



Rapid Review Update 1: What risk factors are associated with COVID-19 outbreaks and mortality in long-term care facilities and what strategies mitigate risk?



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Executive Summary

Background

Older adults have the highest rates of mortality due to the coronavirus disease 2019 (COVID-19) and long-term care (LTC) facilities were particularly affected by high rates of infection and mortality in the first wave of the pandemic. To date, strategies used by certain facilities and jurisdictions have shown preliminary evidence of efficacy at reducing risk of infections and outbreaks. Understanding risk factors for infections and outbreaks at the resident, facility and community level will facilitate the development of strategies to help mitigate this risk.

This rapid review was produced to support public health decision makers' response to the COVID-19 pandemic. This review seeks to identify, appraise, and summarize emerging research evidence to support evidence-informed decision making.

This rapid review is based on the most recent research evidence available at the time of release. A previous version was completed on October 16, 2020. This updated version includes evidence available up to November 30, 2020 to answer the question: **What risk factors are associated with COVID-19 outbreaks and mortality in LTC facilities and what strategies mitigate risk?**

What Has Changed in this Version?

- Two new syntheses on risk factors associated with COVID-19 outbreaks and mortality were identified; findings are consistent with this rapid review
- One new cohort study explored the temporal relationship between community-transmission and LTC outbreaks. With an increase of 2.3 cases per 100 000, there is a 75% probability of a LTC outbreak 5 days later.
- Four new cross-sectional studies and 6 new cohort studies explored relationships between various resident and organizational-level factors and risk of COVID-19 infection and mortality; findings are consistent with the previous update
- Three new syntheses describing the interventions to control spread are included. Findings are consistent with those from this rapid review.
- 5 new case reports describe comprehensive, multicomponent interventions to mitigate the spread of COVID-19 within a LTC facility following a confirmed case, or outbreak. Universal testing of staff and patients, frequent symptom screening, cohorting of patients, and universal masking were most often described along with enhanced hygiene and cleaning protocols, and PPE. No comparator groups were included to determine which measure may be most effective or whether a combination of measures is needed to reduce spread.
- One qualitative study with elder care physicians described the potential adverse effects of measures such as restricting visitors, on patients' well-being and quality of life.

Key Points

What risk factors are associated with COVID-19 outbreaks and mortality in LTC facilities?

- Across studies, incidence in the surrounding community was found to have the strongest association with COVID-19 infections and/or outbreaks in LTC settings. The certainty of the evidence is moderate (GRADE).
- Several resident-level factors including, racial/ethnic minority status, older age, male sex, receipt of Medicaid or Medicare were associated with risk of COVID-19 infections, outbreaks and mortality; severity of impairment was associated with infections and outbreaks, but not mortality. The certainty of the evidence is low (GRADE) and may change as more data become available.
- At the organizational level, increased staffing, particularly Registered Nurse (RN) staffing was consistently associated with reduced risk of COVID-19 infections, outbreaks and mortality while for-profit status, facility size/density and movement of staff between facilities was consistently associated with increased risk of COVID-19 infections, outbreaks and mortality. The certainty of the evidence is low (GRADE) and may change as more data become available.

What strategies mitigate risk of outbreaks and mortality within LTC?

- Most guideline recommendations include surveillance, monitoring and evaluation of staff and resident symptoms, and use of personal protective equipment (PPE). The certainty of the evidence is low (GRADE) and may change as more data become available. Other interventions demonstrating some effect on decreased infection rates within syntheses and a small number of single studies include promotion of hand hygiene, enhanced cleaning measures, social distancing, and cohorting. The certainty of the evidence is low (GRADE) and may change as more data become available.
- Technological platforms and tools (e.g., digital contact tracing, apps, heat maps) are being developed and show potential for decreased transmission through efficient case and/or contact identification that further informs infection control planning strategies. The certainty of the evidence is very low (GRADE) and may change as more data become available.

Overview of Evidence and Knowledge Gaps

What risk factors are associated with COVID-19 outbreaks and mortality in LTC facilities?

- In several studies, adjusting for levels of community transmission in multivariate models reduced or eliminated the estimated associations between organization-level factors and risk of outbreaks or mortality. This is an important confounding factor that should be accounted for in future studies. Within studies that did not adjust for community transmission, large variations were observed between geographic regions which could be explained by variations in community transmission.
- Across studies, there was a large variation in the potential confounders controlled for in the analyses and the way various risk factors and confounding factors were measured, making it difficult to compare the strength of the relationship across studies.
- Resident-level risk factors for infection were often measured at the group level and may not correspond to individual-level risk of contracting or dying from COVID-19.

- Several studies from the US compared five-star facility ratings between sites with and without COVID-19 infections and outbreaks; several studies found that lower overall facility quality, history of fines/complaints, substandard cleaning practices, and having external staff brought in were associated with increased risk of COVID-19 cases, outbreaks and mortality within the facility.
- Facility size (reported as number of residents or beds) was consistently positively associated with increased risk of infections and mortality; however, several studies suggest that facility crowding, or the ratio of residents to staff may be the key drivers of transmission.

What strategies mitigate risk of outbreaks and mortality within LTC?

- Findings from low and high quality syntheses report a variety of interventions to decrease infection transmission in LTC. Common interventions across syntheses were promotion of hand hygiene and regular/enhanced environmental cleaning. Two syntheses included studies conducted in the context of COVID-19, as well as other respiratory infections. Notably, the quality of included evidence in syntheses was very low or not reported. Further evidence is needed on the effect of restricting staff movement between multiple long-term care facilities.
- Single studies consisted primarily of cohort or quasi-experimental designs. A number of interventions were described with the potential to decrease COVID-19 transmission:
 - Proactive facility-wide active screening and testing of residents and staff
 - Infection control audits
 - Compliance with proper use of masks and other personal protective equipment
 - Cohorting
 - Technological tools (i.e., digital contact tracing, COVID-19 app tool)
 - Social distancing
 - Enforcement of maximum occupancy in small areas
 - Voluntary staff self-confinement in facilities (i.e., spending ≥ 7 days a week and 24 hours a day in the facility; sleeping in unused areas)
- While several case reports describe implementing visitor restriction policies, no studies that include a comparator group were identified to explore the efficacy of this measure.
- Most studies did not address potential confounding factors at the resident, organizational, or community level that may influence measured outcomes of implemented infection control interventions.

Methods

Research Questions

1. What risk factors are associated with COVID-19 outbreaks and mortality in LTC facilities?
2. What strategies mitigate risk of outbreaks and mortality within LTC?

Search

On November 30, 2020, the following databases were searched:

- Pubmed's curated COVID-19 literature hub: [LitCovid](#)
- [Trip Medical Database](#)
- World Health Organization's [Global literature on coronavirus disease](#)
- [COVID-19 Evidence Alerts](#) from McMaster PLUS™
- [COVID-19 Living Overview of the Evidence \(L-OVE\)](#)
- [McMaster Health Forum](#)
- [Prospero Registry of Systematic Reviews](#)
- NCCMT [COVID-19 Rapid Evidence Reviews](#)
- [MedRxiv preprint server](#)
- NCCDH [Equity-informed Responses to COVID-19](#)
- NCCEH [Environmental Health Resources for the COVID-19 Pandemic](#)
- NCCHPP [Public Health Ethics and COVID-19](#)
- NCCID [Public Health Quick Links](#)
- NCCID [Disease Debrief](#)
- NCCIH [Updates on COVID-19](#)
- [Uncover \(USHER Network for COVID-19 Evidence Reviews\)](#)
- [Morbidity and Mortality Weekly Report \(MMWR\)](#)
- [Institute national d'excellence en santé et en services sociaux \(INESSS\)](#)
- [Institut national de santé publique du Québec \(INSPQ\)](#)
- [Guidelines International Network \(GIN\) Library](#)
- [BC Centre for Disease Control \(BCCDC\)](#)
- [Public Health England](#)

A copy of the search strategy is available at this [link](#).

Study Selection Criteria

The search results were first screened for recent guidelines and syntheses. Single studies were included if no syntheses were available, or if single studies were published after the search was conducted in the included syntheses. English-language, peer-reviewed sources and sources published ahead-of-print before peer review were included. Surveillance sources were excluded. When available, findings from syntheses and clinical practice guidelines are presented first, as these take into account the available body of evidence and, therefore, can be applied broadly to populations and settings.

	Inclusion Criteria	Exclusion Criteria
Population	Residents and staff in LTC facilities (defined as a non-hospital setting where care is provided to assist with activities of daily living)	Hospital or rehabilitation wards
Intervention	Resident, organizational and community-level risk factors (including modifiable and non-modifiable) Strategies to reduce introduction of infection, transmission of infection, mortality	Non-COVID-19 related
Comparisons	-	
Outcomes	Outbreaks / cases	

Data Extraction and Synthesis

Data relevant to the research question, such as study design, setting, location, population characteristics, interventions or exposure and outcomes were extracted when reported. We synthesized the results narratively due to the variation in methodology and outcomes for the included studies.

Appraisal of Evidence Quality

We evaluated the quality of included evidence using critical appraisal tools as indicated by the study design below. Quality assessment was completed by one reviewer and verified by a second reviewer. Conflicts were resolved through discussion.

Study Design	Critical Appraisal Tool
Synthesis	Assessing the Methodological Quality of Systematic Reviews (AMSTAR) AMSTAR 1 Tool
Cohort	Joanna Briggs Institute (JBI) Checklist for Cohort Studies
Cross sectional	Joanna Briggs Institute (JBI) Checklist for Cross Sectional Studies
Quasi-experimental	Joanna Briggs Institute (JBI) Checklist for Quasi-Experimental Studies
Case Report	Joanna Briggs Institute (JBI) Checklist for Case Reports
Prevalence	Joanna Briggs Institute (JBI) Checklist for Prevalence Studies

Completed quality assessments for each included study are available on request.

The Grading of Recommendations, Assessment, Development and Evaluations ([GRADE](#)) approach was used to assess the certainty in the findings based on eight key domains. In the GRADE approach to quality of evidence, **observational studies**, as included in this review, provide **low quality** evidence, and this assessment can be further reduced based on other domains:

- High risk of bias
- Inconsistency in effects
- Indirectness of interventions/outcomes
- Imprecision in effect estimate
- Publication bias

and can be upgraded based on:

- Large effect
- Dose-response relationship
- Accounting for confounding.

The overall certainty in the evidence for each outcome was determined taking into account the characteristics of the available evidence (observational studies, some not peer-reviewed, unaccounted-for potential confounding factors, different tests and testing protocols, lack of valid comparison groups). A judgement of 'overall certainty is very low' means that the findings are very likely to change as more evidence accumulates.

Findings

Summary of Evidence Quality

This update adds 3 new syntheses, 2 new in-progress syntheses, and 18 new single studies. In total, 60 publications are included in this review addressing two distinct questions. The quality of the evidence included in this review is as follows:

Question	Evidence included		Overall certainty in evidence
What are risk factors that are associated with outbreaks and deaths in LTC?	Completed syntheses	3	Low-moderate
	In progress syntheses	4	
	Single studies	37	
What strategies can prevent introduction of and transmission within LTC?	Completed syntheses	5	Very low-low
	In progress syntheses	1	
	Single studies	14	

Warning

Given the need to make emerging COVID-19 evidence quickly available, many emerging studies have not been peer reviewed. As such, we advise caution when using and interpreting the evidence included in this rapid review. We have provided a summary of overall certainty of the evidence to support the process of decision making. Where possible, make decisions using the highest quality evidence available.

