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What long-term care interventions and policy measures have been studied during the Covid-19 pandemic? Findings from a rapid mapping review of the scientific evidence published during 2020.

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Citation:

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Abstract

Context – Throughout the Covid-19 pandemic, long-term care researchers have aimed to generate evidence rapidly to inform the pandemic response. It is unclear which areas were prioritised during this period of rapid evidence generation.

Objective(s) – We aimed to map the international scientific evidence on interventions and policy measures to mitigate the impacts of the Covid-19 pandemic on people who use and provide long-term care.

Method(s) – We conducted a pragmatic, rapid mapping review of international evidence to identify the range of interventions, policies, and measures in long-term care studied during the Covid-19 pandemic and published throughout 2020. Reports were primarily identified from two academic databases (MEDLINE; Web of Science).

Findings – We included 137 studies from 22 countries, mostly focusing on the United States, Europe, and Canada. Half of the studies focused on preventing or controlling Covid-19 infections. Other common types of interventions were measures to treat Covid-19 or improve access to general healthcare, and studies of possible targets for policies and interventions, such as care home ownership. Only 13 studies covered home or community-based care.

Limitations – This was a pragmatic review that aimed to map key areas of research in long-term care during the pandemic, rather than a systematic review of all available studies.

Implications – During the first year of the Covid-19 pandemic, a substantial body of evidence on interventions to mitigate impacts of the pandemic in the long-term care sector emerged. However, reflecting the context and speed with which they were carried out, most studies did not apply an analytical lens and instead provided descriptive findings only. There were very few studies on home care or community-based care settings. As countries assess the lessons that can be learnt from the pandemic and improve preparedness of their long-term care systems for future pandemics and other shocks, it will be important to consider the importance of facilitating rapid generation of more robust evidence.

Key words – Covid-19; care homes; community care; infection prevention; evidence review

Introduction

The Covid-19 pandemic has taken a disproportionate toll on people using long-term care, particularly people living in care homes. While typically accounting for less than 1% of the population, residents of long-term care facilities represented 41% of all Covid-19 related deaths in 22 high-income countries (Comas-Herrera *et al.*, 2021).

The concentration of deaths among people using long-term care has led to a flurry of measures to prevent infections or manage the consequences of the disease in institutional and home-based settings, going beyond existing infection prevention and control (IPC) protocols. While some measures reflected high-level policy changes at the country level, others were implemented pragmatically by care providers ahead of official guidance (Comas-Herrera *et al.*, 2020; Langins *et al.*, 2020; Rajan, Comas-Herrera and Mckee, 2020). Researchers made efforts to rapidly assess the effectiveness of some of these measures and generate timely evidence to inform the pandemic response. This involved adapting and re-orienting existing studies, as well as responding to new research funding calls. Given the rapid nature of the development of this new area of research, it can be expected that some measures were studied more frequently than others, leading to an uneven evidence landscape for measures intended to mitigate the consequences of the pandemic in long-term care.

We therefore aimed to map the evidence published during the first year of the pandemic in relation to interventions and policy measures to prevent and mitigate the impacts of Covid-19 on people who use and provide long-term care. We adopted a pragmatic approach that allowed us to rapidly identify emerging evidence, rather than one that aimed to exhaustively document all long-term care focused studies. We also summarised key findings on the effects of identified interventions and policy measures.

Methods

We conducted a pragmatic, rapid mapping review of international evidence to identify the range of interventions, policies, and measures in long-term care studied during the Covid-19 pandemic. Relevant measures were defined broadly as any action that could be taken by those organising and delivering care to mitigate the impact of Covid-19 on people receiving and providing long-term care.

Search strategy

The search strategy builds on highly sensitive database searches that were previously developed to identify international reports on Covid-19 and long-term care published until July 2020 (Salcher-Konrad *et al.*, 2020; WHO, 2020). Weekly database searches were conducted for seven databases (MEDLINE; Embase; CINAHL Plus; Web of Science; Global Health; WHO COVID-19 Research Database; medRxiv) from April through 31 July 2020. From 1 August through 31 December 2020, database searches were restricted to MEDLINE (via PubMed) and Web of Science, due to significant overlap between these two databases and the remaining ones. We combined the terms "Covid-19" and "long-term care" and their variants and relevant subject headings. Search terms did not include any specific outcomes or interventions. As an example, we provide the search syntax for MEDLINE in the appendix (Table A1).

To complement these searches and identify potentially relevant studies, we also searched for systematic reviews of Covid-19 and long-term care in Google Scholar and MEDLINE, but did not identify any relevant systematic reviews.

Inclusion criteria and selection process

All records were screened by one reviewer and records that were either clearly not relevant for Covid-19 in long-term care populations (e.g., studies in animals or cells, studies of previous infectious disease outbreaks, studies of Covid-19 in non-long term care populations) or did not constitute an original report (e.g., opinion pieces or review articles clearly labelled as such) were discarded. For the remaining records, full texts were obtained and independently assessed for relevance by two reviewers.

We included reports that met the following inclusion criteria:

- Provides original data about any intervention or measure that was implemented in response to the Covid-19 pandemic in a long-term care population, or original data on possible targets for such measures.
- Reports on adults (aged 18 years or older) receiving (service users) or providing (service providers) long-term care services. "Long-term care" means all health, personal, and community care services for people with long-term care needs, including care provided in institutional settings (including all non-acute residential and nursing facilities that house people with some form of long-term care need) and care provided in the homes of people with long-term care needs or the community (including unpaid care, home-care services, day-care centres, and other community-based care services).
- Reports on any intervention or measure that aims to either prevent Covid-19 outbreaks in long-term care settings or manage the disease and its impact on users and providers of long-term care services once an outbreak has occurred. We also included studies that empirically assess possible targets for policy interventions, including, but not limited to, staffing levels at long-term care facilities, the qualification levels of staff, environmental factors such as ventilation systems and spacing. We did not include studies only assessing the association of Covid-19 outcomes with non-policy amenable characteristics, such as the age or ethnicity of long-term care users or staff.
- Reports on any outcome related to the impact of Covid-19 on long-term care, including the prevention of Covid-19 related deaths, prevention of Covid-19 cases, and prevention of other detrimental outcomes, such as hospitalisations or ICU admissions. We also included other outcomes, such as mental health and overall wellbeing of long-term care users and providers, adequate care provision for service users with Covid-19, adequate end-of-life care, and other unintended outcomes related to infection prevention and control and other public health measures in long-term care settings.

Mapping of interventions

From each included report, we extracted some basic characteristics, including date and location of the study, the population for which the intervention was intended, a brief description of the intervention, and results as reported by the study authors.

We categorised the identified measures to analyse which types were more commonly employed and in what setting. We adapted an existing, pragmatic taxonomy of Covid-19 measures for long-term care that was initially developed by the LTCcovid.org collaboration to categorise ongoing research projects and early policy responses to the pandemic (also used in Yu and Comas-Herrera, 2021).

From studies that used a control group or other analytical approaches, we also extracted findings about the effects of interventions and summarised them narratively.

