QRP). This report summarizes the TEP proceedings, detailing the key issues for the measure concept and the TEP discussion regarding those issues. In this section, we summarize the background of and rationale for the development of this measure concept and the process for the TEP meeting.

1.2 Background and Purpose

CMS has contracted with RTI to develop and implement the SNF QRP, including the development and maintenance of quality measures in the SNF QRP, to address current performance gaps in SNFs, measure implementation, and measure reporting. This work is being done under the Development and Maintenance of Symptom Management Measures contract, and the CMS Contract number is HHSM-500-2013-13015I.

As part of the measure development process, CMS asks measure developers to convene groups of stakeholders and experts to contribute thoughtful input and recommendations to the measure developer during the measure development and maintenance process.

The development of this SNF HAI measure supports CMS's Meaningful Measure Initiative, which established high-priority domains for quality measurement and improvement across health care settings. *Making Care Safer by Reducing Harm Caused in the Delivery of Care* is one of the six Meaningful Measure domains and a companion priority for quality assurance and improvement work at CMS. The meaningful measure area of HAIs is under this domain.

To address this high-priority domain and fill an important quality measurement gap, this project will develop a claims-based measure of HAIs for SNFs. Claims data are readily available for measure calculation as they are collected for payment purposes and there is no additional data submission burden for providers. This measure will supplement the current SNF QRP measure set, which includes 11 quality measures assessed using Minimum Data Set (MDS) and Medicare fee-for-service (FFS) claims.

The objective of this TEP was to seek expert input on the importance, conceptualization, and operationalization of the claims-based HAI measure concept. Comments and recommendations gathered from the TEP will inform the next steps in measure development.

1.3 Process of the TEP Meeting

On January 21, 2019, RTI posted a Call for TEP on the CMS website to initiate the recruitment of TEP members. The Call for TEP was also disseminated through national healthcare provider associations, measure development experts, previous TEP participants, and

several other stakeholder organizations. At the close of the nomination period, RTI selected 12 nominees with a diverse range of expertise, including SNF and post-acute care subject matter knowledge, clinical and infectious disease expertise, patient and family perspectives, and measure development experience. The TEP Composition List is included in *Appendix A*.

Prior to the TEP meeting, TEP members reviewed and provided feedback on an environmental scan conducted by RTI. The pre-TEP materials are included in *Appendix B*. The environmental scan reviewed existing conceptual definitions of HAIs and provided evidence supporting the measure concept's importance, actionability, and usability. These three elements are key criteria that the National Quality Forum (NQF) considers when reviewing measures' suitability for receiving endorsement and are thus crucial for determining the appropriateness of an HAI measure for further development.

The importance of a measure is defined by two domains: (a) whether the measure captures a high-priority aspect of health care and (b) whether the measure focuses on an area of care where a performance gap (i.e., overall less-than-optimal performance or considerable variation in quality across providers/populations) is indicated. Actionability is defined by whether a relationship exists between health outcome measured and processes or structures of care and whether there is potential to close performance gaps. Usability is defined by whether the measure could be used to further the goal of high-quality, efficient healthcare and whether the benefits of measuring outweigh any potential consequences.

TEP members rated each measure concept on each of the four criteria (measure importance/high priority, performance gap, actionability and usability for improvement) using a standardized scoring sheet that RTI created based on NQF scoring guidelines. RTI received TEP members' scoring and comments prior to the TEP meeting and used this information to develop discussion topics for the TEP meeting. (Detailed scoring results are summarized in *Appendix C*.)

The TEP meeting was organized based on discussion of the claims-based HAI measure conceptualization and operationalization. Discussion was facilitated by the SNF QRP lead at RTI, Dr. Qinghua Li, with support from RTI project team members. The meeting was audio recorded. In addition, RTI conducted a separate individual phone call with one TEP member who was unable to participate in the larger group discussion held on May 9.

1.4 Organization of the Report

In *Section 2*, we introduce the measure concepts and summarize the TEP members' feedback on the pre-TEP materials and TEP discussion on the measure concept. *Section 3* presents TEP discussion on the conceptual and operational definition of HAIs and measure specification components such as exclusions and risk adjustment. In *Section 3*, we also summarize TEP feedback on unintended consequences and recommendations for future directions for the measure, including implementation in other settings and potential future data sources. The report concludes with key takeaways and next steps in measure development.

SECTION 2. MEASURE CONCEPT: SUMMARY OF PRE-TEP FEEDBACK AND TEP DISCUSSION

2.1 Measure Concept Description

This measure will assess the risk-standardized rate of HAIs that are acquired during SNF care and require acute care transfer. It is important to recognize that HAIs in SNFs are not considered “never-events.” The goal of this risk-adjusted measure is to identify SNFs that have notably higher rates of HAIs that are acquired during SNF care and result in acute care transfer compared with their peers.

The operational definition of this measure will focus on HAIs that require transfer to acute care, a criterion that will be used to assess the severity of infections and providers’ ability to manage them. This measure will use Medicare FFS claims data. Claims data are readily available for measure calculation as they are collected for payment purposes and there is no additional data submission burden for providers. SNF HAIs will be identified by examining the principal diagnosis on the acute care claims for SNF residents transferred during a predefined time window.

2.2 Summary of TEP Feedback on Pre-TEP Materials and the TEP Discussion

Before the TEP meeting, we asked TEP members to score this measure using four NQF endorsement criteria (detailed scoring results are summarized in *Appendix C*; one TEP member did not submit scores). The majority of TEP members agreed that this measure concept is of high priority/importance, with 5 out of 11 TEP members rating this measure as high priority and 6 rating it as medium-high priority. Although ratings were slightly lower than for high-priority/importance criteria, most TEP members indicated that this measure area shows a performance gap, with 8 TEP members rating the performance gap as high or medium-high.

There was less consensus about the measure’s actionability and usability. Four TEP members rated the actionability of the measure as high or medium-high, with the rest rating the actionability as medium. Scoring on usability for improvement was slightly higher than actionability but displayed more variability, with 6 TEP members rating usability as high or medium-high and five rating it as medium or medium-low.

TEP members also provided comments on the measure concept before and during the TEP meeting. The comments and feedback centered on the following:

- **Measure importance/high priority.** TEP members agreed that the prevention and reduction of HAIs are top priorities, and that an HAI quality measure would fill a gap in current quality reporting programs, help address the lack of data, and increase transparency. TEP members also suggested that an infection measure would help establish baseline rates and evaluate the effectiveness of interventions, promote attention on HAIs, spur provider action, and combat the rise of antibiotic-resistant infections. A potential concern that TEP members raised is that the lack of data makes it hard to assess the magnitude of the issue.

- ***Performance gap.*** Most TEP members agreed that performance gaps exist in HAI prevention based on research and personal observations of variation in care. There were common concerns regarding lack of data and lack of knowledge and training among staff regarding infection detection and prevention.
- ***Actionability.*** Overall, TEP members believed that reducing HAIs is feasible with well-designed interventions. Some TEP members emphasized the need for stronger empirical evidence of the relationship between providers' actions and infection rates in SNFs.
- ***Usability for improvement.*** Overall, most TEP members agreed that there is potential for the quality measure to reduce rates of HAIs. TEP members stated that usability depends on how the measure is specified (including its data source and ability to accurately reflect HAIs). TEP members believed that the measure would incentivize providers to focus on HAIs but noted that barriers to action may exist, including lack of knowledge, inadequate staff-to-resident ratios, staff turnover, and provider resources.
- ***Limitations of the data source and importance of measure specifications.*** TEP members expressed concern about the ability of claims to accurately capture infections acquired in a SNF and provide timely data for quality improvement. They were also concerned about the lack of standardization of infection diagnoses and treatment, both within SNF and across settings. A common concern was that SNFs may be penalized for inappropriate diagnostic practices in acute care hospitals. TEP members noted that acute settings may not use the minimum criteria for infection diagnoses that nursing homes use. TEP members noted that inappropriate diagnostic practices could reduce accuracy of a claims-based HAI measure as well as its actionability as SNFs have limited ability to correct diagnostic practices in acute care settings. RTI addressed this concern by presenting research from the Potentially Preventable Readmissions measures, which showed a high agreement rate between the acute care medical record and claims coding of readmissions from the post-acute care setting. TEP members noted that such results were encouraging, but also cited personal experiences that suggest less consistency and expressed the importance of continued research into this issue.
- ***Lack of provider knowledge and resources.*** TEP members noted that SNFs often lack the basic infection prevention knowledge, resources, and staffing needed to adequately address infection rates. They emphasized the need for provider education to support effective use of the measure.

