Public Health England

Protecting and improving the nation's health

# Factors associated with COVID-19 in care homes and domiciliary care, and effectiveness of interventions

## A rapid review

# Contents

# Main messages

1. Twenty-two studies were identified, 13 (4 preprints) examining factors associated with the transmission of COVID-19 in care homes and 9 (3 preprints) examining the effectiveness of interventions (search up to 31 August 2020). No studies reported on domiciliary care.

2. Multiple observational studies have consistently reported the use of temporary staffing and the movement of staff between different care homes, lack of sick pay provision for care home staff, ‘for profit’ ownership (US-based studies), lower quality ratings, and lower levels of trained nurses (amongst other factors) as being associated with increased levels of COVID-19.

3. There is limited evidence on the effectiveness of interventions, and available evidence is weak. Routine testing with early intervention (one study) and voluntary staff confinement (one study) were associated with lower COVID-19 and descriptive studies reported the use of multiple consecutive strategies. Further research is needed, and studies that better infer causality.

# Background

Adults living in care homes or receiving domiciliary care, are particularly vulnerable to COVID-19 due to age (less functional immunity), pre-existing health conditions, varying levels of immobility and dementia (1). The World Health Organisation has estimated that as many as half of all COVID-19 deaths in Europe occurred in care homes (2). In the UK, the latest figures from the Office for National Statistics (ONS) show that 29.3% (19,394 out of a total of 66,112 deaths) of all deaths of care home residents between the period 2 March to 12 June 2020, registered up to 20 June 2020, involved COVID-19 (3). Prevalence of COVID-19 within care homes is high. One US study reported an 85% prevalence in a single nurse facility with no known case of COVID-19 (4). A recent study in UK nursing homes identified 40% of residents and 20% of staff as COVID-19 positive using systematic testing; of residents, 43% were asymptomatic and 18% had atypical symptoms (symptoms other than cough, fever or anosmia) and two-thirds of staff were asymptomatic (5). The ONS reported that dementia and Alzheimer's disease was the most common main pre-existing condition found among deaths involving COVID-19, identified in 49.5% of all deaths of care home residents involving COVID-19 in England and Wales (3). Patients suffering from cognitive decline with chronic respiratory conditions may be unable to express symptoms, or symptoms may go unnoticed or unrecognised if mild (6).

Staff may be an important source of COVID-19 within care settings, although due to nature of the work (which involves particular close contact between both the care giver and receiver) there is a two-way risk of transmission (7). Staff movement between care homes, domiciliary care and even other jobs is commonplace, increasing opportunities for COVID-19 transmission (8). Strategies currently recommended to control transmission within care homes in England include enhanced infection prevention and control, the isolation of symptomatic residents and staff (who are required to remain at home if they or any member of their household have symptoms or test positive) (9), appropriate use of personal protective equipment (PPE) (10,11) and a programme of testing for staff and residents (12). There is similar guidance related to domiciliary care (13). The importance of adequate funding has been highlighted to ensure that main resources (for example staffing, PPE, and cleaning materials), are available and to ensure the careful monitoring of COVID-19 within these settings (2).

A rapid review conducted earlier this year (search date 14 May 2020) examined the effectiveness of restricting staff movement between and isolation of symptomatic residents ('cohorting') in reducing the transmission of COVID-19 in care homes (14). The review included 5 papers reporting on 3 outbreaks in North America, and reported that whilst these strategies may help to minimise transmission more robust evidence was needed. A second review focused on factors associated with transmission and interventions to minimise transmission in domiciliary care settings (search date 2 June 2020) found no relevant studies (15). Given the ongoing challenges related to COVID-

19 in residential and domiciliary care settings there is a need for a full and up to date look at the evidence.

# Objective

The purpose of this rapid review was to identify and assess direct evidence from the COVID-19 pandemic on factors associated with COVID-19 in care homes and domiciliary care, and interventions to minimise the extent of COVID-19.

# Review questions

1. What factors are associated with incidence, prevalence or transmission of COVID-19 within care homes and domiciliary care?
2. What interventions (single or packages of interventions) are effective in minimising COVID-19 incidence, prevalence or transmission in care homes and domiciliary care?

# Summary of methods

A literature search was undertaken to look for primary evidence related to the COVID-19 outbreak, published (or available as preprint) between 1 January and 31 August 2020. See Annexe A for details of the methodology. A protocol was developed a priori and is available in Annexe D.

Studies focussed on the effectiveness of various testing strategies, including serial mass surveillance testing, targeted testing, compared with symptom-based identification were excluded.

A note about terminology: the term ‘care home’ is used to encompass facilities providing care typically to older adults, although studies that included other adult populations were also included if the primary focus was on care for older adults. The included studies use different terms to refer to the facilities investigated. This review reports findings using the preferred term in each study.

# Summary of the evidence

The database search returned 3,976 records. After removal of duplicates, 2,437 records were screened by title and abstract. Of these, 166 full-text articles were assessed for eligibility and 22 met the inclusion criteria and were included in this review (13 for question 1, 9 for question 2). A PRISMA diagram is provided in Figure A.1. Seven of

these articles were preprint (not peer-reviewed). Full data extraction tables are available in Annexe C. An additional preprint study (16) relevant to question 1 (and from the UK) was identified through routine evidence monitoring after the search cut-off date, and brief results are included in the evidence summary for completeness.

# Q1. What factors are associated with levels of COVID-19 within care homes and domiciliary care?

13 studies (3 retrospective cohort, 9 cross-sectional, 1 modelling study), including 4 preprints (17 to 20), examined factors associated with COVID-19 in care homes. Factors examined included staff movement between care homes, varying staffing levels, size of facility, quality ratings, percentage of ethnic minority residents, or 'for profit' status. No studies were identified from domiciliary care settings.

Five studies were conducted in the UK and Ireland, 2 were conducted in Canada and 6 were from the US. Observational studies typically assessed factors associated with i) any COVID-19 case within a facility, and ii) a COVID-19 outbreak (which was defined in different ways).

## Evidence from observational studies

**Studies from the UK and Ireland**
Two cross-sectional studies conducted in the UK considered the effects of staff movement between care homes on COVID-19 infection rates amongst other factors.

Ladhani and others (21) assessed occupational risk factors for COVID-19 infection among staff (n=254, 54% of all staff working at the time of the study) in 6 London care homes reporting a suspected outbreak (at least 2 cases) between 10 and 13 April 2020. Level of COVID-19 in London at the time of the study was reported to be high. Staff provided a nasal self-swab which was tested by reverse transcription polymerase chain reaction (RT-PCR) assay, and were asked to report any symptoms, contact with residents and if they worked in any other care homes. Whole genome sequencing was conducted on positive samples (n=61 residents, 31 staff). Of 15 permanent staff with regular contact with residents and who occasionally worked across different care homes 47% tested positive for COVID-19, and 58% in 12 staff who frequently worked across different care homes. Compared to 227 staff working in a single care home, the 27 staff members working in different care homes had a 3 times higher risk of testing positive for COVID-19 (95% confidence interval [CI], 1.9 to 4.8; $p<0.001$). Whole genome sequencing revealed that there were numerous introductions of COVID-19 in individual care homes with large outbreaks and evidence of clustering between staff and residents suggesting cross-infection in individual care homes.