Results

We screened 11,715 references and reviewed 850 full texts to arrive at our set of 137 included studies (Figure 1). A list of all included studies and their main characteristics is provided in the appendix (Table A2). Included studies were conducted in 22 countries. Most studies were from the United States (n=58; or 42%). Eleven studies were from the United Kingdom. Four studies were from low- and middle-income countries (two studies from China and one each from Brazil and Cuba). Figure 2 shows the geographical distribution of studies.
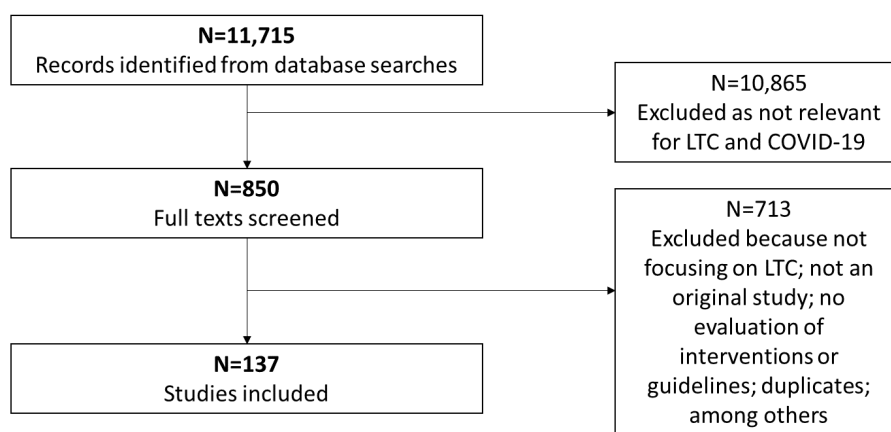
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┌─────────────────────────────────┐
│          N=11,715               │
│ Records identified from database │        ┌──────────────────────┐
│            searches             │───────▶│      N=10,865        │
└─────────────────────────────────┘        │  Excluded as not     │
                │                           │  relevant for LTC    │
                ▼                           │  and COVID-19        │
┌─────────────────────────────────┐        └──────────────────────┘
│            N=850                │
│      Full texts screened        │        ┌──────────────────────┐
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                │                  ───────▶ │  Excluded because    │
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┌─────────────────────────────────┐        │  LTC; not an         │
│            N=137                │         │  original study; no  │
│       Studies included          │         │  evaluation of       │
└─────────────────────────────────┘        │  interventions or    │
                                            │  guidelines;         │
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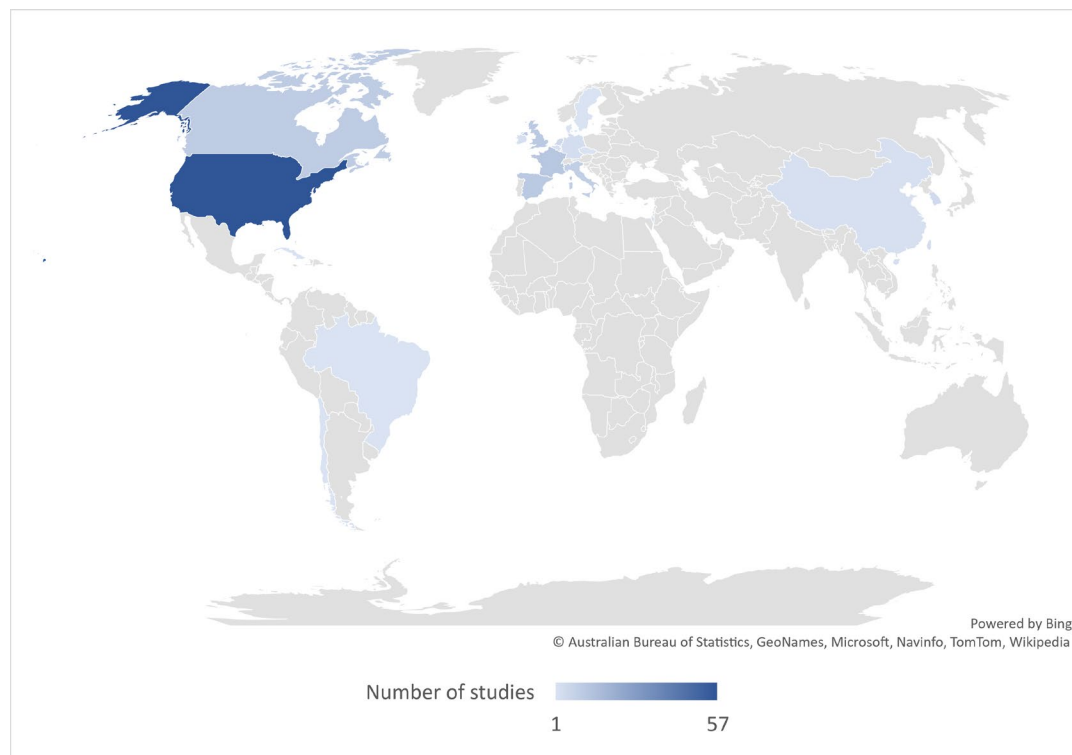*Figure 1: Flow chart of inclusion and exclusion decisions*

Figure 2: Geographical distribution of 137 studies of long-term care interventions and measures during the Covid-19 pandemic

There was a strong focus on institutional care, with 95% of studies focusing on this setting. Only 8% of studies looked at care provided in the homes of people with long-term care needs, and 1% were conducted in community settings (some studies investigated more than one type of care).

All included studies were observational, and the majority were descriptive; 46% were outbreak reports or case studies of measures taken in individual care homes or organisations; 19% were case studies at national or regional level; the remaining studies were analytical quantitative studies using individual participant level data (9%), institutional-level data (22%), or ecological studies using regional-level data (5%).

*Table 1: Frequency of different types of long-term care interventions and measures studied during the Covid-19 pandemic ***

Intervention/measure type	Number of studies (n=137)	% of all included studies	Institutional	Home-based	Community-based
Preventing/controlling Covid-19 infections	69	50%	66	4	1
Measures to treat Covid-19 / improve access to general healthcare	26	19%	23	2	1
Possible targets for policies and interventions	24	18%	24	0	0
Policy and governance	15	11%	15	2	0
Measures to compensate for isolation policies	11	8%	11	1	0
Measures to improve care coordination/governance	9	7%	9	1	0
End of life care and advanced care planning	6	4%	6	1	0
Measures to support staff and unpaid carers	4	3%	2	2	0
Adaptation of existing interventions	2	1%	1	1	0
Interventions to improve quality of care	2	1%	2	0	0
Measures to support care provider organisations	0	0%	0	0	0

* Note that the same study could contribute to several categories of interventions.

Prevention/control of Covid-19 infections

Of the 137 included studies, 50% (n=69) reported on interventions for preventing or controlling Covid-19 infections, most of which were focusing on institutional care settings (Table 1). The majority were descriptive studies of multifaceted outbreak responses, ranging from outbreak reports of individual care homes to case studies at a national level.

The most common interventions (n=45) were testing approaches, which varied between care homes. Basic testing was limited to screening symptomatic cases (Balestrini *et al.*, 2020; Callaghan *et al.*, 2020; Tarteret *et al.*, 2020), thus missing asymptomatic cases. In one case this was extended to testing close contacts and other high-risk groups in response to contact tracing (Park *et al.*, 2020). A more thorough approach involved repeat universal testing (Bakaev, Retalic and Chen, 2020; Lipsitz *et al.*, 2020; Louie, Scott, *et al.*, 2020; Louie, Stoltey, *et al.*, 2020; Ly *et al.*, 2020; McBee *et al.*, 2020; Montoya *et al.*, 2020; Österdahl *et al.*, 2020; Psevdos *et al.*, 2020; Rudolph *et al.*, 2020; Sanchez *et al.*, 2020; Blackburn *et al.*, 2020; Shea *et al.*, 2020; Shih, Wang and Chao, 2020; Shimotsu *et al.*, 2020; Tan and Chua, 2020; Telford *et al.*, 2020; Veronese *et al.*, 2020; White *et al.*, 2020; Blasco *et al.*, 2020; Borras-Bermejo *et al.*, 2020; Collison *et al.*, 2020; Eckardt *et al.*, 2020; Escobar *et al.*, 2020a; Guery *et al.*, 2020; Heudorf *et al.*, 2020; Birgand *et al.*, 2021). Repeat testing was sometimes undertaken until there were either no new cases or until everyone in the care home tested negative (Table 2) (Blain *et al.*, 2020; Dora *et al.*, 2020; Munanga, 2020; Shrader *et al.*, 2020; Sohn *et al.*, 2020). Pooled testing was used as a means to preserve resources when there were no current cases (Cabrera *et al.*, 2020; Tan and Chua, 2020). Antibody detection was used in conjunction with testing for diagnosing those with a low viral load (Buntinx *et al.*, 2020). In addition to testing, lung ultrasonography was used to track the progression of disease and make clinical assessments (Table 2) (Dini *et al.*, 2020; Nouvenne *et al.*, 2020; Veronese *et al.*, 2020).