SECTION 3. MEASURE DEFINITION AND SPECIFICATIONS: SUMMARY OF TEP DISCUSSION

3.1 Introduction

The TEP discussion focused on six major topics: (a) conceptual definition of SNF HAIs; (b) operational definition of SNF HAIs: infection categories and time window; (c) exclusions; (d) risk adjustment; (e) unintended consequences; and (f) future directions for the measure.

The purpose of this TEP discussion was to develop a claims-based conceptual and operational approach for defining HAIs in the SNF setting. The current literature puts forth definitions of HAIs, but there is no consistent, universal definition of HAIs that may indicate inadequate care quality in post-acute care settings.

3.2 Conceptual Definition of HAIs

RTI structured the TEP discussion on the conceptual definition of HAIs based on two broad questions. The following is a summary of the discussion of each question.

3.2.1 Should we include all HAIs or only HAIs that are severe enough to require acute care transfer?

TEP members discussed positives and negatives for both options. Some TEP members thought it would be beneficial to include all HAIs to increase the amount of infection data provided to SNFs and empower quality improvement. However, another TEP member countered that we could risk information overload if we include every possible HAI. Instead, the TEP member suggested that it would be more valuable to have a concentrated list of infections to target quality improvement at the biggest impact areas.

One drawback of including all HAIs that the TEP discussed was that doing so would require using SNF claims rather than acute care claims. One TEP member cited problems pertaining to SNF claims, such as the lack of present on admission information and inconsistency in coding by SNF providers. Another disadvantage of using SNF claims to identify HAIs is that SNF providers submit the claims themselves, increasing potential manipulation to improve scores and creating disincentives for data submission. Given these considerations, some TEP members felt that it was better to use acute care claims only and focus on HAIs that require acute care transfer.

Based on discussion, TEP members supported the inclusion of only those HAIs severe enough to require acute care transfer.

3.2.2 For acute care transfers, what should be included: hospitalization, emergency department (ED) visits, observation stays?

TEP members reached a consensus that only hospitalizations should be considered. A common concern of TEP members was that ED visits and observation stays are not long enough to acquire all the lab results needed for accurate diagnosis of infections. As a result, some

infections such as urinary tract infections (UTIs) may be overdiagnosed on the acute care claims based on less stringent criteria, such as altered mental status and urinalysis results. In addition, TEP members commented that acute care settings — particularly EDs — may have incentives to preemptively screen and diagnose SNF residents with infections to avoid attribution to the hospital for the purposes of value-based purchasing (VBP). TEP members felt that diagnoses of SNF residents transferred and hospitalized would be more likely to be based on the whole history and comprehensive test results and thus more likely to represent true infections. Some TEP members also noted that using only hospitalizations would better indicate the severity of infections, because SNF residents transferred must meet criteria for acute care admission.

3.3 Operational Definition

RTI presented the proposed methodology for identifying SNF HAIs, using Medicare FFS claims: We proposed to identify SNF HAIs using the principal diagnosis on the Medicare claims for residents' acute care transfers during a predefined time window. Based on the earlier discussion, the TEP reached consensus that the acute care transfers would include hospitalizations only, not ED visits or observation stays. The TEP discussion of the operational definition of SNF HAIs focused on two parameters: types of infections on the principal diagnosis of the acute care claims for hospitalization and the time window.

3.3.1 Operational Definition: Types of Infections

RTI presented criteria for inclusion and exclusion of infection categories as SNF HAIs and preliminary analysis using acute care claims for Medicare beneficiaries who had a SNF stay in fiscal year 2018.

The general inclusion criteria for SNF HAIs are:

- Infections that are likely to be acquired during SNF care and severe enough to require acute care transfer (e.g., life-threatening methicillin-resistant *Staphylococcus aureus* infections)
- Infections related to invasive (not implanted) medical devices (e.g., infections associated with catheters, insulin pumps, and central lines; infection of tracheostomy stoma)

The proposed exclusion criteria for SNF HAIs are listed below. Conditions that meet one of more of the following criteria will not be counted as a SNF HAI for this measure:

- Chronic infections (e.g., chronic viral hepatitis B with or without the delta agent)
- Infections that typically take a long period of time to present (e.g., typhoid arthritis)
- Infections that are more likely related to the prior hospital stay (e.g., postprocedural retroperitoneal abscess)
- Infections under sequela and subsequent encounter codes (e.g., sequelae of inflammatory diseases of the central nervous system)

- Codes that include “causing disease classified elsewhere” (e.g., meningitis in bacterial diseases classified elsewhere)
- Codes likely to represent secondary infection, where the primary infection would likely already be coded (e.g., viral endocarditis, pericarditis, myocarditis, or cardiomyopathy)
- Infections likely to be community acquired (e.g., *Echinococcus granulosus*-caused infection of the liver)
- Infections common in other countries and/or acquired through animal contact (e.g., subacute and chronic melioidosis)
- Potential exclusion: infections where the condition is coded on the prior hospitalization claims

Overall, TEP members expressed strong support for the inclusion and exclusion criteria, considering them realistic and comprehensive. They also supported the potential exclusion of infections captured on the prior hospital stays to prevent SNFs from being held responsible for ongoing or reoccurring infections. TEP members debated the merits of creating a list of infections based on frequency rather than clinical criteria, which can be more subjective. However, they concluded that a frequency-based approach would not be comprehensive enough and that formal clinical criteria are important for developing a strong conceptual basis for the measure.

The only criterion subject to debate was the exclusion of infections that were likely to be community acquired. RTI noted that this exclusion pertains to infections that are unlikely to occur in a SNF (such as insect-related diseases) rather than viral infections such as flu, which could be transmitted in the normal process of care. Several TEP members noted that we cannot consider SNFs to be completely isolated and that infection prevalence rates in SNFs often reflect population-level infection trends. TEP members who had caregiver perspectives were most concerned with this exclusion, stating that their loved ones were frequently exposed to community-acquired infections by visitors, staff returning from vacations, and outside contractors. Residents may also be exposed to the environment surrounding the facility, such as wooded areas with ticks. Some TEP members felt that it was reasonable to hold providers responsible for community-acquired infections because those providers can take precautions such as screening visitors during outbreaks.

RTI asked specifically for TEP input on whether transplant-related infections should be attributed to SNFs. One TEP member supported excluding transplant-related infections because they are more indicative of the condition necessitating the transplant than of SNF quality of care. However, another TEP member differentiated between transplant-related infections related to the organ and those related to the incision site. Although the TEP member agreed with excluding the former, they felt that SNFs should be held responsible for incision site infections because SNFs should be able to account for the higher likelihood of infections resulting from the use of immunosuppressive drugs.

3.3.2 Operational Definition: Time Window

Determination of the time window to identify HAIs centered on two key considerations: (a) How many days after SNF admission should infections start being attributed to the SNF, and (b) how many days after SNF discharge should infections stop being attributed to the SNF? To facilitate discussion, RTI presented analyses on when the first acute care transfer within a SNF stay and the first acute care transfer after SNF discharge occurred as well as the national rate of HAIs using different combinations of time windows.

The TEP strongly favored aligning the measure with the Center for Disease Control and Prevention's National Healthcare Safety Network (NHSN) time window for HAIs, which would make infections attributable to the SNF starting on the fourth day after admission and ending 3 days after discharge. TEP members noted that providers are already familiar with such a time window and that alignment would be useful if submission of NHSN data ever became mandatory.

