

Preventing the Transmission of COVID-19 in Older Adults Aged 60 Years and Above Living in Long-Term Care

Rapid Review Update

The Health Technology Assessment Unit, University of Calgary

October 30th, 2020

Cite as: Oluwaseun Egunsola, Mark Hofmeister, Laura E. Dowsett, Tom Noseworthy, and Fiona Clement. Preventing the Transmission of COVID-19 in Older Adults Aged 60 Years and Above Living in Long-Term Care: Rapid Review Update. University of Calgary, Health Technology Assessment Unit. Produced for DSEN MAGIC Team. October 30th, 2020.

Acknowledgements: We thank Andrea Tricco and the Drug Safety and Effectiveness Network (DSEN) Methods and Applications Group for Indirect Comparisons (MAGIC) team.

For questions about this report, please contact:

Dr. Fiona Clement

Director, Health Technology Assessment Unit, University of Calgary

Email: fclement@ucalgary.ca

Phone: 403-210-9373

Key Messages:

- This is an update of a previous rapid review
- Literature search of databases MEDLINE, Cochrane library, and pre-print servers (biorxiv/medrxiv) was conducted from July 31, 2020 to October 9, 2020. EMBASE was searched from July 31, 2020 until October 18, 2020.
- Five observational studies and one clinical practice guideline were identified.
- Infection prevention measures identified in this rapid review included: social distancing and isolation, PPE use and hygiene practices, screening, training and staffing policies.
- The use of PPE, laboratory screening tests, sick pay to staff, self-confinement of staff within the LTCFs for 7 or more days, maintaining maximum residents' occupancy, training and social distancing significantly reduced the prevalence of COVID-19 infection among residents and/or staff of LTCFs ($p < 0.05$).
- Practices such as hiring of temporary staff, not assigning staff to care separately for infected and uninfected residents, inability to isolate sick residents and infrequent cleaning of communal areas significantly increased the prevalence of infection among residents and/or staff of LTCFs ($p < 0.05$).

Table of Contents

1	Purpose	5
2	Methods	5
2.1	Search Strategy.....	5
2.2	Study Selection.....	6
2.3	Data Extraction.....	7
2.4	Quality Assessment	7
2.5	Synthesis.....	7
3	Results	7
3.1	Study Characteristics.....	7
3.2	Quality Assessment	10
3.3	Narrative Synthesis of Observational Studies	12
3.3.1	Staffing Policies	12
3.3.2	Isolation and Social Distancing	12
3.3.3	Personal Protective Equipment and Personal Hygiene	13
3.3.4	Screening.....	13
3.3.5	Education	13
3.3.6	Clinical Practice Guideline	13
4	Conclusion	15
5	Appendix	17

1 Purpose

As compared to other segments of the population, older adults living in long-term care facilities have a higher risk of infection and death as a result of coronavirus 2019 (COVID-19).¹ The overall objective of this rapid review was to examine the control and management of COVID-19, SARS, or MERS in adults 60 years or above living in long-term care facilities. This is an update of a previous work done by Rios et al.² The specific research questions were:

1. What are the infection prevention and control practices for preventing or reducing the transmission of COVID-19, Middle East Respiratory Syndrome (MERS), and Severe Acute Respiratory Syndrome (SARS) in older adults aged 60 years and above living in long-term care facilities?
2. Do the infection prevention and control practices for adults aged 60 years and above living in long-term care with severe comorbidities or frailty differ as compared to those without such severe comorbidities/frailty?
3. What are the employment and remuneration policies of care providers that may have contributed to the COVID-19 outbreaks in adults aged 60 years and above living in long-term care facilities?

2 Methods

2.1 Search Strategy

A rapid review was conducted in accordance with the Rapid Review Guide for Health Policy and Systems Research.³ A combination of comprehensive literature searches and automated search and citation screening was used to search MEDLINE, EMBASE, Cochrane library, and pre-print servers (biorxiv/medrxiv). Grey literature was searched via international clinical trial registries (e.g., clinical trials.gov, WHO international clinical trials register), COVID-19 focused evidence gathering services (e.g., EPPI Mapper, COVID-END), as well as guideline producers/repositories (e.g., NICE guidance, ECRI).

The search for all sources for the previous review was conducted from inception up to July 31, 2020.² The literature search for this update, for all sources except EMBASE, was conducted on October 9, 2020. Titles and abstracts from public archives were identified for screening using Gordon V. Cormack and Maura R. Grossman's Continuous Active Learning® ("CAL®") tool, which uses supervised machine learning.⁴ For archives that could be retrieved in their entirety (e.g., Medline), the entire archive was processed and searched using CAL®.

For those archives that could only be accessed using keywords (e.g. clinicaltrials.gov), relevant search terms were applied (e.g., COVID-19, long-term care). The CAL® tool identifies the titles and abstracts most likely to meet specific inclusion criteria, based on the screening results that have been previously identified and reviewed. This process continues iteratively, until none of the identified articles meet the inclusion criteria. The EMBASE search was carried out from July 31, 2020 until October 18, 2020. The search strategy is available in Appendix 1. This rapid review is registered in the International Prospective Register of Systematic Reviews (CRD42020181993).

2.2 Study Selection

The eligibility criteria followed the PICOST framework outlined in Table 1. No other limitations were imposed. Both peer-reviewed and non-peer-reviewed papers were eligible for inclusion, as were papers written in languages other than English.

In order to meet the requested timeline, an automated approach to initial screening was used to identify the most relevant citations, the full-text of which were subsequently screened. Prior to full-text screening, calibration was conducted on five consecutive studies. Full-text screening was completed by two reviewers using Microsoft Excel. All included studies were verified by a second reviewer. A screening form based on the eligibility criteria was utilized and studies were excluded if they failed to meet the inclusion criteria as stated below.

Table 1. Eligibility Criteria

Population	Individuals aged ≥ 60 years living in long-term care facilities (e.g., nursing home, long-term care hospital/facility, skilled nursing facility, convalescent home, assisted living facilities).
Intervention	Any form of infection control and prevention. Only those measures used to prevent COVID-19, MERS or SARS were included, measures related to control and prevention of other infections (e.g., vaccination for influenza, oral care to prevent bacterial pneumonia) were excluded. Additionally, interventions related to remuneration/compensation policies for long-term care facility staff, staffing models, policies on mixing of staff in long-term care facilities, and policies on staff travelling between long-term care facilities were included.
Comparator	Any of the above listed interventions listed above or no intervention
Outcomes	Lab-confirmed respiratory infection [primary outcome], symptoms, secondary transmission (e.g., other patients, healthcare workers), goal concordant care, hospitalization, intensive-care unit (ICU) admission, mortality
Study designs	Clinical practice guidelines (CPGs) and systematic reviews, using the Cochrane definition of a systematic review. Primary human studies of all designs (e.g., experimental studies, quasi-experimental studies, and observational studies excluding case series) that involved patients with COVID-19, SARS or MERS) were included.
Time periods	All periods of time and duration of follow-up were included.

