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## Infection prevention and control in nursing homes during COVID-19: An environmental scan

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### ABSTRACT

To examine processes and programmatic elements of infection prevention and control (IPC) efforts and identify themes and promising approaches in nursing homes (NHs), an environmental scan was conducted. Data sources included a literature search, relevant listservs and websites, and expert consensus based on a virtual summit of leaders in IPC in long-term care settings. Three thematic areas emerged which have the potential to improve overall IPC practices in the long-term care setting: staffing and resource availability, training and knowledge of IPC practices, and organizational culture. If improved IPC practices and reduced cross-transmission of infections in NHs are to be sustained, both short-term and long-term changes in these areas are essential to fully engage staff, build trust, and enhance a 'just' organizational culture.

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### Introduction

Over 1.2 million people reside in NHs in the United States.<sup>1</sup> These residents typically have multiple conditions that increase their risk for infection, including chronic diseases, incontinence, fragile skin, malnutrition, dehydration, and depressed immune systems.<sup>2</sup> Even prior to the recent SARS-CoV-2 pandemic, annual estimates of infection prevalence in NHs were as high as 2 million infections.<sup>3</sup> For example, a May 2020 report by the Government Accountability Office for the U.S. Senate Committee on Finance found that 82 percent of CMS-certified NHs had at least one infection-related deficiency between 2013 and 2017 and nearly half of those had received infection-related deficiencies for multiple consecutive years, an indication of the pervasiveness of this problem.<sup>4</sup> The purpose of this report is to summarize an environmental scan which we performed during the early stages of the pandemic to describe current common IPC nursing home processes, practices and programmatic elements that have the potential to reduce the burden of healthcare-associated infections (HAIs).

### Materials and methods

#### Data sources

Through several initial waves of the pandemic in the United States during 2020 and early 2021, four data sources were incorporated in

this environmental scan: a search of peer-reviewed, published literature; the monitoring of relevant listservs and websites; expert consensus from a convened virtual summit of international leaders in IPC in long-term care facilities; and qualitative interviews to assess the wellbeing of long-term care providers working in the New York City metropolitan area. A full report of this qualitative study was recently published in this journal,<sup>5</sup> to which the reader is referred.

#### Literature search

To identify trends in processes and programmatic elements of IPC efforts in NHs and compare general national trends with the other sources of data in our environmental scan, we conducted a targeted overview of what had been published in two major sources of peer-reviewed and gray literature, PubMed and Google Scholar, using the following keywords: infection control; long-term care facilities; healthcare-associated infections; antibiotic stewardship; infection prevention; and COVID-19. Studies were included if they were written in English, published between January 2000 and November 2020, and examined any aspect of IPC in long-term care facilities. International research from nine member-states of the Organization for Economic Co-Operation and Development (OECD) was included.

To more formally screen literature specific to the pandemic, another author (EL) reviewed articles listed in Ovid Medline and Journals at Ovid from the peer-reviewed literature that met the following criteria: published or in press between 1/1/20 and 6/30/20; a keyword, abstract or title word that included COVID-19 or SARS-CoV-2 or coronavirus; content relevant to direct patient care or frontline care providers which included new or confirmatory information; and

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published in English. Screened articles had to fit into one or more of seven categories: prevention (public/community or health care settings), treatment, epidemiology (e.g., incidence and prevalence of infection, risk factors, etc.), emergency preparedness, psychological impact on the public, infected individuals and healthcare providers; and/or telemedicine.

