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Original Study

Remote Infection Control Assessments of US Nursing Homes During the COVID-19 Pandemic, April to June 2020

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ABSTRACT

Background: Nursing homes (NHs) provide care in a congregate setting for residents at high risk of severe outcomes from SARS-CoV-2 infection. In spring 2020, NHs were implementing new guidance to minimize SARS-CoV-2 spread among residents and staff.
Objective: To assess whether telephone and video-based infection control assessment and response (TeleICAR) strategies could efficiently assess NH preparedness and help resolve gaps.
Design: We incorporated Centers for Disease Control and Prevention COVID-19 guidance for NH into an assessment tool covering 6 domains: visitor restrictions; health care personnel COVID-19 training; resident education, monitoring, screening, and cohorting; personal protective equipment supply; core infection prevention and control (IPC); and communication to public health. We performed TeleICAR consultations on behalf of health departments. Adherence to each element was documented and recommendations provided to the facility.
Setting and Participants: Health department—referred NHs that agreed to TeleICAR consultation.
Methods: We assessed overall numbers and proportions of NH that had not implemented each infection control element (gap) and proportion of NH that reported making ≥1 change in practice following the assessment.
Results: During April 13 to June 12, 2020, we completed TeleICAR consultations in 629 NHs across 19 states. Overall, 524 (83%) had ≥1 implementation gap identified; the median number of gaps was 2 (interquartile range: 1-4). The domains with the greatest number of facilities with gaps were core IPC practices (428/625; 68%) and COVID-19 education, monitoring, screening, and cohorting of residents (291/620; 47%).
Conclusions and Implications: TeleICAR was an alternative to onsite infection control assessments that enabled public health to efficiently reach NHs across the United States early in the COVID-19 pandemic. Assessments identified widespread gaps in core IPC practices that put residents and staff at risk of infection. TeleICAR is an important strategy that leverages infection control expertise and can be useful in future efforts to improve NH IPC.
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Early in the emergence of SARS-CoV-2, the virus that causes COVID-19, nursing homes (NHs) were identified as settings at high risk for transmission. NHs are licensed residential health care facilities that care for persons with chronic illness or disability; most provide skilled nursing care. NH residents are primarily older adults with chronic medical conditions and therefore are at high risk for severe outcomes of SARS-CoV-2 infection.[1–4] NHs historically have had less infection control infrastructure relative to acute care hospitals. Since the first report of COVID-19 in a US NH resident on February 28, 2020, in Seattle, Washington,[2] NHs have reported more than 655,000 cases of COVID-19 among residents and more than 132,000 resident COVID-19 deaths.[5]

Preventing the introduction and spread of SARS-CoV-2 in NHs has been a national public health priority since the beginning of the US COVID-19 response. In March 2020, the US Centers for Disease Control and Prevention (CDC) released key strategies for NHs to prevent introduction and spread of SARS-CoV-2[6] and developed a standardized infection control assessment and response (ICAR) tool to assist health departments and NHs in assessing NH implementation of COVID-19 preparedness and core infection prevention and control (IPC) practices.[7] To reach many facilities rapidly, we developed strategies to perform assessments by telephone and video conferencing (referred to as TeleICAR) and provide immediate feedback. Here, we present findings from these remote assessments, including describing common gaps in COVID-19 preparedness in NHs and illustrating the potential utility and limitations of remote assessments for understanding and improving IPC.

Methods

ICAR Tools

Since 2015, the CDC Infection Control Assessment and Response (ICAR) Program has provided a suite of tools to support health departments in nonregulatory assessments of IPC practices and policies across an array of health care facility types (https://www.cdc.gov/hai/prevent/infection-control-assessment-tools.html). Typically, ICAR consultations are conducted as an approximately half-day site visit by health department representatives. During the spring 2020 peak of the COVID-19 pandemic, the high volume of facilities in need of outreach and limited numbers of health department staff with infection control expertise necessitated an approach using shorter visits without the need to travel onsite.

We developed the TeleICAR tool for NH COVID-19 preparedness by updating the existing ICAR tool for long-term care facilities to reflect CDC COVID-19 guidance and facilitate remote administration, including adding open-ended questions and prompts to elicit more detailed descriptions of facility practices. The TeleICAR tool included assessment of 58 infection control elements over 6 infection control domains. A supplementary video assessment component using the camera on a mobile phone was based on the COVIDeo strategy deployed by the New York Department of Health in March 2020[8] and supported guided tours of common areas of the facility, beginning at the entrance and progressing to the screening station, residential hallways, dining room, and group activity areas.

Facility Selection, Outreach, and TeleICAR Consultation

We offered to perform NH TeleICARs on behalf of health department Healthcare Associated Infections (HAI) Programs.[9] HAI Programs provided us with contact information for facilities that had not reported having residents or staff with SARS-CoV-2 infection, to use this as a prevention, preparedness, and education opportunity and enable health departments to focus their limited onsite consultation capacities on facilities experiencing COVID-19 outbreaks. NHs that were successfully contacted and agreed to consultation could choose to participate by telephone only or by telephone and video. We prioritized the individual responsible for facility infection prevention for participation in the TeleICAR. Generally, this was the facility administrator, director of nursing, infection preventionist, or other administrative staff; multiple facility staff were able to participate if desired.

TeleICARs were facilitated by trained staff; if an element was partially or fully implemented, it was considered compliant. For elements partially implemented or not implemented, facilitators were encouraged to record comments. Visual observations and comparison to telephone findings were documented on a supplementary form. To protect privacy, occupied resident rooms were not entered during the video tour. At the conclusion of the TeleICAR, verbal recommendations were provided, and written recommendations were provided to the NH and health department within approximately 1 week of the TeleICAR. Critical IPC gaps, such as personal protective equipment (PPE) shortages or outages, staffing shortages, and COVID-19 outbreaks ($\geq$1 confirmed resident or staff case) were reported to the health department on the same day.