2.3 Data Extraction

Items for data extraction included: title of the article, author, year of publication, country of publication, study design, inclusion criteria, total population sample, group sample sizes, number of LTCF, infection control methods and outcomes. For the clinical practice guidelines, the recommendations and level of evidence for each recommendation was abstracted. Included studies were abstracted by a single reviewer.

2.4 Quality Assessment

Risk of bias appraisal was carried out by a single reviewer using the AGREE-II tool⁵ for clinical practice guidelines and the Newcastle Ottawa Scale (NOS)⁶ for cohort and case-control studies. For the NOS scale, each study was assessed across three categories: selection, comparability, and outcome. The cross-sectional studies were assessed with the Joanna Briggs Institute (JBI) checklist.⁷

2.5 Synthesis

The infection control interventions were classified into five broad categories: staffing policy, isolation and social distancing, personal protective equipment and hygiene, screening, and education. A narrative synthesis of the included studies was conducted.

3 Results

3.1 Study Characteristics

The search strategy yielded 457 unique citations; 376 were excluded after abstract review. Eighty-one studies proceeded to full-text review (Figure 1). Seventy-five studies were excluded for the following reasons: study design not of interest (n=35); no intervention of interest (n=33); duplicate (n=3); not retrievable (n=3); and one was an older published version of this rapid review. A total of 6 relevant studies were included in the final dataset.⁸⁻¹³

Two of the included studies were cohort studies,^{10,11} two were cross-sectional studies^{8,9} and one was a case-control study.¹² One clinical practice guideline was identified.¹³ A total of 14,830 long term care facilities and 864,434 residents were involved in these studies. Two studies were conducted in France^{8,10} and the United States^{11,12}, respectively and one was

conducted in the United Kingdom.⁹ The only included clinical practice guideline was developed for nursing homes in Canada¹³ (Table 2).