An ONS report (the 'Vivaldi' study) (22), looking at prevalence of COVID-19 in care homes in England providing dementia care or care for residents at least 65 years old, assessed factors associated with the number of residents and staff testing positive for COVID-19. Testing was completed by care home staff using nasal and throat swabs, and this information (alongside other data) was gathered via a telephone survey with care home managers. Data was collected between 26 May and 19 June 2020, there was a 56% response rate (n=5,126) and results were adjusted to account for non-response. Risk of infection in residents increased by 11% for each additional member staff infected, whereas the risk of infection in staff increased by 4% (95% CI: 4% to 4%) for each additional infected resident. The likelihood of infection was higher in care homes using bank or agency staff most or all days (odds ratio [OR] = 1.58, 95% CI: 1.50 to 1.65) compared with those who never used bank or agency staff. When staff received sick pay, care homes were less likely to have cases of COVID-19 in residents (OR = 0.87, 95% CI: 0.82 to 0.93). Care homes where staff regularly worked elsewhere had increased odds of staff infection (OR = 2.40, 95% CI: 1.92 to 3.00) compared with those whose staff never worked elsewhere, and risk of infection in care home staff increased by 4% (95% CI: 4% to 4%) for each additional infected resident. In care homes using bank or agency nurses or carers most or every day the odds of infection in staff were higher (OR = 1.88, 95% CI: 1.77 to 2.00), compared with those not using bank or agency staff. Estimates are based on numbers of confirmed cases of COVID-19 at the time of reporting, so any suspected cases yet to be tested would have been excluded. The use of survey data, as opposed to test results, could also have impacted on the accuracy of results and the authors note that the numbers of COVID-19 cases could be underestimated.

Emmerson and others (preprint) (19) examined 3,115 hospital discharges to 1,068 Welsh adult care homes and subsequent outbreaks of COVID-19 occurring over an 18-week period to determine whether this exposure (discharge from hospital to care homes) was associated with increased risk of an outbreak compared with no exposure. No significant association was identified after adjusting for care home characteristics (including size, type of care provided and region). Care home size was determined to be the most significant predictor of an outbreak with larger homes reported to be at greater risk of an outbreak than smaller homes. The study assumed that any COVID-19 case reported 7 to 21 days following a hospital discharge was associated with this discharge; however not all discharges would have had COVID-19 so the true effect could have been diluted. Sixteen care homes without any discharge exposure reported a COVID-19 outbreak.

A cross-sectional analysis of survey data from 28 nursing homes in 3 community healthcare organisations in Dublin and Eastern Ireland (preprint) (20) found a significant correlation between the proportion of staff with symptomatic (but not asymptomatic) COVID-19 (Spearman's rho=0.81, p<0.001) and the number of residents with confirmed or suspected COVID-19. There was no association between single room occupancy

standards and outbreak occurrence, and significantly more residents with confirmed or suspected COVID-19 in the 4 public (106 of 157; 67.5%) versus 17 private (620 of 1,500; 41.3%) nursing homes experiencing an outbreak. Data was collected on 29 February 2020. Responses were received from 62% of all nursing homes invited to participate (n=28 of 45) and the community healthcare organisations involved in the study were reported to be areas most affected by COVID-19 in nursing homes. The results were based on survey data with interviewer assisted completion which brings a risk of recall and observer bias.

Subsequent to our searches, an additional study (16) (preprint) was identified via routine literature monitoring. The study (conducted between April and June 2020) reported on a cross-sectional survey of managers of all long term care facilities (LTCFs) providing either care to adults aged over 65 years or dementia care in England, linked to individual-level RT-PCR test results obtained via national testing. A broad range of risk factors for infections and outbreaks were reported (including 'for profit' status, staff movement between different care homes and high numbers of admissions) and factors that minimised the risk for infections (such as the use of sick pay and higher staff to resident ratios). Full data has not been extracted and risk of bias has not been considered as this study has not been formally included in our review.

**Non-UK studies: Canada**

Two Canadian retrospective cohort studies examined the link between COVID-19 cases and overcrowding (18) and 'for profit' status (23) using data on 623 Ontario LTCFs obtained from the Ontario Ministries of Health and Long-Term Care.

Brown and others (18) (preprint) developed a measure of crowding based on numbers of occupants per room and bathroom. Facility and COVID-19 data from 618 (99%) of 623 LTCFs homes. They reported that in the first months of the COVID-19 pandemic, 4,496 (86%) of COVID-19 infections occurred in 63 (10%) LTCFs, with incidence in 'high crowding' index homes at 9.7% compared with 4.5% in 'low crowding' facilities ($p<0.001$). The authors note that other factors could have been linked to the increased number of infections apart from crowding, for example the size of rooms and the size of the facility.

Stall and others (23) examined the associations between 'for profit' status of the same 623 Ontario LTCFs ('for profit', 'not for profit' or public) and COVID-19 outbreaks. 190 facilities (30.4%) reported outbreaks (defined as at least one COVID-19 case); whilst there were some differences based on 'for profit' status this was not significantly linked to odds of an outbreak. However, the proportion of residents with COVID-19 was highest in 'for profit' homes (23.8%) compared with 'not for profit' (17.2%) and public (5.5%) facilities. In both unadjusted and adjusted (for health region characteristics) regression models 'for profit' status was significantly associated with the size of an

outbreak in a facility compared with 'not for profit' status (unadjusted risk ratio [RR] = 1.83, 95% CI: 1.18 to 2.84, adjusted RR = 1.96, 95% CI: 1.26 to 3.05).

Both studies reported a lack of data on demographic characteristics of residents (such as socio-economic status and ethnicity).

**Non-UK studies: US**

A cross-sectional study (24) examined associations between nursing home quality and COVID-19 cases in 8 US state health departments. Data on COVID-19 cases was publicly available (methods not reported, n=4,254 nursing homes) and linked to nursing home quality data from the Centers for Medicare & Medicaid Services (CMS) which includes 3 domains: health inspection rating, quality of care, and level of nurse staffing. Facilities were grouped according to numbers of COVID-19 cases (up to 10, 10 to 30, over 30) due to available data and analysis compared the 3 groups. Nursing homes with higher quality ratings overall (4- or 5-star) were less likely than those with lower quality ratings (less than 3-star) to have had more than 30 COVID-19 cases (health inspections, 348 [24.0%] vs 948 [33.8%]; quality measures, 897 [30.2%] vs 397 [31.3%]; nurse staffing, 382 [25.2%] vs 907 [33.5%], p values not reported). When adjusting for size of facility and fixed state-level characteristics, a significant positive effect was observed only for staffing; facilities with highest staff ratings were 80% less likely to have over 30 COVID-19 cases than under 30 cases (OR = 0.82; 95% CI: 0.70 to 0.95; p=0.01). It is unclear how the COVID-19 data was collected and reported for this study, so potential issues cannot be fully considered. The authors note that the included states have highest levels of COVID-19 in communities, which needs to be considered when interpreting the results and considering generalisability.