The number of articles identified increased exponentially over the monitoring period, averaging around 50–100/week. In total, more than 20,000 articles were screened and categorized and approximately 680 of those were recommended. The focus of the published literature evolved rapidly over time. Initially publications simply described what was happening such as rates, symptoms and outcomes of infection; resource needs (e.g., lack of personal protective equipment and masks for the public) and how the curve of the pandemic might be flattened. By March 2020, epidemiologic and surveillance studies of risk factors and vulnerabilities (e.g., older age, obesity, communal living such as long-term care facilities, pregnancy, immunosuppressed) were growing, and in April there were increasing numbers of publications regarding the psychological impact of the pandemic on the public, infected individuals, and frontline healthcare professionals. In May and June 2020, treatment options were increasingly reported along with legal and ethical implications and early results from clinical trials. By June, discussions increased regarding vaccine development as well as recognition that the outbreak may last longer than previously thought. Although publication of such relevant information was rapid, very few studies described IPC practices occurring in healthcare facilities. This project was pilot tested in collaboration with and supported by a national publishing firm (Wolters Kluwer, [www.wolterskluwer.com](http://www.wolterskluwer.com)), but because the volume of articles being published increased rapidly and several other formal websites specifically monitoring COVID-19 had emerged, this daily monitoring was terminated after the initial 6 months of the pandemic.

For the purposes of our project there was an important takeaway message from the literature: even though the severity and high prevalence of infection in long-term care settings was frequently reported, there was a paucity of published information regarding IPC practices and how NHs were managing in the pandemic. This finding further highlighted the need for work such as this environmental scan.

#### Monitoring of listservs and websites

Members of our team and other staff of The New York Academy of Medicine (NYAM) routinely monitored relevant listservs and websites through waves of the pandemic. The key federal websites providing frequent COVID-19 updates were the Centers for Disease Control and Prevention (<https://www.cdc.gov/coronavirus/2019-ncov/index.html> and <https://www.cdc.gov/coronavirus/2019-ncov/hcp/nursing-home-long-term-care.html>); the Occupational Safety and Health Administration (<https://www.osha.gov/>); and the Centers for Medicaid and Medicare Services (<https://www.cms.gov/>) Infectious disease/infection prevention society websites also regularly screened included Association for Professionals of Infection Control and Epidemiology (APIC, <https://apic.org/>); Infectious Diseases Society of America, [www.idsociety.org](http://www.idsociety.org); and Society for Healthcare Epidemiology of America (SHEA), [www.shea-online.org](http://www.shea-online.org) Numerous websites established during the pandemic by academic health centers and private foundations (e.g., the Kaiser Family Foundation) were also screened routinely, although the plethora of data being disseminated primarily reiterated or repeated information available from other federal or regional sources such as those noted above.

#### Expert consensus

On December 2 and 8, 2020, NYAM convened a virtual summit to address IPC in nursing homes. The summit featured presenters (listed in Table 1) from across the United States and from Scotland, Australia,

**Table 1**  
Virtual Summit presenters.

Virtual Summit Presenter	Professional Role
Anucha Apisarnthanarak, MD Evelyn Cook, RN, CIC	Thammasat University Hospital, Thailand Associate Director, Statewide Program for Infection Control and Epidemiology University of North Carolina at Chapel Hill, United States
Lisa Hall, PhD, FSHEA	Associate Professor in Epidemiology, University of Queensland, Australia
Karen Hoffman RN, MS, CIC, FAPIC, FSHEA	Clinical Instructor in the Division of Infectious Diseases University of North Carolina at Chapel Hill, United States
Donald Macaskill, PhD Judith A. Salerno, MD, MS	Chief Executive, Scottish Care, Scotland President, New York Academy of Medi- cine, United States
Steven Schweon, RN, MPH, MSN, CIC, FSHEA, FAPIC Ann Spenard, DNP, RN-BC	Infection Preventionist, Steven J. Schweon LLC, United States Chief Clinical Officer, National Health Care Associates, United States
Nimalie Stone, MD, MS	Medical Epidemiologist for Long-term Care, Division of Healthcare Quality Promotion, Centers for Disease Control and Prevention, United States
Patricia W. Stone, PhD, RN, FAAN	Centennial Professor in Health Policy, and Director, Center for Health Policy Columbia School of Nursing, United States
Michael Wasserman, MD	Past President California Association of Long-term Care Medicine, United States