Several TEP members expressed concern that infections may be misattributed to the SNF if an infection began within 3 days of SNF admission, but the resident was transferred to acute care later in the stay after the SNF tried unsuccessfully to treat the infection at the facility. RTI noted that some noise in the measure is to be expected and that such a scenario would apply to all SNFs. Misattribution could also go in both directions, with a resident being hospitalized for SNF-attributable infections 3+ days after SNF discharge. A possible scenario is when treatment was first started as an outpatient for a few days prior to hospitalization. One TEP member asked how attribution would work in scenarios when a resident is bouncing between SNF and acute care. CMS noted that we would apply the same 3-day time window to each new SNF admission and that the number of acute care episodes prior to each SNF admission would be included as part of the risk adjustment for the measure. The TEP also noted that attribution may be complicated by the new interrupted stay policy because a return to the SNF will not be considered a new stay if it is within 3 days.

The TEP also discussed whether the hospital and SNF should be responsible for the same infection if there were overlaps in the attribution time window. Most felt that the overlap in responsibility would be beneficial because it would increase collaboration between the SNFs and acute care settings, as seen with the readmission measures.

One TEP member expressed concern that a 3-day window was too long because it gives a free pass to infections that arise quickly over the weekend when staffing levels may be reduced. Other TEP members noted that the time window may not be appropriate for all infections. For example, UTIs may be attributable to SNFs prior to day 4. However, the TEP agreed that the same time window should be applied to all infection and that 3 days was suitable for most infections.

3.4 Exclusions

Measure exclusions presented by RTI included age less than 18, because of non-inclusion in Medicare, and Medicare Advantage status, because of the lack of available Medicare claims data for risk adjustment. RTI solicited TEP feedback about whether we should also consider a length-of-stay (LOS) exclusion of 3 days to align with the time window decision of starting

attribution on day 4 of a SNF stay. RTI presented analysis showing that 8.7% of SNF admissions would be excluded on the basis of this LOS exclusion criterion. Some TEP members did not feel strongly about the need for an LOS exclusion, noting that such an exclusion would shift the scores of everyone and would not have significant impacts on provider behavior. Other TEP members argued that it would not be meaningful to include residents with short lengths of stay in the measure, because the time window is too short for inclusion in the measure numerator. One TEP member with a caregiver's perspective felt strongly that an LOS exclusion was necessary to avoid artificially improving SNFs' measure scores. This TEP member noted that no LOS exclusion would hinder the measure's usability by making it harder for residents and families to interpret the results. The TEP overall supported the LOS exclusion but suggested further sensitivity analyses to determine the impact on performance scores.

TEP members did not recommend any additional measure exclusions.

3.5 Risk Adjustment

TEP members supported using the same risk adjustor categories used for other claims-based quality measures: age; sex; original reason for Medicare entitlement (age, disability or ESRD); surgical categories based on the prior hospital claim; principal diagnosis on the prior hospital claim; comorbidities on the prior hospital claim or a 365-day look-back; length of stay in the prior hospital stay; any prior acute ICU or CCU utilization; and a count of the prior hospital discharges in the prior year. The TEP particularly favored accounting for the number of previous hospital stays in risk adjustment. One TEP member disagreed with risk adjusting for surgery-specific codes in the measure as the SNF should be responsible for any post-operative infection.

The TEP members agreed that social risk factors should not be included in the measure but recommended including stratification analysis on social risk factors as part of measure testing.

3.6 Unintended Consequences

TEP members expressed concerns that the 3-day time window could incentivize facilities to transfer residents to acute care early in the stay, prior to an HAI being attributed to the SNF. However, the TEP noted that readmission measures adopted in the SNF VBP program, which have no attribution time windows, could potentially counter any such incentive as increased readmission rates are more directly related to payment. One TEP member also noted that hospitals would likely begin directing patients away from SNFs that inappropriately transfer residents back to acute care soon after SNF admission. Another concern expressed by TEP members was that SNFs might avoid transferring residents to acute care even when medically necessary. Finally, some TEP members were concerned that the measure could encourage premature or inappropriate use of antibiotics, countering antibiotic stewardship efforts.

TEP members noted that the HAI measure may also have positive interactions with other policies. For example, the new patient-driven payment model policy maps specific ICD-10 codes such as surgical procedures to higher payment rates, which could encourage SNFs to take sicker patients even if they do not have ability to appropriately treat them. However, these conditions

are also associated with increased risk of infection. Thus, the HAI measure could counter the incentive to unsuitably take on patients by linking unsuccessful treatment to quality scores.

3.7 Future Direction

TEP members strongly supported developing an HAI measure in other healthcare settings. They supported having similar measure specifications across settings to increase standardization and align goals across continuum of care. One TEP member particularly supported the expansion of this measure for use in the long-stay nursing home population, because SNF and long-stay residents are housed in the same facility and should be treated consistently in terms of infection prevention and management. However, another TEP member stated that the HAI measure in its current form should not be used in the hospice setting.

Several TEP members supported increased education on infection prevention across settings and disciplines. They noted that best infection control practices are available but have not been implemented and cited barriers such as staff turnover, inadequate staff-to-resident ratios, and lack of financial resources.

RTI solicited recommendations for additional data sources to explore in the future. TEP members had already stated concerns with the use of claims, particularly with accuracy of diagnostic information as well as the time lag between when care is provided and when quality data is available and reported back to providers. One TEP member noted that a SNF may have a high reported HAI rate but may have already addressed the issue by the time the data appeared in a quality measure.

The TEP members supported the suggestion of providing facilities with quarterly claims data through CASPER reports, rather than only annual reporting of the measure results. Several TEP members also recommended increasing the number of infection items collected on the MDS. These members believe that additional infection items on the MDS would encourage SNFs to improve infection control and management as well as increase the aggregate amount of data available for quality improvement. Other TEP members disagreed with modifying the MDS, expressing reservations about the extra burden of adding items to the MDS. Another TEP member expressed concerns about using MDS infection data for a quality measure because of potential manipulation by SNF providers and felt that claims data is of higher quality. Some TEP members suggested that CMS further partner with CDC and require all SNFs report to NHSN. However, others were concerned about the level of increased burden for SNF providers.

3.8 Main Takeaways and Next Steps.

TEP members agreed that HAIs are an important measure concept and that we should proceed with the measure development in SNFs. TEP members agreed that a claims-based measure would strengthen the SNF QRP measure portfolio without increasing burden.

The TEP agreed that the measure should focus on infections that are acquired during a SNF stay and that are severe enough to require acute care transfer. TEP members also reached a consensus that only hospitalizations should be considered for acute care transfers in order to increase the rate of accurate diagnoses.

TEP members supported RTI's list of clinical criteria for inclusion and exclusion of *International Classification of Disease (ICD)* codes for HAI identification. TEP members also reached a consensus that the HAI measure should use the time window for attribution specified by NHSN, which starts at day 4 of SNF admission and ends on day 3 after SNF discharge.

In addition to age and Medicare Advantage status exclusion, some TEP members expressed support for an LOS exclusion to address the 3-day time window before HAIs are attributed to SNFs. There was concern among some TEP members about artificially improving SNFs' performance if such short stays were not excluded.

Most TEP members supported using the same risk adjustors included in the other claims-based measures, e.g. SNFPPR. TEP members agreed with not including social risk factors in the final measure specifications but suggested that we test on social risk factors as part of measure testing.

The TEP members supported providing facilities with quarterly claims data through CASPER reports in order to make the measure more actionable.

The TEP members supported potential future application of this measure in other healthcare settings and populations, including the long-stay nursing home population.

There was a common concern among several TEP members regarding using Medicare claims for this measure. Some TEP members suggested adding infections items onto MDS or requiring submission to the NHSN, while others were strongly against these suggestions.

RTI will use the TEP members' recommendations to refine measure specifications and guide future analyses using claims data. RTI will incorporate the TEP recommendations into the SNF HAI specifications, including the use of only hospitalizations for acute care transfer and a time window that aligns with the NHSN. RTI will refine and finalize the *ICD* code list for the SNF HAI definition according to the criteria agreed upon by the TEP members. Finally, RTI will conduct measure testing, examining the application of the exclusions and risk adjustment discussed during the TEP meeting.