Similar results were reported in a cross-sectional study examining the links between quality (again using CMS data) and cases of COVID-10 within skilled nursing facilities (SNFs, n=1223) in California (25). Higher quality was significantly associated with lower odds of COVID-19 cases and odds decreased as quality increased. Compared with the 3-star facilities, 4-star facilities had 66% lower odds (OR = 0.66, 95% CI: 0.44 to 0.98, p<0.05) and 5-star had 41% lower odds (OR = 0.41, 95% CI: 0.27 to 0.62, p<0.01) of COVID-19 cases. The study also reported significantly higher odds of COVID-19 cases in i) 'for profit' facilities compared with 'not for profit' and public (OR = 1.49, 95% CI: 0.97 to 2.34, p<0.10), ii) facilities with lower than the state average proportion of White residents compared with higher than state average number of White residents (OR = 1.95, 95% CI: 1.49 to 2.55, p<0.01), and iii) larger compared with smaller facilities (OR = 1.009, 95% CI: 1.006 to 1.012, p<0.01). The authors noted additional factors that may have influenced the results but were not examined, including location of facilities, staffing patterns and clinical and health-related characteristics of residents

Another cross-sectional study used CMS data to compare nurse staffing in Californian nursing homes (n=1,091) with and without COVID-19 infections.(26) The almost 80% of

nursing homes with total registered nurse staffing levels under the recommended minimum standard (0.75 hours per resident day) had twice the probability of having COVID-19 resident infections. Nursing homes with lower CMS quality ratings on total nurse and registered nurse staffing levels, higher total health deficiencies, 'for profit' ownership, more beds and insufficient infection prevention and control had a higher probability of having COVID-19 resident infections. COVID-19 incidence data was self-reported by facilities so could have been incomplete or inaccurate.

A cross-sectional study (27) of all US nursing homes in the CMS Nursing Home Dataset (N=13,167) was combined with CMS data on COVID-19 cases primarily to identify associations between staffing levels and COVID-19 cases, although as per other studies associations with wider care home characteristics were also examined (but are not reported in detail here). In the regression-adjusted analysis, higher registered nurse hours was significantly associated with there being any COVID-19 cases but higher registered nurse and nurse assistant hours were significantly associated with a lower likelihood of an outbreak. Prevalence in the community was reported to be the strongest predictor of COVID-19 in facilities.

The associations between nursing staff hours and COVID-19 are supported by a cross-sectional analysis of Connecticut nursing homes (n=215) (28). Routinely collected data on COVID-19 cases (gathered by the Connecticut Department of Health and Human Services) was combined with CMS data on facility characteristics. Whilst no significant associations were reported when examining any COVID-19 cases, there were significant associations with the size of outbreaks in facilities with at least one confirmed case. Every 20-minute increase in registered nurse staffing was associated with a 22% reduction in COVID-19 cases (incidence rate ration [IRR] = 0.78; 95% CI: 0.68 to 0.89; p<0.001). In addition, there were 13% less cases in facilities with higher quality ratings (1- to 3-star compared with 4- or 5-star; IRR = 0.87; 95% CI: 0.78 to 0.97; p<0.015), 16% less cases in facilities with a high concentration of Medicaid residents (IRR = 1.16; 95% CI: 1.02 to 1.32; p=0.025) and (in contrast to other included studies (25,27,29)), 15% less confirmed cases in facilities with a higher proportion of ethnic minority residents (IRR = 1.15; 95% CI: 1.03 to 1.29; p=0.026).

A cross-sectional analysis of US SNF characteristics sought to identify county and facility factors associated with COVID-19 outbreaks (29). The study used publicly available data and data from a large LTC provider (Genesis) gathered between 21 April and 4 May 2020. All 341 Genesis SNFs were included in the study and 3,041 non-Genesis facilities from 12 states with publicly available data. 35% of Genesis SNFs had reported an outbreak and 21% of non-Genesis SNFs (although 'outbreak' was defined here as one or more COVID-19 cases. When comparing SNFs with and without an outbreak, that SNFs with outbreaks were significantly bigger, and reported greater proportions of Black residents. Significant associations were also reported for facilities in areas of higher population density, with larger Black populations and higher

community prevalence of COVID-19. Multivariate analysis reported a 1% increase in the probability of an outbreak with a 10-bed difference in size of facility (percentage points = 0.9%, 95% CI: 0.6% to 1.2%, p<.0001) although a 1% change in community rates of COVID-19 led to a 33% increased probability of an outbreak (percentage points = 33.6%, 95% CI: 9.6% to 57.7%, p=0.008).

In considering the results of these studies, it's important to note that other contextual factors may have affected the results; for example, facility-level infection prevention and control practices and characteristics of individual residents. In addition, the studies which examined wider community prevalence reported this to be the biggest driver of COVID-19 in care homes. Not all studies adjusted for this in their analyses. Studies used different definitions of outbreaks which affects comparability of results, and the use of public datasets or self-reported COVID-19 cases (as opposed to real-time testing data) means that numbers may have been under-reported. Finally, the CMS quality data used within several US studies was up to date as of 2019 and it was noted that better quality facilities may be in a better position to test and report COVID-19 cases.(24) If this were the case, the true difference between higher and low quality facilities could be greater.

Main findings: overall, there is consistent evidence from observational studies which indicates that transmission of COVID-19 within different type of LTCFs from the UK, Ireland, Canada and the US is positively associated with movement of staff between facilities, use of bank or agency staff, lower care home quality, higher occupancy rates, 'for profit' ownership (US and Canada only, public ownership in the case of Ireland) and lower nurse staffing levels. Some evidence suggests that a higher proportion of non-White compared to state averages (US) is also associated with lower levels of COVID-19. Most of the studies used publicly available data sets, with the risk of geographical variation and incomplete data; others relied on self-reporting by participants, risking recall bias and underestimation of effects. In addition, due to study design, other confounding factors could have contributed to results.

**Evidence from modelling studies**

A UK modelling study (preprint) (17) carried out a secondary analysis on a data set of 248 Norfolk care homes to explore which identifiable risk factors could be linked to COVID-19 transmission. A generalised linear model demonstrated that risk of infection was linked to the number of non-care workers employed by the care home (including cooks, maintenance, administrative and other employees who do not normally provide face to face care); the risk was 6.502 times higher (95% CI: 2.614 to 16.1) in care homes employing one to 20 non-care workers, 9.870 times higher (95% CI: 3.224 to 30.22) with 21 to 30 non-care workers and 18.927 times higher (95% CI: 2.358 to 151.90) with more than 30 workers (p<0.001). Reduced availability of PPE for eye protection and for facemasks had the greatest impact on COVID-19 spread (p<0.001) and showed an increase even after adjusting for staff counts.

# Q2: What interventions (stand alone, or combination of interventions) are effective in minimising transmission in residential or domiciliary care settings?

Nine studies contained evidence specific to this question (8 observational studies, one modelling study). Three of these were preprints. (30 to 32) No studies were identified from domiciliary care settings.