and Thailand. These speakers were charged with sharing their expertise and perspectives regarding the personnel, clinical management, regulatory, research, and human rights aspects of trends and the current status of IPC in NHs. Criteria for selection of speakers with expertise related to infection prevention and control in long-term care were established by a core planning group. These criteria included authorship of peer-reviewed publications or guidelines, researchers with funded research, and leaders in relevant national and global organizations addressing IPC in long-term care settings. Efforts were made to assure geographic distribution throughout the U.S. and in other English-speaking OECD countries as well as representation and experience across disciplines (epidemiology, medicine, nursing, bioethics, law, etc.), content area (e.g., clinical practice, public health, research, policymaking, and administration), and type of workplace setting. Ten speakers meeting these criteria were identified and each invitee agreed to participate.

Invitations to the virtual summits were disseminated through the networks of NYAM, APIC (with specific outreach to their long-term care interest group), and the networks and recommendations of each of the speakers. In total, 200 people attended the two summits. The presentations explored a range of best practices, policy recommendations, summaries of recent research and considerations for further research, lessons learned from the pandemic, and human rights considerations.

#### Compilation of data sources

In the initial targeted scan of the literature, we identified three themes common to NH settings: staffing and resource availability, training and knowledge of IPC practices, and organizational culture. Next, the findings from the other data sources were examined by research team members to assess whether the themes accurately and consistently reflected issues that were raised and/or whether there were other important or major issues that were missed and needed to be added. The team reached consensus that these three themes

were consistent across all of our data sources, and no additional themes emerged. Themes are summarized below.

## Results and synthesis

### *Staffing and resource availability*

#### *Nurse staffing challenges and relationship to infection rates*

Although adequate nurse staffing is pivotal to the delivery of high-quality care and plays an important role in reducing the transmission of healthcare-associated infections, in NHs there is a chronic shortage of direct care staff which is projected to continue worsening as the general population ages and requires more treatment for chronic health conditions.<sup>6–9</sup> High staff turnover has also been linked to a variety of infection-related negative outcomes for NH residents including higher rates of urinary tract infections (UTIs), incontinence, dehydration, resident transfers to hospitals, and lower overall quality of life.<sup>10–11</sup> Additionally, NHs are often staffed by personnel with minimal skill and training; the optimal skill mix for frontline LTC nursing staff (certified nursing assistants, RN, LPN, etc.) has yet to be identified.<sup>12</sup>

Inadequate nurse staffing in NHs has been identified as a primary driver of job dissatisfaction and lower quality care. Nurses acknowledge the role of facility budget constraints, excessive paperwork, and the stress of covering work absences as reasons for high turnover and report that this overload limits their ability to spend necessary time with residents.<sup>13</sup> NH residents are often unable to effectively communicate their needs and symptoms due to cognitive, physical, or neurological deficits. Improved nurse tenure allows for more accurate monitoring of the often-subtle presentation of infection symptoms. Indeed, the presence of RNs and directors of nursing who have over one year of tenure in a facility is associated with improvements in falls, weight loss, incontinence, and UTIs.<sup>10</sup>

#### *Cost cutting measures and effect on infections*

Despite evidence linking adequate licensed nurse staffing to improved IPC, NHs generally employ certified nursing assistants (CNAs) to maintain adequate staffing with lower costs. Reliance on part-time rather than full-time staff creates other challenges; because of low pay, scarce hours, and/or absence of benefits, staff members sometimes seek concurrent employment from multiple NHs. Staff interchange between facilities and the reliance on agency contracts increase the likelihood of intra- as well as inter-facility transmission of infection as staff work back-to-back shifts at different facilities and create barriers to facility-wide IPC implementation.<sup>14,15</sup> Early in 2020, the CDC identified NH staff members who work in multiple facilities as a likely source of COVID-19 transmission in NHs. On average, U.S. NHs have staffing exchanges with 7 facilities; eliminating these connections could have resulted in a 49% decrease in COVID-19 infections.<sup>16</sup>