Facility Evaluation of Infection Control Assessment

At the conclusion of the TeleICAR consultation, we asked permission to contact facility representatives for a brief follow-up. During April 20 to May 29, 2020, we randomly selected 50% of facilities that agreed to be contacted. TeleICAR staff not involved in the initial consultation attempted to call each facility up to 3 times, with 1 follow-up email. Facilities were asked to complete a telephone evaluation to assess whether the facility made changes in IPC policies or practices and whether the TeleICAR consultation changed understanding of specific COVID-19 prevention practices.

Data Entry and Analysis

Data from completed TeleICARs and evaluation calls were collected and managed using REDCap (Nashville, TN) electronic data capture tools. TeleICAR data included both dichotomous responses (element implemented or not implemented) and facilitator comments; prior to analysis, dichotomous responses were compared with comments to assess data quality and identify potential discrepancies. When responses and comments appeared discordant, ICAR facilitators were contacted for additional information and review of paper notes; a dichotomous response value was determined by consensus of 3 reviewers.

A TeleICAR was classified as completed and included in the analysis if $\geq$ 75% of ICAR elements had responses recorded. Facilities were matched based on name and address to Centers for Medicare & Medicaid Services (CMS) administrative data sets to obtain additional facility demographics, overall quality ratings, and infection control survey and citation histories. Domain-level analyses included facilities for which 75% of elements in the domain had responses recorded. Comments entered by ICAR facilitators were qualitatively coded using an immersion and crystallization technique, and themes were summarized.[10]

Among the subset of facilities that had a TeleICAR consultation with video, telephone and video findings were compared for 11 selected elements across 6 domains that were assessed using both formats. Among facilities that reported partial or complete implementation of an infection control element during the TeleICAR consultation, we assessed whether video observations were concordant (video observations showed adherence to an element reported as implemented during the telephone-based assessment) or discordant (video observations showed at least 1 instance of nonadherence to an element reported as implemented during the telephone-based

assessment). Differences in median number of gaps by facility characteristic were assessed by nonparametric test (Mann-Whitney U test for comparing 2 groups and Kruskal-Wallis test for comparing more than 2 groups). Analyses were conducted in SAS (version 9.4; SAS Institute) and R Studio (version 1.2.1335).

Ethics Statement

This activity was reviewed by institutional human subjects research experts and was conducted consistent with applicable federal law and institutional policy (See, eg, 45 CFR part 46, 21 CFR part 56; 42 USC §241(d); 5 USC §552a; 44 USC §3501 et seq.).

Results

During April 13 to June 12, 2020, we completed TeleICAR consultations in 629 NHs from 19 states: Alabama (69), Arizona (9), California (9), Colorado (30), Connecticut (45), Georgia (20), Illinois (15), Kansas (76), Kentucky (31), Maryland (43), Minnesota (40), North Carolina (22), North Dakota (42), Nebraska (37), South Carolina (40), Tennessee (15), Virginia (36), West Virginia (23), and Wyoming (27). We attempted to contact an additional 181 NHs, of which 131 did not respond and 50 refused participation. Among facilities that completed TeleICAR, 253 (40%) reported sustained transmission in the surrounding community. Overall, 123 (20%) reported having confirmed COVID-19 in residents or staff in their facility at the time of the consultation.

The 629 NHs had a median licensed bed size of 91 [interquartile range (IQR): 60-120] and median occupancy of 82.5% of licensed beds (IQR: 72.9%-89.2%) (Table 1). The most common specialty units were rehabilitation (157; 25%) and memory care (152; 24%). The majority (618; 98%) of facilities were certified by CMS. Among the 613 that had an overall CMS quality rating in CMS Compare, a greater proportion had a rating of 1 star (the lowest rating on the 5-star scale) compared to facilities nationally [153/613 (25%) vs 2835/14,616 (19%), $P = .01$]; the proportion of NHs with TeleICARs and higher quality ratings did not significantly vary from NHs nationally.

A gap in implementation of at least 1 element was identified for 524 (83%) NHs, and the median number of gaps identified was 2 (IQR: 1, 4) (Supplementary Table 1). The proportion of facilities with gaps and the number of gaps per facility did not vary by whether the facility reported cases of COVID-19 at the time of the TeleICAR or had a recent CMS Infection Control citation, but did vary by CMS Overall Quality rating and was higher at the small number of government-owned (eg, state, county, local government or hospital district-owned or part of Veteran's Health Administration) facilities [median 4 (IQR 2, 6)] that participated than at facilities that were privately owned [median 2 (IQR 1, 5); $P = .01$]. Table 2 shows the number of facilities with gaps by domain and the elements where at least 5% of NHs had gaps identified; gaps for all domains and elements are shown in Supplementary Table 2. The domain with the greatest number of facilities with gaps in 1 or more elements was the core IPC practices domain (428/625; 68%). The most frequently identified gap within this domain and overall was failure to recommend alcohol-based hand sanitizer (ABHS) over soap and water for hand hygiene in most clinical situations; this was identified at 242 (39%) of 620 facilities. Gaps in environmental cleaning policies and practices, including respondent's lack of knowledge of disinfectant contact times (24%), not performing regular audits of environmental cleaning (19%), and inaccessibility of disinfectants (12%) were also common. At least 1 lapse in resident education, monitoring, screening, and cohorting was identified in 291 (47%) facilities; most frequent gaps were not having residents wear a cloth face covering or face mask when leaving their rooms (14%) and not bundling care and treatment activities (14%). Among domains assessed, gaps were

Table 1

Characteristics of Nursing Homes That Participated in Remote Infection Control Consultations, April to June 2020, N = 629