## Evidence from observational studies

Of the 8 observational studies, 2 were retrospective cohort studies (30,33), one was a prospective cohort (34), one was cross-sectional (35), 2 were outbreak investigations (31,36), and 2 were descriptive reports (32,37).

A UK retrospective cohort study examined the effectiveness of enhanced surveillance (weekly testing) followed by early intervention. Data was gathered between 16 March 2020 and 5 June 2020 from 3 LTCFs in London for people with severe epilepsy or comorbidities (n=286 residents aged 19-91 years, n=740 carers (30). The intervention facility sent symptomatic individuals to a specialised facility for nasal or throat swab RT-PCR testing and individuals who tested positive for COVID-19 were isolated. Staff contact was minimised while test results were awaited, repeat testing was implemented for those with negative test results. Several weeks later, additional routine testing for all asymptomatic residents and care givers was also initiated. This facility was compared with 2 ‘comparator’ facilities where onsite testing was not available (although other strategies were implemented). In the intervention facility, no resident to carer transmission was observed and infections were contained within 3 weeks in the intervention facility; whereas infections continued throughout the 12-week study period for the one comparator facility with a confirmed outbreak. Lower rates of morbidity and mortality were also observed in the intervention facility relative to the comparators. The study results are reported as descriptive statistics of numbers and proportions testing positive in each facility without statistical tests statistics Due to the observational study design it is possible that differences were a result of factors other than the availability of testing.

In nursing homes in France, a staff-led initiative was implemented where staff voluntarily stayed at the facility with residents (‘voluntary staff confinement’) to reduce the risk of introducing COVID-19 into the facility. A retrospective cohort was conducted (33) to compare 17 nursing homes (794 staff, 1250 residents) that implemented voluntary staff confinement between 1 March 2020 and 11 May 2020 with nursing homes (n=9,513;

385,290 staff, 695,060 residents) without voluntary staff confinement ('comparison'). The 17 intervention facilities were identified via the media, data was gathered via telephone survey and national survey data was used for non-intervention facilities. The study reported significantly lower levels of COVID-19 in the intervention facilities. Only one intervention facility (5.8%) had cases of COVID-19 compared with 4,599 comparison facilities (48.3%) ($p<0.001$). In intervention facilities 0.4% of residents (all in 1 facility) and 0.8% of staff (none of whom had participated in staff confinement) had confirmed COVID-19 whereas 4.4% of residents and 3.8% of staff in comparison facilities had confirmed COVID-19 ($p<0.001$). Authors caveat their findings due to variation in the type and size of nursing home between comparison groups, and there are likely to many confounding factors that could have contributed to the results including, but not limited to other infection prevention and control practices, characteristics of staff and residents and other characteristics of facilities. There may also be data variations as different data sources were used for the intervention and comparator groups.

A prospective cohort study (34) observed the effects of a combination of detection and infection prevention strategies in one LTCF (with 120 bed capacity) in Florida over a 6-week period during April and May 2020. Strategies included twice daily symptom screening of healthcare professionals and residents; banning of visitors and group activities; offering more shifts to incentivise working in one facility only; virtual patient consultations; universal masking of staff, visitors and residents in shared spaces; sanitising; establishment of a cohorting unit for residents exposed to COVID-19; and staff resumed work only once asymptomatic for 72 hours and after 2 negative nasal swab RT-PCR tests. Employees were also quarantined if a member of their household tested positive for COVID-19. Routine RT-PCR testing every 14 days for all staff and residents was also implemented for 6 weeks covering the duration of the study. Over 6 weeks, the spread of COVID-19 was reportedly contained, with prevalence decreasing from 5.4% (7 April) to 3.6% (22 April) to 0.41% (6 May). No test statistics or statistical significance are reported, and it is not possible to attribute any observed results to distinct interventions within the broader set of actions taken. No wider factors were considered, such as changes in community transmission.

A cross-sectional study (35) used data from 7 US health departments (288 nursing homes) to compare state-wide testing with targeted testing in homes with a newly reported case (staff or resident) during 24 March 2020 to 14 June 2020. Where universal facility wide testing was conducted across all nursing homes (2 health departments, n=195), 0.4% of individuals (95 of 22,977 individuals) tested had positive COVID-19 test results, compared with 12% of individuals (1,619 of 13,443 individuals) where testing was targeted following a newly reported case. Regression analyses showed each additional day between identification of the first case and completion of facility-wide testing was associated with identification of 1.3 additional cases. An estimated 1.3 of cases in health care staff were identified for every 3 cases in residents.

Facility-wide testing in areas without any COVID-19 cases and with low community incidence had a lower proportion of positive COVID-19 tests. It is important to note that nursing homes that underwent universal facility testing were also in low incidence areas and may not be representative of areas with higher incidence. The analysis did not account for possible confounders (such as infection prevention and control practices or any other interventions) that could have impacted on results.

Two studies described the use of routine testing and isolation to contain outbreaks within the US. Dora and others (36) studied 99 residents and 136 staff in Long Term Care Skilled Nursing Facilities between 29 March 2020 and 23 April 2020. All residents were tested approximately every week and both symptomatic and asymptomatic residents with continued RT-PCR–positive test results were isolated within a dedicated COVID-19 recovery ward ('cohorting'). The study does not report the direct impact of this approach but notes that no further positive tests were obtained in residents on the other wards in the penultimate and ultimate testing rounds during the study period. Escobar and others (preprint) (31) is based on one 135-bed nursing home with 84 residents (83 male), and similarly used testing every 3 to 5 days and rapid isolation in a dedicated unit, but together with universal symptom screening, closure of communal areas, nebulizer use was transitioned to metered dose inhalers, universal masking of all residents, mandatory use of eye shields for staff, ban on visitation and 'cohorting' staff to specific units. Positive COVID-19 results were obtained in 26 (of 212) asymptomatic staff screened, and 6 (of 67) symptomatic staff tested. In total 27 (of 84 residents) tested positive with a reported attack rate of 37%. No new cases were identified between end of April and first of July. The study does not report the results of any statistical tests.

One US study (preprint) described the development and use of negative pressure isolation space (32). The results are largely focused on efficacy, which is not relevant to the review question. The isolation space was utilised as one of multiple strategies (for example, a largely exclusive team of health professionals), and the authors describe no ongoing transmission following isolation; however limited data is provided, and it is unclear the extent to which the use of negative pressure is important as opposed to the use of isolation.

One descriptive report from Spain described implementation of a digital App for early identification and self-isolation of suspected COVID-19 cases, remote monitoring of mild cases, and real-time monitoring of the progression of the infection (37). Data was collected via the App from 169 nursing homes and 27 institutions for people with physical and mental disabilities (10,000 residents and 4000 staff). Case numbers over the 30-day study period are provided without test statistics or statistical significance, and the role of the App in minimising transmission (as opposed to capturing data) is unclear from the results reported.