#### *Workforce challenges and effects on hand hygiene*

One cornerstone of an effective IPC program is staff training in basic practices such as hand hygiene, which has been linked to reduced mortality and the decreased use of antibiotics in NHs.<sup>17</sup> Yet despite the wealth of evidence, NHs struggle to maintain acceptable levels of hand hygiene. For example, in one observational study of six NHs, nurses performed hand hygiene about one-third of the time before entering a room and 57% after exiting a room. CNAs were recorded at 24% and 49%, respectively, and other NH personnel rates were even lower.<sup>18</sup>

#### *Staffing and infection preventionists*

The Centers for Medicare and Medicaid Services (CMS) Section 483.80 of the Code of Federal Regulations, implemented in October

2016, expanded NH IPC program requirements to include an antibiotic stewardship program and a designated individual to serve as an infection preventionist (IP) to oversee the program.<sup>19</sup> This was based on research demonstrating that NHs with IPs who had specialized training were 5–13 times more likely to have a stronger IPC program.<sup>20</sup> However, IPs in NHs are more likely to have multiple organizational responsibilities (employee health director, director of nursing, etc.) and dedicate less than half of their working hours to IPC.<sup>21</sup> The implementation of antimicrobial stewardship programs in NHs is further challenged by multiple factors including inadequate access to infectious disease expertise and off-site laboratory delays. Multidisciplinary IPC committees are needed to provide a systems-level perspective on surveillance and treatment in NHs to avoid these pitfalls.<sup>22</sup>

#### *COVID-19 and the workforce*

The coronavirus pandemic has exposed the NH staffing crisis and studies have examined the role of staffing in the management of the COVID-19 response. NHs with higher total CNA hours reported better containment of the virus and decreased mortality among residents<sup>23</sup> and those with higher RN staffing and higher CMS Nursing Home Compare quality ratings had the potential to better control transmission. In fact, in facilities with at least one confirmed case, every 20-minute increase in RN staffing per resident day was associated with 26% fewer COVID-19 cases.<sup>24</sup>

In a survey of 56 U.S. NHs, 83% of respondents expected significant staff shortages due to staff fears of contracting the illness and the high number of COVID-19 cases amongst nursing staff. Additionally, NHs with higher ratings on nurse staffing were likely to have fewer COVID-19 cases, further suggesting that poorly staffed NHs may be at increased risk of spreading the infection.<sup>25</sup> Strategies for combating these shortages included: asking staff to volunteer for extended hours (55%); having non-clinical staffing fill different roles (45%); relying on agency staff (19%); and mandating extended hours (16%).<sup>26</sup>

#### *Resource availability*

Even before COVID-19, the most frequent theme to emerge from qualitative interviews was “poor infection precautions related to poor hand washing [and] lack of soap or alcohol-based hand cleansing solution at site”.<sup>27</sup> A 2019 examination of nurse hand hygiene in NHs found that while alcohol-based hand rubs were “generally available”, 15% of nurses were unable to clean their hands during active care as hand rubs were unavailable in the residents’ rooms.<sup>28</sup>

The COVID-19 pandemic exposed the critical need for PPE and other resources. Adequate access to antimicrobial soaps and an increase in the number of sinks per 100 residents have been shown to reduce the spread of a variety of infections in NHs.<sup>29</sup> The availability of private rooms for proper isolation and/or cohorting has also been recognized as critical.<sup>30</sup> In a recent survey of NHs, respondents ( $n = 56$ ) reported inadequate supplies of the following: “N-95 respirators (90%), gowns (90%), face shields/eye protection (88%), alcohol-based sanitizer (67%), surgical masks (64%), and gloves (39%)”. Forty-three percent reported “lack of supplies” as their greatest concern.<sup>25</sup> A separate analysis of the CMS COVID-19 Nursing Home Data database found 20.7% and 19.1% of respondents reporting shortages in PPE, respectively.<sup>31</sup> These data suggest that most NHs were vastly unprepared for the onset of an emergent pandemic. While some NHs recovered, 20% were still under-resourced three months into the pandemic. For-profit NHs had substantially greater shortages.<sup>31</sup> In addition, NHs with healthcare worker union representation had a 30% relative decrease in COVID-19 mortality compared to NHs without union representation.<sup>32</sup>