Cohorting and isolation were commonly used to limit the spread of disease (n=24). Isolation was undertaken to prevent infected residents from leaving their rooms (Bakaev, Retalic and Chen, 2020; Balestrini *et al.*, 2020; Lee, Son and Peck, 2020; McBee *et al.*, 2020; Munanga, 2020; Shea *et al.*, 2020; Shimotsu *et al.*, 2020; Voeten *et al.*, 2020), which sometimes included those who had been exposed (Callaghan *et al.*, 2020; Heudorf *et al.*, 2020; McBee *et al.*, 2020). Some facilities isolated new admissions before they were allowed to integrate (Callaghan *et al.*, 2020; Tan and Chua, 2020). Cohorting enabled the spatial separation of infected residents from the rest of the care home (Borras-Bermejo *et al.*, 2020; Eckardt *et al.*, 2020; Gonzalez de Villaumbrosia *et al.*, 2020; Louie, Stoltey, *et al.*, 2020; Montoya *et al.*, 2020; Tan and Seetharaman, 2020). Separation was sometimes done in special facilities (Dora *et al.*, 2020; Escobar *et al.*, 2020a; Espasandin-Duarte, Cinza-Sanjurjo and Portela-Romero, 2020; Heras *et al.*, 2020; Psevdos *et al.*, 2020; Shih, Wang and Chao, 2020; Shrader *et al.*, 2020; Sohn *et al.*, 2020). In one case, separate cohorts were created for those who had been exposed (Collison *et al.*, 2020). Specific groups of staff were sometimes cohorted with these specific groups (Dora *et al.*, 2020; Montoya *et al.*, 2020; Sohn *et al.*, 2020; Voeten *et al.*, 2020).

Several measures aiming to reduce the risk of infection from staff were studied (n=24). Symptom and temperature screening before shifts enabled symptomatic staff to be identified, although this was unable to detect asymptomatic staff (Bakaev, Retalic and Chen, 2020; Borras-Bermejo *et al.*, 2020; Shimotsu *et al.*, 2020; Sohn *et al.*, 2020; Tan and Seetharaman, 2020; Eckardt *et al.*, 2020; Escobar *et al.*, 2020; Louie, Stoltey, *et al.*, 2020; Mills, Buccola, *et al.*, 2020; Munanga, 2020; Park *et al.*, 2020; Psevdos *et al.*, 2020; Shea *et al.*, 2020). In one case staff movement was limited by assigning caregivers to one resident (Balestrini *et al.*, 2020). In some cases staff were isolated on site or in hotels to reduce the risk of infection transmission (Table 2) (Belmin *et al.*, 2020; Kim, 2020; Lee, Son and Peck, 2020;

Mills, Sender, Lichtefeld, *et al.*, 2020; Tan and Chua, 2020). In one case a care home allowed asymptomatic staff to work, providing care for infected residents only (Louie, Stoltey, *et al.*, 2020).

IPC protocols that were implemented early on in response to the pandemic included measures such as social distancing, use of personal protective equipment (PPE), enhanced hygiene, closure of communal areas, and restriction of activities in care homes (n=22). In addition, visitors were banned or severely restricted (n=17). IPC protocols were often implemented through training interventions (n=15). Adherence to IPC was also monitored for some sites (Dolveck *et al.*, 2020; Escobar *et al.*, 2020b; Louie, Stoltey, *et al.*, 2020; Mills, Sender, Lichtefeld, *et al.*, 2020; Park *et al.*, 2020).

In some cases, action committees were convened to produce outbreak preparedness plans, which were disseminated to infection control teams on the ground (Mills, Buccola, *et al.*, 2020; Mills, Sender, Lichtefeld, *et al.*, 2020). These committees enabled coordination between hospitals and care homes, including managing patient flow, but also to help care providers acquire PPE.

Table 2: Selected examples from the included studies relating to preventing or controlling Covid-19 infections

Authors	Study overview and findings
Telford et al. (2020)	In Georgia, the United States, 15 Long-Term Care Facilities (LTCFs) performed facility wide testing in response to identified cases, and 13 LTCFs performed it as a preventative strategy. The LTCFs who conducted testing as a preventative strategy had significantly fewer cases upon testing and follow-up testing.
Dini et al. (2020)	In Italy, lung ultrasonography was utilised to measure the presence of lung damage in those with a history of Covid-19 symptoms. This was able to predict infection with a sensitivity of 79% and specificity of 57%, which was especially useful for detecting false negatives from RT-PCR testing.
Belmin et al. (2020)	In France, staff were voluntarily confined in care homes for periods of a week or longer whilst working. In the care homes where this was practiced, only 6% (n=1) had cases, compared to 48% in the remaining 9,513 care homes in France.

Measures to treat Covid-19 / improve access to general healthcare

Twenty-six studies reported on measures to treat Covid-19 or improve access to general healthcare for people living in care homes or other care facilities. Of these, 12 observational studies focused on pharmaceutical interventions. No randomised controlled trials of pharmaceuticals were identified. We identified cohort studies of angiotensin converting enzyme inhibitors, angiotensin receptor blockers, and statins (De Spiegeleer *et al.*, 2020); antithrombotics (Brouns *et al.*, 2020), vitamin D3 (Annweiler *et al.*, 2020); itolizumab (Díaz *et al.*, 2020); metformin (Lally *et al.*, 2021); and hydroxychloroquine and azithromycin (Ly *et al.*, 2020; Shrader *et al.*, 2020). Uncontrolled studies reported on doxycycline (Ahmad *et al.*, 2020; Alam *et al.*, 2020) and inosine pranobex (Beran *et al.*, 2020).

Non-pharmaceutical interventions included the creation of contingency plans to maintain access to general healthcare (including in both institutional and home care) (Archbald-Pannone *et al.*, 2020; Benaque *et al.*, 2020; Chen *et al.*, 2020; Christ, 2020; Harris *et al.*, 2020; Siu *et al.*, 2020). Telemedicine by videocall or telephone was used to reduce in person consultations and was reported to increase the resilience and wellbeing of residents (Echeverria *et al.*, 2020; Eckardt *et al.*, 2020; Lai *et al.*, 2020; Renzi *et al.*, 2020; Shrader *et al.*, 2020). One study recognised the need for simple technology so that it was accessible (Ickert *et al.*, 2020). In two studies, task forces were deployed to identify those in

need of care in facilities where access to healthcare was limited due to high infection rates (Diamantis *et al.*, 2020; Eckardt *et al.*, 2020).