Nursing Home Characteristic	Median (IQR) or n/n (%)
Bed size, n = 628	91 (60, 120)
Resident census at time of consultation, n = 628	71 (45, 97)
No. of staff (n = 608)	101 (70, 148)
Percentage occupancy (census/licensed beds × 100)	82.5 (73, 89)
Care provided	
Long-term care only	580/629 (92)
Long-term care and assisted living	49/629 (8)
Specialty units	
Rehabilitation unit	157/629 (25)
Memory care unit	152/629 (24)
Psychiatric unit	22/629 (4)
Ventilator unit	19/629 (3)
Dialysis unit	11/629 (2)
Certification	
Centers for Medicare & Medicaid Services Certified	618/629 (98)
Medicare	18/618 (3)
Medicaid	22/618 (4)
Medicaid and Medicare	578/618 (94)
CMS Overall Quality Rating (n = 613*)	
1 star	153/613 (25)
2 star	144/613 (23)
3 star	129/613 (21)
4 star	135/613 (22)
5 star	52/613 (8)
CMS Infection Prevention, Control & Immunizations Survey, Conducted April 2019−March 2020	552/618 (89)
CMS Infection Control Citation: Provide and implement an infection prevention and control program.	225/552 (41)
Ownership	
For profit	400/627 (64)
Corporate for Profit	304/400 (76)
Other for Profit	96/400 (24)
Not for profit	170/627 (27)
Corporate Not for Profit	137/170 (81)
Other Not for Profit	33/170 (19)
Government	57/627 (9)
Local COVID-19 epidemiology at time of consultation	
No cases reported in the surrounding community	78/629 (12)
Cases reported in the surrounding community	413/629 (66)
Sustained transmission in the surrounding community	253/629 (40)
Cases identified in facility among HCP or residents	123/629 (20)

*Five CMS-certified facilities did not have star rating in CMS compare.

least frequently identified in visitor and nonessential personnel restrictions (30/627; 5%).

Additional themes identified during qualitative review of comments in the TeleICAR assessments are summarized in Table 3. Most facilities reported exceeding the minimum recommended frequency for at least some sign and symptom screening activities for non-ill residents (eg, every shift rather than daily) and many tracked oxygen saturation during routine monitoring. Facilities reported challenges in applying recommendations to residents with dementia or communication difficulties (eg, nonverbal); these residents were difficult to assess for symptoms and often had trouble using a cloth face covering or face mask for source control.

Among the 130 video assessments conducted as part of the TeleICAR, we compared reported and observed findings for 123 consultations in which the video assessment was performed after the telephone assessment; 7 performed concurrently were excluded. Figure 1 summarizes these results; the highest discordance was observed for resident masking and ABHS accessibility.

Among 244 facilities randomly identified for follow-up to evaluate the ICAR consultation process, 154 (63%) were reached for interview.

Table 2
Selected Gaps in Nursing Home Implementation of CDC-Recommended Infection Control Practices to Prepare for COVID-19, Among Nursing Homes Participating in Remote Infection Control Consultations, N = 629

Infection Control Element Assessed	Nursing Homes with Element Not Implemented, n/n* (%)
Any element (58 questions)	524/629 (83)
Domain 1: Visitor and Nonessential personnel restrictions	30/627 (5)
Domain 2: Health care personnel COVID-19 training and symptom monitoring	103/588 (18)
Facility has provided staff with education to use face mask or respirator	38/581 (7)
Health care personnel trained on COVID-19, sick leave, and source control[†]	39/629 (6)
Facility is aware of staffing needs and has plan in the event of staffing shortages	28/619 (5)
Domain 3: Education, monitoring, screening and cohorting of residents	291/620 (47)
If residents leave their rooms, they wear a cloth face covering or face mask	79/560 (14)
Facility bundles resident care and treatment activities to minimize room entry	80/587 (14)
Facility provided resident education on COVID-19 prevention[‡]	66/629 (10)
Facility has dedicated primary HCP staff who work only in COVID area	54/574 (9)
Facility has stopped communal dining	45/622 (7)
The facility monitors ill residents at least 3 times daily	38/598 (6)
Facility has dedicated a space in the facility to care for residents with COVID-19	37/578 (6)
Facility has stopped group activities inside the facility and field trips	36/625 (6)
Domain 4: Personal protective equipment supply	101/613 (16)
PPE is available in resident care areas	48/613 (8)
Facility has implemented measures to optimize current PPE supply	34/610 (6)
Domain 5: Core infection prevention and control practices	428/625 (68)
Facility has preference for alcohol-based hand sanitizer over soap and water	242/620 (39)
Facility is aware of the contact time for the EPA-registered disinfectant	150/613 (24)
Cleaning and disinfection of environmental surfaces is audited	119/627 (19)
EPA-registered disinfectants available for frequent cleaning of high-touch resident areas	72/597 (12)
Hand hygiene and PPE compliance are audited	72/616 (12)
Facility uses recommended personal protective equipment[§] for care of residents with suspected or confirmed COVID-19	51/629 (8)
Hand hygiene supplies are available in all resident care areas	48/625 (8)
HCP perform hand hygiene at 5 recommended moments[‖] when performing patient care	45/629 (7)
Selection and use of PPE are audited	43/627 (7)
EPA-registered disinfectants are prepared and used in accordance with label instructions	32/601 (5)
Domain 6: Communication about suspected or confirmed COVID-19 cases	68/620 (11)
Facility notifies health department about suspected or confirmed COVID-19, including clusters of new-onset respiratory symptoms in resident or health care personnel**	62/561 (11)

EPA, Environmental Protection Agency.

Domain-level analysis (boldface) was limited to nursing homes for which ≥75% of elements in the domain were assessed. Elements shown are those that at least 5% of nursing homes reported not implementing. Proportion of nursing homes with gaps for all elements assessed under each domain shown in Supplementary Table 2.

*Denominator varies by small numbers because of missing responses for individual elements.

[†]Includes the following elements: COVID-19 (1/629; 0.2%), sick leave policies and importance of not reporting to work when ill (27/629; 4.3), and new policies for source control while in facility (19/569; 3.3).

[‡]Includes the following elements: COVID-19 and actions residents and the facility can take (11/629; 1.7%), importance of immediately informing HCP if they feel feverish or ill (54/629; 8.6), actions residents can take to protect themselves (18/629; 2.9), and actions the facility is taking to keep residents safe (9/629; 1.4).