## Training and knowledge of infection control practices

### Knowledge gaps

A number of studies have documented the inadequate understanding of IPC processes and protocols. In interviews with direct care workers, Cohen et al. identified “lack of understanding” as one of four primary themes that impacted IPC decisions made by NH staff.<sup>30</sup> Misunderstandings of key infection control concepts such as cohorting, isolation, bacterial colonization versus clinical infection, and proper PPE use have been documented among NH staff.<sup>31</sup> In one qualitative study, staff reported “knowledge/training” as a barrier to IPC for CNAs. Lower educational requirements and lack of a uniform educational approach for CNAs were specifically identified as impediments.<sup>15</sup>

In addition, Travers, et al. noted that language and culture play an important role in training efforts since a large proportion of NH staff members may be non-native speakers who are unable to fully comprehend resources printed in English. To add to the confusion, IPC terminology used within different training tools and by various agencies is often inconsistent or even contradictory.<sup>33</sup>

A national knowledge assessment of licensed nurses (439 RNs, 378 LPNs) and 624 CNAs found limited knowledge of the basics of hand hygiene best practices. Only about one-fourth of unlicensed personnel correctly identified the recommended time duration for hand sanitizing and 10.6% knew which cleansing agent was most effective at killing germs on hands. Knowledge was also limited amongst unlicensed personnel as to whether blood glucose meters should be shared between multiple residents (55.5% answered incorrectly) and the application of standard precautions (83.5% incorrect responses). These low numbers of correct answers were recorded despite the fact that all participating NHs reported providing hand hygiene-specific training programs.<sup>34</sup>

### Approaches to IPC education

Multiple factors have been found to influence the effectiveness of IPC training. Of particular concern is that CNAs often have minimal education in this field and require additional in-service training. The timing and frequency of staff training have an impact on quality measures,<sup>35</sup> and infrequent, irregular, and non-standardized training has been identified as a risk factor for infection.<sup>22</sup> In a national study, NHs that used both a technical and socio-adaptive education bundle had a 54% reduction in catheter-associated UTIs, with 75% of facilities showing an improvement of  $\geq 40\%$ .<sup>36</sup> The technical bundle included clinical skills training on catheter care and maintenance, aseptic insertion, antimicrobial stewardship, and also addressed the role and importance of leadership, effective communication and team building. The educational sessions were interactive, regularly scheduled, and included resources such as infographics, simplified train-the-trainer materials, and pocket cards. All of this demonstrated the value of a multidimensional and multidisciplinary training approach that includes sustained repetition and reminders.

Innovative ideas for training have also been explored. Employing nursing students as observers in NH units has demonstrated a wide array of benefits. Their reflections on real-world scenarios have increased their awareness of their own and others' hand hygiene habits and other IPC competencies.<sup>27,37,38</sup> Students reported insights into the value of moving from theoretical concepts to real-life situations as well as observing which clinical scenarios present critical IPC challenges. They also reported that employees became more conscious of their hand hygiene and their IPC actions in the presence of an observer.<sup>38</sup> However, a number of studies have confirmed that direct observation is not an accurate indicator of hand hygiene since individuals modify their behavior in response to the presence of an observer.<sup>39</sup> Such studies suggest that building more immersive clinical learning opportunities into nursing curricula may aid in developing IPC practices and habits.