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**APPENDIX A:
TABLES OF RESULTS FROM PSYCHOMETRIC ANALYSES**

Twila Bridges

Advocate & Family Council President

Laurel, MD

Twila Bridges is an advocate for her special need son, who has resided in a nursing home for over 21 years. She provides an important patient and family perspective and valuable first-hand insight into the care needs of nursing home residents. She is motivated to improve nursing home quality from her years of observing care lapses in nursing homes and the impacts on her son's health. Since 1999, she has served as the Family Council President at her son's nursing home, leading fellow family members and friends of residents in promoting their loved ones' rights, quality of care, dignity and respect. In 2018, Ms. Bridges and the Family Council hosted Town Hall Meeting with Senator Jim Rosapepe, Delegate Joseline Pena Melnyk and now Delegate Mary Lehman to express their concerns and solicit support to make a change in the Nursing Home Reform Law of 1987, which is outdated for nursing homes in the State of Maryland.

Pam Campbell, ASN

Regulatory Product Team Specialist

PointClickCare, Climax Springs, MO

Pam Campbell is a registered nurse with an Associate of Science, Nursing Degree who has worked in post-acute care for more than 25 years. Throughout her career, she has held a number of positions ranging from clinician and Director of Nursing in both free-standing skilled nursing facilities (SNFs) as well as hospital-based SNFs. She has also been an LTC consultant for a hospital system as well as clinical consultant for an MDS Software vendor, where she designed Infection Control software. Throughout her career she has extensively researched Infection Control and its evolution throughout the years. Regardless of her role, she has always had a determined focus on quality improvement dedicated to enhancing the lives of patients and healthcare workers alike.

She has currently serving on the IT Committee, a collaborative group, and the Transfer of Health (TOH) Tiger Team with NASL (the National Association for the Support of Long Term Care). At PointClickCare, she is an integral member of the Regulatory Compliance team and she leads a cross functional team to address the Infection Prevention and Control Program (IPCP) requirements while facilitating the design of a unique IPCP solution to assist customers in achieving excellence.

Patricia Cruz Martinez, MPH, CIC

Clinical Program Director, Post-Acute Care Services

Houston Methodist Hospital, Houston TX

Patricia Cruz Martinez is the Clinical Program Director at The Houston Methodist Hospital in the Texas Medical Center. She graduated with a Masters in Public Health from the University of Michigan and has worked at several community and large acute facilities as an

Infection Control Practitioner. She has been in her current role for over 4 years and primarily oversees regulatory and accreditation activities for both the Skilled Nursing Facility and the Inpatient Rehabilitation Facility. She also has a Certification in Infection Control and has maintained this for nearly 8 years.

Shanna Davis, MSN, RN

Director, Health Information Systems
Briar Hill Management, LLC, Ridgeland, MS

Shanna Davis is an RN who serves as Director of Health Information Systems for six small facilities in Mississippi. She has several certifications including Certified Nurse Executive (CNE), Resident Assessment Coordinator-Certified (RAC-CT), Director of Nursing Services-Certified (DNS-CT), and Certified Associate in Healthcare Information and Management Systems (CAHIMS). Ms. Davis also provides a family/caregiver perspective as she helped care for her grandmother in a nursing home for several years. Ms. Davis has expertise in skilled nursing facility policies and clinical practices, infection control, quality and performance improvement. Ms. Davis is also familiar with healthcare disparities. Additionally, as Director of Health Information Systems, Ms. Davis provides a health information technology perspective.

Ms. Davis received her Associate in Nursing from Holmes Community College in 2010. She received her Bachelor of Science in Health Science—End of Life Care from Excelsior College in 2011. She also received her Master of Science in Nursing—Specialized Nursing Informatics from Excelsior College in 2013.

Caitlin Gillooley, MS

Senior Associate Director, Policy
American Hospital Association, Washington, DC

Caitlin Gillooley is the Senior Associate Director for Policy at the American Hospital Association (AHA), where she works on quality-of-care policy. In addition to developing policy positions on quality measurement, quality improvement programs, and value-based purchasing models, Ms. Gillooley leads the AHA's work on the quality reporting programs for post-acute care, outpatient, and psychiatric/substance abuse settings. Her role at AHA includes coordination with the National Quality Forum's Measure Applications Partnership; she also leads AHA's Measures that Matter initiative, a multi-stakeholder collaborative of quality measurement and policy experts from various provider and payer associations, where she developed a framework to systematically and objectively evaluate quality measures to quantify the beneficial and burdensome attributes of each measure. Ms. Gillooley holds a Master of Science in Public Health from Harvard University and a Bachelor's in Political Science from Johns Hopkins University.

Rebecca Kaufmann, BSN, RN

Senior Director, Care Excellence – Quality, Infection, Safety
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Becky Kaufmann graduated from Deaconess College of Nursing with BSN in 1996. She began her career in Long-term Care in 1999, over the years serving as DON, Director of Quality, Staff Educator, MDS Coordinator, Safety Officer, Risk Manager and Infection Preventionist.

Currently she serves as Senior Director of Care Excellence – Quality, overseeing quality, infection prevention and control and safety for Ascension Living. Ms. Kaufmann lives in Collinsville, IL with her husband, Scott.

Pauline Kinney, MA, RN, LNHA

Senior Director, Healthcare Quality Improvement
IPRO, Lake Success, NY

Pauline Kinney is a licensed Nursing Home Administrator and Registered Professional Nurse with several years of progressive and diverse clinical and organizational management experience in nursing home and hospital settings. As the Senior Director of Quality Improvement at IPRO, she has worked extensively with New York State nursing facilities on improving the quality of care they provide to residents. Ms. Kinney has participated in other national nursing home projects such as the National Nursing Home Improvement Collaborative: Pressure Ulcer Prevention and Treatment, and the Improving Nursing Home Culture – Person-Centered Care Project.

Buffy Lloyd-Krejci, MS, CIC

Consultant & Infection Preventionist
Lloyd-Krejci Consulting, LLC, Scottsdale, AZ

Buffy Lloyd-Krejci comes to you with more than 20 years of healthcare experience with expertise in quality improvement (QI) and Healthcare-Associated Infections (HAI) surveillance and statistical analysis. She is Board Certified in Infection Prevention and Control through the Association for Professionals in Infection Control and Epidemiology (APIC) and currently holds the 2019 APIC president position in the state of Arizona. As a national consultant, she offers solutions to federal, state and local public healthcare professionals implementing interventions to mitigate healthcare and community-acquired infectious diseases through targeted, data-driven solutions and advanced statistical analytics. She is a subject matter expert with the Centers for Disease Control and Prevention (CDC) infection prevention and control HAI prevention practices including the National Healthcare Safety Network (NHSN) HAI surveillance tracking system. She is currently completing her doctorate of public health/epidemiology degree with Capella University, obtained her Bachelors of Science degree in Applied Mathematics and Masters of Science degree in Biomedical Informatics through Arizona State University.

Dheeraj Mahajan, MD, FACP, CMD, CIC, CHCQM

President and CEO (CIMPR); Chair, Quality Measures Committee (AMDA)
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Dr. Dheeraj Mahajan is president and CEO of Chicago Internal Medicine Practice and Research (CIMPAR, SC) and leads its affiliated group of companies. Dr. Mahajan is the clinical associate professor of medicine at the University of Illinois at Chicago and is also attending physician in the Loyola University affiliated geriatrics fellowship program at Hines VA hospital. He is a Fellow of American College of Physicians and Board certified in Internal Medicine and Geriatric Medicine. Additionally, Dr. Mahajan is a certified medical director, a certified physician advisor in utilization review and healthcare quality management and is certified in

infection control and epidemiology. He is a nationally recognized expert and speaker on physician payment models, clinical documentation improvement, denial management, quality measurement in post-acute and long-term care (PALTC) and transitional care quality improvement. Dr. Mahajan has completed MBA coursework and is wrapping up MPH portion of his MBA-MPH dual degree this spring. His areas of interest in research include Antimicrobial stewardship, Quality measures, Health information exchange and interoperability.