Figure 1. PRISMA Flowchart of Included and Excluded Studies

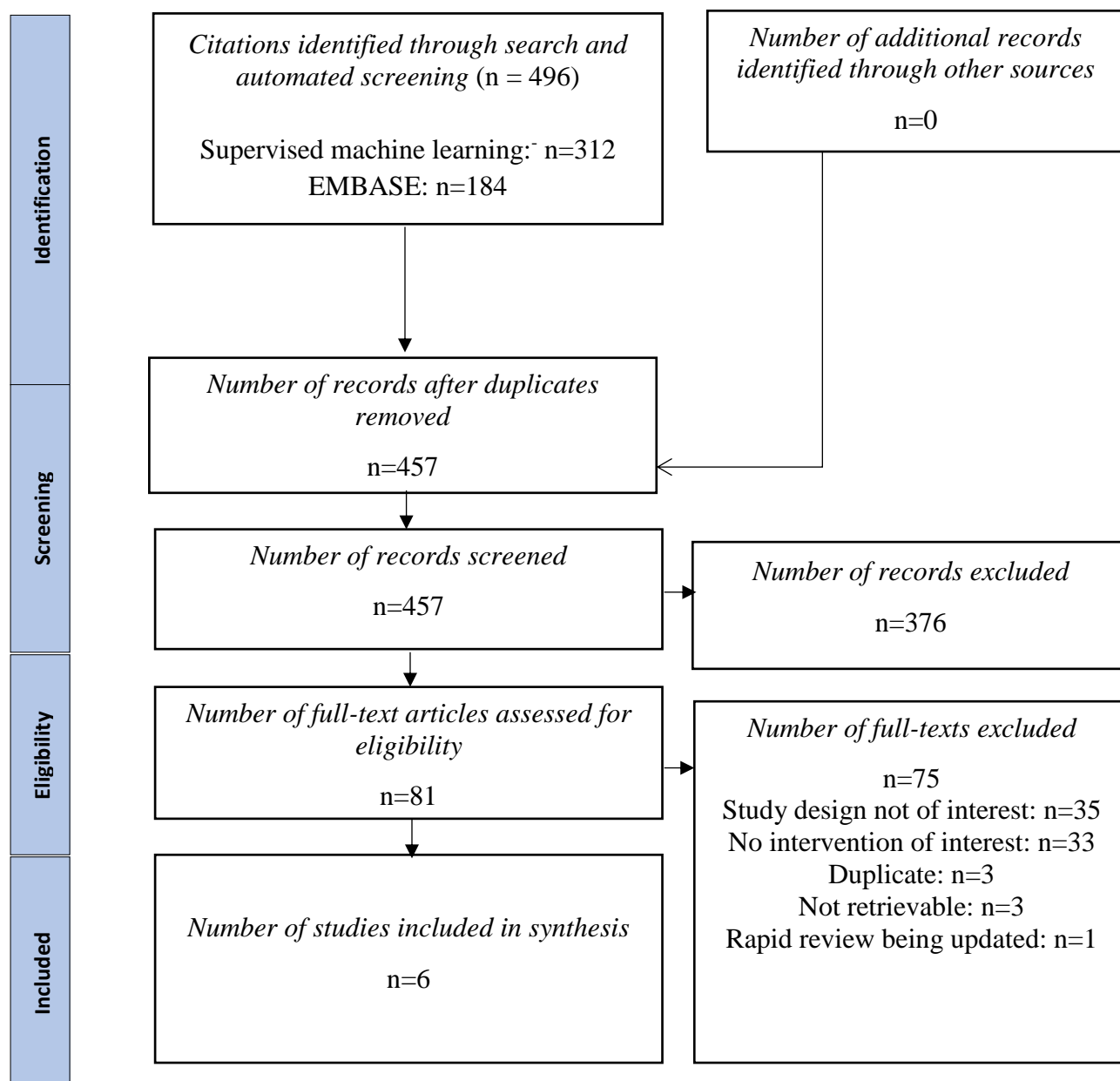


Table 2. Table of Study Characteristics

Author, Year, Country	Design	Population Sample Size	Inclusion	Infection Control Methods	Outcomes
Rolland, 2020 ⁸ France	Cross-Sectional	Total Population: NR Total LTCF: 124 Population Group 1: NR Population Group 2: NR	All LTCF in Occitania Region	<ul style="list-style-type: none"> – Staff compartmentalization – Resident compartmentalization – Use of PPE – Access to PPE and alcoholic sanitizers – Social distancing – Training 	<ul style="list-style-type: none"> – At least 1 case in LTCF
Shallcross, 2020 ⁹ United Kingdom	Cross-Sectional	Total Population: 160,033 Total LTCF: 5,125 Population Group 1: NR Population Group 2: NR	LTCF providing Care for residents with dementia or adults 65 years old or more	<ul style="list-style-type: none"> – No temporary staffing – Working in single locations – Staff compartmentalization. – Payment of sick leave – Isolating sick residents – Cleaning communal areas – Use of PPE – Barrier Nursing 	<ul style="list-style-type: none"> – Prevalence of infection among residents – Prevalence of infection among staff – Proportion of LTCF with at least one case – Proportion of LTCF with large outbreaks
Belmin, 2020 ¹⁰ France	Cohort	Total Population: 696,310 Total LTCF: 9,530 Population Group 1: 1,250 Population Group 2: 695,060	Nursing homes in which staff voluntarily confined themselves to the facility for 7 or more days	<ul style="list-style-type: none"> – Self-confinement by staff 	<ul style="list-style-type: none"> – At least 1 case in LTCF – Prevalence of infection among residents – Prevalence of infection among staff – Death rate among residents
Telford, 2020 ¹¹ USA	Cohort	Total Population: 5,671 Total LTCF: 28 Population Group 1: NR Population Group 2: NR	Residents in LTCF	<ul style="list-style-type: none"> – Preventive Screening 	<ul style="list-style-type: none"> – Prevalence of infection among residents – Prevalence of infection among staff – Hospitalization rate among residents
Telford, 2020 ¹² USA	Case-Control	Total Population: 2,420 Total LTCF: 23 Population Group 1: 1,150 Population Group 2: 1,270	LTCF in Fulton county with at least one case of COVID-19	<ul style="list-style-type: none"> – Social distancing – Use of PPE – Maximum occupancy – Training – Cleaning and disinfection – Screening 	<ul style="list-style-type: none"> – Prevalence of infection among residents
Author, Year, Country	Design	Participants	Evidence Collection	Guideline Scope	
Stall, 2020 ¹³ Canada	Clinical Practice Guideline	Various authors from across Canada	10 Provinces and 3 Territories	Guidance for reopening nursing homes for family caregivers and visitors	

LTCF: Long Term Care Facility, PPE: Personal Protective Equipment, NR: Not Reported

3.2 Quality Assessment

The two included cohort studies were truly representative of the general population and the non-exposed cohorts were from the same community as the intervention groups. In both studies, outcomes were not present at the start of the study, the cohorts were comparable, outcomes were assessed independently, with sufficient and complete follow-up. However, in one study, exposure was ascertained by self-report, thus earning no star;¹¹ while exposure in the other was ascertained by structured interview.¹⁰ Overall, one study earned seven of eight stars¹¹ while the other earned eight stars¹⁰ (Table 3).

The case-control study was judged to be representative of the general population; the control group was from the community and had no prior history of disease. Both cases and control were comparable and the methods of ascertainment of exposure between them were comparable. There was no description of the method of ascertainment of exposure and no designation for non-response rate. Overall, this study had six of eight stars (Table 3).¹²

The two cross-sectional studies had clearly defined inclusion criteria, properly defined participants and setting, and reported objective standard for measuring COVID-19 cases. Both studies did not demonstrate the validity or reliability of the questionnaires used for exposure measurement. Both studies identified confounding factors and stated strategies to deal with them. Appropriate statistics were used in both studies^{8,9} (Table 3).

The clinical practice guideline scored four of twelve points on the scope and purpose domain, five of eleven points on the stakeholder involvement domain, no points on the rigour of development domain, two of eight points on the clarity of presentation domain, none of thirteen points on the applicability domain and one of six points on editorial independence.¹³ The full appraisal results for the included clinical practice guideline can be found in Appendix 2.

Table 3. Quality Assessment of Non-Randomized Studies

Cohort Studies (NOS)			Cross-Sectional Studies (JBI)			Case-Control Studies (NOS)	
Appraisal Items	Telford ¹¹	Belmin ¹⁰	Appraisal Items	Shallcross ⁹	Rolland ⁸		Telford ¹²
Representative-ness of the exposed cohort	x	x	Clearly defined inclusion criteria	Yes	Yes	Case definition adequate	Yes
Selection of the non-exposed cohort	x	x	Subjects and setting described in detail	Yes	Yes	Representativeness of cases	Yes
Ascertainment of exposure		x	Exposure measurement valid and reliable	No	No	Selection of Controls	Yes
Demonstration that outcome was not present at start	x	x	Objective, standard criteria for measuring condition	Yes	Yes	Control definition	Yes
Comparability of cohorts (design or analysis)	x	x	Confounding factors identified	Yes	Yes	Comparability of case and controls (design or analysis)	Yes
Assessment of outcome	x	x	Stated strategies to deal with confounding factors	Yes	Yes	Ascertainment of exposure	No
Was follow-up long enough for outcomes to occur	x	x	Outcomes measured validly and reliably	Yes	Yes	Same method of ascertainment of exposure for case and control	Yes
Adequacy of follow up of cohorts	x	x	Appropriate statistic used	Yes	Yes	Non-response rate	No

3.3 Narrative Synthesis of Observational Studies

3.3.1 *Staffing Policies*

Two studies evaluated the effect of different staffing policies on COVID-19 outcomes.^{8,9} Shallcross et al. reported an almost two-fold increase in the prevalence of COVID-19 infection among residents of LTCFs employing temporary staff on most days compared with those that never employed temporary staff ($p < 0.001$). They also found that LTCFs were about two times more likely to report a case of COVID-19 or a large outbreak of the disease if they hired temporary staff ($p < 0.001$).⁹ Similarly, COVID-19 infection was significantly more prevalent among the staff of LTCFs that hired temporary staff than those that did not ($p < 0.001$).⁹ However, Rolland et al. did not show any significant relationship between the proportion of LTCFs with a reported case of COVID-19 and the use of temporary staff ($p = 0.26$).⁸ The study showed that staff compartmentalization i.e. organization of the work so that the team works in small groups in one area of the LTCF with no physical connection with the other members of the team, statistically significantly lowered the risk of COVID-19 cases in LTCFs ($p = 0.01$).⁸ Finally, Shallcross et al. showed that providing sick pay to LTCF staff statistically significantly lowered the prevalence of infection among residents and staff ($p < 0.001$)⁹ (Table 4, Appendix 3).