Possible targets for policies and interventions

Twenty-four studies analysed possible targets for interventions, including ownership structures, quality of services, and staffing policies. Most were institution-level cohort studies, which analysed associations between care home characteristics, and infection and mortality rates. The majority were conducted in the United States (n=15). Some studies found that private ownership was associated with more infections and higher mortality, which was often related to a lack of PPE (Braun *et al.*, 2020; He, Li and Fang, 2020; McGarry, Grabowski and Barnett, 2020; Stall *et al.*, 2020). In some studies, high nursing home quality ratings were associated with fewer infections and lower mortality (Bui *et al.*, 2020; Chatterjee *et al.*, 2020; He, Li and Fang, 2020; Li *et al.*, 2020; McGarry, Grabowski and Barnett, 2020; Sugg *et al.*, 2021). However, other studies found that ratings were not independently associated with Covid-19 outcomes, and that it was more important whether or not the care home was part of a chain (Abrams *et al.*, 2020; Bowblis and Applebaum, 2020; Dean, Venkataramani and Kimmel, 2020). High staffing levels were found to be associated with fewer infections and lower mortality, which was suspected to reflect the need for sufficient staff to implement IPC and cohort patients (Figueroa *et al.*, 2020; Harrington *et al.*, 2020; McGarry, Grabowski and Barnett, 2020; Sugg *et al.*, 2021). Although in some cases high staffing levels increased the probably of infection in the care home, this was associated with a decreased chance of outbreak and lower mortality (Dutey-Magni *et al.*, 2020; Gorges and Konetzka, 2020; Li *et al.*, 2020). In one case, the presence of a healthcare union had a protective effect (Table 3) (Dean, Venkataramani and Kimmel, 2020). Resource availability was important, with PPE shortages being associated with more infections and higher mortality (Bowblis and Applebaum, 2020; Brainard *et al.*, 2020; Christ, 2020a; Figueroa *et al.*, 2020; McGarry, Grabowski and Barnett, 2020). In Canada, crowding in care homes was associated with larger and deadlier outbreaks (Table 3) (Brown *et al.*, 2020). In the United Kingdom, higher mortality was linked to residents being transferred back to care homes from hospital (Burton *et al.*, 2020). One study found that the number of agency staff working at a home was important (Office for National Statistics, 2020), with staff working in multiple homes being more likely to be infected (Table 3) (Ladhani *et al.*, 2020).

Table 3: Selected examples from the included studies relating to possible targets for policies and interventions

Authors	Study overview and findings
Dean, Venkataramani, and Kimmel (2020)	In New York, the United States, a study analysed the relationship between the presence of healthcare unions, and infection and mortality rates. The presence of a healthcare union in 246 care homes was associated with a 30% decrease in Covid-19 related mortality, when compared to 109 care homes where there were no healthcare unions.
Brown et al. (2020)	In Ontario, Canada, a crowding index was generated for 618 care homes, which considered the size of a facility, the proportion of 1/2/4 bedrooms, and the number of residents per bathroom. A high crowding index did not affect the introduction of Covid-19 to care homes, but it did increase the rate of spread of infection once it was introduced.
Ladhani et al. (2020)	In London, United Kingdom, testing was carried out on 254 staff who worked between six care homes. Staff working in a single care home (n=227) had a positivity rate of 17%, whereas staff who worked across multiple care homes (n=27) had a positivity rate of 52%.

Policy and governance

Fifteen studies reported on policy and governance, with the majority of these being descriptive regional and national case studies. The regulation and oversight of social care services was analysed, which highlighted that the number of available beds and the maximum occupancy of nursing homes were associated with the number of infections and mortality (Buja *et al.*, 2020; Liotta *et al.*, 2020; Romero-Ortuño and Kennelly, 2020; Rothgang *et al.*, 2020). Covid-19 specific measures varied between countries, with strict IPC policies and more robust responses leading to fewer infections and deaths (Liu *et al.*, 2020; Sepulveda, Stall and Sinha, 2020; Siu *et al.*, 2020; Villalobos Dintrans, Browne and Madero-Cabib, 2020), although implementation was dependent on resources (Miller *et al.*, 2020; Rolland *et al.*, 2020; Rothgang *et al.*, 2020). Within Canada there were uneven responses that led to regional differences (Table 4) (Liu *et al.*, 2020). Studies from Hong Kong and Taiwan highlighted local preparedness following the experiences during the SARS epidemic (Chow, 2020; Lum *et al.*, 2020; Yang and Huang, 2020). This included convening central command centres, who utilised strict emergency response plans to effectively manage the pandemic and protect nursing homes.

Table 4: A selected example from the included studies relating to policy and governance

Authors	Study overview and findings
Liu et al. (2020)	Covid-19 infection and mortality rates in care homes were lower in the Canadian province of British Columbia (BC) compared to Ontario. The different pandemic experiences of the two provinces were contrasted with pre-pandemic levels of regulation and oversight of social care services. Care homes in BC had higher funding per resident and more comprehensive inspections. The pandemic response was faster and more wide reaching in BC.

Data and Information and Communication Technology

Data and information and communication technology were the focus of 25 studies. Care home residents were sometimes supplied with technology (Gallo Marin *et al.*, 2020; McArthur *et al.*, 2021), with preferences varying between telephone calls and video calls (Table 5) (Sacco *et al.*, 2020). This enabled them to maintain social contact (Archbald-Pannone *et al.*, 2020), either with families (Shrader *et al.*, 2020; Van der Roest *et al.*, 2020; Wammes *et al.*, 2020) or dedicated volunteers (Office *et al.*, 2020; van Dyck *et al.*, 2020). In one case this extended to facilitating the real time monitoring and remote treatment of residents (Echeverria *et al.*, 2020).

Electronic health record data enabled efficient admission of residents, allowing the history of patients to be tracked (Bernabeu-Wittel *et al.*, 2020). Electronic health records also facilitated the development of a model to track the real time geographical spread of infection in addition to the trajectories of outbreaks within facilities (Caspi *et al.*, 2020). Other models utilised machine learning trained on outcome data to generate risk indexes at a patient and facility level (Table 5) (Stow *et al.*, 2020; Sun *et al.*, 2020).

Table 5: Selected examples from the included studies relating to data and information and communication technology

Authors	Study overview and findings
Sacco et al. (2020)	In Angers, France, 132 residents in care homes and geriatric acute care units were surveyed to understand their preference between telephone calls and video calls. They were able to complete telephone calls more

	independently than videocalls, and tended to use them more often, although satisfaction tended to be higher when video calls were undertaken.
Sun et al. (2020)	In the United States a model was trained on Covid-19 outcomes reported in 1,146 care homes. This model generated a risk index associated with the likelihood of Covid-19 infection in a care home. This was then validated by outcomes separate from the original sample, which demonstrated moderate predictive power and strong association with outcomes.

Home-based care and community-based care

There were few studies that focused on home-based care and community-based care (n=13). Many of these studies reported on the use of telemedicine to replace face-to-face consultations (Benaque *et al.*, 2020; Goodman-Casanova, 2020), with video calls associated with greater improvements in resilience and wellbeing than telephone calls, Table 6 (Lai *et al.*, 2020). Additionally, technology was used for cognitive stimulation and to aid social connectedness (Goodman-Casanova, 2020; Villalobos Dintrans, Browne and Madero-Cabib, 2020), which had a positive impact on users, Table 6 (Office *et al.*, 2020). Some studies focused on multifaceted interventions (Benaque *et al.*, 2020; Chen *et al.*, 2020; Huang *et al.*, 2020; Lum *et al.*, 2020; Mills, Buccola, *et al.*, 2020; Mills, Sender, Reynolds, *et al.*, 2020; Shea *et al.*, 2020), including enhanced IPC, strict safety protocols, and selectively carrying out home visits to those with the highest need, Table 6 (Khatri *et al.*, 2020). In some cases, studies focused on educating home-care users (Chen *et al.*, 2020; Goodman-Casanova, 2020), and supporting nurses through training and psychological interventions (Benaque *et al.*, 2020; Khatri *et al.*, 2020; Shea *et al.*, 2020). Some studies reported that day centres were closed and activities and clubs cancelled (Benaque *et al.*, 2020; Villalobos Dintrans, Browne and Madero-Cabib, 2020), with home-based services limited to delivering meals, maintaining nursing care, and administering medicines (Khatri *et al.*, 2020; Shea *et al.*, 2020). Other studies reported on temperature and symptom screening for nurses and home-care users (Koeberle *et al.*, 2020; Lum *et al.*, 2020; Shea *et al.*, 2020), which was tracked using custom applications (Mills, Buccola, *et al.*, 2020; Mills, Sender, Reynolds, *et al.*, 2020).