A number of mathematical modelling studies are emerging related to COVID-19. While these studies may provide important estimates, their ultimate usefulness depends on the quality of the data that is entered into the model. Given the constantly evolving nature and changing understanding of COVID-19 around the world, a high degree of caution is warranted when interpreting these studies, and when presented, include the range of confidence intervals rather than single effect estimates.

Important to this question, we did not assess the methodological quality of the included modelling study. Due to the highly technical nature of these studies, we highly recommend consulting a content-area expert to inform decision making.

Question 1: What risk factors are associated with COVID-19 outbreaks and mortality in LTC facilities?

Table 1: Syntheses

Reference	Date Released	Description of Included Studies	Summary of Findings	Quality Rating: Synthesis	Quality Rating: Included Studies
New Evidence Reported December 10, 2020					
Frazer, K., Lachlan, M., Stokes, D., Crowley, E., & Kelleher, C.C. (2020). A rapid systematic review of measures to protect older people in long term care facilities from COVID-19. <i>Preprint.</i>	Nov 3, 2020 (Search completed Jul 27, 2020)	Of 38 studies, 20 included studies reported on risk factors for COVID-19 cases.	Numerous facility-specific characteristics were linked with risk of COVID-19 cases including facility size, staffing levels, use of agency staff, being part of a chain of organizations, overcrowding and lack of availability of single rooms. The authors note the overall low quality of included studies.	High PREPRINT	Low
Public Health England (2020). Factors associated with COVID-19 in care homes and domiciliary care, and effectiveness of interventions: A rapid review.	Oct 28, 2020 (Search completed Aug 31, 2020)	This rapid review included 13 studies (4 preprints) examining factors associated with transmission in LTC: <ul style="list-style-type: none"> • 3 cohort • 9 cross-sectional • 1 modelling 5 studies were from the UK and Ireland, 2 were from Canada and 6 were from the US.	There is consistent evidence across included countries that transmission of COVID-19 in LTC is associated with: <ul style="list-style-type: none"> • Movement of staff between facilities • Use of bank or agency staff • Lower care home quality • Higher occupancy rates • For-profit ownership (US and Canada only; public ownership in Ireland) • Lower nurse staffing levels There is some evidence that there is a higher risk of COVID-19 in facilities with lower proportions of white residents. Most studies used publicly available datasets with incomplete data, others relied on self-report which increases the risk of recall bias and underestimation of effects. The authors note a number of confounding factors were not controlled for in analyses.	Moderate	Not reported

<p>Gmehlin, C., & Munoz-Price, L.S. (2020). COVID-19 in Long Term Care Facilities: A Review of Epidemiology, Clinical Presentations, and Containment Interventions. <i>Infection Control & Hospital Epidemiology</i>. Epub ahead of print.</p>	<p>Oct 26, 2020 (Search date not reported)</p>	<p>This review included 12 studies, set in USA and European facilities (study designs not reported)</p>	<p>Characteristics associated with risk of at least one resident with COVID-19 were:</p> <ul style="list-style-type: none"> • Increased facility size • Degree of occupancy • County-level transmission rates <p>Resident demographics associated with COVID-19 cases were:</p> <ul style="list-style-type: none"> • Higher proportion of African American residents • Higher Medicaid share • Comorbidities (e.g. hypertension, cardiac disease, diabetes, cognitive impairment, renal disease, pulmonary disease, obesity) <p>Other characteristics associated with incidence of COVID-19 were:</p> <ul style="list-style-type: none"> • Decreased nursing hours • Lower Five-Star nursing score • Higher levels of resident independence • Higher number of Centers for Medicare and Medicaid Services health deficiencies • For-profit status <p>Among facilities with at least one death attributed to COVID-19, having more nursing hours was protective.</p>	<p>Low</p>	<p>Not reported</p>
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Table 2: In-progress Syntheses

Title	Anticipated Release Date	Description of Document
New Evidence Reported December 10, 2020		
Durao, C., Rafael Henriques, H., Costa, A., Sousa, D., Pinto, J., Faria, J., & Henriques, A. (2020). Measures to minimize the risk of COVID-19 infection in nursing homes: a systematic review . PROSPERO, CRD42020214566.	Feb 26, 2021	This systematic review will examine the effect of the organizational, individual and environmental measures to prevent and manage the spread of COVID-19 in long-term care facilities/nursing homes/aged care facilities.
Previously Reported Evidence		
Wu, J., Bourouiba, L., McCarthy, Z., Nah, K., Alavinejad, M., Tosato, M., & Bragazzi, N.L. (2020). COVID-19 in long-term care facilities: a systematic review and meta-analysis of the literature . PROSPERO, CRD42020192091.	Aug 16, 2020	This review will explore characteristics of COVID-19 cases and outbreaks in LTC facilities, in terms of seroprevalence, symptoms, hospitalization rates and case fatality rates for residents, staff and visitors.
Gomes, Z., Aithal, S., Antonipillai, V., Kurmi, K., & Baumann, A. (2020). Prognostic factors associated with morbidity and mortality due to COVID-19 infection in adults using long-term care facilities: a systematic review . PROSPERO, CRD42020198170.	Oct 29, 2020	<p>This review seeks to identify key prognostic factors associated with COVID-19 that result in higher morbidity and mortality among residents and staff and the strength of association of same. Potential factors to be examined include:</p> <ul style="list-style-type: none"> • Lifestyle • Environmental factors • Sociodemographic factors • Personal characteristics • Comorbid health conditions • Mental health • Availability/use of personal protective equipment (PPE) • Facility policies (testing, isolation, care ratio) • Infection control practices <p>Subgroup analysis will be conducted for gender, ethnicity, age group, geographical region, and facility type (public vs. private).</p>
Rashidul Hashan, M., Smoll, N., King, C., Ockenden-Muldoon, H., Walker, J., Booy, R., & Khandaker, G. (2020). Epidemiology and clinical features of COVID-19 outbreaks in aged care facilities: a systematic review and meta-analysis . PROSPERO, CRD42020211424.	Oct 30, 2020	<p>This review will examine the global epidemiological burden of COVID-19 in LTC facilities, the clinical manifestations of outbreaks among residents and the risk factors associated with adverse outcomes for COVID-19 outbreaks in LTC (such as prevalence of co-morbidities).</p> <p>Subgroup analysis will be conducted on any available data.</p>

Table 3: Single Studies

Reference	Date Released	Study Design	Population and Setting	Summary of findings	Quality Rating:
New Evidence Reported December 10, 2020					
Malikov, K., Huang, Q., Shi, S., Stall, N. M., Tuite, A. R., & Hillmer, M. P. (2020). Temporal Associations between Community Incidence of COVID-19 and Nursing Home Outbreaks in Ontario, Canada . <i>Preprint</i> .	Nov 19, 2020	Cohort	37,274 COVID cases in Ontario, Canada <ul style="list-style-type: none"> • 5545 were residents of LTC • 343 were LTC outbreaks 	<p>This study reports on the temporal relationship between COVID-19 cases in geographic areas and the number of LTC outbreaks from Mar 1 to Jul 16, 2020.</p> <p>The risk of LTC outbreaks is strongly associated with rates in communities surrounding the facilities.</p> <ul style="list-style-type: none"> • The average lag time between community cases and LTC outbreaks was 23 days for Ontario overall, with substantial variability across geographic regions ranging from 11 to 43 days. <p>For the province overall, when daily active COVID-19 community cases are 2.30 per 100,000 population, there is a 75% probability of a LTC outbreak occurring five days later.</p>	Moderate PREPRINT
Ly, T. D. A., Zanini, D., Laforge, V., Arlotto, S., Gentile, S., Mendizabal, H., ... Gautret, P. (2020). Pattern of SARS-CoV-2 infection among dependant elderly residents living in long-term care facilities in Marseille, France, March-June 2020 . <i>International Journal of Antimicrobial Agents</i> , 56(6), 106219.	Nov 16, 2020	Cross sectional	n=1691 residents, 1000 staff in 24 facilities, France	<p>Between Mar 24 and Jun 2, 2020, mass screening identified 226 resident cases (13.4%) and 87 staff cases (8.7%).</p> <p>After adjusting for known confounders, death due to COVID-19 (residents only) was associated with:</p> <ul style="list-style-type: none"> • Male gender, OR: 3.95, 95% CI: 1.65, 9.44 • Older age (> 85 vs. 50-85), OR: 2.43, 95% CI: 1.04, 5.69 <p>Those diagnosed through mass screening (vs. case-by-case testing) had lower odds of death, OR: 0.20 (95% CI: 0.08, 0.53).</p>	Moderate

<p>Morciano, M., Stokes, J., Kontopantelis, E., Hall, I., & Turner, A. J. (2020). Excess mortality for care home residents during the first 23 weeks of the COVID-19 pandemic in England: a national cohort study. <i>Preprint</i>.</p>	<p>Nov 13, 2020</p>	<p>Cohort</p>	<p>15 524 facilities, England</p>	<p>From Jan 1 to Aug 7, 2020, 27.4% of facilities reported a confirmed/suspected COVID-19 death.</p> <p>In multivariable analyses, odds of COVID-19 attributable deaths were higher in:</p> <ul style="list-style-type: none"> • Facilities providing nursing services vs. residential services only (OR: 1.81, 95%CI: 1.64 to 1.99) • Facilities providing services to older people and/or with dementia vs. children or adults only (OR: 5.45, 95%CI: 4.36 to 6.81) • Larger facilities (41+ beds vs. 0-23 beds), OR: 13.28, 95%CI: 11.46 to 15.39 and medium facilities (24-40 beds vs. 0-23 beds), OR: 5.20, 95% CI: 4.52, 5.98 • Chain facilities (OR: 1.21, 95%CI: 1.1 to 1.34) 	<p>High PREPRINT</p>
<p>Suñer, C., Ouchi, D., Àngel Mas, M., Lopez Alarcon, R., Massot Mesquida, M., Negredo, E., ... Mitjà, O. (2020). Risk factors for mortality of residents in nursing homes with Covid-19: a retrospective cohort study. <i>Preprint</i>.</p>	<p>Nov 10, 2020</p>	<p>Cohort</p>	<p>n=8716 residents in 167 facilities, Spain</p>	<p>From Mar 1 to Jun 1, 2020, median all-cause mortality was 14.3 (interquartile range (IQR): 7.6, 26.1) deaths/100 residents, and median COVID-19 mortality was 3.9 (IQR: 0.0, 18.4) deaths/100 residents.</p> <p>COVID-19 mortality rates across facilities were associated with:</p> <ul style="list-style-type: none"> • % of complex patients (per 10% increase, HR: 1.09; 95%CI 1.05-1.12 per 10% increase) • % patients with advanced diseases (per 10% increase, HR: 1.13; 95% CI: 1.07-1.19) • Lower capacity for implementing preventive measures (HR: 1.08; 95% CI: 1.05-1.10) • Community-level incidence of COVID-19, per 1000 cases/100 000, HR: 2.98; 95% CI: 2.53-3.50 • Community population density, per 10 people/km² HR: 0.60, 95% CI: 0.50, 0.72 	<p>Moderate PREPRINT</p>