3.3.2 *Isolation and Social Distancing*

In a study of LTCFs in Fulton county, USA, social distancing and maintaining maximum occupancy limit in the facilities were statistically significantly associated with lower prevalence of COVID-19 infection ($p < 0.05$).¹² A French study by Belmin et al. also found significantly lower prevalence of COVID-19 infection among LTCF residents and staff, in addition to a lower prevalence of death among residents, when staff voluntarily confine themselves to the facilities for seven or more days ($p < 0.001$).¹⁰ Shallcross et al. also showed that non-isolation of sick residents and non-assignment of staff to care separately for infected and uninfected residents significantly increased the risk of infections among residents and staff ($p < 0.001$).⁹ Conversely, Rolland et al. found that compartmentalization of LTCF residents, i.e. organization of the LTCF so that they live in small groups in one area of the LTCF with no possible physical connection with the other residents; social distancing during meals and the discontinuation of group activities were not significantly associated with COVID-19 cases in the facilities⁸ (Table 4, Appendix 3).

3.3.3 Personal Protective Equipment and Personal Hygiene

When compared with using PPE all the time, Shallcross et al. found that PPE use only during contact with all or infected residents was associated with a statistically significantly lower prevalence of infection among residents and staff⁹ (Table 4). The study also showed that cleaning of communal areas less than twice daily was significantly associated with higher prevalence of COVID-19 infection among residents and staff.⁹ Similarly, Telford et al. , found that nursing homes that use PPE and had bathrooms and sinks in the residents' rooms had significantly lower infection rates ($p<0.001$ and $p=0.04$ respectively) than those that did not. They however did not find any significant relationship between cleaning and hand hygiene, and the prevalence of COVID-19 infection .¹² Rolland et al. also did not find any significant association between PPE supply and use or the availability of hydro-alcoholic solutes and the occurrence of COVID-19 in LTCFs in France (Appendix 3).⁸

3.3.4 Screening

A study by Telford et al. showed that preventive laboratory screening tests for COVID-19 in LTCFs significantly reduced the prevalence of infection among residents and staff ($p<0.001$). However, screening did not significantly reduce the rate of hospitalization.¹¹ Another study by Telford et al. did not show any statistical association between the prevalence of COVID-19 and temperature or symptom screening ($p=0.15$).¹²

3.3.5 Education

Telford et al. showed that LTCFs that placed signage on droplet and contact precaution in required areas reported significantly lower rates of COVID-19 infection ($p=0.03$). Also, those that conducted trainings and frequent audits to ensure proper mask use among staff members reported significantly fewer rates of infection ($p=0.01$) (Table 4).¹²

3.3.6 Clinical Practice Guideline

The only clinical practice guideline included in this review was developed to guide the reopening of nursing homes to families and visitors in Canada.¹³ The guideline provided recommendations on personal protective equipment, policies for visitors, recommendations for supplies, social distancing and surveillance. Table 5 describes how this guideline compares with other available guidelines identified in the previous rapid review.²

Table 4: Effects of Infection Control Methods and Practices on COVID-19 Outcomes in LTCFs and Residents

Author	Practice/Infection Control Method	Outcome	Comparison	p values
Rolland et al. ⁸	*Staff compartmentalization	at least 1 case in LTCF	Yes vs No	0.01
Shallcross et al. ⁹	Use of temporary staff	Prevalence of Infection among residents	Most days vs Never	<0.001
	*Non-cohorting of staff	Prevalence of Infection among residents	Often vs Never	<0.001
	*Non-cohorting of staff	at least 1 case in LTCF	Often vs Never	<0.001
	Sick Pay to staff	Prevalence of Infection among residents	Statutory vs None	<0.001
	Unable to isolate sick residence	Prevalence of Infection among residents	Yes vs No	<0.001
	Unable to isolate sick residence	at least 1 case in LTCF	Yes vs No	<0.001
	Cleaning communal areas	Prevalence of Infection among residents	Once vs at least twice daily	0.003
	PPE use	Prevalence of Infection among residents	Any contact with all residents vs all the time	<0.001
	PPE use	Prevalence of Infection among residents	Direct care of all residents vs all the time	0.007
	PPE use	Prevalence of Infection among residents	Direct care of infected residents vs all the time	<0.001
Belmin el el. ¹⁰	Self-confinement of staff within the facility for ≥ 7 days	at least 1 case in LTCF	Yes vs No	<0.001
	Self-confinement of staff within the facility for ≥ 7 days	Prevalence of Infection among residents	Yes vs No	<0.001
	Self-confinement of staff within the facility for ≥ 7 days	Prevalence of death among residents	Yes vs No	<0.001
Telford et al. ¹¹	Laboratory screening	Prevalence of Infection among residents	Preventive vs Responsive	<0.001
Telford et al. ¹²	Social distancing	Prevalence of infection among residents	High vs Low infection rate	0.01
	PPE use	Prevalence of infection among residents	High vs Low infection rate	<0.001
	Maximum occupancy in LTCFs	Prevalence of infection among residents	High vs Low infection rate	0.02
	Laminated signage about droplets	Prevalence of infection among residents	High vs Low infection rate	0.03
	Bathroom and sink in rooms	Prevalence of infection among residents	High vs Low infection rate	0.04
	Training and audit	Prevalence of infection among residents	High vs Low infection rate	0.01

Red: Statistically significant increase in outcome; Green: Statistically significant decrease in outcome, PPE: Personal Protective Equipment; LTCF: Long-Term Care Facility; *Non-cohorting: Staff not assigned to care separately for infected and uninfected residents; Staff compartmentalization: organization of the work so that the team works in small groups in one area of the LTCF with no physical connection with the other members of the team

Table 5: COVID-19 Infection control recommendations from clinical practice guidelines

Recommendations	Stall, et al. 2020 ¹³	AGS, 2020	CDC, 2020	ECRI, 2020a	ECRI, 2020b	MOH, 2020
Cohorting equipment				X		
Communication					X	
Consulting/notifying health professionals		X		X		X
Diagnostic testing						X
Disinfecting surfaces			X	X		X
Droplet precautions						X
Education		X	X		X	
Hand hygiene			X	X		X
Personal protective equipment	X		X	X		X
Policies for visitors	X		X			X
Policies for staff/residents						X
Provide supplies	X	X	X		X	
Respiratory hygiene/cough etiquette			X		X	X
Social distancing/ isolation/cohorting	X	X	X	X		
Surveillance/monitoring/evaluation	X	X	X		X	X
Compensation/sick leave policies for staff		X	X			

Grey Shaded areas adapted from Rios et al.²

4 Conclusion

The effect of infection prevention and control practices on COVID-19 in long-term care facilities have not been adequately explored. The available studies are limited to only three countries despite the global nature of the disease. The majority of these studies showed that infection control measures such as favourable staffing policies, training, screening, social distancing, isolation and use of PPE significantly improved residents and staff related outcomes.