Main findings: there is limited evidence on the impact of specific interventions delivered singularly or in combination on the transmission or prevalence of COVID-19 in care homes, and no evidence from domiciliary care. Most studies report combination of interventions using a descriptive approach. Routine facility wide testing followed by isolation of residents (one study) and voluntary staff confinement in care homes (one study) were associated with significantly lower levels of COVID-19. However available evidence is weak due to study design, the descriptive nature of results, and it is impossible to rule out other factors that may have contributed to COVID-19 incidence or transmission.

## Evidence from modelling studies

One modelling study compared a digital contact tracing system (CarePredict PinPoint) against conventional methods of identifying and containing COVID-19 infections (38). Interventions included in the comparative assessment included: no intervention; symptom mapping; PCR testing; manual contact tracing; digital contact tracing. Participants (a simulated 80 residents and 40 staff) wore wearable devices that allowed identification of cases, their contacts and potentially contaminated spaces within the facility. Under all scenarios, digital contact tracing was more effective for infection control compared with conventional methods. After 40 days, the digital contact tracing provided 6% and 12% fewer cases than PCR testing and manual contact tracing, respectively. Symptom-based monitoring alone was the least effective control method yielding 60% to 71% more cases and 10% to 20% more deaths than the other intervention groups. Time delays resulted in increased cases and deaths in all simulated intervention groups and led to PCR testing being less effective than manual contact tracing. No test statistic or statistical significance is reported. Model simulation does not account for underlying morbidities amongst participants and computer simulated results had not been tested against existing data from digital system in use in several US LTC facilities.

Main findings: one modelling study reported that symptom-based detection and screening was least effective in reducing transmission of COVID-19 and digital contact tracing was more effective than non-digital approaches.

# Limitations

LTCFs represent a diverse range of health and care institutions, which may limit generalisability of study findings across these settings. This, combined with study designs and some methodological flaws, limits the strength of the evidence presented and the results of all studies are subject to important confounders. In particularly, community prevalence of COVID-19 was only accounted for in some of the studies. Several included observational studies carry risk of biases such as responder, interviewer or recall bias, and the use of cross-sectional studies establishes

associations rather than causality. Several studies were conducted in the US and Canada, and may not be entirely generalisable to the UK.

A number of studies identified during the screening stage of this review examined the effectiveness of different testing or surveillance strategies for the identification of COVID-19 cases within care homes. These were excluded, as they did not meet the pre-defined inclusion criteria for our review, however they may provide useful evidence in considering the role of testing within care homes. In addition, some studies reported on factors associated with COVID-19 deaths and these results were not reported again as this outcome was not pre-specified for our review.

# Conclusions

There is consistent evidence from multiple observational studies conducted in different settings and with different populations that main characteristics of care homes and their staffing practices are linked to transmission, incidence or prevalence of COVID-19 in these settings.

In relation to staffing: provision of sick pay, higher levels of nursing staffing, the use of permanent staff and staff working in only one care home were significantly linked to reduced COVID-19. Use of bank or agency staff, lower levels of nurse staffing and staff working in multiple care homes were linked to increased COVID-19.

In relation to other care home characteristics: larger and crowded facilities, ‘for profit’ status, facilities scoring lower on quality and in areas of higher community prevalence were significantly linked to increased COVID-19.

There is limited evidence on the effectiveness of interventions for reducing COVID-19 in care homes, and available evidence is weak. Although regular facility wide testing followed by isolation and the voluntary confinement of staff within care homes were associated with significantly lower levels of COVID-19. Descriptive reports of outbreak management describe the important role of multiple strategies for minimising and containing COVID-19 transmission.

Whilst inequalities were not the main focus of any included studies, three non-UK studies reported higher risk of COVID-19 infection in homes with lower proportions of White residents. Homes with ‘for profit’ ownership, lower quality ratings and those with lower than recommended qualified nurse staffing levels were also found to have higher infection rates; it will be important to understand the characteristics of care homes within lower socio-economic areas.

Given the limitations and limited evidence, further research is required.

# Disclaimer

PHE's rapid reviews aim to provide the best available evidence to decision makers in a timely and accessible way, based on published peer-reviewed scientific papers, unpublished reports and papers on preprint servers. Please note that the reviews: i) use accelerated methods and may not be representative of the whole body of evidence publicly available; ii) have undergone an internal, but not independent, peer review; and iii) are only valid as of the date stated on the review.

In the event that this review is shared externally, please note additionally, to the greatest extent possible under any applicable law, that PHE accepts no liability for any claim, loss or damage arising out of, or connected with the use of, this review by the recipient or any third party including that arising or resulting from any reliance placed on, or any conclusions drawn from, the review.

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36. Dora AV and others. 'Universal and Serial Laboratory Testing for SARS-CoV-2 at a Long-Term Care Skilled Nursing Facility for Veterans - Los Angeles, California, 2020'. MMWR - Morbidity & Mortality Weekly Report 2020: volume 69, issue 21, pages 651-5
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# Annexe A. Methods

## Literature search

This report employed a rapid review approach to address the review questions:

1. What factors are associated with the levels or transmission of COVID-19 within care homes and domiciliary care settings?
2. What interventions (stand alone, or bundle of interventions) are effective in minimising care home or domiciliary care transmission?

Notes: This work is underpinned by previous rapid reviews produced by PHE, although as the questions are broader the searches and screening have been repeated

## Protocol

A protocol was produced by the project team before the literature search began, specifying the research question and the inclusion and exclusion criteria. The protocol is available in Annexe D.

## Sources searched

Medline, Embase, medRxiv preprints, WHO COVID-19 Research Database and Social Care Online.

## Search strategy

Searches were conducted for papers published between 1 January 2020 and 31 August 2020.

Search terms covered main aspects of the research questions, including terms related to the intervention. The search strategy for Ovid Medline is presented below. Searches were not limited by language, but non-English language studies were excluded during the screening stage due to resource and time constraints.

**Search strategy for Ovid Medline**

1. (home adj3 (care or caring)).tw,kw.
2. (nurs* adj home*).tw,kw.
3. ((patient* or client* or resident* or elderly or disabled) adj3 home*).tw,kw.
4. (sheltered hous* or long term care or residential care* or residential home* or long term facilit*).tw,kw.
5. assisted living.tw,kw.
6. (old age home* or old people* home* or retirement home*).tw,kw.
7. Home Nursing/