<p>Braun, R. T., Yun, H., Casalino, L. P., Myslinski, Z., Kuwonga, F. M., Jung, H.-Y., & Unruh, M. A. (2020). Comparative Performance of Private Equity-Owned US Nursing Homes During the COVID-19 Pandemic. <i>JAMA Network Open</i>, 3(10), e2026702.</p>	<p>Oct 28, 2020</p>	<p>Cross sectional</p>	<p>Private equity-owned (543, 4.7%), for-profit (7793, 67.9%), nonprofit (2525, 22.0%), and government-owned (511, 5.3%) facilities, USA</p>	<p>From May 17, 2020 to Jul 2, 2020, private equity owned facilities had the highest incidence of COVID-19 cases per 1000 residents (110.8±8.1) followed by for-profit (88.3±2.1), nonprofit (67.0±3.8) and government-owned (39.8±7.6).</p> <p>Multivariate analyses adjusted for resident-level factors (age, gender, activities of daily living score, race, % covered by Medicaid and Medicare) and facility-level factors (occupancy rate, chain membership, location, number of beds). Compared to private equity owned facilities, only government-owned had lower cases (-35.5, 95% CI: -69.2, -1.8). There were no differences in COVID-19 deaths or all-cause mortality.</p> <p>Compared with private equity-owned facilities, the other -types were more likely to have:</p> <ul style="list-style-type: none"> • At least 1-week supply of N95 masks <ul style="list-style-type: none"> ○ For-profit, 10.5% (9.1 percentage points, 95% CI: 1.8, 16.3, p=0.006) ○ Nonprofit, 15.0% (13.0 percentage points, 95% CI: 5.5, 20.6, p < 0.001) ○ Government-owned, 17.0% (14.8 percentage points, 95% CI: 6.5, 23.0, p < .001) • At least 1-week supply of medical gowns <ul style="list-style-type: none"> ○ For-profit, 24.3% (21.3 percentage points, 95% CI: 11.8, 30.8, p < 0.001) ○ Nonprofit, 30.7% (27.0 percentage points, 95% CI: 17.7, 36.2, p < 0.001) ○ Government-owned, 29.2% (25.7 percentage points, 95% CI: 16.1, 35.3, p < 0.001) • A shortage of nurses <ul style="list-style-type: none"> ○ Only government-owned (6.9 percentage points, 95% CI: 0.0, 13.9, p=0.049) <p>The authors note inconsistent data reporting and COVID-19 testing across the facilities, reliance on public announcements to determine private equity ownership status, and self-report data.</p>	<p>Moderate</p>
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<p>Rutten, J.J.S., van Loon, A.M., van Kooten, J., van Buul, L.W., Joling, K.J., Smalbrugge, M., & Hertogh, C.M.P.M. (2020). Clinical Suspicion of COVID-19 in Nursing Home Residents: Symptoms and Mortality Risk Factors. <i>Journal of the American Medical Directors Association</i>, 21(12), 1791-1799.</p>	<p>Oct 28, 2020</p>	<p>Cohort</p>	<p>n=4007 residents with suspected COVID-19, Netherlands</p>	<p>From Mar 18 to May 13, 2020, 38% of residents tested due to clinical suspicion had confirmed COVID-19.</p> <p>Residents positive for COVID-19 were more likely to:</p> <ul style="list-style-type: none"> • Reside on a psychogeriatric ward (47% vs 39%, p<0.001) • Have dementia (62% vs. 51%, p<0.001); • Have no chronic respiratory disease (18% vs. 21%, p=0.02). <p>Risk factors associated with COVID-19 mortality (after adjusting for age, gender and comorbidities) included:</p> <ul style="list-style-type: none"> • Male gender (HR: 1.82, 95% CI: 1.54, 2.15) • Age: 86 – 90 (HR: 1.49, 95% CI: 1.19, 1.85), 90+ (HR: 1.38, 95% CI: 1.09, 1.75) vs. <80 • Dementia (HR: 1.26, 95% CI: 1.06, 1.50) • Reduced kidney function (HR: 1.35, 95% CI: 1.11, 1.64) • Parkinson’s disease (HR: 1.49, 95% CI: 1.11, 2.00) 	<p>Moderate</p>
<p>Mas Romero, M., Avendaño Céspedes, A., Tabernero Sahuquillo, M. T., Cortés Zamora, E. B., Gómez Ballesteros, C., Sánchez-Flor Alfaro, V., ... Abizanda, P. (2020). COVID-19 outbreak in long-term care facilities from Spain. Many lessons to learn. <i>PLOS ONE</i>, 15(10), e0241030.</p>	<p>Oct 27, 2020</p>	<p>Cohort</p>	<p>n=198 residents and 147 staff, Spain</p>	<p>From Mar 6 and Jun 5, 2020 134 residents (67.7%) were presumed to have COVID-19 (symptomatic, but not tested).</p> <p>Symptomatic residents (all p < 0.05):</p> <ul style="list-style-type: none"> • Had a worse functional index (Functional Ambulation Classification, Barthel index and frailty classification) • Had higher prevalence of immobility, urinary incontinence, and fecal incontinence <p>Mortality was higher among residents who were:</p> <ul style="list-style-type: none"> • Older (86.2 vs. 81.1, p < 0.05) • Male (64.5 % vs. 36.2%, p < 0.05) • Had fecal incontinence, auditive impairment, higher overall number of chronic diseases 	<p>High</p>

<p>Tramarin, A., Gennaro, N., Dal Grande, G., Bragagnolo, L., Carta, M.R., Giavarina, D., ... Stopazzolo, G. (2020). The impact of COVID-19 on Long Term Care Facilities (LTCFs) of an Italian Province: a cohort study and a retrospective analysis of observed vs. expected mortality. <i>Preprint.</i></p>	<p>Oct 23, 2020</p>	<p>Cohort</p>	<p>9 facilities in Vicenza Province, Italy</p>	<p>From Dec 1 to Jun 15, 2020 53 residents (82.8%) tested positive for COVID-19. Risk of infection was associated with:</p> <ul style="list-style-type: none"> • Older age (90.9% in those >85 vs. 64.3% in those <74) • Barthel score (disability) <p>No differences by gender or presence of comorbidities were found.</p> <p>Case fatality rate was 22%. Risk of death was associated with:</p> <ul style="list-style-type: none"> • Older age (30% in those >85 vs. 0% in those < 74) <p>No differences by gender, disability score or comorbidities were found.</p>	<p>High PREPRINT</p>
<p>Kirby, R.S., & Kirby, J.A. (2020). Correlation of COVID-19 Mortality with Clinical Parameters in an Urban and Suburban Nursing Home Population. <i>Preprint.</i></p>	<p>Oct 20, 2020</p>	<p>Cross sectional</p>	<p>2 facilities in New Jersey, USA</p>	<p>From Mar 16 to Jul 13, 2020, the mortality rate was 14.3% (vs. community-level rate of 28.3% in LTC in all of New Jersey).</p> <p>No relationship was found between demographic or clinical characteristics and mortality rate.</p> <p>In subgroup analyses, only those over 80 in suburban vs. urban facilities were at increased risk of death (43.3 vs. 36.4, p = 0.003).</p>	<p>High PREPRINT</p>

<p>Bowblis, J., & Applebaum, R. (2020). Prevalence of COVID-19 in Ohio Nursing Homes: What's Quality Got to Do with It? <i>Journal of Aging & Social Policy</i>. Epub ahead of print.</p>	<p>Oct 11, 2020</p>	<p>Prevalence</p>	<p>943 certified Medicare and/or Medicaid facilities in Ohio, USA</p>	<p>Having at least one resident with COVID-19 was associated with:</p> <ul style="list-style-type: none"> • Government ownership (vs. for-profit) • Being a chain facility (vs. independent) • Having a dementia unit • % of Black, Indigenous and residents of colour • Lower % of residents with depression • Registered nurse and licensed nurse hours <p>No relationship was found between occupancy, payer-mix and most resident case-mix covariates.</p> <p>Factors associated with higher incidence in facilities with a case include:</p> <ul style="list-style-type: none"> • Fewer beds <p>There was no consistent association with having a COVID-19 positive resident and staffing level, category of staff or use of agency staff.</p> <p>Indicators of quality (star systems) were not associated with having a positive resident or higher overall COVID-19 incidence</p>	<p>Moderate</p>
<p>Sun, C. L. F., Zuccarelli, E., Zerhouni, E. G. A., Lee, J., Muller, J., Scott, K. M., ... Levi, R. (2020). Predicting Coronavirus Disease 2019 Infection Risk and Related Risk Drivers in Nursing Homes: A Machine Learning Approach. <i>Journal of the American Medical Directors Association</i>, 21(11), 1533-1538.</p>	<p>Aug 27, 2020</p>	<p>Modelling</p>	<p>1146 LTC facilities in 3 states in the USA</p>	<p>This study assesses risk and possible vectors of infection in facilities reporting COVID-19 cases (60.3%) in 3 USA states on Apr 20, 2020, using a modelling approach. The model was validated against data up to May 11, 2020 to create a LTC risk algorithm.</p> <p>The strongest predictors of COVID-19 infection were identified as:</p> <ul style="list-style-type: none"> • The facilities home country's infection rate • The number of separate units in the facility <p>Other predictors were identified as:</p> <ul style="list-style-type: none"> • The country's population density • Historical Centers of Medicare and Medicaid cited health deficiencies • Resident density (in persons per 1000 square feet) <p>The facility's historical percentage of non-Hispanic white residents was identified as a protective factor.</p>	<p>Not appraised</p> <p><i>Interpret with caution</i></p>

Previously Reported Evidence					
Heras, E., Garibaldi, P., Boix, M., Valero, O., Castillo, J., Curbelo, Y., ... Piqué, J. M. (2020). COVID-19 mortality risk factors in older people in a long-term care center . <i>European Geriatric Medicine</i> . Epub ahead of print.	Nov 27, 2020	Cross sectional	n=100 residents with confirmed COVID-19, Andorra	<p>This study reports on factors that predict COVID-19 mortality from Mar 15-Jun 5, 2020.</p> <p>Risk of mortality was associated with:</p> <ul style="list-style-type: none"> • Male gender, OR: 38.1, CI not reported • Lymphopenia, OR: 6.55, CI not reported • Treatment with hydroxychloroquine and azithromycin, OR: 0.04, CI not reported • Barthel's index, OR: 0.92, CI not reported <p>Analyses adjusted for known confounders.</p>	Moderate
Brown, K. A., Jones, A., Daneman, N., Chan, A. K., Schwartz, K. L., Garber, G. E., ... Stall, N. M. (2020). Association between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada . <i>JAMA Internal Medicine</i> . Epub ahead of print.	Nov 9, 2020	Cohort	n=78,607 residents of 618 facilities, Canada	<p>This study explored the relationship between crowding in facilities and incidence of COVID-19 from Mar 29-May 20, 2020. Infections were distributed unevenly; 86% of infections occurred in 10% of facilities.</p> <p>Factors associated with COVID-19 incidence include:</p> <ul style="list-style-type: none"> • Regional incidence, 4th vs. 1st quartile, RR: 5.00, 95%CI: 1.19, 21.11 • Private, for profit vs. municipal ownership, RR: 2.49, 95%CI: 1.14, 5.45 • Crowding index (vs. 1.5, lowest), 2, RR: 1.20, 95% CI: 1.03, 1.39; 2.5, RR: 1.44, 95% CI: 1.07, 1.95, 3, RR: 1.74, 95% CI: 1.10, 2.72, 3.5, RR: 2.08, 95% CI: 1.13, 3.80 <p>Factors associated with COVID-19 mortality include:</p> <ul style="list-style-type: none"> • Private, for-profit vs. municipal ownership, RR: 2.67, 95%CI: 1.04, 6.84 <p>Factors associated with presence of at least one infection include:</p> <ul style="list-style-type: none"> • Community population size, >500 000 vs. < 10 000, OR: 4.71, 95%CI: 1.97, 11.25 • % residents born outside of Canada, OR: 1.01, 95% CI: 1.00, 1.03 <p>Analyses were adjusted for crowding index, facility-level factors (size, ownership, ratio of staff to residents) and resident-level factors (age, sex, comorbidities, activities of daily living score, education) and regional characteristics.</p>	High