[§]Gown, gloves, eye protection, and N95 or higher-level respirator (or face mask, if N95 respirator unavailable).

[‖]Before and after contact with the resident, after contact with blood, body fluids, or contaminated surfaces or equipment, before performing an aseptic task, and after removing PPE.

**Includes the following elements: suspected or confirmed COVID-19 in resident or health care personnel (6/622; 1.0%), resident with severe respiratory infection resulting in hospitalization or death (46/562; 8.2%), cluster of new-onset respiratory symptoms in residents or health care personnel (51/622; 8.2).

Interviews occurred a median 8 days (range: 5-17) after the TeleICAR consultation. Among these, 107 (69%) reported having made any changes in IPC practices and policies since the consultation, of which the most common were changes in PPE use (n = 51; 48%) and hand hygiene practices (n = 38; 36%) (Table 4). Twenty-six (17%) facilities reported wanting to make changes to policies and practices after the TeleICAR consultation but had been unable to implement the changes prior to the follow-up call.

Discussion

NHs are congregate health care settings that require comprehensive IPC programs to reduce transmission of SARS-CoV-2 and other pathogens. During the height of the initial COVID-19 response in Spring 2020, NH residents and staff were disproportionately impacted, with residents suffering from restrictions on visitation and communal activities, staff experiencing physical and emotional exhaustion,[12,13] and facilities facing severe staffing and PPE shortages.[14] In response to the need for rapid, individualized consultations to help NHs implement new CDC COVID-19 IPC guidance and prepare for potential SARS-CoV-2 outbreaks, we adapted the ICAR strategy to enable remote assessment, promoted TeleICAR use by health department partners, and offered CDC staff to perform assessments on behalf of health departments. From April to June 2020, CDC conducted TeleICAR consultations at 629 NH facilities across 19 states.

The TeleICAR strategy proved useful for identifying critical areas where NHs could improve COVID-19 prevention and preparedness. Overall, 69% of the facilities we assessed had not implemented 1 or more core infection control practices and nearly half (47%) had not implemented all measures for education, monitoring, screening, and cohorting of residents. Consistent with findings from video-based infection control assessments conducted in New York,[8] consultations that included video were superior to those that were phone-based for differentiating facility policy from practice. The use of video also enabled more tailored, concrete, and observation-based recommendations. This aligned well with the overall ICAR imperative of providing real-time education and coaching to address identified gaps, which differentiates ICAR from regulatory inspection activities.

Our follow-up evaluation found that 69% of facilities verbally reported 1 or more improvements in the week following their

Table 3
Themes Among Nursing Homes Preparing for COVID-19 and Participating in Remote Infection Control Consultations, Among Infection Control Domains where ≥15% of Facilities Had 1 or More Gaps

Infection Control Domain	Themes
Health care Personnel COVID-19 Training and Symptom Monitoring	• Often unable to provide medical clearance and fit testing for N95 respirators • Provided pay incentives to retain and reward staff while others supplemented health care providers through staffing agencies
Education, Monitoring, Screening, and Cohorting of Residents	• Performed at least some symptom-screening activities for non-ill patients more often than minimum recommendation (eg, every shift rather than daily) • Tracked oxygen saturation in addition to routine, recommended assessment for symptoms of COVID-19 • Unaware of or had not yet implemented additional symptoms added to CDC guidance in May 2020 (among facilities that performed screening and were assessed after guidance update) • Had difficulty assessing residents with communication difficulties (eg, dementia, nonverbal) • Reported that residents with dementia had difficulty using a cloth face covering or face mask for source control and staying in their room • Described safety concerns about keeping doors closed for rooms of residents with fall risks • Residents requiring feeding assistance eat in the dining room using social distancing, while other residents have meals in their rooms
Personal protective equipment supply	• Implemented PPE optimization strategies but often did not understand when or how to safely implement these strategies • Described using crisis capacity PPE strategies* in the absence of a shortage • Locked-up PPE or limited accessibility due to concern for or evidence of theft • Sought alternative approaches to usual suppliers to manage shortages, including recruiting volunteers to sew launderable gowns, purchasing supplies from local retailers, and reimbursing staff • Substituted clothing items (eg, rain ponchos) for isolation gowns • Described using excess PPE including shoe and hair covers • Attempted to disinfect used N95 respirators, face masks, and isolation gowns by spraying with disinfectant or exposing to ultraviolet light prior to reuse
Core infection prevention and control practices	• Reported difficulty obtaining ABHS and ABHS dispensers; multiple facilities reported receiving ABHS compounded by local distilleries; facilities would reuse and refill single use ABHS bottles and ABHS dispensers • Staff unaware of contact time for EPA-registered disinfectants or provided inappropriate contact times for products

*Crisis capacity: Strategies that are not commensurate with US standards of care but may need to be considered during periods of known PPE shortages. Crisis capacity strategies should only be implemented after considering and implementing conventional and contingency capacity strategies. Facilities can consider crisis capacity strategies when the supply is not able to meet the facility's current or anticipated utilization rate.[11]

TeleICAR. Overall, we demonstrated that remote assessments can leverage public health resources to quickly reach large numbers of geographically dispersed facilities. Beyond COVID-19, we expect TeleICAR could find applications in locales where travel is challenging and resources limited or when rapid assessment of multiple facilities is needed. For example, TeleICAR could be deployed to help contain the spread of newly emerging antibiotic-resistant organisms or assess IPC practices within a region, to identify facilities most in need of onsite assistance.