Table 6: Selected examples from the included studies relating to home-based care and community-based care

Authors	Study overview and findings
Lai et al. (2020)	In Hong Kong, 60 home-care recipients and their carers were surveyed to understand changes in general cognitive functions, symptoms of dementia, and their quality of life, in response to using video calls instead of telephone calls to carry out telemedicine. This was associated with improved resilience and wellbeing, partly because it could capture the important social elements intrinsic to face-to-face interactions.
Office et al. (2020)	In the United States, 14 students made 25 telephone calls as part of an outreach programme to older adults who were at risk of social isolation. These conversations focused on sources of support and personal topics. This programme had a positive impact on both the students and the receivers of the calls.
Khatri et al. (2020)	In Singapore, a home hospice service initiated a multifaceted response including enhanced IPC, substantial safety and communication training for staff, reduced size of home hospice teams, and pre-visit triage to assess the need so that visits could be selectively carried out for those with the highest need. There were no infections among staff members.

Evidence gaps

Evidence gaps were identified relating to studies that focused on home-based care (n=11) and community-based care (n=2). Additional evidence from these settings may yet emerge, because over 30 ongoing and planned research projects relating to these settings have identified (Yu and Comas-Herrera, 2021). Due to the timing of the vaccination approvals and rollouts, studies on the roll-out and effectiveness of vaccinations in social care settings were largely missing until the end of 2020, and consequently they do not feature in this review. A large majority of the studies focused on the United States, Europe, and Canada, with most of the others focusing on countries in East Asia. We did not find published studies assessing psychological or rehabilitation interventions to mitigate the impacts of the pandemic, especially isolation. Additionally, we found no studies reporting on measures to support care provider organisations. There were a few studies that described environmental or building interventions (n=3), mainly focusing on natural and mechanical ventilation, but which did not empirically assess their efficacy. We found little evidence on measures to support staff and unpaid carers (n=4), which was mainly focused on improving mental wellbeing. There were few studies reporting on interventions to improve quality of care (n=2), end of life care and advanced care planning (n=6), and adaptations to existing interventions (n=2).

Discussion

Our rapid review of long-term care focused interventions studied during the Covid-19 pandemic published during 2020 found that, in the first year of the pandemic, the state of evidence was poor overall, reflecting both the time it takes to generate evidence and for it to be published, but also the crisis context in which most of this research was carried out. Despite identifying 137 studies reporting on a variety of different types of interventions, most studies did not apply an analytical lens and instead provided descriptive findings only. The availability of evidence was particularly poor in relation to care provided outside congregate settings, with only 11 studies covering home care and 2 community-based care. This suggests that the evidence available to decision-makers and those developing guidance documents was very limited.

The long-term care measures studied during the first year of the pandemic tended to focus on the prevention or management of infections in institutional care settings. There was a heavy emphasis on outbreak management and testing strategies. Other measures that may be key to preventing infections were less well studied, for example physical characteristics of care homes and, particularly, buildings ventilation.

Most of the studies we identified focused on Infection Prevention and Control and reported on a bundle of measures adopted as part of the outbreak response, which means that it is not clear to what extent a single measure would have contributed to better or worse outcomes. The use of multifaceted packages to reduce the risk of outbreaks is in line with the findings of a systematic review of guidelines for long-term care organisations during the pandemic (National Collaborating Centre for Methods and Tools, 2021). That review also found existing evidence on the effectiveness of these measures to be of very low certainty.

Some of the measures adopted, particularly banning visitors and isolating infected people have the potential to impact severely on the wellbeing of people using and providing long-term care (Low *et al.*, 2021).

Our review identified an important evidence gap in relation to non-institutional care, despite growing evidence that people using care at home and unpaid carers have been severely affected by the pandemic (Lorenz-Dant and Comas-Herrera, 2021).

Most studies we identified were descriptive reports of outbreaks and the responses of individual nursing homes or care organisations, reflecting the speed and crisis context in which these interventions were implemented and written up to share learnings. While descriptive case studies can provide valuable evidence in the face of a rapidly evolving pandemic, more robust studies will be needed to inform the future planning of long-term care. We expect that more studies exploiting natural variation in how measures were implemented will be published. Such studies, providing a counterfactual, will allow researchers and policy-makers to better gauge what measures were successful in preventing infections and more severe outcomes and which were not. An international database of studies of Covid-19 in the long-term care sector has identified at least 14 trials or other evaluations that will contribute to increasing the quality of available evidence.

The findings from this mapping show that only low-quality evidence on measures to prevent and mitigate Covid-19 in the long-term care sector was available to guide decisions on how to respond to the pandemic in the LTC sector during 2020. While, particularly at the beginning of the pandemic this was inevitable due to the pandemic being due to a new virus, there may be scope for researchers, research funders, governments and publishers to learn lessons from the scientific response to the pandemic in relation to long-term care and to consider the role of research in future pandemics or major other emergencies. This may involve assessing the degree to which the existing research infrastructure was able to support, or not, the rapid generation of evidence to support decision-making during the pandemic and to identifying opportunities to both strengthen the long-term care evidence base and have better "research preparedness" for future events.

Limitations

This review was pragmatic, rather than systematic. We focused on mapping which types of interventions were studied during the pandemic but did not attempt to systematically synthesise findings on the effectiveness of these. Other reviews have systematically synthesised available evidence on the effects of specific interventions or other factors that could explain variations in outcomes (Kruse *et al.*, 2021; National Collaborating Centre for Methods and Tools, 2021).

The pragmatic nature of the review also meant that we only searched two databases from August through December 2020. It is therefore possible that we have missed published studies of long-term care interventions during the pandemic. However, this was compatible with the aim of our review, which was to map the evidence base in terms of key areas of research focus, rather than to exhaustively list every published study. Furthermore, we compared search results for these two databases with results from a wider set of six databases of peer-reviewed articles that were searched up until the end of July 2020 and did not find reduced sensitivity when only searching MEDLINE and Web of Science.

We focused on English databases only and the findings of this mapping review may therefore not be representative of the global literature on long-term care interventions during the pandemic.

Due to the high death toll among care home residents during the early phase of the pandemic, we were initially more primed to identify interventions aimed at preventing infections and mitigating their consequences, i.e. managing outbreaks. It is therefore possible that we missed some studies of interventions focusing on the psycho-social impact of the pandemic early on.

Conclusion

This review aimed to map the range of interventions, policies, and measures in long-term care studied during the Covid-19 pandemic and published throughout 2020. We identified 137 studies, the majority of which were descriptive case studies from high income countries, covering multiple infection control measures adopted in care homes. By the end of 2020 there was very little evidence available on measures for home-based or community-based settings.

Decision-makers in long-term care had very limited scientific evidence on the measures to respond to the pandemic at their disposal during 2020. The rapidly evolving pandemic appears to have hampered 'gold-standard' approaches to generate and synthesize evidence in long-term care. As countries assess the lessons that can be learnt from the pandemic and improve preparedness of their long-term care systems for future pandemics and other shocks, it will be important to consider the importance of facilitating rapid generation of more robust evidence.