8. Home Care Services/
9. exp Nursing Homes/
10. Residential Facilities/
11. Group Homes/
12. Homes for the Aged/
13. Hospice Care/
14. domicil*.tw,kw.
15. home visit*.tw,kw.
16. home monitor*.tw,kw.
17. community care.tw,kw.
18. health visitor*.tw,kw.
19. district nurs*.tw,kw.
20. community nurs*.tw,kw.
21. (patient* adj2 home*).tw,kw.
22. public health nurse*.tw,kw.
23. (care assistant* or healthcare assistant* or care staff* or home help* or carer or support worker* or rehabilitation worker* or care manager* or care worker*).tw,kw.
24. social care.tw,kw.
25. social worker*.tw,kw.
26. exp Home Care Services/
27. Caregivers/
28. exp Community Health Services/
29. House Calls/
30. Nurses, Community Health/
31. Social Workers/
32. Home Health Aides/
33. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
34. exp coronavirus/
35. exp Coronavirus Infections/
36. ((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw.
37. (coronavirus* or coronovirus* or coronavirinae* or CoV or HCoV*).ti,ab,kw.
38. covid*.nm.
39. (2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or COVID-19 or COVID19 or CORVID-19 or CORVID19 or WN-CoV or WNCoV or HCoV-19 or HCoV19 or 2019 novel* or Ncov or n-cov or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARS-CoV2 or SARSCov19 or SARS-Cov19 or SARSCov-19 or SARS-Cov-19 or Ncovor or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or SARS-2 or SARScoronavirus2 or SARS-coronavirus-2 or SARScoronavirus 2 or SARS coronavirus2 or SARScoronovirus2 or SARS-coronovirus-2 or SARScoronovirus 2 or SARS coronovirus2).ti,ab,kw.
40. (respiratory* adj2 (symptom* or disease* or illness* or condition*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw.
41. ((seafood market* or food market* or pneumonia*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw.
42. ((outbreak* or wildlife* or pandemic* or epidemic*) adj1 (Wuhan* or Hubei or China* or Chinese* or Huanan*)).ti,ab,kw.

43. or/34-42
44. 33 and 43
45. limit 44 to yr="2020"

# Inclusion and exclusion criteria

Article eligibility criteria are summarised in Table A.1. Once screening had commenced, the decision to exclude studies that had examined the validity (or effectiveness) of different testing approaches (or surveillance) was made more explicit and these studies were excluded.

**Table A.1. Inclusion and exclusion criteria**

| | Included | Excluded |
|---|---|---|
| Population | • staff<br>• residents of all ages receiving care in care homes or domiciliary care<br>• visitors | Non-human studies |
| Settings | • all residential care homes with and without nursing (not restricted to care homes for the elderly)<br>• domiciliary care settings | Healthcare settings |
| Context | COVID-19 outbreak | Other diseases |
| Intervention or exposure | • any intervention to reduce or minimise transmission, including those pertaining to movement of staff or residents.<br>• interventions may be stand-alone interventions or combinations | Effectiveness of PPE (in Q2 only) |
| Outcomes | • transmission of SARS-CoV-2 infection or COVID-19<br>• incidence or prevalence of SARS-COV-2 Infections or COVID-19 (including the existence of an outbreak)<br>• reproduction number | |
| Language | English | |
| Date of publication | 1 January 2020 to 31 August 2020 | |
| Study design | • experimental or observational studies<br>• case series and case reports | • systematic reviews<br>• guidelines |

| | Included | Excluded |
|---|---|---|
| | • modelling studies | • opinion pieces |
| Publication type | Published and preprint | |

# Screening

Screening on title and abstract was undertaken in duplicate by 2 reviewers for at least 10% of the eligible studies, with full screening conducted by one reviewer. Disagreement was resolved by discussion.

Screening on full text was undertaken by one reviewer and excluded articles were checked by a second reviewer.

# Data extraction and quality assessment

Data was extracted by one reviewer and checked by a second reviewer.
Due to the rapid nature of the work, a validated risk of bias tool was not used to assess study quality of primary studies. However, papers were evaluated based on study design and main source of bias (mainly population, selection, exposure and outcome).

A formal grading of evidence was not undertaken, however if evidence is considered to be limited (due to the number of studies) or weak (due to research design or quality) this was highlighted. Preprint and publication status was also considered in determining this.

Variations across populations and subgroups, for example cultural variations or differences between ethnic, social or vulnerable groups will be considered, where evidence is available.

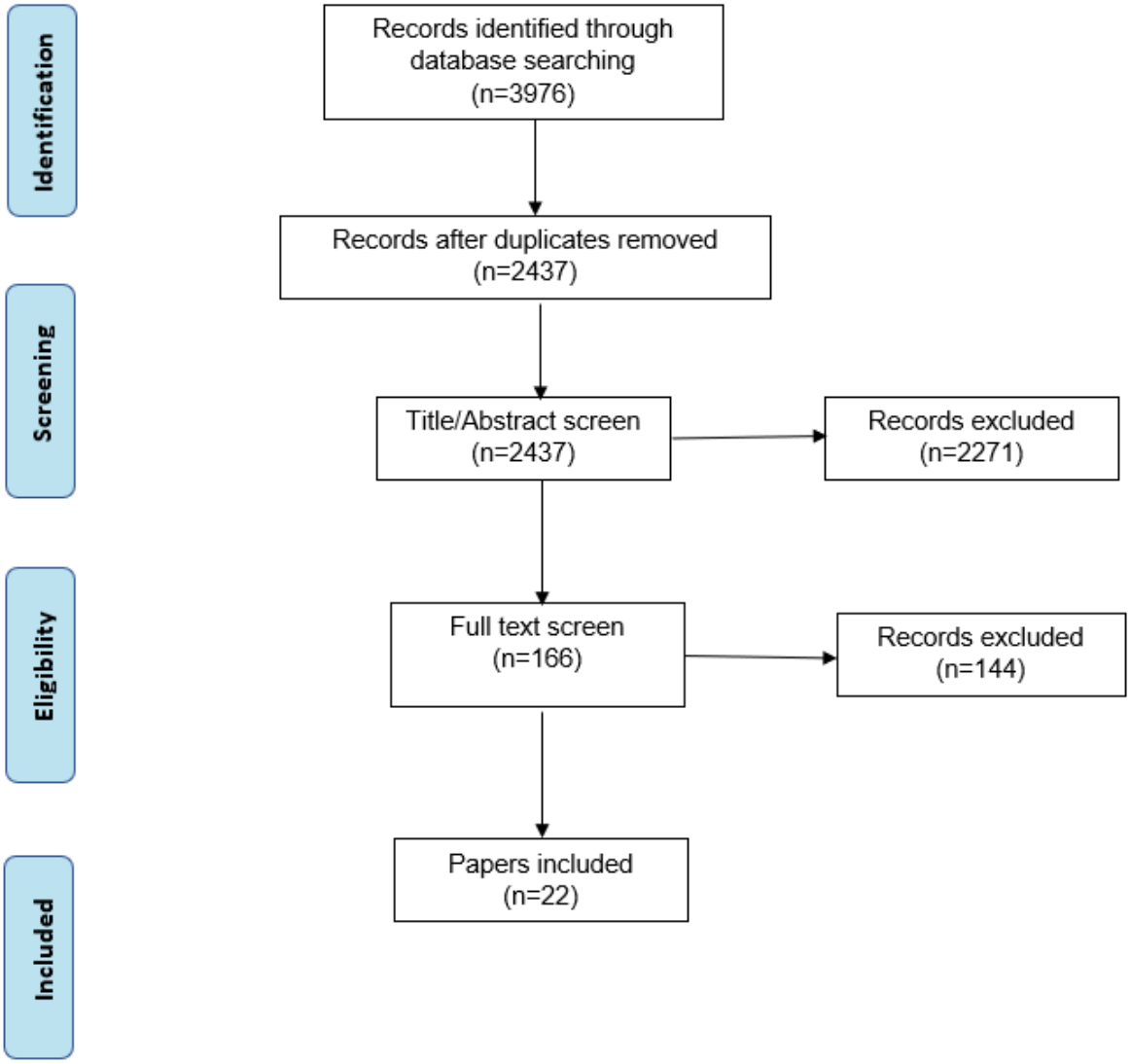


**Figure A.1. PRISMA diagram**

Figure A.1. PRISMA diagram alt text

A PRISMA diagram showing the flow of studies through this review.