TeleICAR assessments provided insights into some of the challenges NHs faced implementing COVID-19 IPC guidance. Distinct difficulties were identified for elements that required resident participation (eg, wearing a cloth face covering outside of room), more specialized infection control knowledge (eg, making ABHS available at levels that support adherence), or operationalization of inherently complex guidance (eg, PPE supply optimization strategies). In contrast, interventions that involved a 1-time effort, such as posting signage about visitor restrictions, or that could be facilitated by
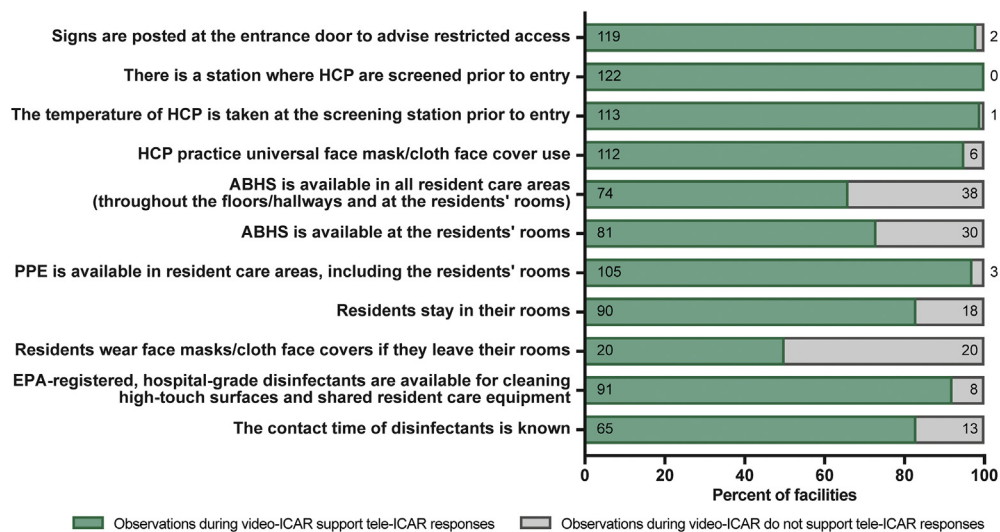
Fig. 1. Comparison of telephone and video findings during remote infection control consultations for nursing homes in 16 states—United States, April—June 2020, n = 123. Affirmative answers to questions posed by telephone were compared to observations during video portions of the assessment. Concordance was calculated as the percentage of facilities where the video confirmed answers given by telephone. Numbers in the bars represent the number of facilities with concordant (green) and nonconcordant (gray) information. EPA, Environmental Protection Agency; Environmental Protection Agency; HCP, health care personnel.

Table 4
Changes in Nursing Home Knowledge and Practices in a Randomly Selected Subset of Facilities Following Remote Infection Control Consultations, n = 154

	n/n (%)
Increased understanding of 1 or more practices for preventing COVID-19 transmission	95/154 (62)
Actions facility could take to prevent the spread of COVID	71/95 (75)
Recommended practices for PPE supplies and use	52/95 (55)
Recommended practices for environmental cleaning and disinfection	46/95 (48)
Recommended practices for hand hygiene	40/95 (42)
Recommended practices for resident source control and social distancing	33/95 (35)
Recommended practices for staff source control and social distancing	29/95 (31)
Recommended practices for cohorting of residents	22/95 (23)
Facility reported change to ≥1 practices and/or policies after consultation	107 (69)
Processes implemented or improved, by domain	
Domain 1: Visitor or nonessential personnel restrictions	1/107 (1)
Process for screening visitors and staff	1/1 (100)
Domain 2: Health care personnel COVID-19 training and symptom monitoring	
Social distancing, source control, screening of staff	26/107 (24)
Screening of HCP at the start of shift	11/26 (42)
Adherence to universal masking of staff	6/26 (23)
HCP social distancing	3/26 (12)
Other	7/26 (27)
Domain 3: Education, monitoring, screening, and cohorting of residents	
Social distancing, source control, screening of residents	32/107 (30)
Admission and daily fever and symptom screening	15/32 (47)
Wearing face masks or cloth face covers and performing hand hygiene when leaving room	9/32 (28)
Screening ill residents at least 3 times daily	1/32 (3)
Encourage residents to stay in rooms	1/32 (3)
Other	11/32 (34)
Planning for care of residents with COVID-19	11/107 (10)
Dedicated space for residents with confirmed COVID-19	4/11 (36)
Created staffing plan for care of residents with confirmed COVID-19	4/11 (36)
Created policy that residents with suspected COVID are immediately placed in appropriate transmission-based precautions	2/11 (18)
Created plan for monitoring residents who develop COVID-19	1/11 (9)
Other	3/11 (27)
Domain 4: Personal protective equipment supply	
Changes in PPE use practices and policies	51/107 (48)
Additional PPE training for staff	15/51 (29)
Instituted PPE optimization strategy	10/51 (20)
Increased audit	8/51 (16)
Reached out to contacts if PPE shortages identified	7/51 (14)
Increased availability and accessibility of PPE	7/51 (14)
Trained staff to clarify use of face mask or cloth face cover for source control vs PPE for resident care	5/51 (10)
Resolved PPE shortage	4/51 (8)
Began to use burn rate calculator	1/51 (2)
Improved bundling of resident care	0 (0)
Other*	12/51 (24)
Domain 5: Core infection prevention and control practices	
Changes in hand hygiene practices and policies	38/107 (36)
Increased audits	13/38 (34)
Clarified preference for ABHS	12/38 (32)
Additional hand hygiene training for staff	9/38 (24)
Increased availability of ABHS	6/38 (16)
Other	2/38 (5)
Changes in environmental cleaning and disinfection	23/107 (21)
Implemented appropriate contact time for disinfectants	6/23 (26)
Additional education and training of environmental services workers	6/23 (26)
Used EPA List N to choose appropriate disinfectants	3/23 (13)
Increased cleaning of nondedicated, nondisposable equipment	2/23 (9)
Other†	13/23 (57)

*N95 fit testing accounted for 5 of 12 (42%) of other changes.
†Increased disinfection and/or auditing of high-touch surfaces accounted for 5 of 13 (38%) of other changes.

administrative controls, such as staff and visitor screening on entry, were implemented at higher levels and NHs reported fewer challenges instituting and maintaining them. In general, the challenges we documented were likely amplified by worsening of chronic staffing shortages during the pandemic and the dearth of trained infection prevention staff in NHs. During the period in which we conducted TeleICAR, approximately 20% of US NHs reported staff shortages, mostly of nurses and nursing aides.[14] Not reflected in these measures of staffing shortages is that those responsible for IPC oversight in NHs often have multiple other responsibilities. During the pandemic, in some NHs a single individual was responsible for synthesizing new guidance, managing infection control programs and employee health,

and navigating supply chain challenges; demands intensified as the same person became responsible for managing outbreaks when COVID-19 cases were identified.