Vicki Nordby, BSN, RN

Nurse Consultant

Marquis Companies, Milwaukie, OR

Vicki has spent the past 45 years working in long term care as a C.N.A., Restorative Aide, C.M.A., Activity Director, Charge Nurse, Director of Nursing, Director of Clinical Services and Nurse Consultant. Vicki is currently a Nurse Consultant for Marquis Companies with her focus on skilled nursing. She is responsible for assisting facilities with regulatory compliance; evidence based clinical program development, implementation and configuration of electronic health record, coordinating infection prevention, antibiotic stewardship programs and providing education on various topics. Vicki currently serves on Oregon Healthcare Infection Advisory Committee. Has served on various committees for Oregon Health Care Association, Oregon Patient Safety Advisory Committee, CDC/PEW Antibiotic Stewardship in Long Term Care stakeholder group member.

Danielle Reusch, BSN, RN, WCC

Assistant Administrator

Harris Hill Nursing and Rehabilitation Facility, The McGuire Group, Williamsville, NY

Danielle Reusch, RN, BSN, WCC is assistant administrator/director of nursing at its Harris Hill Nursing Facility in Williamsville. In this capacity, Reusch will be responsible for the oversight of the nursing department and facility staffing as well as promoting the collaboration between departments, complying with federal and state regulations, staying abreast of quality measures and standards of care, and upholding quality care for the residents and patients. The position also entails promoting growth and retention among employees, interdisciplinary care planning, wound care and infection prevention. Reusch has been employed at the facility for more than 15 years. Prior to her promotion, she served as the assistant director of nursing.

She received a licensed practical nursing degree from Erie I BOCES, an associate degree in nursing from Trocaire College, a bachelor of science in nursing from American Sentinel College and a long-term care administration certificate from St. Joseph's College of Maine. She is a member of the Professional Nurses Association. Reusch resides in Akron and has three children: Alissa, Robert and Gabriella.

Therese Van Male, MSN, RN

Nurse Consultant

Wisconsin Department of Health Services, Milwaukee, WI

Therese Van Male is the Nurse Consultant Resident Assessment Education (RAI) Coordinator for the Wisconsin Department of Health Services, Division of Quality Assurance.

Therese provides education to State nursing home surveyors and providers regarding the RAI MDS (Minimum Data Set), a resident assessment and care planning process.

A Registered Nurse (RN) for 25 years, her experience includes working as a certified nursing assistant, staff nurse, and quality improvement RN in nursing homes, a quality improvement nurse for a major Health Maintenance Organization, and a State nursing home surveyor for 15 years. Other professional experience includes participation in a Master's degree practicum in Nursing Informatics with the Oklahoma Foundation for Medical Quality on their Measures Development team, and serving as the RN coach for an AHRQ (Agency for Healthcare Research and Quality) funded study "Building a Novel Antibiotic Stewardship Initiative for Nursing Homes," led by Dr. Chris Crnich at the University of Wisconsin.

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**APPENDIX B:
PRE-TECHNICAL EXPERT PANEL (TEP) MATERIALS**

The pre-TEP materials include the following:

1. Technical Expert Panel Pre-TEP Survey (*Appendix B-1*)
2. Summary of Environmental Scan (*Appendix B-2*)

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**APPENDIX B-1:
TECHNICAL EXPERT PANEL PRE-TEP SURVEY**

**Development of a Claims-Based Healthcare-Associated Infection
Measure for the Skilled Nursing Facility Quality Reporting
Program**

Technical Expert Panel Pre-Meeting Survey

We appreciate your participation in this Skilled Nursing Facility (SNF) Quality Reporting Program (QRP) Technical Expert Panel (TEP) and are looking forward to our upcoming discussion on May 9th.

In preparation for our in-person meeting, please complete this pre-meeting survey that asks for your feedback on the healthcare-associated infection (HAI) measure concept and development. The results will be used to guide the in-person TEP discussion. Please return your completed survey to RTI at snfhai@rti.org by **5PM on Monday, April 8th**.

Directions: Using your substantive expertise around this measure concept and the literature review document (see email attachment), rate the HAI measure concept on each of the following criteria:

1. Measure importance/high priority
2. Performance gap
3. Actionability
4. Usability for improvement

Because each criterion may have multiple dimensions, you may find that the measure scores high on one dimension but lower on another. Please use your best judgment to determine a single score for the criterion and use the comments column to share any additional thoughts, suggestions or questions you have about the measure.

Criterion: Measure Importance/High Priority

- High score (4–5) indicates that the measure concept addresses at least one of the following:
 - an established national health priority area (such as one identified by the Department of Health and Human Services or National Priorities Partnership convened by the National Quality Forum)
 - a demonstrated high-impact aspect of healthcare (e.g., affects large numbers and/or has a substantial impact for a smaller population; leading cause of morbidity/mortality; high resource use (current and/or future); severity of illness; and/or severity of patient/societal consequences of poor quality)
- Middle score (3) indicates that the measure is important, but that this is not an established national priority area and that the empirical evidence demonstrating that the measure’s focus is a high-impact is limited.
- Low score (1–2) indicates that the measure concept has little or no importance.

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Criteria: Measure Importance/High Priority

Provide a numerical rating from 5 to 1 (5 = high and 1= low)

Rating	Rationale for your rating	Provide comments, suggestions, or questions pertaining to the criteria
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Criterion: Performance Gap

- High score (4–5) indicates at least one of the following:
 - there is considerable variation in quality of performance in this area across providers/populations
 - there is overall less-than-optimal performance in this area across providers/populations
 - there are disparities in performance in this area across different population groups
- Middle score (3) indicates at least one of the following:
 - there is some variation in quality performance in this area across providers/populations/population groups
 - performance in this area is satisfactory across providers/populations
- Low score (1–2) indicates at least one of the following:
 - there is little or no variation in quality of performance in this area across providers/populations/population groups
 - performance in this area is at an optimal level

Criteria: Performance Gap

Provide a numerical rating from 5 to 1 (5 = high and 1= low)

Rating	Rationale for your rating	Provide comments, suggestions, or questions pertaining to the criteria
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Criterion: Actionability

- High score (4–5) indicates that there is a rationale supporting the relationship of the health outcome (i.e., HAIs) to processes or structures of care and evidence that demonstrates that there is a potential for closing the performance gap through the development and use of a quality measure.
- Middle score (3) indicates that there is some rationale supporting the relationship of the health outcome to processes or structures of care and that evidence demonstrates that there is some potential for improving performance through the development and use of a quality measure.
- Low score (1–2) indicates that there is little to no rationale supporting the relationship of the health outcome to processes or structures of care and that evidence related to this measure demonstrate that there is little to no potential for improvement through the development and use of a quality measure.

Criteria: Actionability

Provide a numerical rating from 5 to 1 (5 = high and 1= low)

Rating	Rationale for your rating	Provide comments, suggestions, or questions pertaining to the criteria
--------	---------------------------	--

Criterion: Usability for Improvement

- High score (4–5) indicates that performance results on the measure could be used to further the goal of high-quality, efficient healthcare for individuals or populations and the benefits of the performance measure in facilitating progress toward achieving high-quality, efficient healthcare for individuals or populations outweigh evidence of unintended negative consequences to individuals or populations (if such evidence exists).
- Middle score (3) indicates that there is some potential for furthering the goal of high-quality, efficient healthcare for individuals or populations and some evidence that the benefits outweigh evidence of negative consequences.
- Low score (1–2) indicates that there is little to no potential for furthering the goal of high-quality, efficient healthcare for individuals or populations and no evidence that the benefits outweigh evidence of negative consequences.

Criteria: Usability for Improvement

Provide a numerical rating from 5 to 1 (5 = high and 1= low)

Rating	Rationale for your rating	Provide comments, suggestions, or questions pertaining to the criteria
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Open-ended suggestions and considerations for the HAI quality measure development

1. In your opinion, what are some issues (e.g. clinical, methodological) that are important to consider during HAI measure development/discuss during the TEP meeting? Please list or describe these topics below.

Thank you for completing this Pre-TEP Survey. As a reminder, please return to RTI at snfhai@rti.org by Monday, April 8th, 2019 at 5PM.