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Appendix

Table A1: Search syntax for MEDLINE (via PubMed) with search results from 1 May 2020

#	Search term	No. of hits
1	("COVID-19"[Supplementary Concept] OR "severe acute respiratory syndrome coronavirus 2"[Supplementary Concept] OR (("Coronavirus"[MeSH Terms] OR "Coronavirus Infections"[Mesh:NoExp] OR pneumonia virus*[tiab] OR cov[tiab]) AND (outbreak[tiab] OR wuhan[tiab] OR novel[all] OR 19[tiab] OR 2019[tiab] OR epidem*[tiab] OR epidemy[all] OR epidemic*[all] OR pandem*[all] OR new[tiab])) OR coronavirus*[tiab] OR corona virus*[tiab] OR ncov[tiab] OR 2019ncov[tiab] OR covid19[tiab] OR "covid 19"[tiab] OR "sars cov 2"[tiab] OR sars2[tiab] OR "ncov 2019"[tiab] OR "sars coronavirus 2"[tiab] OR "sars corona virus 2"[tiab] OR "severe acute respiratory syndrome cov 2"[tiab] OR "severe acute respiratory syndrome cov2"[tiab] OR severe acute respiratory syndrome cov*[tiab] OR cov2[tiab])	21525
2	"Residential Facilities"[Mesh] OR "Long-Term Care"[Mesh] OR "Housing for the Elderly"[Mesh] OR "Institutionalization"[Mesh] OR "Home Care Services"[Mesh] OR "Home Nursing"[Mesh] OR "Geriatric Nursing"[Mesh] OR "Adult Day Care Centers"[Mesh]	132210
3	(intermediate[tw] OR "long term"[tw] OR longterm[tw] OR institution*[tw] OR home[tw] OR day[tw]) AND care[tw]	391913
4	("old age"[tw] OR "old people*"[tw] OR "old folk*"[tw] OR elderly[tw] OR aged[tw] OR geriatric[tw] OR retirement[tw] OR nursing[tw]) AND (home[tw] OR homes[tw] OR institution*[tw] OR facility[tw] OR facilities[tw] OR house[tw] OR housing[tw] OR "home care"[tw])	335549
5	#2 OR #3 OR #4	631742
6	#1 AND #5	442
7	#6 AND ("2020/01/01"[PDAT] : "3000/12/31"[PDAT])	270
8	("animals"[MeSH Terms] NOT "humans"[MeSH Terms]))	4695081
9	(editorial[pt] OR comment[pt] OR letter[pt] OR newspaper article[pt])	1850290
10	**#7 NOT #8 NOT #9**	**240**

Table A2: List of all included studies

Authors	Country /terr	Type of care	Study type	Measures studied
Abrams et al. (2020)	USA	Institutional	Cohort study of nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Ahmad, Alam, and Saadi (2020)	USA	Institutional	Cohort study of 46 nursing home residents in New York, US	Pharmacological treatment of COVID-19
Alam et al. (2020)	USA	Institutional	Cohort study of 89 care home residents in New York, US	Pharmacological treatment of COVID-19
An et al. (2020)	South Korea	Institutional	Ecological study of 10,237 COVID-19 patients in South Korea	Machine learning to predict COVID-19 prognosis
Annweiler et al. (2020)	France	Institutional	Cohort study of 66 nursing home residents in France	Pharmacological prophylaxis for COVID-19
Archbald-Pannone et al. (2020)	USA	Institutional	Descriptive case study of a geriatric prevention and response programme in Virginia, US	Geriatric prevention and response programme for COVID-19
Bakaev, Retalic, and Chen (2020)	USA	Institutional	Descriptive case study of the response of 1 assisted living facility	Comprehensive outbreak response including universal testing
Balestrini et al. (2020)	UK	Institutional	Outbreak report from 4 residential care facilities in London, UK	Comprehensive outbreak responses including staff cohorting
Belmin et al. (2020)	France	Institutional	Cohort study of 17 care homes in France	Voluntary staff confinement in care homes
Benaque et al. (2020)	Spain	Community	Descriptive case study of the response of a NGO that delivers dementia care	Comprehensive outbreak response including switching to telemedicine
Beran et al. (2020)	Czech Republic	Institutional	Cohort study of 3 nursing homes in the Czech Republic	Pharmacological treatment of COVID-19
Bernabeu-Wittel et al. (2020a)	Spain	Institutional	Cohort study of 272 nursing home residents in Seville, Spain	The use of prognostic tools to predict COVID-19 outcomes
Bernabeu-Wittel et al. (2020b)	Spain	Institutional	Descriptive case study of the responses of 4 care homes in Seville, Spain	Comprehensive outbreak responses including universal testing and cohorting
Birgand et al. (2021)	France; UK	Institutional	Cohort study of 4 care homes in London, UK, and 136 nursing homes in France	Universal testing

Blackburn et al. (2021)	USA	Institutional	Cohort study of 59,940 nursing home staff in Indiana, US	Universal testing
Blain et al. (2020)	USA	Institutional	Descriptive case study of the response of 1 nursing home in the US	Universal testing
Blasco et al. (2020)	Brazil	Institutional	Cohort study of care homes in Brazil	Comprehensive outbreak responses including universal testing
Borras-Bermejo et al. (2020)	Spain	Institutional	Outbreak report from 69 care homes in Catalonia, Spain	Comprehensive outbreak responses including universal testing and cohorting
Bowblis and Applebaum (2020)	USA	Institutional	Cohort study of all of the care homes in Ohio, US	Nursing home characteristics associated with COVID-19 outcomes
Brainard et al. (2020)	UK	Institutional	Cohort study of 248 care homes in Norfolk, UK	Nursing home characteristics associated with COVID-19 outcomes
Braun et al. (2020)	USA	Institutional	Cohort study of 11,470 nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Britton (2020)	UK	Institutional	Descriptive case study of 1 care home in the UK	WhatsApp to connect staff
Brouns et al. (2020)	Netherlands	Institutional	Cohort study of 101 COVID-19 positive nursing home residents in Maastricht, Netherlands	Pharmacological prophylaxis for COVID-19
Brown et al. (2020)	Canada	Institutional	Cohort study of 618 care homes in Ontario, Canada	Nursing home characteristics associated with COVID-19 outcomes
Bui et al. (2020)	USA	Institutional	Cohort study of all of the care homes in West Virginia, US	Nursing home characteristics associated with COVID-19 outcomes
Buja et al. (2020)	Italy	Institutional	Ecological study of long-term care hospitals in Northern Italy	Nursing home characteristics associated with COVID-19 outcomes
Buntinx et al. (2020)	Belgium	Institutional	Outbreak report from 1 nursing home in Belgium	Antibody testing
Burton et al. (2020)	UK	Institutional	Cohort study of 189 care homes in the NHS Lothian region, UK	Nursing home characteristics associated with COVID-19 outcomes
Cabrera Alvargonzalez et al. (2020)	Spain	Institutional	Descriptive case study of 306 care homes in Galicia, Spain	Pooled testing
Callaghan et al. (2020)	USA	Institutional	Outbreak report from 1 psychiatric hospital in Wyoming, US	Comprehensive outbreak response including testing and cohorting of new admissions
Caspi et al. (2020)	Israel	Institutional	Descriptive case study of the use of heat map technology in Israel	Heat maps to geographically illustrate infection data