<p>Shallcross, L., Burke, D., Abbott, O., Donaldson, A., Hallatt, G., Hayward, A., ... Thorne, S. (2020). Risk factors associated with SARS-CoV-2 infection and outbreaks in Long Term Care Facilities in England: a national survey. <i>Preprint</i>.</p>	<p>Oct 4, 2020</p>	<p>Cross sectional</p>	<p>5126 facilities providing dementia care, England</p>	<p>From Mar–Jun 2020, period prevalence of infection was 10.5% (95% CI: 9.9 to 11.1) in residents and 3.8% (95%CI: 3.4 to 4.2) in staff with 53.1% of facilities reporting at least 1 case and 9.2% reporting large outbreaks.</p> <p>Risk factors for resident infection include:</p> <ul style="list-style-type: none"> • Residents in socially deprived quintile, OR: 1.08, 95%CI: 1.03, 1.14 • For profit, vs. not for profit, OR: 1.19, 95%CI: 1.12, 1.26 • Lower staff to bed ratio, OR: 1.22, 95%CI: 1.16, 1.28 • Employment of agency nurses, OR: 1.57, 95%CI: 1.48, 1.66 • Employment of other agency staff, OR: 1.28, 95%CI: 1.12, 1.37 • Staff care for both infected and uninfected residents, OR: 1.30, 95%CI: 1.23, 1.37 • Cleaning frequency of communal touchpoints < 1/day, OR: 1.15, 95%CI: 1.03, 1.28 • Cleaning staff rooms < 1/day, OR: 1.24, 95%CI: 1.14, 1.34 • Staff personal protective equipment (PPE) only with infected residents, vs. all the time, OR: 1.20, 95%CI: 1.05, 1.37 • Full PPE for infected residents, OR: 3.60, 95%CI: 3.34, 3.88 • Full PPE for all residents, OR: 1.42, 95%CI: 1.37, 1.48 • Inability to isolate a resident, OR: 1.33, 95%CI: 1.28, 1.38 • New admissions, OR: 1.012, 95%CI: 1.010, 1.014 <p>Risk factors for large outbreaks (>20 cases or 1/3 of residents) include:</p> <ul style="list-style-type: none"> • Employment of agency nurses, OR: 1.85, 95%CI: 1.23, 2.77 • Full PPE for all residents, OR: 1.44, 95%CI: 1.08, 1.91 • Full PPE for infected residents, OR: 1.62, 95%CI: 1.24, 2.11 <p>Analyses adjusted for known confounders (e.g., resident and facility level risk factors).</p>	<p>Low PREPRINT</p>
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<p>Temkin-Greener, H., Guo, W., Mao, Y., Cai, X., & Li, Y. (2020). COVID-19 Pandemic in Assisted Living Communities: Results from Seven States. <i>Journal of the American Geriatrics Society</i>. Epub ahead of print.</p>	<p>Sep 21, 2020</p>	<p>Cohort</p>	<p>4865 facilities, USA</p>	<p>This study compared characteristics of facilities with and without cases. Across states, fewer than 10% of facilities reported a case.</p> <p>After controlling for resident characteristics and county-level COVID-19 rates, the odds of having a resident case increased with:</p> <ul style="list-style-type: none"> • Average resident age, OR: 1.05, 95%CI: 1.02, 1.08 • Number of residents, 9-29 vs. < 9 residents, OR: 1.82, 95%CI: 1.22, 2.72; >30 vs. < 9 residents, OR: 2.78, 95%CI: 1.85, 4.18 • % Residents with congestive heart failure, OR: 1.14, 95%CI: 1.04, 1.25 • Community spread, cases/1000, OR: 1.17, 95%CI: 1.10, 1.24 <p>Total number of cases (in facilities with at least 1 case) was associated with:</p> <ul style="list-style-type: none"> • % male residents, OR: 1.03, 95%CI: 1.00, 1.06 • % black/Hispanic residents, OR: 1.08, 95%CI: 1.05, 1.11 • % residents with dementia, COPD, obesity (OR range 1.04 to 1.09) <p>Odds of at least 1 death was associated with:</p> <ul style="list-style-type: none"> • % Medicare only residents, OR: 1.10, 95%CI: 1.01, 1.19 • Number of residents (9-29 vs. < 9 residents, OR: 1.78, 95%CI: 1.02, 3.10; >30 vs. < 9 residents, OR: 2.83, 95%CI: 1.62, 4.93) • % residents with dementia, OR: 1.14, 95%CI: 1.02, 1.26) • Community COVID-19 deaths/1000, OR: 4.44, 95%CI: 2.93, 6.71 	<p>High</p>
<p>Yue, L., Cen, X., Cai, X., & Temkin-Greener, H. (2020). Racial and Ethnic Disparities in COVID-19 Infections and Deaths Across U.S. Nursing Homes. <i>Journal of the American Geriatrics Society</i>, 68(11), 2454-2461.</p>	<p>Sep 21, 2020</p>	<p>Cross sectional</p>	<p>12 576 facilities, USA</p>	<p>Data were reported for one week, May 25-31, 2020. 93% of facilities had zero new cases.</p> <ul style="list-style-type: none"> • Facilities with a high proportion of racial/ethnic minority residents had more COVID-19 related resident cases (mean 1.5 vs. 0.4 in highest vs. lowest quartile), resident deaths (mean 0.4 vs. 0.1 in highest vs. lowest quartile) and staff cases (1.3 vs. 0.7 in highest vs. lowest quartile). All differences were statistically significant. • Facilities with higher proportions of racial/ethnic minority residents tended to be larger, for-profit facilities, affiliated with a chain, have more Medicaid residents and lower nurse staffing hours and were in counties with more COVID-19 cases and deaths. <p>Analyses adjusted for county- and facility-level characteristics.</p>	<p>Moderate</p>

<p>Bui, D., See, I., Hesse, E., Varela, K., Harvey, R., August, E., ... Atkins, A. (2020). Association Between CMS Quality Ratings and COVID-19 Outbreaks in Nursing Homes – West Virginia, March 17– June 11, 2020. <i>MMWR. Morbidity and Mortality Weekly Report</i>, 69(37), 1300–1304.</p>	<p>Sep 18, 2020</p>	<p>Cohort</p>	<p>123 facilities, West Virginia, USA</p>	<p>This study examined the risk of COVID-19 infections and outbreaks based on Centers for Medicare & Medicaid Services star quality ratings from Mar-Jun 2020. 11% of facilities reported outbreaks.</p> <p>Compared to those with no outbreaks, facilities with an outbreak had:</p> <ul style="list-style-type: none"> • Higher number of beds (104.1 vs. 84.6) • Higher number of residents (92.2 vs. 75.6) • Fewer nurse hours per resident per day (1.9 vs. 2.2) • Higher county-level incidence (177.8 vs. 105.1 per 100 000) • Lower overall star quality ratings • More historical substantiated complaints (4.8 vs. 1.3) • More health inspection deficiencies (14.9 vs. 10.5) • Specific health inspection deficiencies that were different between outbreak and non-outbreak facilities were <ul style="list-style-type: none"> ○ Quality of life and care (3.8 vs. 2.4) ○ Resident assessment and care planning (3.5 vs. 2.2) <p>All differences statistically significant but analyses not adjusted for known confounders.</p>	<p>Moderate</p>
<p>Lipsitz, L.A., Lujan, A.M., Dufour, A., Abrahams, G., Magliozzi, H., Herndon, L., & Dar, M. (2020). Stemming the Tide of COVID-19 Infections in Massachusetts Nursing Homes. <i>Journal of the American Geriatrics Society</i>, 68(11), 2447-2453.</p>	<p>Sep 15, 2020</p>	<p>Quasi-experimental</p>	<p>360 facilities, Massachusetts, USA</p>	<p>This study compared factors associated with infection and mortality rates over 9 weeks.</p> <p>Key components that increased infections included:</p> <ul style="list-style-type: none"> • Lack of cohorting, OR: 3.0, 95 %CI: 1.34, 6.71 • Inappropriate PPE use, OR: 2.16, 95%CI: 1.42, 3.30 • Community prevalence <p>Weekly mortality rates were associated with:</p> <ul style="list-style-type: none"> • Inappropriate PPE use, OR: 3.20, 95%CI: 1.87, 5.48 • Community prevalence <p>Analyses not adjusted for known confounders.</p>	<p>Low</p>

<p>Shen, K. (2020). Relationship between nursing home COVID-19 outbreaks and staff neighborhood characteristics. <i>Preprint.</i></p>	<p>Sep 11, 2020</p>	<p>Cross sectional</p>	<p>7154 Medicare and Medicaid-certified facilities, USA</p>	<p>Determinants of COVID-19 deaths per facility were estimated using data to Jul 2020. 25-75% of facilities were infected per state.</p> <p>Factors associated with higher death rate include:</p> <ul style="list-style-type: none"> • Average community-transmission where staff live • Community transmission where LTC facility located • Proportion of residents who are nonwhite • Average severity of residents' impairment • Occupancy rate of facility <p>OR or RR not reported. Analyses adjusted for state-level factors.</p>	<p>Low PREPRINT</p>
<p>Dean, A., Venkataramani, A., & Kimmel, S. (2020). Mortality Rates From COVID-19 Are Lower In Unionized Nursing Homes. <i>Health Affairs, 39</i>(11), 1993-2001.</p>	<p>Sep 10, 2020</p>	<p>Cross sectional</p>	<p>355 facilities, New York State, USA</p>	<p>This study examines the association between the presence of health care worker unions and COVID-19 mortality rates.</p> <p>The presence of a health care union was associated with:</p> <ul style="list-style-type: none"> • Lower mortality (absolute difference -1.29%, 95%CI: -2.41, -0.17) • Fewer infections: -50.1 cases/ 1 000 residents, 95%CI: -96.2, -3.9 <p>Analyses adjusted for known confounders.</p>	<p>Moderate</p>
<p>Emmerson, C., Adamson, J.P., Turner, D., Gravenor, M.B, Salmon, J., Cottrell, S., ... Williams, C.J. (2020). Risk factors for outbreaks of COVID-19 in care homes following hospital discharge: a national cohort analysis. <i>Preprint.</i></p>	<p>Aug 26, 2020</p>	<p>Cohort</p>	<p>n=3,115 hospital discharges to 1,068 facilities, UK</p>	<p>This study followed hospital discharges to LTC to observe COVID-19 outbreaks from Feb 22-Jun 27, 2020. 30.1% of facilities experienced an outbreak.</p> <p>A discharge from hospital was not associated with the risk of outbreak after adjusting for facility characteristics.</p> <p>Factors associated with risk of outbreak include:</p> <ul style="list-style-type: none"> • Number of residents (10-24 vs. <10, Hazard Ratio (HR): 3.40, 95%CI: 1.99, -5.80; 25-29 vs. < 10 residents, HR: 8.25, 95%CI: 4.93, 13-81; 50+ vs. < 10, HR: 17.35, 95%CI: 9.65, 31.19) • Local health board (proxy for community transmission) <p>Analyses adjusted for known confounders.</p>	<p>Moderate PREPRINT</p>