**APPENDIX B-2:
SUMMARY OF ENVIRONMENTAL SCAN**

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DEVELOPMENT OF HEALTHCARE-ASSOCIATED INFECTION QUALITY MEASURE
FOR SKILLED NURSING FACILITY QUALITY REPORTING PROGRAM

FINAL SUMMARY OF ENVIRONMENTAL SCAN

by
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CMS Contract No. HHSM-500-2013-13015I

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SECTION 1. INTRODUCTION

A healthcare associated infection (HAI) is an infection acquired while receiving care at a health care facility, which was not present or incubating at the time of admission (World Health Organization). HAIs are an important public health and patient safety issue, particularly among older adults. It is one of the most common adverse events in health care delivery. HAIs are associated with longer length of stays, use of higher-intensity care (e.g., critical care services and hospital readmissions) and increased mortality (Office of Inspector General [OIG], 2014; Ouslander, Diaz, Hain, & Tappen, 2011; Zimlichman et al., 2013). HAIs also lead to increased health care costs and present an economic burden. However, most HAIs are considered potentially preventable because they are outcomes of care related to processes or structures of care. In other words, these infections typically result from inadequate management of patients following a medical intervention, such as surgery or device implantation, or poor adherence to hygiene protocol and antibiotic stewardship guidelines.

Addressing HAIs in skilled nursing facilities (SNFs) is particularly important because several factors place SNF residents at high risk for infection, including increased age, cognitive and functional decline, use of indwelling devices, frequent care transitions, and close contact with other residents and health care workers (Office of Disease Prevention and Health Promotion [ODPHP], 2013; Montoya & Mody, 2011). Within the SNF and LTC population, there are additional facility and individual risk factors that put residents at risk for specific types of infections (see *Section 3.3*) In 2000, 1.6 to 3.8 million infections were estimated among 1.5 million nursing home residents in the United States (Strausbaugh, 2000). A recent report from the OIG (2014) estimated that 1 in 4 adverse events among SNF residents are due to HAIs, and that more than half of all HAIs are potentially preventable. Using data from the OIG report, RTI estimates that averting preventable HAIs in SNFs may save more than \$646 million (2018 US\$) in hospitalization costs (OIG, 2014; Bureau of Labor Statistics).

Preventing and reducing HAIs is crucial to delivering safe and high-quality care across the health care system. It has been a priority objective at the federal, state, and local levels. For example, the Office of Disease Prevention and Health Promotion has created a National Action Plan to Prevent Health Care-Associated Infections, with specific attention to HAIs in long-term care facilities (LTCFs) (ODPHP, 2013). Efforts across the Department of Health and Human Services aimed at addressing HAIs, and relevant to SNFs, include the following:

- National Health and Safety Network (NHSN) infection surveillance reporting
- Centers for Medicare & Medicaid Services (CMS) reporting of quality measures, including measures for influenza and pneumococcal vaccination
- Assessments of infection control programs for CMS certification of nursing homes and through the National Survey of Long-Term Care Providers
- Various Centers for Disease Control and Prevention (CDC) partnerships with states to prevent and surveil HAIs, including the Emerging Infections Program (EIP)

- Partnership for Patients goals, including improving care transitions and reductions in CLABSI, catheter-associated urinary tract infection (CAUTI), *Clostridium difficile* infection (CDI), and other HAIs

In 2017, CMS launched the Meaningful Measures framework, which identifies several high-priority areas for quality measurement and improvement across health care settings. Making Care Safer by Reducing Harm Caused in the Delivery of Care is one of the six meaningful measure domains and is a companion priority for quality assurance and improvement work at CMS. The meaningful measure area of HAIs is under this domain.

Historically, efforts to address HAIs have concentrated on acute care settings, although infections among the long-term care and PAC populations have received increasing attention over the last decade. Still, although many existing measures and surveillance criteria assess individual infections, no measures aim to capture all HAIs in the SNF setting. Some researchers have urged that additional patient safety measures be developed and reported in nursing homes (Brauner et al., 2018).

To address this high-priority domain and fill an important quality measurement gap, CMS has contracted with RTI International to develop a quality measure of HAIs in SNFs.

This summary presents results of an environmental scan on HAIs, including the definition of HAIs, patient and provider characteristics associated with HAIs, and strategies to prevent and reduce HAIs.

SECTION 2. DEFINING HAIS

There is some consensus around the conceptual definition of HAIs. The literature broadly presents two definitions, one based on traditional efforts to identify nosocomial (or hospital-acquired) infections and a second based on more-recent efforts to address hospitalizations from the community for infections associated with previous health care exposure (Cardoso et al., 2014). Under the former definition, HAIs are infections that are absent on admission to a health care facility but develop over the course of a medical treatment or intervention. It also includes infections acquired in the facility that are not detectable until after discharge. The latter definition recognizes HAIs as infections that are present upon hospital admission or shortly after among patients who had prior health care services such as a hospital or nursing home stay (Cardoso et al., 2014). Infections arising from health care interventions are distinct from community-acquired infections, which occur independent of any health care contact.

Approaches for creating an operational definition of HAIs vary widely with respect to types of infections considered, data sources, criteria for provider attribution, and purpose of measurement. Most established metrics for assessing HAIs use primary laboratory and clinical data, which are used to diagnose and determine the appropriate course of treatment for patients.

- CDC's definition of HAIs emphasizes infections associated with medical interventions such as surgery or catheter, central line, or ventilator use, followed by specific diseases and organisms that typically cause infections in health care settings.
- NHSN's definition, which is used for surveillance purposes, considers 14 major types of infections grouped by organ system. Clinical criteria for each infection must be met on or after the third day of admission for the HAI to be attributed to the index stay provider.
- Common surveillance criteria include the McGeer and updated McGeer criteria, which were adapted for LTCFs based on hospital surveillance methods. These criteria focus on symptoms, diagnoses, and laboratory results that must be met for a given infection to be included in surveillance counts (McGeer et al., 1991; Stone et al., 2012). The McGeer criteria are typically used in the nursing home literature to evaluate whether providers appropriately diagnose and report infections. A second commonly used criteria, the Loeb minimum criteria, is similar but defines infections for the purpose of appropriate clinical treatment. It defines the minimum clinical criteria needed to initiate antibiotic treatment (Loeb et al., 2001). The Loeb criteria was also created for LTCFs and is typically used to assess whether antibiotics are being appropriately prescribed and to evaluate antibiotic stewardship programs. Neither of these metrics are used to determine the source of infections.
- Some metrics and definitions from the literature used diagnosis codes from administrative claims data to identify specific conditions commonly considered as HAIs (Yu, Baser, & Wang, 2016; Ziakas et al., 2016; Zilberberg et al., 2017).

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SECTION 3. PERFORMANCE GAP

3.1 Prevalence of HAIs

Despite the ramifications of HAIs among SNF residents, the literature is scarce on the epidemiology of HAIs in SNF. Common HAIs among SNF residents include the following:

- Urinary tract infection (UTI)
- Lower respiratory tract
- Skin infections
- Gastroenteritis
- Influenza (ODPHP, 2013; Montoya & Mody, 2011)

The 2014 OIG report estimated that 22% of Medicare beneficiaries had adverse events during their SNF stays, defined as events that prolong SNF stays, lead to transfer or hospitalization, result in permanent resident harm, require intervention to sustain life, or contribute to or result in a resident's death (OIG, 2014). Infections accounted for 26% of the adverse events among Medicare SNF Residents. Of the infection-related adverse events, 10% of all adverse events were due to aspiration pneumonia and other respiratory infections, 5% to surgical site infections, 3% to CAUTIs, 3% to *Clostridium difficile* infection (CDI), and 5% to other infection types. In recent analysis conducted by RTI International for CMS, almost half of all potentially preventable hospital readmissions among SNF residents in the 30 days following hospital discharge were for infections. Among readmissions for infections, the most common types of infections were septicemia (accounting for 35% of readmissions), UTI/kidney infection (6%), and bacterial pneumonia (5%).