There were n=3,976 records identified via database searching, reduced to n=2,437 records after duplicates were removed, leaving n=2,437 records screened on title and abstract.

From these, n=2,271 records were excluded. This left n=166 records screened on full text, of which n=133 were excluded, leaving n=22 papers that were included in the review.

# Annexe B. Studies excluded at full text

| Excluded reference | Reason |
|---|---|
| Abrams, H.R and others., 'Characteristics of U.S. Nursing Homes with COVID-19 Cases'. Journal of the American Geriatrics Society, 2020. 68(8): p. 1653-1656. | Intervention |
| Abrams, L.S and A.J. Dettlaff, 'Voices from the Frontlines: Social Workers Confront the COVID-19 Pandemic'. Social Work, 2020. 09: p. 09. | Publication type |
| Almeida, B and others., 'The Demographics and Economics of Direct Care Staff Highlight Their Vulnerabilities Amidst the COVID-19 Pandemic'. Journal of Aging & Social Policy, 2020. 32(4-5): p. 403-409. | Publication type |
| Anonymous, 'Tackle coronavirus in vulnerable communities'. Nature, 2020. 581(7808): p. 239-240. | Publication type |
| Arons, M.M and others., 'Presymptomatic SARS-CoV-2 Infections and Transmission in a Skilled Nursing Facility'. New England Journal of Medicine, 2020. 382(22): p. 2081-2090. | Outcome |
| Aslan, D and I. Sayek, 'We need to rethink on medical education for pandemic preparedness: Lessons learnt from COVID-19'. Balkan Medical Journal, 2020. 37(4): p. 178-179. | Publication type |
| Association of Directors of Adult Social, S., 'ADASS coronavirus survey'. 2020, London: Association of Directors of Adult Social Services. 23. | Study design |
| Bakaev, I., T. Retalic, and H. Chen, 'Universal Testing-Based Response to COVID-19 Outbreak by a Long-Term Care and Post-Acute Care Facility'. Journal of the American Geriatrics Society, 2020. 68(7): p. E38-E39. | Publication type |
| Bigelow, B.F and others., 'Outcomes of Universal COVID-19 Testing Following Detection of Incident Cases in 11 Long-term Care Facilities'. JAMA Internal Medicine, 2020. 14: p. 14. | Outcome |
| Birgand, G and others., 'Testing strategies for the control of COVID-19 in nursing homes: Universal or targeted screening?' Journal of Infection, 2020. 05: p. 05. | Outcome |
| Blackman, C and others., 'An Illustration of SARS-CoV-2 Dissemination Within a Skilled Nursing Facility Using Heat Maps'. Journal of the American Geriatrics Society, 2020. 13: p. 13. | Outcome |
| Blain, H and others., 'Efficacy of a Test-Retest Strategy in Residents and Health Care Personnel of a Nursing Home Facing a COVID-19 Outbreak'. Journal of the American Medical Directors Association, 2020. 21(7): p. 933-936. | Outcome |
| Bloch, F., 'COVID-19 in Nursing Homes: The Problematic Management of Residents Without Positive COVID-19 RT-PCR'. International Journal of Health Policy & Management, 2020. 10: p. 10. | Study design |
| Boas, P.J.F.V and others., 'Recommendations for the prevention and control of coronavirus infections (SARS-CoV-2) in long term care facilities'. Geriatr., Gerontol. Aging (Impr.), 2020. 14(2): p. 134-137. | Publication type |
| Borras-Bermejo, B and others., 'Asymptomatic SARS-CoV-2 Infection in Nursing Homes, Barcelona, Spain, April 2020'. Emerging Infectious Diseases, 2020. 26(9). | Outcome |
| Bouza, E and others., 'Outbreak of COVID-19 in a nursing home in Madrid'. Journal of Infection, 2020. 25: p. 25. | Publication type |
| British Geriatrics, S., 'COVID-19: Managing the COVID-19 pandemic in care homes'. 2020. | Study design |

| Excluded reference | Reason |
|---|---|
| Cabrera, J.J and others., 'Pooling for SARS-CoV-2 control in care institutions' medRxiv, 2020: p. 2020.05.30.20108597. | Study design |
| Cabrero, G.R., 'The coronavirus crisis and its impact on residential care homes for the elderly in Spain'. Ciencia & Saude Coletiva, 2020. 25(6): p. 1996. | Publication type |
| Callaghan, A.W and others., 'Screening for SARS-CoV-2 Infection Within a Psychiatric Hospital and Considerations for Limiting Transmission Within Residential Psychiatric Facilities - Wyoming, 2020'. MMWR - Morbidity & Mortality Weekly Report, 2020. 69(26): p. 825-829. | Setting |
| Care Quality, C., 'COVID-19 Insight: focus on adult social care'. 2020, Newcastle upon Tyne: Care Quality Commission. 29. | Study design |
| Carta, M and others., 'Anti SARS-CoV-2 antibodies monitoring in a group of residents in a long term care facility during COVID-19 pandemic peak'. Diagnosis, 2020. 24: p. 24. | Intervention, outcome |
| Caspi, G and others., 'Heat Maps for Surveillance and Prevention of COVID-19 Spread in Nursing Homes and Assisted Living Facilities'. Journal of the American Medical Directors Association, 2020. 21(7): p. 986-988.e1. | Publication type |
| Chandrasekar, S., T. Mandal, and S.K. Tripathi, 'Community triage and home-based care of Covid-19'. Journal of the Indian Medical Association, 2020. 118(6): p. 85. | Study design |
| Chatterjee, P and others., 'Characteristics and Quality of US Nursing Homes Reporting Cases of Coronavirus Disease 2019 (COVID-19)'. JAMA Network Open, 2020. 3(7): p. e2016930. | Intervention |
| Chen, A.T., K.L. Ryskina, and H.Y. Jung, 'Long-Term Care, Residential Facilities, and COVID-19: An Overview of Federal and State Policy Responses'. Journal of the American Medical Directors Association, 2020. 21(9): p. 1186-1190. | Publication type |
| Chen, C.R and others., 'Preparing for COVID-19: The experiences of a long-term care facility in Taiwan'. Geriatrics & gerontology international, 2020. 20(7): p. 734-735. | Publication type |
| Comas-Herrera, A. and J.-L. Fernandez, 'Summary of international policy measures to limit impact of COVID19 on people who rely on the Long-Term Care sector'. 2020, London: International Long Term Care Policy Network. 9. | Publication type |
| Comas-Herrera, A and others., 'COVID-19: Implications for the Support of People with Social Care Needs in England'. Journal of Aging & Social Policy, 2020. 32(4-5): p. 365-372. | Study design |
| Cormi, C and others., 'Telemedicine in nursing homes during the COVID-19 outbreak: A star is born (again)'. Geriatrics & gerontology international, 2020. 20(6): p. 646-647. | Publication type |
| Cozzolino, M and others., 'The COVID-19 infection in dialysis: are home-based renal replacement therapies a way to improve patient management?' Journal of Nephrology, 2020. 33(4): p. 629-631. | Outcome, population, publication type |
| D'Adamo, H., T. Yoshikawa, and J.G. Ouslander, 'Coronavirus Disease 2019 in Geriatrics and Long-Term Care: The ABCDs of COVID-19'. Journal of the American Geriatrics Society, 2020. 68(5): p. 912-917. | Publication type |