<p>Shi, S.M., Bakaev, I., Chen, H., Trivison, T.G, & Berry, S.D. (2020). Risk Factors, Presentation, and Course of Coronavirus Disease 2019 in a Large, Academic Long-Term Care Facility. <i>The Journal of Post-Acute and Long-Term Care Medicine</i>, 21(10), 1378-1383.</p>	<p>Aug 25, 2020</p>	<p>Retrospective Cohort</p>	<p>n=389 residents, USA</p>	<p>This study described risk factors associated with COVID-19 in LTC residents. All residents were tested between Mar and May 2020, 37.5% tested positive.</p> <p>Factors associated with risk of infection after adjusting for confounders include:</p> <ul style="list-style-type: none"> • Male sex, Relative Risk (RR): 1.80, 95%CI: 1.07, 3.05 • Bowel incontinence, RR: 1.97, 95%CI: 1.10, 3.52 • % staff living in a high prevalence community (per 10% increase): RR: 1.06, 95%CI: 1.04, 1.08 <p>Mortality rates increased with frailty (16.7% in pre-frail, 22.2% in moderately frail, and 50.0% in frail; $p < .001$).</p>	<p>High</p>
<p>Sugg, M., Spaulding, T., Lane, S., Runkle, J., Harden, S., Hege, A., & Iyer, L. (2020). Mapping community-level determinants of COVID-19 transmission in nursing homes: A multi-scale approach. <i>The Science of the Total Environment</i>, 752, 141946.</p>	<p>Aug 25, 2020</p>	<p>Cross sectional</p>	<p>13,709 facilities, USA</p>	<p>This study explored the association between facility- and county-level place-based variables and COVID-19 cases in LTC. 40% of facilities reported at least one case. Clustering of cases was similar to county-level clustering among the general population.</p> <p>Facility level factors associated with risk of COVID-19 include:</p> <ul style="list-style-type: none"> • Number of fines in 2020, RR= 1.13, 95%CI: 1.07, 1.19 • Licensed Practical Nurse staffing, RR: 1.07, 95%CI: 1.00, 1.15 • Total staff levels, RR: 0.86, 95%CI: 0.78, 0.94 <p>County-level factors associated with risk of COVID-19 include:</p> <ul style="list-style-type: none"> • County COVID-19 rate, RR: 1.83, 95%CI: 1.70, 1.97 • Per-capita income, RR: 2.20, 95%CI: 2.00, 2.42 • County unemployment rate, RR 1.26, 95%CI: 1.16, 1.36 • Average household size, RR: 1.18, 95%CI: 1.07, 1.31 • % population African American, RR: 1.30, 95%CI: 1.20, 1.41 • Population per sq. mile, RR: 1.10, 95%CI: 1.00, 1.20 <p>All analyses adjusted for known confounders.</p>	<p>High</p>

<p>Stall, N., Jones, A., Brown, K., Rochon, P., & Costa, A. (2020). For-profit long-term care homes and the risk of COVID-19 outbreaks and resident deaths. <i>Canadian Medical Association Journal</i>, 192(33), E946–E955.</p>	<p>Aug 17, 2020</p>	<p>Cohort</p>	<p>623 facilities, Ontario, Canada; n=75,676 residents</p>	<p>This study explored the association between for-profit vs. not-for-profit status on outbreaks, resident infections and deaths. 30.5% of facilities reported outbreaks.</p> <p>Outbreaks were not associated with profit status of home, but were associated (after adjusting for confounders) with:</p> <ul style="list-style-type: none"> • Rate of COVID-19 in the public health region, OR: 1.91, 95%CI: 1.19, 3.05 • Number of residents, OR: 1.38, 95%CI: 1.18,1.61 • Older design standards of facility, OR: 1.55, 95%CI: 1.01, 2.38 • Local population size (<10 000 vs. >500 000, OR: 0.39, 95%CI: 0.18, 0.83; 10 000 – 499 999, OR: 0.56, 95%CI: 0.33, 0.95) <p>Extent of outbreaks and mortality was associated with for-profit status after adjusting for number of residents, design standards, and chain ownership.</p>	<p>High</p>
<p>Figuroa, J.F., Wadhwa, R.K., & Papanicolaos, I., Riley, K., Zheng, J., Orav, E.J., & Jha, A.K. (2020). Association of Nursing Home Ratings on Health Inspections, Quality of Care, and Nurse Staffing With COVID-19 Cases. <i>The Journal of the American Medical Association Network</i>, 324(11), 1103-1105.</p>	<p>Aug 10, 2020</p>	<p>Cohort</p>	<p>4254 facilities, USA</p>	<p>This study explored the association between health inspections, quality ratings and nurse staffing and number of COVID-19 cases.</p> <p>Higher total nursing hours/resident/day and RN hours/resident/day were associated with lower odds of resident COVID-19 cases (OR: 0.82, 95%CI: 0.70, 0.95 after adjustment for facility size and county-level effects.</p> <p>There was no association between health inspection or quality measure ratings and COVID-19 cases.</p>	<p>Moderate</p>

<p>Gorges, R.J., & Konetzka, R.T. (2020). Staffing Levels and COVID-19 Cases and Outbreaks in U.S. Nursing Homes. <i>Journal of the American Geriatrics Society</i>, 68(11), 2462-2466.</p>	<p>Aug 8, 2020</p>	<p>Cohort</p>	<p>13,167 facilities, USA</p>	<p>This study explored the association between nursing staff and confirmed COVID-19 cases, outbreaks and mortality.</p> <p>71% of facilities had at least one case; of those, 25% experienced an outbreak (>1 case per 10 certified beds, or >1 confirmed and suspected case per 5 certified beds, or >10 deaths).</p> <p>Factors associated with risk of a case include:</p> <ul style="list-style-type: none"> • Lowest tertile of total nursing hours, OR: 0.83 • Highest tertile of RN/Total nursing hours, OR: 1.22 • County-level cases (Highest vs. lowest quartile, OR: 6.20) • Number of beds, OR: 1.01 <p>Factors associated with outbreaks include:</p> <ul style="list-style-type: none"> • Highest tertile of total nursing hours, OR: 0.82 • County-level cases (Highest vs. lowest quartile, OR: 6.32) <p>Factors associated with mortality include:</p> <ul style="list-style-type: none"> • High total nursing hours (marginal effect (ME) = -1.06) • County-level cases (Highest vs. lowest quartile, ME = 6.10) <p>Analyses adjusted for known confounders, but CI not reported. Authors note the decreased risk of infection with lower total staff hours may be related to fewer individuals coming in and out of the building and potentially introducing the virus, while increased staffing may help to control outbreaks and provide care.</p>	<p>Moderate</p>
<p>Harrington, C., Ross, L., Chapman, S., Halifax, E., Spurlock, B., & Bakerjian, D. (2020). Nurse Staffing and Coronavirus Infections in California Nursing Homes. <i>Policy, Politics & Nursing Practice</i>, 21(3), 174–186.</p>	<p>Aug 1, 2020</p>	<p>Cross sectional</p>	<p>1091 facilities, USA</p>	<p>The purpose of this study was to examine the characteristics of facilities with and without COVID-19. 24.9% of facilities reported at least one case.</p> <p>Factors associated with confirmed COVID-19 cases include:</p> <ul style="list-style-type: none"> • RN staffing levels < 0.75 hours/resident/day, OR: 2.06, 95%CI: 1.31, 3.30 • Resident health deficiencies, OR: 1.02, 95%CI: 1.00, 1.04 • Total beds, OR: 1.01, 95%CI: 1.00, 1.01 • Medicare five-star nurse staffing rating, OR: 0.83, 95%CI: 0.72, 0.97 • Medicare five-star RN staff rating, OR: 0.82, 95%CI: 0.71, 0.94 <p>Analyses adjusted for known confounders, including community transmission.</p>	<p>Moderate</p>

<p>Chatterjee, P., Kelly, S., Qi, M., & Werner, R.M. (2020). Characteristics and Quality of US Nursing Homes Reporting Cases of Coronavirus Disease 2019 (COVID-19). <i>The Journal of the American Medical Association Network Open</i>, 3(7), e2016930.</p>	<p>Jul 29, 2020</p>	<p>Cross sectional</p>	<p>8943 facilities, 23 states, USA</p>	<p>This study describes the characteristics and quality of facilities with COVID-19 cases from Apr 22–29, 2020. 33.8% reported ≥ 1 cases.</p> <p>Facilities that reported COVID-19 cases had:</p> <ul style="list-style-type: none"> • Residents with higher mean (SD) health deficiencies, 67.0 (67.6) vs. 56.2 (68.7) • More emergency preparedness deficiencies, 3.9 (3.6) vs. 3.2 (3.4) • More reported incidents 2.4 (4.7) vs. 1.1 (3.1) • More substantiated complaints 5.7 (9.5) vs. 4.0 (7.4) • For-profit facilities, 78.9% vs 69.1% • Higher mean (SD) % of Medicaid-insured residents 59.3% (25.2%) vs 56.7% (24.1%) • Higher county-level infection rates (505.6 vs. 231.3 per 100 000) <p>There were no differences in outcome by staffing, overall 5-star ratings, or star ratings of deficiencies. Statistical significance is not reported, and analyses were not adjusted for known confounders.</p>	<p>Moderate</p>
<p>Fisman, D.N., Bogoch, I., Lapointe-Shaw, L., McCready, J., & Tuite, A.R. (2020). Risk Factors Associated with Mortality Among Residents with Coronavirus Disease 2019 (COVID-19) in Long-term Care Facilities in Ontario, Canada. <i>The Journal of the American Medical Association Network Open</i>, 3(7), e2015957.</p>	<p>Jul 22, 2020</p>	<p>Cohort</p>	<p>627 facilities, Canada</p>	<p>This study compared COVID-19 mortality in facilities vs. community. 43.4% of facilities reported at least one case in resident or staff.</p> <p>There was no association between presence of COVID-19 in a facility and number of beds, region, or for-profit status.</p> <p>Resident mortality was associated with:</p> <ul style="list-style-type: none"> • Staff cases with a 2-day lag, RR: 1.20; 95%CI: 1.14, 1.26 • Staff cases with a 6-day lag, RR=1.17; 95%CI: 1.11, 1.26 <p>Definition of ‘lag’ is unclear but appears to be lag between testing and results. Analyses were not adjusted for known confounders.</p>	<p>Moderate</p>