Chatterjee et al. (2020)	USA	Institutional	Cohort study of nursing homes across 23 states in the US	Nursing home characteristics associate with COVID-19 outcomes
Chen et al. (2020)	China	Institutional	Descriptive case study of the response of home-care in China	Comprehensive outbreak response
Chow (2020)	Hong Kong	Institutional	Descriptive case study of the responses of care homes in Hong Kong	Comprehensive outbreak responses
Christ (2020a)	USA	Institutional	Descriptive case study of the responses of 2 post-acute care facilities	Comprehensive outbreak responses
Christ (2020b)	USA	Institutional	Cohort study of nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Collison et al. (2020)	USA	Institutional	Outbreak report from 1 skilled nursing facility in Chicago, US	Universal resident testing and three-tiered cohorting strategy
De Spiegeleer et al. (2020)	Belgium	Institutional	Cohort study of 2 nursing homes in Ghent, Belgium	Pharmacological prophylaxis for COVID-19
Dean, Venkataramani, and Kimmel (2020)	USA	Institutional	Cohort study of 355 nursing homes in New York, US	Nursing home characteristics associated with COVID-19 outcomes
Diamantis et al. (2020)	France	Institutional	Descriptive case study of the response of 1 care home in Île-de-France, France	Comprehensive outbreak response including deployment of a task force
Díaz et al. (2020)	Cuba	Institutional	Cohort study of 19 care home residents in Cuba	Pharmacological treatment of COVID-19
Dini et al. (2020)	Italy	Institutional	Descriptive case study of 12 nursing homes in Northern Italy	Lung ultrasonography to detect the presence of lung damage
Dolveck et al. (2020)	France	Institutional	Descriptive case study of 8 care homes in France	Comprehensive outbreak responses including the deployment of a task force
Dora et al. (2020)	USA	Institutional	Outbreak report from 1 nursing homes in Los Angeles, US	Universal testing and cohorting
Dutey-Magni et al. (2020)	UK	Institutional	Cohort study of 179 care homes in the UK	Nursing home characteristics associated with COVID-19 outcomes
Echeverría et al. (2020)	Spain	Institutional	Descriptive case study of an app to detect and record COVID-19 cases in Catalonia, Spain	App to detect and record COVID-19 cases
Eckardt et al. (2020)	USA	Institutional	Outbreak report from 1 nursing home in California, US	Comprehensive outbreak response including universal testing and cohorting

Escobar et al. (2020)	USA	Institutional	Outbreak repot from 1 care home in Eastern Pennsylvania, US	Comprehensive outbreak response including universal testing and cohorting
Espasandin-Duarte et al. (2020)	Spain	Institutional	Descriptive case study of 2 specialised hospital-like facilities in Galicia, Spain	Comprehensive outbreak responses including transferring COVID-19 positive residents to hospital-like facilities
Figueroa et al. (2020)	USA	Institutional	Cohort study of nursing homes across 8 states in the US	Nursing home characteristics associated with COVID-19 outcomes
Fisman et al, (2020)	Canada	Institutional	Cohort study of 627 care homes in Ontario, Canada	Nursing home characteristics associated with COVID-19 outcomes
Gallo Marin et al. (2020)	USA	Institutional	Descriptive case study of 46 assisted living facilities in Rhode Island, US	Electronic devices to improve digital connectivity
Gaur et al. (2020)	USA	Institutional	Descriptive case study of the use of a tool for communication and care planning in the US	Structured tool for communication and care planning to help discussions
Gleason et al. (2020)	USA	Institutional	Descriptive case study of the use of videoconferencing software in Chicago, US	Training using videoconferencing software
Gonzalez de Villaumbrosia et al. (2020)	Spain	Institutional	Descriptive case study of the use of a cohorting algorithm in Madrid, Spain	Cohorting algorithm
Goodman-Casanova et al. (2020)	Spain	Home-care	Cohort study of home-care recipients in Malaga, Spain	Electronic devices for telemedicine and to improve digital connectivity
Gorges and Konetzka (2020)	USA	Institutional	Cohort study of all of the nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Guery et al. (2020)	France	Institutional	Outbreak report from 1 nursing home in Nantes, France	Universal testing of staff
Harrington et al. (2020)	USA	Institutional	Cohort study of 1,091 nursing homes in California, US	Nursing home characteristics associated with COVID-19 outcomes
Harris et al. (2020)	USA	Institutional	Outbreak report from 1 nursing home in Charlottesville, US	Comprehensive outbreak response including telemedicine
He, Li, and Fang (2020)	USA	Institutional	Cohort study of 1,223 skilled nursing facilities in California, US	Nursing home characteristics associated with COVID-19 outcomes
Heras et al. (2020)	Spain	Institutional	Outbreak report from 1 intermediate care home facility in Andorra, Spain	Transferring COVID-19 positive residents to an intermediary care home facility

Heudorf et al. (2020)	Germany	Institutional	Descriptive case study of the responses of care homes in Frankfurt am Main, Germany	Comprehensive outbreak responses including universal testing
Hofschulte-Beck et al. (2021)	USA	Institutional	Descriptive case study of 242 nursing home staff in Indiana, US	Testing and vaccinations
Huang et al. (2020)	Taiwan	Community	Descriptive case study of the response of 1 dementia day care centre in Kaohsiung, Taiwan	Comprehensive outbreak response
Ickert et al. (2020)	Canada	Institutional	Descriptive case study of 10 care homes in Alberta, Canada	Electronic devices
Khatri et al. (2020)	Singapore	Home-care	Descriptive case study of the response of 1 home hospice service in Singapore	Comprehensive outbreak response
Kim (2020)	South Korea	Institutional	Outbreak report from 1 long-term care hospital in Seoul, South Korea	Comprehensive outbreak response including voluntary staff confinement in the long-term care hospital
Koeberle et al. (2020)	France	Home-care; Institutional	Descriptive case study of a geriatric evaluation and coordination unit in Besancon, France	Geriatric evaluation and coordination unit
Ladhani et al. (2020a)	UK	Institutional	Outbreak report from 1 care home in London, UK	Antibody testing
Ladhani et al. (2020b)	UK	Institutional	Cohort study of 254 nursing home staff in London, UK	Universal testing of staff
Lai et al. (2020)	Hong Kong	Home-care	Cohort study of 60 home-care recipients and their carers in Hong Kong	Electronic devices for telemedicine
Lally et al. (2021)	USA	Institutional	Cohort study of 775 nursing home residents in the US	Pharmacological prophylaxis for COVID-19
Lee, Son, and Peck (2020)	South Korea	Institutional	Outbreak report from 1 long-term care hospital in Busan, South Korea	Pharmacological treatment of COVID-19
Li et al. (2020)	USA	Institutional	Cohort study of nursing homes in Connecticut, US	Nursing home characteristics associated with COVID-19 outcomes
Liotta et al. (2020)	Italy	Institutional	Ecological study of citizens over 80 years of age in Italy	Nursing home characteristics associated with COVID-19 outcomes
Lipsitz et al. (2020)	USA	Institutional	Cohort study of 360 nursing homes in Massachusetts, US	Comprehensive outbreak responses including convening a central command committee

Liu et al. (2020)	Canada	Institutional	Descriptive case study of care homes in British Columbia and Ontario, Canada	Nursing home characteristics associated with COVID-19 outcomes
Lombardo et al. (2021)	Italy	Institutional	Cohort study of 1,356 care homes in Italy	Nursing home characteristics associated with COVID-19 outcomes
Louie et al. (2020a)	USA	Institutional	Outbreak report from 4 care homes in San Francisco, US	Universal testing
Louie et al. (2020b)	USA	Institutional	Descriptive case study of the responses of care homes in San Francisco, US	Comprehensive outbreak response including universal testing and cohorting
Lum et al. (2020)	Hong Kong	Home-care; Institutional	Descriptive case study of the responses of institutional and domiciliary care homes in Hong Kong	Comprehensive outbreak responses
Ly et al. (2020)	France	Institutional	Descriptive case study of the responses of 24 care homes in Marseille, France	Universal testing and pharmacological treatment of COVID-19
McArthur et al. (2021)	Canada	Institutional	Descriptive case study of the responses of 7 care homes in New Brunswick, Canada	Electronic devices to improve digital connectivity
McBee et al. (2020)	USA	Institutional	Descriptive case study of the responses of 123 nursing homes in West Virginia, US	Universal testing
McConeghy et al. (2020)	USA	Institutional	Outbreak report from 416 nursing homes and community-based facilities in the US	Temperature testing
McGarry, Grabowski, and Barnett (2020)	USA	Institutional	Cohort study of 15,288 nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Miller et al. (2020a)	USA	Institutional	Descriptive case study of 63 nursing home staff in the US	Staff support
Miller et al. (2020b)	USA	Institutional	Descriptive case study of the response of 1 nursing home in Pennsylvania, US	Negative pressure isolation space
Mills et al. (2020a)	USA	Institutional	Descriptive case study of the responses of 2,400 residential community settings and intermediate care facilities in Ohio, US	Comprehensive outbreak responses including convening an outbreak preparedness and action committee