## Organizational culture

Organizational culture, the accumulation of invisible and often unspoken ideas, values, and approaches that permeate organizational life,<sup>40</sup> also plays an important role in the success of IPC programming. A growing body of research has confirmed that educational reinforcement measures alone do not necessarily result in sustained behavioral change nor do they lead to improved antimicrobial stewardship. A greater focus on teamwork and shared responsibilities rather than a “blame-and-shame” management style are key to cultural reframing. A systems-approach to IPC measures which highlights the importance of role modeling and interdisciplinary collaboration is essential rather than placing responsibility solely on individual clinicians. Executive, mid-level, and local leadership are vital to this process.<sup>41</sup>

A study in six German NHs randomly selected from a pool of 542 reported that isolated interventions to improve hand hygiene in NHs had little effect if not supported by a shared attitude by nurses and nursing managers that hygiene management is a safety priority.<sup>28</sup> These findings are consistent with the role of explicit facility-wide adoption of the importance of IPC practices; the authors of that study concluded that shifting staff members' concept of NHs from solely a home-like environment to one in which infection risk is high will aid in establishing better hygiene practices.

The need for shared accountability and teamwork has been endorsed across disciplines. In a survey of 116 hospital workers in the U.S., Raveis et al. found that the breaking down of departmental silos and the development of an ethos of shared accountability are critical steps to establishing effective teamwork to implement IPC protocols. Respondents viewed IPC adherence as a form of advocacy for their patients and noted the importance of empowering staff by communicating that their behaviors have a direct impact on patient outcomes. Because staff members perceived their role as patient advocates, they expressed more comfort with correcting lapses in a colleague's IPC practices. However, institutional and social power differentials within the care environment were reported as barriers to shared accountability because some staff may feel uncomfortable correcting or redirecting a colleague with higher authority. High-level endorsement from facility administration was seen as a foundational element for the success of IPC policy implementation.<sup>40</sup>

The work environment is significantly related to quality outcomes, nurse burnout, and job satisfaction. Reduction in nurse burnout has been associated with fewer infections in hospitals.<sup>42</sup> Although research in long-term care is limited, nurses working in NH settings have higher rates of job dissatisfaction and burnout.<sup>43</sup> The ability of nurses to fulfill their multiple responsibilities relies heavily on a healthy and supportive work environment, one in which nurses have “adequate staff and resources, supportive managers, strong nursing foundations underlying care, productive relationships with colleagues, input into organizational affairs, and opportunities for advancement”.<sup>11</sup> In a survey of 687 nurses working in NHs, 95% of those experiencing burnout and 83% of those with job dissatisfaction reported at least one missed care event (e.g., poor patient surveillance of early symptoms of an infection, failure to document changes in patient status, or neglecting wound care) during their most recent shift compared to 72% among those not experiencing burnout.<sup>44</sup> Not to be overlooked, turnover rates among NH administration and top-management have also been linked to issues with quality of care.<sup>45</sup>

### Just culture, leadership, & role modeling

All of this suggests the need for a model of health care culture described in the landmark Institute of Medicine report “To Err is Human: Building a Safer Health System”.<sup>46</sup> A just culture eliminates long-existing punitive structures, replacing them with systems-based solutions. Addressing medical errors relies upon accurate reporting, but staff who fear penalty or reprisals for reporting their own or a

colleague's error are reluctant to share this information.<sup>47</sup> Just culture emphasizes shared accountability between leadership and staff and organizational learning from mistakes. Learning collaboratives with these characteristics have fewer communication gaps and misunderstandings between direct care workers and leaders which could enhance the development of patient-centered priorities.<sup>48</sup>

The first of the CDC's seven core elements of antimicrobial stewardship is leadership commitment.<sup>49</sup> Beyond their supervisory role, leaders are responsible for modeling IPC best practices. In a survey of 165 nurses and 27 nurse managers, nurse managers underestimated the extent to which they were viewed as role models while nurses reported looking to their nurse managers as models for antimicrobial stewardship and hand hygiene.<sup>28</sup> Simply asking leaders about their own perceptions of their role modeling prompted self-reflection and the recognition of their own gaps in hand hygiene practices. This suggests that IPC efforts would benefit from better awareness among nurse managers of the impact of their actions and that clearer, more transparent communication between staff and leaders is needed.