<p>White, E., Kosar, C., Feifer, R., Blackman, C., Gravenstein, S., Ouslander, J., & Mor, V. (2020). Variation in SARS-CoV -2 Prevalence in U.S. Skilled Nursing Facilities. <i>Journal of the American Geriatrics Society</i>, 68(10), 2167-2173.</p>	<p>Jul 16, 2020</p>	<p>Cross sectional</p>	<p>3357 facilities, USA</p>	<p>This study identified county and facility factors associated with COVID-19 outbreaks in skilled nursing facilities. 22.6% of facilities reported at least one case.</p> <p>Factors associated with probability of at least one case include:</p> <ul style="list-style-type: none"> • County prevalence, for every 1,000 cases per 100,000, probability increased 33.6%, 95%CI: 9.6, 57.7 • Facility size, for every 10-bed increase, probability increased 0.9%, 95%CI: 0.6, 1.2) • Higher star-rating for health inspections was associated with a 2.9% decrease in probability of a case, 95%CI: -5.1, -0.7 <p>Factors associated with number of cases include:</p> <ul style="list-style-type: none"> • County prevalence, per 1000 cases per 100 000, number of resident cases increases by 12.6, 95%CI: 4.4, 20.8 • Facility size, for every 10-bed increase, the number of cases increase by 2.0, 95%CI: 0.9, 3.0 • Date of first county case, early county cases were associated with fewer resident cases <p>Analyses were only adjusted for state.</p>	<p>High</p>
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<p>Dutey-Magni, P.F., Williams, H., Jhass, A., Rait, G., Hemingway, H., Hayward, A.C., & Shallcross, L. (2020). COVID-19 infection and attributable mortality in UK Long Term Care Facilities: Cohort study using active surveillance and electronic records (March-June 2020). <i>Preprint</i>.</p>	<p>Jul 15, 2020</p>	<p>Cohort</p>	<p>n=9,339 residents and n=11,604 staff across 179 facilities, UK</p>	<p>The purpose of this study was to assess risk factors for COVID-19 infection in residents and staff.</p> <p>10.2% (95%CI: 9.6, 10.8) of residents, and 5.0% (95%CI: 4.7, 5.5) of staff had confirmed infections.</p> <p>Factors independently associated with risk of infection include:</p> <ul style="list-style-type: none"> • Male sex, HR: 1.32, 95%CI: 1.11, 1.56 • Age 75-84 vs. <75, HR: 1.32, 95%CI: 1.03, 1.71; 85-94 vs. <75, HR: 1.42, 95%CI: 1.10, 1.82; 95+ vs. <75, HR: 1.43, 95%CI: 1.01, 2.03 • Bed type, nursing vs. residential, HR: 1.40, 95%CI: 1.15, 1.70 • Facility size, 45-59 beds vs. 20-34 beds, HR: 1.59, 95%CI: 1.27, 1.99; 70-85 beds vs. 20-34 beds, HR: 1.87, 95%CI: 1.44, 2.43 • Average 85-100 residents per 100 rooms vs. 70-85 residents per 100 rooms, HR: 2.48, 95%CI: 1.84, 3.33; >100 residents per 100 rooms vs. 70-85 residents per 100 rooms, HR: 9.28, 95%CI: 6.20, 13.90 • Bed to staff ratio, HR: 8.22, 95%CI: 4.62, 14.63 <p>Factors independently associated with all-cause mortality include:</p> <ul style="list-style-type: none"> • Male sex, HR: 1.44, 95%CI: 1.30, 1.59 • Age 75-84 vs. <75, HR: 1.36, 95%CI: 1.14, 1.61; 85-94 vs. <75, HR: 1.75, 95%CI: 1.49, 2.06; 95+ vs. <75, HR: 2.32, 95%CI: 1.88, 2.85 • Bed type, nursing vs. residential, HR: 1.36, 95%CI: 1.21, 1.54 <p>Analyses were adjusted for known confounders.</p>	<p>Moderate PREPRINT</p>
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<p>Rolland, Y., Lacoste, M., De Mauleon, A., Ghisolfi, A., De Souto Barreto, P., Blain, H., & Villars, H. (n.d.). Guidance for the Prevention of the COVID-19 Epidemic in Long-Term Care Facilities: A Short-Term Prospective Study. <i>The Journal of Nutrition, Health & Aging</i>, 24, 812-816.</p>	<p>Jul 13, 2020</p>	<p>Cross sectional</p>	<p>124 facilities, France</p>	<p>This study compared the association between self-reported adherence to COVID-19 guidance and resident COVID-19 cases. 24.2% of facilities had at least one case.</p> <p>Facilities with no cases were more likely to:</p> <ul style="list-style-type: none"> • Be publicly funded, OR: 0.39, 95%CI: 0.20, 0.73 • Have organized staff within zones within the facilities, OR: 0.19, 95%CI: 0.07, 0.48 • Have higher reported implementation of preventative measures in the facility, OR: 0.65, 95%CI: 0.43, 0.98) <p>Analyses were adjusted for known confounders.</p>	<p>Low</p>
<p>Brainard, J.S., Rushton, S., Winters, T., & Hunter, P.R. (2020). Introduction to and spread of COVID-19 in care homes in Norfolk, UK. <i>Preprint</i>.</p>	<p>Jun 18, 2020</p>	<p>Cross sectional</p>	<p>248 facilities, UK</p>	<p>The study examined the relationship between staffing and PPE introduction and spread of COVID-19. 10% of facilities had a COVID-19 case between Apr 5 and May 6, 2020.</p> <p>Time to first infection was associated with the number of non-care workers (e.g., cooks, maintenance, administrative) employed. Compared to those with <10, 11-20 non-care workers, HR: 6.50, 95%CI: 2.61, 16.17; 21-30 non-care workers, HR: 9.87, 95%CI: 3.22, 30.22; >31 non-care workers, HR: 18.93, 95%CI: 2.36, 151.9.</p> <p>Daily increment in cases was associated with:</p> <ul style="list-style-type: none"> • Reduced availability eye protection (OR: 1.66, 95%CI: 1.29, 2.13) and facemasks (OR: 1.26, 95%CI: 1.09, 1.46) • Number of care workers employed, per 1-unit increase OR: 1.04, 95%CI: 1.02, 1.05 • Number of nurses employed, per 1-unit increase OR: 1.18, CI: 1.13, 1.24 <p>Cases were not laboratory confirmed but based on home manager's judgement. Analyses not adjusted for other known confounders.</p>	<p>Moderate PREPRINT</p>

<p>Li, Y., Temkin-Greener, H., Shan, G., Cai, X. (2020). COVID-19 Infections and Deaths among Connecticut Nursing Home Residents: Facility Correlates. <i>Journal of the American Geriatrics Society</i>, 68(9), 1899-1906.</p>	<p>Jun 18, 2020</p>	<p>Cross sectional</p>	<p>215 facilities, USA</p>	<p>This study explored associations between facility and resident characteristics and COVID-19 cases and mortality. 50.2% of facilities reported at least one case by Apr 16, 2020.</p> <p>After controlling for facility and county covariates, no relationship was found between RN staffing, five-star ratings, or % of Medicaid and racial/ethnic minority residents and confirmed cases or mortality.</p> <p>Among facilities with at least <i>one confirmed</i> case, case counts were associated with:</p> <ul style="list-style-type: none"> • RN staff, per 20-min increase, RR: 0.78, 95%CI: 0.68, 0.89 • Star rating, 4- or 5-star vs. < 4, RR = 0.87, 95%CI: 0.78, 0.97 • High % Medicaid residents, RR: 1.16, 95%CI: 1.02, 1.32 • High % racial/ethnic minority residents, RR: 1.15, 95%CI: 1.03, 1.29 <p>No statistically significant associations were found for mortality.</p>	<p>Moderate</p>
<p>He, M., Li, Y., & Fang, F. (2020). Is There a Link between Nursing Home Reported Quality and COVID-19 Cases? Evidence from California Skilled Nursing Facilities. <i>The Journal of Post-Acute and Long-Term Care Medicine</i>, 21(7), 905-908.</p>	<p>Jun 15, 2020</p>	<p>Cohort</p>	<p>1223 facilities, USA</p>	<p>This study explored the relationship between facility quality and COVID-19 cases and mortality. 35% of facilities reported ≥ 1 case.</p> <p>Factors associated with COVID-19 amongst residents include:</p> <ul style="list-style-type: none"> • Quality ratings, 5-star vs 3-star, OR: 0.41, 95%CI: 0.27, 0.62; 4-star vs. 3-star, OR: 0.66, 95%CI: 0.44, 0.98 • Bed occupancy, per 1-bed increase, OR: 1.009, 95%CI: 1.006, 1.012 • % non-white residents, >59.5% vs. <59.5%, OR: 1.95, 95%CI: 1.49, 2.55 <p>Factors associated with COVID-19 mortality include:</p> <ul style="list-style-type: none"> • Quality ratings, 5-star vs. 3-star, OR: 0.30, 95%CI: 0.18, 0.48 • Bed occupancy, per 1-bed increase, OR: 1.006, 95%CI: 1.003, 1.009 • % white residents, <59.5 vs. >59.5, OR: 1.64, 95%CI: 1.21, 2.23) • For-profit status, OR: 1.69, 95%CI: 1.01, 3.00 <p>Analyses were adjusted for known confounders.</p>	<p>High</p>

<p>Unruh, M.A., Yun, H., Zhang, Y., Braun, R.T., & Jung, H.Y. (2020). Nursing Home Characteristics Associated With COVID-19 Deaths in Connecticut, New Jersey, and New York. <i>The Journal of Post-Acute and Long-Term Care Medicine</i>, 21(7), 1001-1003.</p>	<p>Jun 15, 2020</p>	<p>Cross sectional</p>	<p>1162 facilities, USA</p>	<p>This study compared facilities with 6+ deaths to those with < 6. 15.8% had 6 or more deaths.</p> <p>Factors associated with having 6+ COVID-19 deaths include:</p> <ul style="list-style-type: none"> • % Medicaid residents, highest vs. lowest quintile, 8.6%-point increase, 95%CI: 1.1, 16.1 • Mean resident ADL scores, for every 1-unit increase, 2.6%-point increase, 95%CI: 1.4, 3.8 • Total beds, per bed +0.1%-point increase, 95%CI: 0.00, 0.1 • Occupancy rate, per resident +0.3%-point increase, 95%CI: 0.1, 0.5 • For-profit status, +4.8%-point increase vs. not for profit, 95%CI: 0.8, 8.8 • Probabilities higher in New Jersey (+12.5, 95%CI: 1.5, 23.6) and lower in New York (-7.8, 95%CI: -15.6, 0.0) compared to Connecticut <p>Analyses were adjusted for known confounders.</p>	<p>Moderate</p>
<p>Abrams, H.R., Loomer, L., Gandhi, A., & Grabowski, D.C. (2020). Characteristics of U.S. Nursing Homes with COVID-19 Cases. <i>Journal of the American Geriatrics Society</i>, 68(8), 1653-1656.</p>	<p>Jun 2, 2020</p>	<p>Cross sectional</p>	<p>9,395 facilities, 30 states, USA</p>	<p>This study compared characteristics of facilities with and without COVID-19 cases. 31.4% of facilities had a COVID-19 case.</p> <p>Factors associated with presence of a case include:</p> <ul style="list-style-type: none"> • Facility size, >150 beds vs. < 50 beds, OR: 6.52; 50-150 beds vs. <50 beds, OR: 2.63 • Urban vs rural location, OR: 3.22 • Higher % black residents, OR: 2.05 • Chain vs. non-chain OR: 0.89 • Geographic location, ORs varied by state <p>Factors associated with outbreak size include:</p> <ul style="list-style-type: none"> • Facility size, >150 beds vs. < 50 beds, % point change: -10.8; 50-150 beds vs. <50 beds, \$ point change: -15.9 • For profit vs. non-profit, % point change: 1.9 • Geographic location, % point change varied by state <p>Analyses were not adjusted for any confounders. All factors were statistically significant, but CI not reported.</p>	<p>Moderate</p>

Question 2: What strategies mitigate risk of outbreaks and mortality within LTC?