Most other estimates on infections for SNF residents come from studies with the broader population of nursing home residents. Even these estimates are uncertain, and many are outdated. The number of HAIs in nursing homes occurring annually is unclear, partly because of variations in HAI definitions and estimation techniques. An estimated 1.6 to 3.8 million HAIs occur annually in nursing homes, resulting in around 388,000 deaths (Strausbaugh, 2000; Teresi, 1999). Although frequently cited, this estimate is based on cross-sectional data from the 1970s through 1990s and may be an inaccurate representation of the state of HAIs today (Herzig et al., 2017). Herzig and colleagues (2017) updated this estimate by analyzing the 2006–2013 Minimum Data Sets (MDS) and estimated that 1.13 to 2.68 million infections occurred in nursing home residents in 2013; however, they cautioned that this is likely an underestimate because of data limitations. For example, the MDS does not include all infection types.

Herzig and colleagues (2017) also examined trends in HAIs over time and found that the prevalence of all studied infections increased from 2006 through 2010, with the greatest increases in multidrug resistant organisms (MDROs) and UTI. After 2010, the composition of HAIs changed: from 2011 through 2013, the prevalence of UTI, MDROs, and wound infection decreased while viral hepatitis increased. However, the researchers noted that these decreases are

partly attributed to stricter definitions for these infection types, particularly UTI. Overall, Herzig and colleagues (2017) found UTI and pneumonia are the most commonly reported infections across all years of data.

Some other studies focus on a specific infection or a subset of HAIs. Guh and colleagues (2018) estimated a 49% reduction in CDI from 2011 through 2015 in LTCFs under CDC Emerging Infection Program (EIP) surveillance. However, the results may not be representative of LTCFs nationwide because of the non-random selection of facilities based on the EIP participation and the Hawthorne effect inherent to surveillance programs, in which facilities change their behavior because they are being observed. Estimates indicate the rate of other types of infections remain high, although the exact frequency and trends are uncertain. UTI rates are reported by nursing homes as part of Nursing Home Compare, with a national average infection rate of 2.9% among long-stay residents (CMS, 2019.); however, there is not a comparable measure for SNF residents.

In addition, certain types of infections are becoming increasingly concerning, especially antibiotic-resistant varieties. There are high rates of antibiotic-resistant bacteria colonization in nursing homes, with up to 25% of residents being MRSA colonized and up to 40% being colonized with resistant gram-negative bacilli (Albrecht, Croft, Morgan & Roghman 2017; Blanco et al., 2017). We would also expect high levels of colonization among SNF residents because of the similar populations and environments. Gucwa, Dolar, Ye, and Epstein (2016) examined 1,142 cases of UTIs in SNFs and found that 14.4% of positive urine cultures were caused by an MDROs (including MRSA, VRE, or ESBL-producing Gram-negative bacteria), although these cases were confined to a small number of SNFs in a limited geographical area.

Overall, given the lack of SNF-specific data, these estimates and trends are the best insight into the epidemiology of overall HAIs in SNF. Although the exact numbers for HAIs in SNF cannot be derived from these studies, these estimates suggest that infection rates are high in post-acute elderly populations such as those in SNFs and that certain infection types, such as UTI and pneumonia, would be expected to occur more frequently.

3.2 Provider Characteristics Related to HAIs

Research suggests that infection rates vary by provider characteristics, although findings are not always conclusive or consistent.

Studies have found that staffing levels are associated with the HAI rate in nursing homes but that the relationship may depend on staffing type.

- Gucwa and colleagues (2016) found that the odds of UTI were 35% lower with every additional star increase in Registered Nurse (RN) staff rating. Similarly, the odds of MDROs were 97% lower with each star increase in RN staff rating.
- Castle, Engberg, Wagner, and Handler (2017) found higher RN levels were associated with lower rates of UTIs in US nursing home residents. However, the relationship between LPN levels and UTI rates was negative among non-catheterized residents and nonsignificant among catheterized residents.

- Stephens (2018) found no significant relationship between nursing staff levels and UTIs, regardless of staff type. However, because the study only included nursing homes in one state, Georgia, it is unclear whether the results are generalizable at the national level.

Researchers also found that nursing facility structure characteristics and resident case-mix impact infection rates in both nursing homes and SNFs.

- Castle and colleagues (2017) found that national chain membership and higher occupancy rates were associated with higher rates of UTI in nursing homes
- Joyce, Mylonakis, and Mor (2017) found that SNFs with CDI were larger, located in urban areas, and had a greater proportion of Medicare beneficiaries and a lower proportion of Medicaid beneficiaries, compared with those without CDI.

Lastly, the adoption of infection surveillance and prevention policies was associated with facility characteristics, with the exact relationship varying by policy and study.

- Dick and colleagues (2019) examined rates of participation in the LTCF component of the NHSN and found that 1.6% of nursing homes enrolled early, while the rest (10.6% of nursing homes) enrolled after the implementation of the CMS-funded CDI Reporting and Reduction Project; 87.8% did not enroll. The researchers also found that earlier enrollees were more likely to be government or nonprofit, not part of a chain, and hospital-based compared with later enrollees (Dick et al., 2019). Compared to non-enrollees, enrollees overall were more likely to be larger, part of a chain, hospital-based, and government or nonprofit. They also had a higher percentage of Medicare residents and indicators of higher quality (higher pneumonia vaccination rates, higher transferring index for Activity of Daily Living, and higher nursing hours for patient day) (Dick et al., 2019).
- Nursing homes with higher influenza vaccination rates are more likely to be small, government or nonprofit, and not part of a chain; they tend to have a lower proportion of residents in Medicare and are less likely to be in a metropolitan area (Travers et al., 2016).

The association between infection policy adoption and provider characteristics may be explained by the fact that limited resources (e.g., lack of capacity for laboratory testing and imaging), low staff-to-resident ratios, and high staff turnover are challenges to infection prevention efforts such as antibiotic stewardship (Crnich, Jump, Trautner, Sloane, & Mody, 2015; Feldstein, Sloane, & Feltner, 2018). Herzig and colleagues (2016) found that nursing homes with higher director of nursing and administrator turnover and without a physician on their infection control committee were more likely to have infection control deficiency citations. However, as with provider characteristics and infection rates, exact relationships between provider characteristics and infection surveillance and prevention policies vary by policy and study.

3.3 Individual Characteristics Related to HAIs

The relationships between individual characteristics and HAIs also vary by infection types and study.

Age. The literature almost unanimously found that increased age is associated with increased risk of infections (Montoya & Mody, 2011; Ziakas et al., 2016; Friedman et al., 2018; Guh et al., 2018; Karanika et al., 2017; Castle et al., 2017; Feldstein et al., 2018). The only exception was one study that found a slightly lower rate of CDI in the oldest residents, those at least 85 years of age (Yu et al., 2016). A separate study found contradicting results; rates of CDI were higher for those at least 85 years of age, compared with other age groups (Ziakas et al. 2016).

Sex. Multiple studies have found that being female is associated with UTI (Gucwa et al., 2016; Castle et al., 2017). Some studies found that men were more likely to get CDI (Yu et al., 2016), but others did not find a significant relationship (Mao, Kelly, & Machan, 2015).

Treatment characteristics. Other consistent risk factors for infection are antibiotic exposure, hospital exposure, and duration of stay in a long-term care facility (Guh et al., 2018; Karinika et al., 2017; Friedman et al., 2018; Patel, Mantey, & Mody, 2017).

Social risk factors. Mao and colleagues (2015) found that CDI rates are higher for patients with higher income level and more-comprehensive insurance (Medicare and private over Medicaid and self-pay), perhaps because of increased interaction with health care centers and antibiotic usage.

Race/ethnicity. Lastly, the differences in infections across racial/ethnic groups vary by infection type and studies. Castle and colleagues (2015) found that White residents were more likely to get UTIs than non-White residents, especially when they did not have an indwelling catheter. The results were less clear for CDI. Yu and colleagues (2016) found that White residents were slightly less likely to get CDI, whereas Ziakas and colleagues (2016) found the opposite. Mao and colleagues study (2015) found that, when examining all hospital stays involving CDI, White patients had the highest rates. However, this relationship disappears when only looking at hospital patients with a point of origin of SNF. Mao and colleagues (2015) suggest that this occurs because there are more racial disparities in access to care among patients in the community than in SNFs, where care is provided more uniformly. Mao et al. concludes that differences in CDI rates by race are caused by disparities in health treatment rather than genotypic reasons; in this case, these disparities decrease morbidity as increased access to care is linked to greater exposure to antibiotics and health care settings, factors contributing to CDI risk. However, decreased access to care is more commonly detrimental, especially for preventive care, as Black residents are less likely to receive influenza and pneumococcal vaccinations and less likely to be offered influenza vaccines, which puts them at increased risk of influenza and pneumonia (Travers et al., 2016).