Infection prevention in nursing homes was a growing concern prior to the COVID-19 pandemic. CMS has steadily increased requirements for IPC implementation by NHs and since 2016 has required NH to designate 1 or more individuals responsible for IPC at the facility (eg, full- or part-time infection preventionist) who meet minimum standards for specialized training in IPC.[15] Despite these requirements, infection prevention staffing was unchanged overall between 2014 and 2018,[16] and in 2018, 44% of facilities reported that their designated infection preventionists did not have nursing home—specific IPC

training[17]; these likely contributed to 57% of NH inspections identifying at least 1 IPC deficiency during the years just preceding the pandemic.[18] Ongoing initiatives, such as the CDC and CMS IPC training for infection prevention staff in nursing homes (www.train.org/cdctrain/training_plan/3814) that launched in March 2019, are anticipated to help correct these deficiencies. Expanded TeleICAR capacity for nursing homes may augment these efforts by increasing connectivity with public health agencies,[19] resulting in timelier outbreak support, more frequent infection control consultations, and improved access and uptake to other forms of remote support.

We found that most gaps identified during TeleICAR were in basic infection control practices central to preventing the spread of infections, such as hand hygiene and environmental cleaning, rather than COVID-19—specific practices. Recognized deficits, many of which pre-date the COVID-19 pandemic and were also identified by federal nursing home strike teams,[20] reflect a constellation of factors including staffing challenges with high rates of staff turnover,[21] residential structure (eg, shared rooms), need for communal activities, inadequately developed infection control infrastructure, and a shift toward more medically complex residents.[22,23] Comprehensive reforms may be needed to address these deficits, chief among them support for direct care staff including but not limited to training and PPE for self-protection and reducing resident infection risks.[19]

IPC programs are time and resource intensive, requiring support from NH leadership and corporations; however, gains from infection prevention, including cost savings, are seldom realized by the NH itself. At least 1 study found that lower profit margins were associated with higher odds of infection prevention citations.[24] This may in part be due to the perceived expense of infection control measures, in particular PPE. Additionally, although infection prevention interventions can lead to substantial cost savings, implementation costs are generally borne by NH whereas cost savings are realized by payers (eg, Medicare, private insurers).[25] Additional reimbursement or financial incentives to NHs to bolster IPC programs and provide frontline staff with necessary materials (eg, PPE, catheter-associated urinary tract infection—prevention bundles, hand hygiene supplies) could support implementation of more robust IPC policies and programs in this setting.

Our findings are subject to limitations beyond those described above. For most ICAR elements, both full and partial implementation could be credited as adherent, thus introducing a potential positive bias. Additional positive bias could have arisen from social desirability if respondents gave responses they knew to be correct rather than describe actual practice; the potential for such bias supports the preferential use of video in assessments. Some elements, such as ABHS availability in resident rooms and adherence to social distancing and room restrictions, were challenging to observe even by video, because of privacy concerns and the short nature of the interaction. We conducted remote assessments at a convenience sample of 629 facilities, a fraction of the >15,000 NHs nationally. Health departments additionally conducted several thousand NH ICARs, both in-person and remotely, from March to July 2020, and data from those assessments are not included here and are not available for analysis. Likewise, we conducted follow-up at a sample of facilities; although follow-up was performed by individuals not involved in the original assessment or in nursing home regulatory activities to reduce social desirability bias, responses may have been biased toward reporting changes. We were unable to evaluate the extent of changes or whether they were sustained throughout the pandemic. Facility referrals among jurisdictions that requested TeleICAR assistance reflected a range of factors including local COVID-19 incidence, CMS quality rating, and history of past outbreaks or infection control gaps. Therefore, although our findings highlight common themes, they are not generalizable. Future studies may

consider comparing remote assessments to in-person assessments for both identifying gaps and assessing changes in response to recommendations.

Conclusions and Implications

TeleICAR provided an alternative to on-site infection control assessments that enabled public health to efficiently reach NHs across the United States early in the COVID-19 pandemic. Assessments identified widespread gaps in core infection control practices that put residents and staff at risk of infection. TeleICAR is an important strategy that leverages infection control expertise and can be useful in future efforts to improve NH IPC. Addressing the root causes of poor infection control in NHs has the potential to further protect residents and staff from SARS-CoV-2 and from other infectious diseases that affect the health and well-being of NH populations.