Table 4: Syntheses

Reference	Date Released	Description of Included Studies	Summary of Findings	Quality Rating: Synthesis	Quality Rating: Included Studies
New Evidence Reported December 10, 2020					
Frazer, K., Lachlan, M., Stokes, D., Crowley, E., & Kelleher, C.C. (2020). A rapid systematic review of measures to protect older people in long term care facilities from COVID-19. <i>Preprint.</i>	Nov 3, 2020 (Search completed Jul 27, 2020)	This review included 38 studies (5 preprints) that focused on the research question: <ul style="list-style-type: none"> • 8 cohort • 28 cross-sectional • 1 case study • 1 ecological study 	<p>Strategies used in long-term care homes included</p> <ul style="list-style-type: none"> • Mass testing (22 studies) • Use of PPE (10 studies) • Screening of residents, staff, visitors (8 studies) • Visitor restrictions (10 studies) • Hand hygiene and droplet precautions (6 studies) • Cohorting and isolation (11 studies) <p>Most studies are cross sectional or have no comparator group, making it difficult to draw conclusions about the most effective strategies.</p>	High PREPRINT	Low
Public Health England (2020). Factors associated with COVID-19 in care homes and domiciliary care, and effectiveness of interventions: A rapid review.	Oct 28, 2020 (Search completed Aug 31, 2020)	This rapid review included 9 studies (3 preprints) that focused on the research question: <ul style="list-style-type: none"> • 3 cohort • 1 cross-sectional • 2 outbreak investigations • 2 descriptive • 1 modelling 	<p>There is limited evidence on the impact of specific interventions on the transmission or prevalence of COVID-19 in care homes.</p> <p>Based on weak evidence, interventions associated with significantly lower levels of COVID-19 included:</p> <ul style="list-style-type: none"> • Routine facility wide testing followed by isolation of cases • Voluntary staff confinement in care homes <p>One modelling study reported that symptom-based detection and screening was least effective in reducing transmission of COVID-19 and digital contact tracing was more effective than non-digital approaches.</p>	Moderate	Not reported

<p>Gmehlin, C., & Munoz-Price, L.S. (2020). COVID-19 in Long Term Care Facilities: A Review of Epidemiology, Clinical Presentations, and Containment Interventions. <i>Infection Control & Hospital Epidemiology</i>. Epub ahead of print.</p>	<p>Oct 26, 2020 (Search date not reported)</p>	<p>This literature review included: 12 studies, set in USA and European facilities (study designs not reported)</p>	<p>Containment interventions used by LTC facilities before an outbreak occurred included:</p> <ul style="list-style-type: none"> • Surveillance and social distancing • Cancelled group activities • Daily screening / symptom assessment (residents, staff, visitors) • Symptom-based testing (residents) • Infection control training (staff) • Visitation restrictions • Admission suspension • Use of metered inhalers vs. nebulizers <p>Once an outbreak occurred, additional strategies included:</p> <ul style="list-style-type: none"> • Cohorting with universal / point prevalence testing • Universal use of personal protective equipment <p>This study is limited in the quality of its review methods.</p>	<p>Low</p>	<p>Not reported</p>
<p>Previously Reported Evidence</p>					
<p>Rios, P., Radhakrishnan, A., Williams, C., Ramkissoon, N., Pham, B., Cormack, G.V., ... Tricco, A.C. (2020). Preventing the transmission of COVID-19 and other coronaviruses in older adults aged 60 years and above living in long-term care: a rapid review. <i>Systematic Reviews</i>, 9(1), 1–8.</p>	<p>Sep 25, 2020 (Search completed Jul 31, 2020)</p>	<p>This rapid review included 9 clinical practice guidelines (CPG) from:</p> <ul style="list-style-type: none"> • Government agencies (n=3) • Medical associations (n=3) • Non-profit research trusts (n=2) • International health organizations (n=1) 	<p>The most common recommendations among CPGs were:</p> <ul style="list-style-type: none"> • Surveillance, monitoring, and evaluation of symptoms in staff and residents • Mandated personal protective equipment (PPE) use • Social distancing/isolation or cohorting among residents • Enhanced cleaning • Promotion of hand and respiratory hygiene measures • Sick leave policies <p>Further evidence needed on impact of restricting staff movement between multiple facilities.</p>	<p>Moderate</p>	<p>Very low</p>

<p>Koshkouei, M., Abel, L., & Pilbeam, C. (2020, April 24). <i>How can pandemic spreads be contained in care homes?</i></p>	<p>Apr 14, 2020, (Search date not reported)</p>	<p>This rapid review included: 30 studies (study designs and countries not reported)</p>	<p>Measures such as hand hygiene, regular cleaning, and limiting staff movement between facilities may reduce infection spread.</p> <p>Further evidence is needed regarding restrictions on visitors and testing of staff.</p>	<p>Low</p>	<p>Not reported</p>
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Table 5: In-progress Syntheses

Title	Anticipated Release Date	Setting	Description of Document
New Evidence Reported December 10, 2020			
Cardot, T., Josseran, L., Herr, M., & Delarocque-Astagneau, E. (2020). Resilience of nursing homes in Europe during the first wave of COVID-19: a systematic review of control measures implemented according to the magnitude of the outbreak and national guidelines. <i>PROSPERO, CRD42020223089.</i>	Dec 30, 2020	Nursing Homes and long-term care facilities for aged residents in Western Europe	This review will explore the COVID-19 control measures that were implemented in nursing homes and long-term care homes in Western Europe during the first wave of the pandemic including room ventilation, hygiene management, access to and use of personal protective equipment, testing, physical restrictions on movement, isolation and cohorting of staff.

Table 6: Single Studies

Reference	Date Released	Study Design	Population	Setting	Summary of findings	Quality Rating:
New Evidence Reported December 10, 2020						
Shimotsu, S. T., Johnson, A. R. L., Berke, E. M., & Griffin, D. O. (2021). COVID-19 Infection Control Measures in Long-Term Care Facility, Pennsylvania, USA. <i>Emerging Infectious Diseases, 27</i> (2).	Nov 20, 2020	Case report	Residents, staff and visitors of a LTC facility	Pennsylvania, USA	<p>From Jun 23 to Oct 1, 2020, 5,625 nasal swabs (collected twice per week) and daily symptom checks were performed on residents, staff, and visitors. In addition, the following control measures were implemented:</p> <ul style="list-style-type: none"> • PPE required for all staff and visitors including masks anywhere in the facility, and N95 respirators in isolation and quarantine areas • Strict hygiene practices for the staff and twice-daily cleaning. • Only full-time staff; no per-diem staff • New residents admitted were required to quarantine for 14 days or until 2 negative tests • Family visits and group activities were not allowed <p>Based on data obtained Sep 28–Oct 9, 2020, this facility’s case number was 17 times lower than neighboring facilities.</p>	Low

<p>Psevdos, G., Papamanoli, A., Barrett, N., Bailey, L., Thorne, M., Ford, F., & Lobo, Z. (2020). Halting a SARS-CoV-2 Outbreak in a U.S. Veterans Affairs Nursing Home. <i>American Journal of Infection Control</i>. Epub ahead of print.</p>	<p>Nov 2, 2020</p>	<p>Case report</p>	<p>Residents and Staff</p>	<p>Veterans Affairs LTC facility, New York, USA</p>	<p>An outbreak was declared from Mar 24 to Apr 18, 2020. After an initial case was in the facility a variety of measures were implemented including:</p> <ul style="list-style-type: none"> • Social distancing isolation practices • Resident activities were stopped • Staff cohorting was introduced • New admissions were stopped • Hand hygiene was enforced <p>PPE use was also enforced, and stock quickly became depleted. As such, Ebola PPE stockpile was used including whole body suits, head and neck coverings, booties/shoe coverings, and N95 respirators.</p> <p>Additional measures including the creation of a dedicated COVID unit, the use of rapid RT-PCR test, and universal testing were implemented.</p> <p>Infection control measures lead to a decline in cases and full resolution of the outbreak by Apr 18, 2020.</p>	<p>High</p>
<p>Sizoo, E. M., Monnier, A. A., Bloemen, M., Hertogh, C. M. P. M., & Smalbrugge, M. (2020). Dilemmas with restrictive visiting policies in Dutch nursing homes during the COVID-19 pandemic: A qualitative analysis of an open-ended questionnaire with elderly care physicians. <i>Journal of the American Medical Directors Association</i>, 21(12), 1774-1781.E2.</p>	<p>Oct 23, 2020</p>	<p>Qualitative</p>	<p>n=76 elderly care physicians</p>	<p>Long term care facilities and nursing homes in Netherlands</p>	<p>This study explored the dilemmas experienced by physicians because of the implementation of COVID-19 visitor restrictions in long term care and nursing homes in the Netherlands.</p> <p>The visitor restriction policy contributed to limiting the further spread of COVID-19. The need for balancing safety for all through infection prevention measures versus quality of life of the individual residents and their loved ones is a core dilemma in long term care and nursing homes.</p>	<p>High</p>

<p>Annweiler, C., Hanotte, B., de l'Éprevier, C. G., Sabatier, J.-M., Lafaie, L., & Célarier, T. (2020). Vitamin D and survival in COVID-19 patients: A quasi-experimental study. <i>The Journal of Steroid Biochemistry and Molecular Biology</i>, 204, 105771.</p>	<p>Oct 13, 2020</p>	<p>Quasi experimental</p>	<p>n=66 residents</p>	<p>1 facility, France</p>	<p>Residents who were administered oral vitamin D3 supplementation in the week prior or following a COVID-19 diagnosis (n = 57) were compared to those who did not receive Vitamin D3 as part of routine supplementation (n =9).</p> <p>Vitamin D3 was associated with less severe COVID-19 symptoms ($\beta=-3.84$, 95%CI: 6.07, -1.62, p = 0.001) and lower mortality (HR: 0.11, 95%CI: 0.03, 0.48, p = 0.003).</p> <p>Limitations of this study include its small sample size and quasi-experimental design. Reasons for declining standard Vitamin D3 supplementation were not reported.</p>	<p>Moderate</p>
<p>Montoya, A., Jenq, G., Mills, J. P., Beal, J., Diviney Chun, E., Newton, D., ... Mody, L. (2020). Partnering with Local Hospitals and Public Health to Manage COVID-19 Outbreaks in Nursing Homes. <i>Journal of the American Geriatrics Society</i>. Epub ahead of print.</p>	<p>Oct 9, 2020</p>	<p>Case report</p>	<p>n=215 residents</p>	<p>3 facilities, Michigan, USA</p>	<p>Upon identification of an outbreak, a number of measures were put in place:</p> <ul style="list-style-type: none"> • Cohorting positive residents to a dedicated COVID unit within 48 hours of initial testing • Providing in person, email, and phone communication to residents and healthcare workers, including testing results and potential exposures • Re-educating staff on PPE use and monitoring of use; gowns, gloves, eye protection and N95 respirators were used in COVID-19 areas • Allocating dedicated COVID unit staffing, with incentive pay • Following patient care processes, including residents remaining in assigned rooms, not sharing equipment, and reducing staff exposure • Point prevalence testing occurred three times, with decreasing prevalence <p>A limitation of this study is that interventions were only described; it was not possible to determine which were actually effective, or more effective.</p>	<p>High</p>