Mills et al. (2020b)	USA	Home-care; Institutional	Descriptive case study of the responses of 101 community assisted living facilities in Ohio, US	Comprehensive outbreak responses
Mills et al. (2020c)	USA	Home-care	Outbreak report from 67 home-care recipients in the US	Comprehensive outbreak responses
Montoya et al. (2020)	USA	Institutional	Outbreak report from 3 nursing homes in Michigan, US	Comprehensive outbreak responses including universal testing and cohorting
Munanga (2020)	USA	Institutional	Outbreak report from 1 retirement community in Seattle, US	Comprehensive outbreak responses including universal testing
Nouvenne et al. (2020)	Italy	Institutional	Descriptive case study of 1 nursing home in Emilia-Romagna, Italy	Chest ultrasonography
Office et al. (2020)	USA	Home-care; Institutional	Outbreak report from the US	Electronic devices to improve digital connectivity
Office for National Statistics (2020)	UK	Institutional	Cohort study of 5,126 nursing homes in England, UK	Nursing home characteristics associated with COVID-19 outcomes
Osterdahl et al. (2020)	UK	Institutional	Outbreak report from 1 care home in the UK	Rapid testing
Park et al. (2020)	South Korea	Institutional	Outbreak report from all of the nursing homes in South Korea	Comprehensive outbreak responses including testing
Psevdos et al. (2020)	USA	Institutional	Outbreak report from 1 nursing home in New York, US	Comprehensive outbreak response including universal testing and cohorting
Renzi et al. (2020)	Italy	Institutional	Descriptive case study of the response of 1 care home in Rome, Italy	Electronic devices for telemedicine
Rolland et al. (2020)	France	Institutional	Descriptive case study of the responses of 124 care homes in Haute-Garonne, France	Nursing home characteristics associated with COVID-19 outcomes
Romero-Ortuño and Kennelly (2020)	Ireland	Institutional	Ecological study of care homes in Ireland	Nursing home characteristics associated with COVID-19 outcomes
Rothgang et al. (2020)	Germany	Institutional	Cohort study of 824 nursing homes in Germany	Nursing home characteristics associated with COVID-19 outcomes
Rudolph et al. (2020)	USA	Institutional	Outbreak report from 154 community living centres in the US	Temperature testing
Sacco et al. (2020)	France	Institutional	Outbreak report from care homes and geriatric acute care units in Angers, France	Electronic devices to increase digital connectivity

Sanchez et al. (2020)	USA	Institutional	Descriptive case study of the responses of 26 care homes in Detroit, US	Universal testing
Sepulveda, Stall, and Sinha (2020)	Belgium; Canada; Denmark; France; Germany; Ireland; Italy; Netherlands; Spain; Sweden; UK; USA	Institutional	Descriptive case study of care homes across 12 OECD countries	Nursing home characteristics associated with COVID-19 outcomes
Shea et al. (2020)	Hong Kong	Home-care; Institutional	Descriptive case study of the responses of all of the institutional and domiciliary care facilities in Hong Kong	Comprehensive outbreak responses including universal testing and quarantine measures
Shih, Wang, and Chao (2020)	Taiwan	Institutional	Descriptive case study of the response of 1 care home in Taiwan	Comprehensive outbreak response including universal testing
Shimotsu et al. (2020)	USA	Institutional	Descriptive case study of the response of 1 care home in Pennsylvania, US	Comprehensive outbreak response including universal testing
Shrader et al. (2020)	USA	Institutional	Outbreak report from 1 nursing home in West Virginia, US	Comprehensive outbreak response including universal testing, cohorting, and pharmacological treatment of COVID-19
Siu et al. (2020)	Canada	Institutional	Descriptive case study of 294 clinicians in Ontario, Canada	Comprehensive outbreak responses including telemedicine
Sohn et al. (2020)	USA	Institutional	Outbreak report from 1 post-acute care recovery unit in Los Angeles, US	Comprehensive outbreak response including universal testing
Stacey et al. (2020)	Canada	Institutional	Descriptive case study of the development and dissemination of patient decision aids in Ottawa, Canada	Patient decision aids to improve decision quality
Stall et al. (2020a)	Canada	Institutional	Descriptive case study of the response of 1 acute care hospital in Toronto, Canada	Comprehensive outbreak response
Stall et al. (2020b)	Canada	Institutional	Cohort study of all of the nursing homes in Ontario, Canada	Nursing home characteristics associated with COVID-19 outcomes

Stivanello et al. (2020)	Italy	Institutional	Ecological study of Bologna, Italy	Comprehensive outbreak response
Stow et al. (2020)	UK	Institutional	Cohort study of 460 care homes across 46 local authorities in the UK	Symptom screening for disease surveillance
Sugg et al. (2021)	USA	Institutional	Ecological study of 13,709 nursing homes in the US	Nursing home characteristics associated with COVID-19 outcomes
Sun et al. (2020)	USA	Institutional	Descriptive case study of the development and implications of a machine-learning model in the US	Machine learning to assess risk of COVID-19 infection
Tan and Chua (2020)	Singapore	Institutional	Descriptive case study of the responses of care homes in Singapore	Comprehensive outbreak responses including universal testing and cohorting
Tan and Seetharaman (2020)	Singapore	Institutional	Descriptive case study of the responses of care homes in Singapore	Comprehensive outbreak responses including cohorting
Tarteret et al. (2020)	France	Institutional	Outbreak report from 3 nursing homes in Île-de-France, France	Comprehensive outbreak responses
Telford et al. (2020a)	USA	Institutional	Cohort study of 24 care homes in Georgia, US	Nursing home characteristics associated with COVID-19 outcomes
Telford et al. (2020b)	USA	Institutional	Outbreak report from 28 care homes in Fulton County, Georgia	Comprehensive outbreak responses including universal testing
Unruh et al. (2020)	USA	Institutional	Cohort study of 1,162 care homes across 3 states in the US	Nursing home characteristics associated with COVID-19 outcomes
Van der Roest et al. (2020)	Netherlands	Institutional	Descriptive case study of the responses of 357 care homes and residential care facilities in the Netherlands	Electronic devices to improve digital connectivity
van Dyck et al. (2020)	USA	Institutional	Descriptive case study of 3 care homes in Connecticut, US	Electronic devices to improve digital connectivity
Verbeek et al. (2020)	Netherlands	Institutional	Descriptive case study of the responses of 26 care homes in the Netherlands	Visitation guidelines
Veronese et al. (2020)	Italy	Institutional	Outbreak report from 1 care home in Venice, Italy	Lung ultrasonography to detect the presence of lung damage
Villalobos Dintrans, Browne, and Madero-Cabib (2020)	Chile	Home-care; Institutional	Descriptive case study of the response in Chile	Comprehensive outbreak responses

Voeten et al. (2020)	Netherlands	Institutional	Outbreak report from 1 skilled nursing home facility in Goeree-Overflakkee, Netherlands	Comprehensive outbreak response including testing and cohorting
Wammes et al. (2020)	Netherlands	Institutional	Descriptive case study of 1,997 relatives of nursing home residents in the Netherlands	Visitation ban
Wang (2020)	China	Institutional	Descriptive case study of the responses of 6 care homes in China	Nursing home characteristics associated with COVID-19 outcomes
White et al. (2020)	USA	Institutional	Ecological study of 3,357 skilled nursing facilities in the US	Nursing home characteristics associated with COVID-19 outcomes
Yang and Huang (2020)	Taiwan	Institutional	Descriptive case study of the responses of nursing homes in Taiwan	Comprehensive outbreak responses

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