References

1. CDC COVID-19 Response Team. Severe outcomes among patients with coronavirus disease 2019 (COVID-19) - United States, February 12-March 16, 2020. *MMWR Morb Mortal Wkly Rep.* 2020;69:343—346.
2. McMichael TM, Clark S, Pogosjans S, et al. COVID-19 in a Long-Term Care Facility - King County, Washington, February 27-March 9, 2020. *Morbidity and Mortality Weekly Report.* 2020;69:339—342.
3. Grabowski DC, Mor V. Nursing home care in crisis in the wake of COVID-19. *JAMA.* 2020;324:23—24.
4. McMichael TM, Currie DW, Clark S, et al. Epidemiology of COVID-19 in a long-term care facility in King County, Washington. *N Engl J Med.* 2020;382:2005—2011.
5. Centers for Medicare and Medicaid Services. COVID-19 nursing home data. Accessed June 18, 2021. https://data.cms.gov/stories/s/COVID-19-Nursing-Home-Data/bkwz-xpvg
6. Centers for Disease Control and Prevention. Key strategies to prepare for COVID-19 in long-term care facilities (LTCFs). Accessed May 29, 2020. https://www.cdc.gov/coronavirus/2019-ncov/hcp/long-term-care-strategies.html
7. Centers for Disease Control and Prevention. Infection prevention and control assessment tool for nursing homes preparing for COVID-19. Accessed May 29, 2020. https://www.cdc.gov/coronavirus/2019-ncov/downloads/hcp/assess-ment-tool-nursing-homes.pdf
8. Ostrowsky BE, Weil LM, Olaisen RH, et al. Real-time virtual infection prevention and control assessments in skilled nursing homes, New York, March 2020—a pilot project. *Infect Control Hosp Epidemiol.* 2022;43:351—357.
9. Centers for Disease Control and Prevention. State-based HAI Prevention Activities. Accessed June 18, 2021. https://www.cdc.gov/hai/state-based/index.html
10. Krueger RA. *Focus Groups: A Practical Guide for Applied Research.* 4th. Thousand Oaks, CA: SAGE Publications; 2008.
11. Centers for Disease Control and Prevention. COVID-19: strategies for optimizing the supply of PPE. Accessed June 1, 2021. https://www.cdc.gov/coronavirus/2019-ncov/hcp/ppe-strategy/general-optimization-strategies.html
12. Seshadri S, Concannon C, Woods JA, McCullough KM, Dumyati GK. "It's like fighting a war with rocks": nursing home healthcare workers' experiences during the COVID-19 pandemic. *Infect Control Hosp Epidemiol.* 2021;42:1020—1021.
13. White EM, Wetle TF, Reddy A, Baier RR. Front-line nursing home staff experiences during the COVID-19 pandemic. *J Am Med Dir Assoc.* 2021;22:199—203.
14. McGarry BE, Grabowski DC, Barnett ML. Severe staffing and personal protective equipment shortages faced by nursing homes during the COVID-19 pandemic. *Health Affairs.* 2020;39:1812—1821.
15. Centers for Medicare & Medicaid Services. Medicare and Medicaid programs; reform of requirements for long-term care facilities. *Fed Regist.* 2016;81:68688—68872.
16. Stone PW, Agarwal M, Pogorzelska-Maziarz M. Infection preventionist staffing in nursing homes. *Am J Infect Control.* 2020;48:330—332.
17. Agarwal M, Dick AW, Sorbero M, Mody L, Stone PW. Changes in US nursing home infection prevention and control programs from 2014 to 2018. *J Am Med Dir Assoc.* 2020;21:97—103.
18. Jester DJ, Peterson LJ, Dosa DM, Hyer K. Infection control citations in nursing homes: compliance and geographic variability. *J Am Med Dir Assoc.* 2021;22:1317—1321e2.
19. Dawson WD, Boucher NA, Stone R, Van Houtven CH. COVID-19: the time for collaboration between long-term services and supports, health care systems, and public health is now. *Milbank Q.* 2021;99:565—594.

20. Andersen LE, Tripp L, Perz JF, et al. Protecting nursing home residents from COVID-19: federal strike team findings and lessons learned. *NEJM Catal Innov Care Deliv*. 2021;2.
21. Gandhi A, Yu H, Grabowski DC. High nursing staff turnover in nursing homes offers important quality information. *Health Aff*. 2021;40:384–391.
22. Tian W. An all-payer view of hospital discharge to postacute care, 2013: statistical brief #205. In: *Healthcare Cost and Utilization Project (HCUP) Statistical Briefs*. Rockville, MD: Agency for Healthcare Research and Quality; 2006.
23. Kc A, Schaefer MK, Stone ND, Perz J. Characterizing healthcare delivery in the United States using Census Bureau's County Business Patterns (2000-2016). *Infect Control Hosp Epidemiol*. 2020;41:723–728.
24. Sharma H, Xu L. Nursing home profit margins and citations for infection prevention and control. *J Am Med Dir Assoc*. 2021;22:2378–2383.e2.
25. Hutton DW, Krein SL, Saint S, et al. Economic evaluation of a catheter-associated urinary tract infection prevention program in nursing homes. *J Am Geriatr Soc*. 2018;66:742–747.

Supplementary Table 1
Number of Nursing Homes With Gaps Identified in Implementation of Infection Control Practices to Prepare for COVID-19 and Median Number of Gaps Identified, Among Those Participating in Remote Infection Control Consultations, by Facility Characteristics, N = 629

	Number of Nursing Homes with ≥1 Gap Identified	Median Number of Gaps (IQR)	P Value*
All nursing homes	524/629 (83)	2 (1, 4)	
CMS overall quality rating			
1 star	132/153 (86)	3 (1, 4)	.003†
2 star	127/144 (88)	3 (1, 4)	
3 star	103/129 (80)	2 (1, 3)	
4 star	107/135 (79)	2 (1, 3)	
5 star	46/52 (88)	2 (1, 3)	
Ownership type‡			
Government	51/57 (89)	4 (2, 6)	.011
Nongovernment	477/570 (84)	2 (1, 5)	
For profit	331/400 (83)	2 (1, 4)	
Corporate	253/304 (83)	2 (1, 4)	
Other	78/96 (81)	2 (1, 4)	
Nonprofit	140/170 (82)	2 (1, 5)	
Corporate	111/137 (81)	2 (1, 5)	
Other	29/33 (88)	2 (1, 4)	
COVID-19 cases among HCP or residents			
Yes	101/123 (82)	2 (1, 5)	
No	337/402 (84)	2 (1, 4)	
CMS infection control citation, April 2019 −March 2020			
Yes	199/225 (88)	2 (1, 5)	
No	273/327 (83)	3 (1, 5)	

CMS, Centers for Medicare & Medicaid Services; HCP, health care professional; IQR, interquartile range.

*P value for Kruskall-Wallis test of difference in median number of gaps. Blank cells indicate value > .05.