References

1. Fisman DN, Bogoch I, Lapointe-Shaw L, McCready J, Tuite AR. Risk factors associated with mortality among residents with coronavirus disease 2019 (COVID-19) in long-term care facilities in Ontario, Canada. *JAMA network open*. 2020;3(7):e2015957-e2015957.
2. Rios P, Radhakrishnan A, Williams C, et al. 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. *Systematic Reviews*. 2020;9(1):1-8.
3. Tricco AC, Langlois E, Straus SE, Organization WH. *Rapid reviews to strengthen health policy and systems: a practical guide*. World Health Organization; 2017.
4. Cormack GV, Grossman MR. Technology-Assisted Review in Empirical Medicine: Waterloo Participation in CLEF eHealth 2017. Paper presented at: CLEF (Working Notes)2017.
5. AGREE. AGREE-II Reporting Checklist. <https://www.agreetrust.org/resource-centre/agree-reporting-checklist/>. Published 2016. Accessed 26 October 2020.
6. Wells GA, Shea B, O'Connell D, et al. The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. In: Oxford; 2000.
7. Joanna Briggs Institute. Checklist for analytical cross sectional studies. 2020. [https://joannabriggs.org/sites/default/files/2020-08/Checklist for Analytical Cross Sectional Studies.pdf](https://joannabriggs.org/sites/default/files/2020-08/Checklist%20for%20Analytical%20Cross%20Sectional%20Studies.pdf). Accessed 26 October 2020.
8. Rolland Y, Lacoste M-H, De Mauleon A, et al. Guidance for the Prevention of the COVID-19 Epidemic in Long-Term Care Facilities: A Short-Term Prospective Study. *The journal of nutrition, health & aging*. 2020:1-5.
9. Shallcross L, Burke D, Abbott O, et al. Risk factors associated with SARS-CoV-2 infection and outbreaks in Long Term Care Facilities in England: a national survey. *medRxiv*. 2020.
10. Belmin J, Um-Din N, Donadio C, et al. Coronavirus Disease 2019 Outcomes in French Nursing Homes That Implemented Staff Confinement With Residents. *JAMA network open*. 2020;3(8):e2017533-e2017533.
11. Telford CT, Onwubiko U, Holland D, et al. Mass Screening for SARS-CoV-2 Infection among Residents and Staff in Twenty-eight Long-term Care Facilities in Fulton County, Georgia. *medRxiv*. 2020.
12. Telford CT, Bystrom C, Fox T, et al. 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. *medRxiv*. 2020.
13. Stall NM, Johnstone J, McGeer AJ, Dhuper M, Dunning J, Sinha SK. Finding the Right Balance: An Evidence-Informed Guidance Document to Support the Re-Opening of Canadian Nursing Homes to Family Caregivers and Visitors during the Coronavirus Disease 2019 Pandemic. *Journal of the American Medical Directors Association*. 2020;21(10):1365-1370. e1367.

5 Appendix

Appendix 1

EMBASE search strategy

- 1 exp coronaviridae/ or exp Coronaviridae infection/ or exp Coronavirus infection/ or SARS coronavirus/
- 2 ((wuhan or hubei or huanan) and (severe acute respiratory or pneumonia* or virus*) and outbreak*).mp.
- 3 (coronavir* or "corona virus*" or "coronavirus pneumonia" or betacoronavir* or COVID or COVID-19).mp.
- 4 ("nCoV" or "cov 2" or cov2 or 2019ncov or 2019-nCoV or "2019 ncov" or "2019-ncov" or "2019 novel cov" or "2019 ncov disease*" or "2019 novel coronavirus*").mp.
- 5 ("severe acute respiratory syndrome coronavirus*" or "wuhan virus*" or "sars cov 2 mers" or "middle east respiratory syndrome*" or "Severe Acute Respiratory" or SARS or SARS-CoV or SARS-CoV2 or MERS-CoV).mp.
- 6 or/1-5
- 7 exp communicable disease control/ or exp "prevention and control"/
- 8 contact examination/
- 9 exp protective equipment/ or exp surgical attire/
- 10 exp hygiene/ or exp hand washing/
- 11 patient isolation/ or contact examination/
- 12 instrument sterilization/ or exp disinfection/ or decontamination/
- 13 bleaching agent/
- 14 ("infection control" or "virus control" or "disease control" or prevent* or handwash* or "hand wash*" or quarant* or isolat* or steril* or disinfect* or fumigat* or decontaminat* or resanitiz* or resanitis* or desaniti* or contaminat* or antisept* or biocid* or steriliz* or sanitize* or bleach* or hypochlor* or ozon* or ultraviolet or UV or "contract tracing" or "disease notification").mp.
- 15 ("protective equipment" or "protective cloth*" or "protective product*" or "protective gear" or PPE or PPEs or mask* or facemask* or half-mask* or facepiece* or n95* or n99* or shield* or faceshield* or "Particulate filter*" or "gas filter*" or glov* or gown or gowns or "space suits" or "respiratory protect*" or visor or "eye protect*" or "eye spectacle*" or "hand protect*" or "hand wash*" or "handwash*" or google or goggles or "head cover*" or "shoe cover*" or respirator* or ventilator*).mp.
- 16 (restrict* adj3 (resident* or patient* or visit* or family or travel* or staff or provider* or employee*)).mp.
- 17 ((respiratory or cough or hand) adj2 (hygiene or etiquette)).mp.

- 18 exp ventilator/
- 19 or/7-18
- 20 6 and 19
- 21 nursing home/ or home for the aged/ or assisted living facility/
- 22 ((elder* or senior or nursing or aged or "old age" or "old people" or "old person*" or "long-term care" or "LTC" or "long term care") adj2 (home or homes or hous* or residenc* or facilit* or hospital*)).mp.
- 23 ("convalescence hom*" or "convalescence hospital*" or "extended care facility*" or "charitable hom*" or " home based health care facilit*").mp.
- 24 exp long term care/
- 25 or/21-24
- 26 20 and 25