<p>Escobar, D. J., Lanzi, M., Saberi, P., Love, R., Linkin, D. R., Kelly, J. J., ... Doyon, J. B. (2020). Mitigation of a Coronavirus Disease 2019 Outbreak in a Nursing Home Through Serial Testing of Residents and Staff. <i>Clinical Infectious Diseases</i>. Epub ahead of print.</p>	<p>Jul 20, 2020</p>	<p>Case report</p>	<p>n=84 residents</p>	<p>1 facility, Pennsylvania, USA</p>	<p>This case study described an outbreak investigation at one nursing home and the strategies used to contain it.</p> <p>Interventions to control the outbreak included:</p> <ul style="list-style-type: none"> • Serial rapid testing to identify, isolate, and cohort asymptomatic infectious residents every 3-5 days • Establishment of a COVID isolation ward • Daily meeting of multidisciplinary team of experts (infection prevention, quality improvement, geriatrics) • Universal staff testing • Universal masking for residents and staff • Quality management staff as dedicated observers to prevent lapses in control practice and re-educate on appropriate personal protective equipment use <p>A limitation of this study is that interventions were only described; it was not possible to determine which were actually effective, or more effective. No subsequent outbreaks occurred in the facility as of Jul 1.</p>	<p>High</p>
<p>Dora, A.V., Winnett, A., Jatt L.P., Davar, K., Watanabe, M., Sohn, L., ... Goetz, M.B. (2020). Universal and Serial Laboratory Testing for SARS-CoV-2 at a Long-Term Care Skilled Nursing Facility for Veterans – Los Angeles, California, 2020. <i>Morbidity and Mortality Weekly Report</i>, 69(21), 651-655.</p>	<p>May 29, 2020</p>	<p>Case report</p>	<p>Residents and staff (n=NR)</p>	<p>120-bed facility, Florida, USA</p>	<p>Published recommendations were put into place including training with infection prevention and control practitioners for hand hygiene, PPE use, and HVAC optimization. Twice daily screening for residents and staff, cessation of group activities, visitor bans, reducing staff working in multiple facilities and using telemedicine where possible.</p> <p>Following a second resident testing positive, routine universal testing occurred every 14 days for 6 weeks, and exposed residents were cohorted in a dedicated area and a universal masking policy was applied for all staff and patients when outside their room. Over 6 weeks, prevalence decreased from 5.4% to 3.6% to 0.41%.</p>	<p>High</p>

Previously Reported Evidence						
Telford, C., Onwubiko, U., Holland, D., Turner, K., Prieto, J., Smith, S., ... Shah, S. (2020). Preventing COVID-19 Outbreaks in Long-Term Care Facilities Through Preemptive Testing of Residents and Staff Members — Fulton County, Georgia, March–May 2020 . <i>Morbidity and Mortality Weekly Report</i> , 69(37), 1296–1299.	Sep 18, 2020	Quasi experimental	28 facilities	Georgia, USA	<p>Facility-wide COVID-19 testing for residents and staff was conducted:</p> <ul style="list-style-type: none"> • As a response measure in 15 facilities after a confirmed case was identified (testing based on previous symptomatic screening) • As a prevention measure in 13 facilities with no confirmed cases <p>Prevalence of cases was significantly higher among ‘response’ facilities (28.0% residents; 7.4% staff) compared to ‘preventive’ facilities (0.5% residents; 1.0% staff).</p> <p>After 4 weeks of follow-up screening, overall prevalence was significantly lower in the “preventive” facilities (1.5% residents; 1.7% staff) compared to “response” facilities (42.4% residents; 11.8% and staff).</p>	Low

<p>Lipsitz, L.A., Lujan, A.M., Dufour, A., Abrahams, G., Magliozzi, H., Herndon, L., & Dar, M. (2020). Stemming the Tide of COVID-19 Infections in Massachusetts Nursing Homes. <i>Journal of the American Geriatrics Society</i>, 68(11), 2447-2453.</p>	<p>Sep 15, 2020</p>	<p>Quasi-experimental</p>	<p>360 facilities</p>	<p>Massachusetts, USA</p>	<p>All facilities completed an infection control checklist at baseline. Payment incentives were attached to passing unannounced monthly or more infection control audits, COVID-19 testing of >90% of residents and staff, provision of key data and providing residents with technology for virtual visits with family and friends.</p> <p>Sites that had previous infection control deficiencies or failed an initial audit received additional support through onsite and virtual infection control consultations. All sites had access to weekly webinars and continuous Q&A communication, as well as PPE, staffing and testing resources.</p> <p>For every 1-point increase in the infection control checklist score, there was a decrease in weekly infection rate (8%, $p = .0007$) and decrease in weekly mortality rate (3%, $p=0.179$).</p> <p>Greater compliance with PPE and cohorting was associated with large reductions in infections.</p>	<p>Low</p>
<p>Wilmink, G., Summer, I., Marsyla, D., Sukhu, S., Grote, J., Zobel, G., ... & Movva, S. (2020). Real-Time Digital Contact Tracing: Development of a System to Control COVID-19 Outbreaks in Nursing Homes and Long-Term Care Facilities. <i>JMIR Public Health and Surveillance</i>, 6(3), e20828.</p>	<p>Aug 25, 2020</p>	<p>Simulated model</p>	<p>n=120 individuals (80 residents; 40 staff)</p>	<p>Simulated model</p>	<p>A simulation model was developed to compare the effectiveness of a digital contact tracing system to other transmission control approaches (e.g., symptom mapping, manual contact tracing, polymerase chain reaction testing) in long term care facilities.</p> <p>The digital contact tracing system was more effective in reducing COVID-19 transmission, with a lower number of new cases and lower mortality rate, compared to other approaches, likely due to its speed and efficiency in identifying cases. Symptom-based screening alone was the least effective method resulting in the highest number of new cases and mortality in the simulation model.</p>	<p>Not appraised</p> <p><i>Interpret with caution</i></p>

<p>Telford, C.T., Bystrom, C., Fox, T., Wiggins-Benn, S., McCloud, M., Holland, D.P., & Shah, S. (2020). Assessment of Infection Prevention and Control Protocols, Procedures, and Implementation in Response to the COVID-19 Pandemic in Twenty-three Long-term Care Facilities in Fulton County, Georgia. <i>Preprint.</i></p>	<p>Aug 15, 2020</p>	<p>Cohort</p>	<p>23 facilities</p>	<p>Georgia, USA</p>	<p>Among 23 facilities that reported 1 or more COVID-19 infections, implementation of infection prevention control was greatest for screening measures and lowest for disinfection.</p> <p>Facilities with lower prevalence of COVID-19 infections had greater implementation of social distancing and PPE measures compared to facilities with higher prevalence of infections.</p> <p>Lower prevalence facilities also had greater implementation of:</p> <ul style="list-style-type: none"> • Enforcement of maximum occupancy in small, enclosed areas • Droplet/contact precaution signage in specific areas • Frequent training and audits of proper mask usage by staff • Proper use of masks by staff in COVID-19 and non-COVID-19 units • Adequate supply of PPE 	<p>Low PREPRINT</p>
<p>Belmin, J., Um-Din, N., Donadio, C., Magri, M., Nghiem, Q., Oquendo, B., Pariel, S., & Lafuente-Lafuente, C. (2020). Coronavirus Disease 2019 Outcomes in French Nursing Homes That Implemented Staff Confinement with Residents. <i>The Journal of the American Medical Association Network Open</i>, 3(8), e2017533.</p>	<p>Aug 13, 2020</p>	<p>Quasi experimental</p>	<p>17 facilities (n = 1250 residents; n = 94 staff)</p> <p>9513 facilities (n = 695,060 residents; n = 385,290 staff)</p>	<p>France</p>	<p>Facilities that implemented voluntary staff self-confinement with residents (≥ 7 days) were compared to facilities which did not.</p> <p>Only 1 (5.8%) facility in which self-confinement occurred reported cases of COVID-19, compared with 4,599 (48.3%) facilities with no self-confinement ($p < 0.001$).</p> <p>Lower rates among residents were found in facilities with staff self-confinement compared to those without for:</p> <ul style="list-style-type: none"> • Confirmed cases (0.4% vs 4.4%) • Possible cases (0% vs 4.6%) • Mortality (0.4% vs 1.8%; OR: 0.22, 95%CI 0.09, 0.53) <p>A lower rate of confirmed or possible cases among staff was also found in facilities with staff self-confinement compared to those without (1.6% vs 7.6%).</p>	<p>Low</p>

<p>Echeverría, P., Mas Bergas, M., Puig, J., Isnard, M., Massot, M., Vedia, C., ... & Negro, E. (2020). COVIDApp as an Innovative Strategy for the Management and Follow-Up of COVID-19 Cases in Long-Term Care Facilities in Catalonia: Implementation Study. <i>JMIR Public Health and Surveillance</i>, 6(3), e21163.</p>	<p>Jul 17, 2020</p>	<p>Quasi experimental</p>	<p>196 facilities (169 long terms care facilities and 27 facilities for people with a physical or mental disability)</p>	<p>Catalonia, Spain</p>	<p>Care facilities collaborated with 64 primary care teams in the use of a COVID-19 App tool aimed at monitoring residents' clinical symptoms for early detection of suspected cases, managing care, and monitoring potential transmission within facilities.</p> <p>In the month following commencement of app use, there was an increase in suspected cases in Week 1, but a decrease in weeks 3 and 4. Confirmed cases increased up until the end of week 3, then remained stable. Total deaths and deaths among suspected/confirmed cases increased over the first half of the month, then decreased.</p> <p>There was also a decrease in the number of facilities classified as "high-risk" for COVID-19 over the month.</p>	<p>Moderate</p>
<p>Caspi, G., Chen, J., Liverant-Taub, S., Shina, A., & Caspi, O. (2020). Heat Maps for Surveillance and Prevention of COVID-19 Spread in Nursing Homes and Assisted Living Facilities. <i>The Journal of Post-Acute and Long-Term Care Medicine</i>, 21(7), 986-988.</p>	<p>May 25, 2020</p>	<p>Quasi experimental</p>	<p>Not reported</p>	<p>Israel</p>	<p>Authors have developed a real-time heat mapping website which captures data regarding the number of confirmed cases (residents and/or staff) in facilities within a specified time period, as well as the rate of growth in cases in a facility.</p> <p>This tool could be used by officials to monitor trends in facility transmission and determine whether transmission may be occurring across facilities within a specific geographic area, allowing further investigation.</p>	<p>Low</p>

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