†Pairwise comparisons adjusted for multiple comparisons show significant difference between facilities with 4-star and 1-star quality ratings (P = .029) and with 4-star and 2-star quality ratings (P = .026).

‡Ownership categories sum to 627 facilities. Two nongovernment-owned facilities that provide skilled nursing care but were not in CMS data sets were excluded from analysis by ownership type.

Supplementary Table 2
Gaps in Nursing Home Implementation of Recommended Infection Control Practices to Prepare for COVID-19, Among Long-Term Care Facilities Participating in Remote Infection Control Consultations, N = 629

Infection Control Elements Assessed	Facilities With Element Not Implemented, n/n (%)
Any element (58 questions)	524/629 (83)
Visitor and nonessential personnel restrictions	30/627 (5)
Facility restricts all visitation other than compassionate care	4/628 (0.6)
Decisions about visitation are made on a case-by-case basis.	12/625 (2)
Potential visitors are screened prior to entry	7/623 (1)
Visitors that are permitted inside must wear a cloth face mask	2/617 (0.3)
Facility has restricted nonessential personnel	10/623 (2)
Facility has sent a communication to families	1/625 (0.2)
Facility has provided alternative methods for visitation	1/616 (0.2)
Facility has posted "No Visitors" signs at entrances to the facility	1/618 (0.2)
HCP COVID-19 training and symptom monitoring	103/588 (18)
HCP trained on COVID-19, sick leave, and source control*	39/629 (6)
Facility is aware of staffing needs and has plan in the event of staffing shortages	28/619 (5)
Facility has implemented universal use of face masks or cloth face coverings	7/584 (1)
Facility has provided staff with education to use face mask or respirator	38/581 (7)
HCP reminded to practice social distancing in break and common areas	6/616 (1)
HCP are screened at the beginning of their shift	0/628 (0)
If they are ill, they are instructed to keep their cloth face covering or face mask on	1/615 (0.2)
Facility keeps a list of symptomatic HCP	12/617 (2)
Education, monitoring, screening, and cohorting of residents	291/620 (47)
Facility provided resident education on COVID-19 prevention†	66/629 (10)
Facility assesses residents for fever and symptoms of COVID-19	4/625 (0.6)
Residents with suspected COVID-19 are immediately placed in appropriate precautions	14/605 (2)
Facility keeps a list of symptomatic residents	11/599 (2)
Facility has stopped group activities inside the facility and field trips	36/625 (6)
Facility has stopped communal dining	45/622 (7)
Residents are encouraged to remain in their rooms	18/626 (3)
If residents leave their rooms, they wear a cloth face covering or face mask	79/560 (14)
Facility bundles resident care and treatment activities to minimize room entry	80/587 (14)
The facility monitors ill residents at least 3 times daily	38/598 (6)
Facility has dedicated a space in the facility to care for residents with COVID-19	37/578 (6)
Facility has dedicated primary HCP staff who work only in COVID area	54/574 (9)
Facility has a plan for how residents who develop COVID-19 will be managed	20/570 (4)
Personal protective equipment supply	101/613 (16)
Facility has assessed current supply of PPE and other critical materials	13/624 (2)
If needed, facility has contacted HD for assistance with PPE shortage	27/607 (4)
Facility has implemented measures to optimize current PPE supply	34/610 (6)
PPE is available in resident care areas	48/613 (8)
Tissues and trash cans are available in common areas	6/589 (1)
Core infection prevention and control practices	428/625 (68)
HCP perform hand hygiene at 5 recommended moments‡ when performing patient care	45/629 (7)
Facility uses recommended personal protective equipment§ for care of residents with suspected or confirmed COVID-19	51/629 (8)
Hand hygiene and PPE compliance are audited	18/627 (3)
Selection and use of PPE are audited	43/627 (7)
Cleaning and disinfection of environmental surfaces is audited	119/627 (19)
Facility has preference for alcohol-based hand sanitizer over soap and water	242/620 (39)
PPE are removed in a manner to prevent self-contamination and hand hygiene is performed immediately after removal	13/603 (2)
Hand hygiene supplies are available in all resident care areas	48/625 (8)
Hand hygiene and PPE compliance are audited	72/616 (12)
Nondedicated, nondisposable resident care equipment is cleaned	13/608 (2)
EPA-registered disinfectants available for frequent cleaning high touch resident areas	72/597 (12)
EPA-registered disinfectants are prepared and used in accordance with label instructions	32/601 (5)
Facility is aware of the contact time for the EPA-registered disinfectant	150/613 (24)
Communication about suspected or confirmed COVID-19 cases	**68/620 (11)**
Facility notifies health department about	
Suspected or confirmed COVID-19 in resident or HCP	6/622 (1)
Resident with severe respiratory infection resulting in hospitalization or death	46/562 (8)
Cluster of new-onset respiratory symptoms occurs in residents or HCP	51/622 (8)
Facility has process to notify residents, families, and staff about facility COVID-19 cases	6/618 (1)
Facility communicates information about residents with known or suspected COVID-19 to appropriate personnel prior to transfer	2/618 (0.3)

EPA, Environmental Protection Agency; HCP, health care professional; PPE, personal protective equipment.
Domain-level analysis (boldface) was limited to facilities for which ≥75% of elements in the domain were assessed.
    *Includes the following elements: COVID-19 (1/629; 0.2%), sick leave policies and importance of not reporting to work when ill (27/629; 4.3), and new policies for source control while in facility (19/569; 3.3).
    †Includes the following elements: COVID-19 and actions residents and the facility can take (11/629; 1.7%), importance of immediately informing HCP if they feel feverish or ill (54/629; 8.6), actions residents can take to protect themselves (18/629; 2.9), and actions the facility is taking to keep residents safe (9/629; 1.4).
    ‡Before and after contact with the resident; after contact with blood, body fluids, or contaminated surfaces or equipment; before performing an aseptic task, and after removing PPE.
    §Gown, gloves, eye protection, and N95 or higher-level respirator (or face mask, if N95 respirator unavailable).