Appendix 2

AGREE checklist for Stall et al.¹³

AGREE II Checklist		
CHECKLIST ITEM AND DESCRIPTION	REPORTING CRITERIA	Page #
DOMAIN 1: SCOPE AND PURPOSE		
1. OBJECTIVES Report the overall objective(s) of the guideline. The expected health benefits from the guideline are to be specific to the clinical problem or health topic.	<input checked="" type="checkbox"/> Health intent(s) (i.e., prevention, screening, diagnosis, treatment, etc.) <input type="checkbox"/> Expected benefit(s) or outcome(s) <input checked="" type="checkbox"/> Target(s) (e.g., patient population, society)	1365
2. QUESTIONS Report the health question(s) covered by the guideline, particularly for the key recommendations	<input type="checkbox"/> Intervention(s) or exposure(s) <input type="checkbox"/> Comparisons (if appropriate) <input type="checkbox"/> Outcome(s) <input checked="" type="checkbox"/> Health care setting or context	1365-1366
3. POPULATION Describe the population (i.e., patients, public, etc.) to whom the guideline is meant to apply.	<input checked="" type="checkbox"/> Target population, sex and age <input type="checkbox"/> Clinical condition (if relevant) <input type="checkbox"/> Severity/stage of disease (if relevant) <input type="checkbox"/> Comorbidities (if relevant) <input type="checkbox"/> Excluded populations (if relevant)	1365
DOMAIN 2: STAKEHOLDER INVOLVEMENT		
4. GROUP MEMBERSHIP Report all individuals who were involved in the development process. This may include members of the steering group, the research team involved in selecting and reviewing/rating the evidence and individuals involved in formulating the final recommendations	<input checked="" type="checkbox"/> Name of participant <input type="checkbox"/> Discipline/content expertise (e.g., neurosurgeon, methodologist) <input checked="" type="checkbox"/> Institution (e.g., St. Peter's hospital) <input checked="" type="checkbox"/> Geographical location (e.g., Seattle, WA) <input type="checkbox"/> A description of the member's role in the guideline development group	1365
5. TARGET POPULATION PREFERENCES AND VIEWS Report how the views and preferences of the target population were sought/considered and what the resulting outcomes were.	<input checked="" type="checkbox"/> Statement of type of strategy used to capture patients'/publics' views and preferences (e.g., participation in the guideline development group, literature review of values and preferences) <input type="checkbox"/> Methods by which preferences and views were sought (e.g., evidence from literature, surveys, focus groups) <input type="checkbox"/> Outcomes/information gathered on patient/public information <input type="checkbox"/> How the information gathered was used to inform the guideline development process and/or formation of the recommendations	1366
6. TARGET USERS Report the target (or intended) users of the guideline	<input checked="" type="checkbox"/> The intended guideline audience (e.g. specialists, family physicians, patients,	1366

	clinical or institutional leaders/administrators) <input type="checkbox"/> How the guideline may be used by its target audience (e.g., to inform clinical decisions, to inform policy, to inform standards of care)	
DOMAIN 3: RIGOUR OF DEVELOPMENT		
7. SEARCH METHODS Report details of the strategy used to search for evidence.	<input type="checkbox"/> Named electronic database(s) or evidence source(s) where the search was performed (e.g., MEDLINE, EMBASE, PsychINFO, CINAHL) <input type="checkbox"/> Time periods searched (e.g., January 1, 2004 to March 31, 2008) <input type="checkbox"/> Search terms used (e.g., text words, indexing terms, subheadings) <input type="checkbox"/> Full search strategy included (e.g., possibly located in appendix)	
8. EVIDENCE SELECTION CRITERIA Report the criteria used to select (i.e., include and exclude) the evidence. Provide rationale, where appropriate.	<input type="checkbox"/> Target population (patient, public, etc.) characteristics <input type="checkbox"/> Study design <input type="checkbox"/> Comparisons (if relevant) <input type="checkbox"/> Outcomes <input type="checkbox"/> Language (if relevant) <input type="checkbox"/> Context (if relevant)	
9. STRENGTHS & LIMITATIONS OF THE EVIDENCE Describe the strengths and limitations of the evidence. Consider from the perspective of the individual studies and the body of evidence aggregated across all the studies. Tools exist that can facilitate the reporting of this concept.	<input type="checkbox"/> Study design(s) included in body of evidence <input type="checkbox"/> Study methodology limitations (sampling, blinding, allocation concealment, analytical methods) <input type="checkbox"/> Appropriateness/relevance of primary and secondary outcomes considered <input type="checkbox"/> Consistency of results across studies <input type="checkbox"/> Direction of results across studies <input type="checkbox"/> Magnitude of benefit versus magnitude of harm <input type="checkbox"/> Applicability to practice context	
10. FORMULATION OF RECOMMENDATIONS Describe the methods used to formulate the recommendations and how final decisions were reached. Specify any areas of disagreement and the methods used to resolve them.	<input type="checkbox"/> Recommendation development process (e.g., steps used in modified Delphi technique, voting procedures that were considered) <input type="checkbox"/> Outcomes of the recommendation development process (e.g., extent to which consensus was reached using modified Delphi technique, outcome of voting procedures) <input type="checkbox"/> How the process influenced the recommendations (e.g., results of Delphi technique influence final recommendation, alignment with recommendations and the final vote)	
11. CONSIDERATION OF BENEFITS AND HARMS	<input type="checkbox"/> Supporting data and report of benefits	1366-1367

Report the health benefits, side effects, and risks that were considered when formulating the recommendations.	<input type="checkbox"/> Supporting data and report of harms/side effects/risks <input checked="" type="checkbox"/> Reporting of the balance/trade-off between benefits and harms/side effects/risks <input checked="" type="checkbox"/> Recommendations reflect considerations of both benefits and harms/side effects/risks	
12. LINK BETWEEN RECOMMENDATIONS AND EVIDENCE Describe the explicit link between the recommendations and the evidence on which they are based.	<input type="checkbox"/> How the guideline development group linked and used the evidence to inform recommendations <input type="checkbox"/> Link between each recommendation and key evidence (text description and/or reference list) <input type="checkbox"/> Link between recommendations and evidence summaries and/or evidence tables in the results section of the guideline	
13. EXTERNAL REVIEW Report the methodology used to conduct the external review.	<input type="checkbox"/> Purpose and intent of the external review (e.g., to improve quality, gather feedback on draft recommendations, assess applicability and feasibility, disseminate evidence) <input type="checkbox"/> Methods taken to undertake the external review (e.g., rating scale, open-ended questions) <input checked="" type="checkbox"/> Description of the external reviewers (e.g., number, type of reviewers, affiliations) <input type="checkbox"/> Outcomes/information gathered from the external review (e.g., summary of key findings) <input type="checkbox"/> How the information gathered was used to inform the guideline development process and/or formation of the recommendations (e.g., guideline panel considered results of review in forming final recommendations)	
14. UPDATING PROCEDURE Describe the procedure for updating the guideline.	<input type="checkbox"/> A statement that the guideline will be updated <input type="checkbox"/> Explicit time interval or explicit criteria to guide decisions about when an update will occur <input type="checkbox"/> Methodology for the updating procedure	
DOMAIN 4: CLARITY OF PRESENTATION		
15. SPECIFIC AND UNAMBIGUOUS RECOMMENDATIONS Describe which options are appropriate in which situations and in which population groups, as informed by the body of evidence.	<input type="checkbox"/> A statement of the recommended action Intent or purpose of the recommended action (e.g., to improve quality of life, to decrease side effects) <input checked="" type="checkbox"/> Relevant population (e.g., patients, public) <input type="checkbox"/> Caveats or qualifying statements, if relevant (e.g., patients or conditions for	1366-1368