SECTION 4. EVIDENCE-BASED INTERVENTIONS

Literature suggests that most HAIs may be prevented from occurring and spreading through the implementation of safety procedures, antibiotic stewardship, and staff education.

4.1 Safety Procedures

Interventions addressing safety procedures have demonstrated success at reducing infection rates. A 3-year multimodal intervention, which included hand hygiene, preemptive barriers, and active surveillance, reduced MDRO prevalence density by 23%, CAUTIs by 31%, and CAUTI hospitalizations by 30% (Hutton et al., 2018). A CAUTI-specific version of this intervention resulted in an average of 8.7 fewer CAUTIs a year and 2.9 fewer resident hospitalizations per nursing home per year (Hutton et al., 2018). Smith and colleagues (2018) found that CAUTI rates declined 54% in nursing homes participating in HAI prevention interventions but could not find any a significant relationship between specific safety culture elements (as defined by the Nursing Home Survey on Patient Safety Culture) and CAUTI rates. Thus, although multimodal interventions have proven to be successful, the most important elements of interventions are unclear. Encouragingly, Hutton and colleagues (2018) found that their CAUTI intervention resulted in a net saving of \$34,037 per year, was 85% likely to be cost-saving, and was 96% likely to be cost effective because of reduced CAUTI hospitalization cost savings.

SNFs can reduce the spread of infections by preventing person-to-person transmissions caused by lapses of asepsis procedures. For example, to prevent CDI, CDC recommends safety procedures such as contact precautions, hand hygiene, and regimens for cleaning and disinfecting equipment and care environments (Zarowitz, Allen, O'Shea, & Strauss, 2015). Studies have also found a need for contact precautions for other infections, finding high rates of transmission of MRSA and RGNB from colonized residents to the gowns and gloves of health care workers, especially during high-risk activities such as changing wound dressings, providing hygiene, and bathing (Albrecht et al., 2017; Blanco et al., 2017; Pineles et al., 2017).

Despite these recommendations, Albrecht et al. (2017) found that staff frequently do not use gowns and gloves even for direct resident contact, citing reasons such as staff burden and administrator or resident objections. Research likewise has observed lapses in hand hygiene, particularly before resident contact and during tasks such as delivering food and medicine (Kobayashi et al., 2016).

Lastly, hygiene could be improved among residents themselves, with one study finding that nursing home residents were less likely to have been bathed or showered in the past 12 hours than similar community residents (Roghamann et al., 2017).

4.2 Antibiotic Stewardships

A second pathway for reducing infections is by implementing antibiotic stewardships to reduce over-prescription and unnecessary prescription of antibiotics, which predisposes residents to CDIs and increases antibiotic resistance. Evidence indicates that up to 70% of nursing-home-administered antimicrobials may be inappropriately prescribed, contributing to an increased rate

of CDI and antibiotic-resistant infections (Beganovic & Laplante, 2018). Nursing homes particularly overprescribe antibiotics for UTIs because of overreliance on urinalysis results, underemphasis of symptoms, inability to differentiate asymptomatic bacteria from antibiotic-treatable infections, and poor adherence to guidelines (Cooper et al., 2019; Feldstein et al., 2018). One study found that only 15% of diagnosed UTI given antibiotics met all Loeb criteria for prescribing antibiotics (Kistler et al., 2017), and another found that only 40% of CAUTIs met Loeb's minimum criteria and 32% met NHSN criteria (Armbruster et al., 2017). Inappropriate prescribing extends to other infections; one study found that only 48% of skin and soft tissue infections met the Loeb minimum criteria and only 25% met the McCreer criteria (Feldstein et al., 2017).

Correct infection diagnosis is particularly challenging in nursing homes because of resident factors such as multiple comorbidities, atypical signs of infection due to age, and functional impairment (Cooper et al., 2019; Feldstein et al., 2018). Antibiotics are also prescribed for too long, with 28% of residents receiving antibiotics for more than 7 days, despite recommendations of 3 to 7 days, and only 2% of prescriptions discontinued, despite recommendations to re-evaluate antibiotic necessity (Kistler et al., 2017). To address these concerns, the 2017 Joint Commission and CMS began requiring LTCFs to develop antibiotic stewardship plans (ASP) (Beganovic & Laplante, 2018; Crnich & Drinka, 2014). Multiple ASP intervention studies have shown potential for reducing inappropriate antibiotic use and infection rates (Baganovic & Laplante, 2018; Cooper et al., 2019; Crnich et al., 2015).

4.3 Staff Education and Training

Available evidence suggests that both safety protocol and ASP interventions require staff education to be successful. One predictor of glove and gown use is nursing staff members' knowledge of infection and their prevention. Staff reported ambiguous guidance from administrators regarding appropriate use of gloves and gowns and frequently underestimated the risk of transmission (Albrecht et al., 2017). Likewise, Trautner and colleagues (2017) found that less than 30% of staff members, both licensed and unlicensed, knew how long to wash their hands, and less than 12% knew the most effective agent to use.

Lack of education also inhibits the proper diagnosis and treatment of common infections. The Trautner and colleagues study (2017) found that 36% of staff could not properly interpret pyuria and only 28% knew that they should not routinely culture cloudy, smelly urine, both common occurrences in UTI treatment.

Research emphasizes the role of infection control practitioners in enforcing safety procedures and educating staff (Montoya & Mody, 2011; Trautner et al., 2017), but education and resource gaps have also been found among those in charge of infection control. Herzig and colleagues (2016) found that 61% of infection control leaders have no specific training in infection control, and most are not allocated the appropriate time to focus on infection control activities. Educational interventions have been found to improve staff knowledge and appropriate treatment (Krein et al., Freeman-Jobson et al., 2016). Freeman-Jobson and colleagues (2016) found that an educational presentation increased mean scores on a UTI diagnosis and treatment assessment in health care workers from 6.5 out of 10 to 8.2.

Furthermore, nursing homes with a higher number of infection control deficiency citations are less likely to have weekly, biweekly, or monthly trainings and provide financial resources for education (Herzig et al., 2016). A study by Kaur and colleagues (2017) found that only 30% of nursing homes conducted infection control trainings monthly or more frequently. Furthermore, only 11% conducted infection prevention training at new employee orientation, only 6% conducted training during an outbreak, and 17% conducted neither training at orientation or at an outbreak (Kaur et al., 2017). These gaps indicate that improving education of nursing staff is an important and feasible opportunity for nursing homes to reduce their infection rates.

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**APPENDIX C:
TEP MEMBER SCORING**

Table C-1

	High Priority/Measure Importance	
<i>Score</i>	N	%
5 - High	5	45.5
4	6	54.5
3- Medium	0	0
2	0	0
1-Low	0	0
Mean Score	4.5	

Table C-2

	Performance Gap	
<i>Score</i>	N	%
5 - High	5	45.5
4	3	27.3
3- Medium	2	18.2
2	1	9.1
1-Low	0	0
Mean Score	4.1	

Table C-3

	Actionability *	
<i>Score</i>	N	%
5 - High	2	18.2
4	2	18.2
3- Medium	7	63.6
2	0	0
1-Low	0	0
Mean Score	3.6	

Note: * One score was 4 / 5, which was counted as 4 in the table and as 4.5 in calculating the mean

Table C-4

	Usability for Improvement *	
<i>Score</i>	N	%
5 - High	3	27.3
4	3	27.3
3- Medium	4	36.4
2	1	9.1
1-Low	0	0
Mean Score	3.7	

Note: * One score was 3.5, which was counted as 3 in the table and as 3.5 in calculating the mean.