## Conclusions and recommendations

The impact of the COVID-19 pandemic on NH residents has highlighted the longstanding systemic deficiencies in and need for effective IPC practices in NHs. New, and sometimes confusing and

contradictory, information has been forthcoming at an unprecedented rate, challenging administrators and frontline staff in NHs to keep apace. Long-term care settings are now struggling to retain and retrain current staff, fill staff shortages with new recruits, and improve the safety and quality of resident care while simultaneously dealing with negative press and public scrutiny. Unfortunately, these problems may be so overwhelming that inertia or a sense of hopelessness takes hold and no sustainable changes are accomplished.

There are several limitations to this scan. First, we used a non-standard, informal framework to allow for necessary flexibility in a rapidly changing situation, but this will limit the replicability of the authors' findings since the dynamic landscape associated with the pandemic will continue to evolve quickly over time. We did not conduct a formal literature review as this was not the intention of the project. Further, we did not specifically examine differences that might be present in rural as compared with urban settings despite the fact that staffing shortages and skill mix issues and COVID cases/deaths may differ by rural and urban location.<sup>50</sup> We focused primarily on frontline nursing staff rather than other personnel or administration because of their routine and prolonged proximity to residents during the provision of care as compared to other NH staff. Finally, this scan was conducted prior to the availability of COVID vaccine. Hence, other factors that might have an impact on infection transmission such as low vaccination rates among staff were not included.

**Table 2**

Implications for practice, policy, research, and a summary of key findings from environmental scan.

THEME	PRACTICE	POLICY	RESEARCH	SUMMARY OF FINDINGS
<b>STAFFING &amp; RESOURCE AVAILABILITY</b>	<ul style="list-style-type: none"> <li>• Ensure adequate staffing, especially total RN hours</li> <li>• Provide fair compensation to direct care staff</li> <li>• Build reserve of PPE and related materials</li> <li>• Explore options for making hand hygiene materials readily available in resident rooms during direct care provision</li> </ul>	<ul style="list-style-type: none"> <li>• Provide flexible scheduling to accommodate staff preferences and prevent staff burnout</li> <li>• Involve staff in decision-making on staffing and PPE and related materials to promote engagement</li> </ul>	<ul style="list-style-type: none"> <li>• Examine impact of various nursing home staffing models on HAIs and burnout/staff turnover</li> </ul>	<ul style="list-style-type: none"> <li>• Adequate nurse staffing associated with fewer HAIs</li> <li>• Nurse tenure in facility linked to improved surveillance</li> <li>• Most NHs experienced significant staff shortages during COVID-19</li> <li>• Increased RN staffing linked to decreases in COVID-19 cases</li> <li>• Poor IPC practice during "active care" linked to absence of hand hygiene materials in residents' rooms</li> <li>• High proportion of NHs reported significant PPE &amp; supply shortages during COVID-19</li> </ul>
<b>TRAINING &amp; KNOWLEDGE</b>	<ul style="list-style-type: none"> <li>• Identify champions within organization to promote &amp; role model proper IPC</li> <li>• Ensure training for direct care workers incorporates both technical and soft skills</li> <li>• Maintain continuous and interactive training initiatives to inform new hires and reinforce skills for tenured staff</li> <li>• Partner with schools of nursing for observational learning opportunities</li> </ul>	<ul style="list-style-type: none"> <li>• Incorporate staff successes/challenges into educational plans that are personalized to the unique needs of the facility</li> <li>• Enhance initiatives that support continuing education for staff</li> </ul>	<ul style="list-style-type: none"> <li>• Assess role of resident hand hygiene as well as staff hand hygiene on HAI transmission in NHs</li> <li>• Assess the impact of the role of the champions and leadership (DON, staff, RN, Medical Director, etc.) on standard precaution adherence</li> </ul>	<ul style="list-style-type: none"> <li>• Gaps in staff knowledge of appropriate hand hygiene remains a pervasive problem across disciplines</li> <li>• Education initiatives that bundle technical &amp; socio-adaptive skills have proven effective</li> <li>• Early student-nurse exposure to clinical scenarios may foster improved mindfulness of proper hand hygiene</li> <li>• Tailored &amp; continuous training models are most effective</li> </ul>
<b>ORGANIZATIONAL CULTURE</b>	<ul style="list-style-type: none"> <li>• Implement interdisciplinary meetings for IPC &amp; antibiotic stewardship to encourage teamwork &amp; info exchange</li> <li>• Eliminate punitive structures for medical error to promote accurate surveillance and teamwork</li> <li>• Solicit feedback &amp; input from nursing staff to generate collaborative solutions</li> </ul>	<ul style="list-style-type: none"> <li>• Implement and enhance formal mentorship structures between experienced and newly hired staff</li> <li>• Implement and regulate mandatory surveillance and reporting of HAI rates by staff with appropriate expertise</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the impact of a 'just culture' on staff adherence and commitment to infection prevention and control policies and practices, staff turnover and burnout, and resident outcomes related to HAI rates.</li> <li>• Test strategies for improving effectiveness of interdisciplinary teamwork and collaboration regarding HAI prevention.</li> <li>• Examine the correlation between HAI reporting and providing feedback to staff on HAI rates</li> </ul>	<ul style="list-style-type: none"> <li>• Teamwork and shared responsibility as opposed to a punitive approach to IPC allows for more accurate data collection</li> <li>• Interdisciplinary collaboration is key - engage all staff in shared IP values.</li> <li>• Improved work environments help reduce infection-related medical errors</li> <li>• Nursing leadership/role modeling during direct care linked to improved care</li> </ul>