	<p>whom the recommendations would not apply)</p> <p><input type="checkbox"/> If there is uncertainty about the best care option(s), the uncertainty should be stated in the guideline</p>	
<p>16. MANAGEMENT OPTIONS Describe the different options for managing the condition or health issue.</p>	<p><input type="checkbox"/> Description of management options</p> <p><input type="checkbox"/> Population or clinical situation most appropriate to each option</p>	
<p>17. IDENTIFIABLE KEY RECOMMENDATIONS Present the key recommendations so that they are easy to identify.</p>	<p><input checked="" type="checkbox"/> Recommendations in a summarized box, typed in bold, underlined, or presented as flow charts or algorithms</p> <p><input type="checkbox"/> Specific recommendations grouped together in one section</p>	1367/1368
DOMAIN 5: APPLICABILITY		
<p>18. FACILITATORS AND BARRIERS TO APPLICATION Describe the facilitators and barriers to the guideline's application.</p>	<p><input type="checkbox"/> Types of facilitators and barriers that were considered</p> <p><input type="checkbox"/> Methods by which information regarding the facilitators and barriers to implementing recommendations were sought (e.g., feedback from key stakeholders, pilot testing of guidelines before widespread implementation)</p> <p><input type="checkbox"/> Information/description of the types of facilitators and barriers that emerged from the inquiry (e.g., practitioners have the skills to deliver the recommended care, sufficient equipment is not available to ensure all eligible members of the population receive mammography)</p> <p><input type="checkbox"/> How the information influenced the guideline development process and/or formation of the recommendations</p>	
<p>19. IMPLEMENTATION ADVICE/TOOLS Provide advice and/or tools on how the recommendations can be applied in practice.</p>	<p><input type="checkbox"/> Additional materials to support the implementation of the guideline in practice. For example:</p> <ul style="list-style-type: none"> • Guideline summary documents • Links to check lists, algorithms • Links to how-to manuals • Solutions linked to barrier analysis (see Item 18) • Tools to capitalize on guideline facilitators (see Item 18) • Outcome of pilot test and lessons learned 	
<p>20. RESOURCE IMPLICATIONS Describe any potential resource implications of applying the recommendations.</p>	<p><input type="checkbox"/> Types of cost information that were considered (e.g., economic evaluations, drug acquisition costs)</p> <p><input type="checkbox"/> Methods by which the cost information was sought (e.g., a health economist was part of the guideline development panel,</p>	

	use of health technology assessments for specific drugs, etc.) <input type="checkbox"/> Information/description of the cost information that emerged from the inquiry (e.g., specific drug acquisition costs per treatment course) <input type="checkbox"/> How the information gathered was used to inform the guideline development process and/or formation of the recommendations	
21. MONITORING/ AUDITING CRITERIA Provide monitoring and/or auditing criteria to measure the application of guideline recommendations.	<input type="checkbox"/> Criteria to assess guideline implementation or adherence to recommendations <input type="checkbox"/> Criteria for assessing impact of implementing the recommendations <input type="checkbox"/> Advice on the frequency and interval of measurement <input type="checkbox"/> Operational definitions of how the criteria should be measured	
DOMAIN 6: EDITORIAL INDEPENDENCE		
22. FUNDING BODY Report the funding body's influence on the content of the guideline.	<input type="checkbox"/> The name of the funding body or source of funding (or explicit statement of no funding) <input type="checkbox"/> A statement that the funding body did not influence the content of the guideline	
23. COMPETING INTERESTS Provide an explicit statement that all group members have declared whether they have any competing interests.	<input type="checkbox"/> Types of competing interests considered <input type="checkbox"/> Methods by which potential competing interests were sought <input checked="" type="checkbox"/> A description of the competing interests <input type="checkbox"/> How the competing interests influenced the guideline process and development of recommendations	1365

Appendix 3

Table of study characteristics with quantitative results

Author	Type of infection control	Comparison	Outcome	Quantitative result
Shallcross et al. ⁹	Use of temporary staff	Most days or Never	Prevalence of Infection in residents	aOR: 1.65, 95% CI: 1.56-1.74) p<0.001
	Use of temporary staff	Most days or Never	Prevalence of Infection in Staff	(aOR: 1.85, 95% CI: 1.72-1.98, p<0.001),
	Use of temporary staff	Most days or Never	at least 1 case in LTCF	aOR: 2.33, 95% CI: 1.72-3.16, p<0.001
	Use of temporary staff	Most days or Never	Large outbreaks	aOR: 2.24, 95% CI: 1.67-3.51), p<0.001
	Working multiple locations	Few times a week or Never	Prevalence of Infection in residents	0.97 [0.882, 1.068], p=0.539
	Working multiple locations	Few times a week or Never	Prevalence of Infection in Staff	aOR: 1.26, 95% CI: 1.13-1.41), p<0.001
	Working multiple locations	Few times a week or Never	at least 1 case in LTCF	1.146 [0.694, 1.891], p=0.595
	Working multiple locations	Few times a week or Never	Large outbreaks	1.044 [0.563, 1.934], p=0.892
	Staff care for infected/uninfected residents	Often or Never	Prevalence of Infection in residents	aOR: 1.30, 95% CI: 1.23-1.37), p<0.001
	Staff care for infected/uninfected residents	Often or Never	Prevalence of Infection in Staff	(aOR: 1.20, 95% CI: 1.13-1.29, p<0.001),
	Staff care for infected/uninfected residents	Often or Never	at least 1 case in LTCF	aOR: 2.60: 95% CI: 1.94-3.49), p<0.001
	Staff care for infected/uninfected residents	Often or Never	Large outbreaks	0.978 [0.688, 1.391], p=0.902
	Payment of Sick Pay to staff	Statutory or None	Prevalence of Infection in residents	aOR: 0.80, 95% CI: 0.75-0.86)
	Payment of Sick Pay to staff	Statutory or None	Prevalence of Infection in Staff	(aOR: 0.70, 95% CI: 0.65-0.77, p<0.001)
	Payment of Sick Pay to staff	Statutory or None	Large outbreaks	aOR: 0.59, 95% CI: 0.78-0.87), p=0.02
	Unable to isolate sick residence	Yes or No	Prevalence of Infection in residents	aOR: 1.33, 95% CI: 1.28-1.38) p<0.001
	Unable to isolate sick residence	Yes or No	Prevalence of Infection in Staff	(aOR: 1.48, 95% CI: 1.41-1.56, p<0.001),
	Unable to isolate sick residence	Yes or No	at least 1 case in LTCF	aOR: 1.84, 95% CI: 1.48-2.30), p<0.001
	Unable to isolate sick residence	Yes or No	Large outbreaks	aOR: 1.62, 95% CI: 1.24-2.11), p<0.001
	Cleaning communal areas	Once or at least twice daily	Prevalence of Infection in Staff	aOR: 1.05, 95% CI: 1.00-1.10), p=0.039
	Cleaning communal areas	Once or at least twice daily	Prevalence of Infection in residents	(aOR: 1.10, 95% CI: 1.03-1.17, p=0.003)
	Staff PPE	Any contact with all residents or all the time	Prevalence of Infection in residents	0.858 [0.811, 0.907]p<0.001
	Staff PPE	Any contact with all residents or all the time	Prevalence of Infection in Staff	0.924 [0.862, 0.99] p<0.025
	Staff PPE	Any contact with infected residents or all the time	Prevalence of Infection in residents	1.197 [1.046, 1.37], p=0.009
	Staff PPE	Any contact with infected residents or all the time	Prevalence of Infection in Staff	0.886 [0.725, 1.083], p=0.237

	Staff PPE	Direct care of all residents or all the time	Prevalence of Infection in residents	0.91 [0.85, 0.974], p=0.007
	Staff PPE	Direct care of all residents or all the time	Prevalence of Infection in Staff	0.824 [0.752, 0.904], p<0.001
	Staff PPE	Direct care of infected residents or all the time	Prevalence of Infection in residents	0.578 [0.479, 0.699], p<0.001
	Staff PPE	Direct care of infected residents or all the time	Prevalence of Infection in Staff	0.512 [0.385, 0.68], p<0.001
	Barrier Nursing(infected residents)	Yes or No	Prevalence of Infection in Staff	aOR: 3.60, 95% CI: 3.37-3.88), p<0.001
	Barrier Nursing(infected residents)	Yes or No	Prevalence of Infection in residents	2.598 [2.358, 2.863] p<0.001
	Barrier Nursing(infected residents)	Yes or No	at least 1 case in LTCF	aOR: 5.33, 95% CI: 4.30-6.60, p<0.001
	Barrier Nursing(infected residents)	Yes or No	Large outbreaks	1.288 [0.794, 2.088], p=0.306
	Barrier Nursing (All residents)	Yes or No	Prevalence of Infection in residents	1.422 [1.365, 1.482], p<0.001
	Barrier Nursing (All residents)	Yes or No	Prevalence of Infection in Staff	1.385 [1.312, 1.461], p<0.001
	Barrier Nursing (All residents)	Yes or No	at least 1 case in LTCF	1.68 [1.377, 2.049], p<0.001
	Barrier Nursing (All residents)	Yes or No	Large outbreaks	1.437 [1.081, 1.911], p=0.013
Telford et al. ¹¹	Screening	Preventive or responsive	Prevalence Infection in residents	1.5% vs 47.2%, p<0.0001
	Screening	Preventive or responsive	Prevalence Infection among staff	1.7% vs 12.8%, p<0.0001
	Screening	Preventive or responsive	Hospitalization rate residents	29% vs 21%, p=0.38
Rolland et al. ⁸	Staff compartmentalization	Yes or No	at least 1 case in LTCF	0.17 (0.04-0.67), p=0.01
	Resident compartmentalization	Yes or No	at least 1 case in LTCF	3.01 (0.51-18.51), p=0.22
	Specific dressing procedure at entrance	Yes or No	at least 1 case in LTCF	0.81 (0.10-6.34), p=0.84
	Use of temporary staff vs Never	Yes or No	at least 1 case in LTCF	1.91(0.62-5.93), p=0.26
	Wearing a mask	Yes or No	at least 1 case in LTCF	1.7(0.26-11), p=0.57
	Satisfactory supply of mask	Yes or No	at least 1 case in LTCF	1.43 (0.55-3.72), p=0.46
	Access to effective mask	Yes or No	at least 1 case in LTCF	0.54(0.14-2.10), p=0.37
	Satisfactory supply of hydro-alcoholic solute	Yes or No	at least 1 case in LTCF	2.10(0.61-7.24), p=0.24
	Access to specific training on hygiene measures	Yes or No	at least 1 case in LTCF	0.71(0.28-1.79), p=0.47
	Containment of resident in room	Yes or No	at least 1 case in LTCF	1.67 (0.49-5.76), p=0.41
	Organizing of meals	Yes or No	at least 1 case in LTCF	0.63(0.34-1.15), p=0.13
	Discontinuation of group activities	Yes or No	at least 1 case in LTCF	0.89 (0.41-1.91), p=0.77
Telford et al. ¹²	Social distancing	High or Low infection rate	Prevalence of infection (High vs low)	54% vs 72%, p=0.01
	PPE use	High or Low infection rate	Prevalence of infection (High vs low)	41% vs 72%, p<0.0001
	Maximum occupancy	High or Low infection rate	Prevalence of infection (High vs low)	11% vs 64%, p=0.02
	Laminated signage about droplets	High or Low infection rate	Prevalence of infection (High vs low)	30% vs 77%, p=0.03
	Bathroom and sink in rooms	High or Low infection rate	Prevalence of infection (High vs low)	70% vs 100%, p=0.04

	Training and audit	High or Low infection rate	Prevalence of infection (High vs low)	p=0.01
	hand hygiene implementation	High or Low infection rate	Prevalence of infection (High vs low)	55% vs 69%, p=0.17
	Cleaning and disinfection	High or Low infection rate	Prevalence of infection (High vs low)	30% vs 36%, p=0.60
	Screening	High or Low infection rate	Prevalence of infection (High vs low)	67% vs 82%, p=0.15
Belmin et al. ¹⁰	Self-confinement of staff	Yes or No	at least 1 case in LTCF	5.8% vs 48.3%, p<0.001
	Self-confinement of staff	Yes or No	Prevalence of Infection in residents	0.4% vs 4.4%, p<0.001
	Self-confinement of staff	Yes or No	Prevalence of death among residents	0.4% vs 1.8%, (OR, 0.22; 95%CI, 0.09-0.53; P < .001).
	Self-confinement of staff	Yes or No	Prevalence of Infection in Staff	0.8% vs 3.8%, p<0.001