Nonetheless, this environmental scan adds new information to the literature by synthesizing information about current processes and programmatic elements of IPC efforts and identifying three thematic areas with the potential to improve overall IPC practices and reduce disease transmission in the long-term care setting: staffing and resource availability, training and knowledge of IPC practices, and organizational culture. Further work is clearly essential to examine changes in IPC practices associated with the pandemic and, more importantly, their sustainability over time.

One of the first essential elements of the quality improvement (QI) process is to clearly identify and characterize a problem that needs to be addressed. Attempts to resolve longstanding systems-wide or individual problems with short-term, simplistic solutions are doomed for failure. Once a problem is clearly articulated, QI techniques such as root cause analysis, fishbone diagrams, Pareto charts, and cause and effect analyses can be used to make action plans, establish timelines, and assign responsibilities for action to specific individuals or groups. Engaging NH staff and administration in systematically tackling one small problem at a time reduces the sense of hopelessness, makes successes possible, and builds a culture of trust, respect, and motivation to improve. The three thematic areas identified from our scan can serve as a guide and template to begin or enhance such a problem-solving QI process. Further, the findings suggest several avenues for best practice, policy, and research in these three thematic areas, which are summarized in Table 2.

Regarding practice: adequate staffing and fair compensation are critical in the prevention of HAI, as is a sufficient reserve of PPE. Flexible scheduling and the inclusion of nurse voices in decision-making helps reduce burnout. Identifying and supporting champions within organizations as standard-bearers of IPC and reinforcers of appropriate training promotes adherence to standard precautions. Continuous, interactive training informs new hires and reinforces skills for tenured staff. Continuing education in the form of formal courses can provide much-needed training or retraining. Soliciting information and input from nursing staff encourages more collaborative and successful solutions.

Policy implications include eliminating punitive structures in staff operations in order to improve communication, promote accurate HAI surveillance, and advance just culture. Facility-level policy implications include the implementation of national guidelines and mandatory reporting of infections. Further research is needed to better understand staff retention and management of staff shortages. Additionally, the application of behavioral sciences to enhance practice improvement is a major priority. If improved IPC practices and reduced cross-transmission of infections in NHs are to be sustained, immediate and long-term changes in these areas are essential, starting with shorter term successes which fully engage staff, build trust and enhance a just organizational culture and supportive work environment.

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