| Excluded reference | Reason |
|---|---|
| Daly, M., 'COVID-19 and care homes in England: What happened and why?' Social Policy and Administration, 2020. | Study design |
| de Man, P and others., 'Outbreak of COVID-19 in a nursing home associated with aerosol transmission as a result of inadequate ventilation'. Clinical Infectious Diseases, 2020. 28: p. 28. | Publication type |
| Diamantis, S and others., 'Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2)-Related Deaths in French Long-Term Care Facilities: The Confinement Disease Is Probably More Deleterious Than the Coronavirus Disease-2019 (COVID-19) Itself'. J Am Med Dir Assoc, 2020. 21(7): p. 989-990. | Publication type |
| Dobbs, D., L. Peterson, and K. Hyer, 'The Unique Challenges Faced by Assisted Living Communities to Meet Federal Guidelines for COVID-19'. Journal of Aging & Social Policy, 2020. 32(4-5): p. 334-342. | Publication type |
| Domeracki, S and others., 'Cycle Threshold to Test Positivity in COVID-19 for Return to Work Clearance in Health Care Workers'. Journal of Occupational & Environmental Medicine, 2020. 13: p. 13. | Population |
| Dora, A.V and others., 'Universal and Serial Laboratory Testing for SARS-CoV-2 at a Long-Term Care Skilled Nursing Facility for Veterans - Los Angeles, California, 2020'. MMWR - Morbidity & Mortality Weekly Report, 2020. 69(21): p. 651-655. | Outcome |
| Dunn, P. and others., 'Adult social care and COVID-19: assessing the policy response in England so far'. 2020, London: Health Foundation. 36. | Intervention |
| Etard, J.F and others., 'Potential lethal outbreak of coronavirus disease (COVID-19) among the elderly in retirement homes and long-term facilities, France, March 2020'. Euro Surveillance: Bulletin Europeen sur les Maladies Transmissibles = European Communicable Disease Bulletin, 2020. 25(15): p. 04. | Study design |
| Feaster, M. and Y.Y. Goh, 'High Proportion of Asymptomatic SARS-CoV-2 Infections in 9 Long-Term Care Facilities, Pasadena, California, USA, April 2020'. Emerging Infectious Diseases, 2020. 26(10): p. 02. | Outcome |
| Fenn, D and others., 'Walkie talkies to aid health care workers' compliance with personal protective equipment in the fight against COVID-19'. Critical Care (London, England), 2020. 24(1): p. 424. | Setting, population, publication type |
| Fisman, D.N and others., '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): p. e2015957. | Outcome |
| Gardner, W., D. States, and N. Bagley, 'The Coronavirus and the Risks to the Elderly in Long-Term Care'. Journal of Aging & Social Policy, 2020. 32(4-5): p. 310-315. | Publication type |
| Gaur, S and others., 'Unprecedented solutions for extraordinary times: Helping long-term care settings deal with the COVID-19 pandemic'. Infection Control & Hospital Epidemiology, 2020. 41(6): p. 729-730. | Publication type |
| Goldberg, S.A and others., 'Presymptomatic Transmission of SARS-CoV-2 Amongst Residents and Staff at a Skilled Nursing Facility: Results of Real-Time PCR and Serologic Testing'. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America., 2020. 15. | Outcome |

| Excluded reference | Reason |
|---|---|
| Goldberg, S.A and others., 'Asymptomatic Spread of COVID-19 in 97 Patients at a Skilled Nursing Facility'. Journal of the American Medical Directors Association, 2020. 21(7): p. 980-981. | Outcome |
| Goldman, P.S and others., 'The implications of COVID-19 for the care of children living in residential institutions'. The Lancet Child & Adolescent Health, 2020. 4(6): p. e12. | Publication type |
| Graham, N.S.N and others., 'SARS-CoV-2 infection, clinical features and outcome of COVID-19 in United Kingdom nursing homes'. Journal of Infection, 2020. 81(3): p. 411-419. | Outcome |
| Grossi, E and others., 'Oscillation of SARS CoV-2 RNA load in a cohort of children and adolescents with neuro-psychiatric disorders resident in a nursing home of Lombardy Region (Italy)'. Journal of Infection, 2020. 81(3): p. e16-e17. | Outcome |
| Guery, R and others., 'Limited effectiveness of systematic screening by nasopharyngeal RT-PCR of medicalized nursing home staff after a first case of COVID-19 in a resident'. Medecine et Maladies Infectieuses, 2020. 04: p. 04. | Outcome |
| Gurwitz, J.H., 'COVID-19, Post-acute Care Preparedness and Nursing Homes: Flawed Policy in the Fog of War'. Journal of the American Geriatrics Society, 2020. 68(6): p. 1124-1125. | Study design |
| Hall Dykgraaf, S and others., 'COVID-19 highlights risks of healthcare and social care workers attending work while ill'. Australian Journal Of General Practice, 2020. 49: p. 04. | Study design |
| Hanratty, B and others., 'Covid-19 and lack of linked datasets for care homes'. BMJ, 2020. 369: p. m2463. | Publication type |
| Harris, D.A and others., 'Rapid Telehealth-Centered Response to COVID-19 Outbreaks in Postacute and Long-Term Care Facilities'. Telemedicine Journal & E Health, 2020. 09: p. 09. | Outcome |
| Hartmann, S and others., 'Coronavirus 2019 (COVID-19) Infections Among Healthcare Workers, Los Angeles County, February - May 2020'. Clinical Infectious Diseases, 2020. 17: p. 17. | Population |
| Great Britain Dept of Health and Social Care, 'Coronavirus (COVID-19): care home support package'. 2020, London: Great Britain. Department of Health and Social Care. | Study design |
| Great Britain Dept of Health and Social Care, 'Coronavirus (COVID-19): adult social care action plan'. 2020, London: Great Britain. Department of Health and Social Care. 34. | Study design |
| Heron, C., 'Adult social care after Covid-19: ADASS'. 2020, London: Local Government Information Unit. 8. | Study design |
| Hodgson, K. and others, 'Adult social care and COVID-19: assessing the impact on social care users and staff in England so far'. 2020, London: Health Foundation. 24. | Study design |
| Hoxha, A and others., 'Asymptomatic SARS-CoV-2 infection in Belgian long-term care facilities'. The Lancet Infectious Diseases, 2020. 03: p. 03. | Outcome |
| Iritani, O and others., 'Clusters of COVID-19 in long-term care hospitals and facilities in Japan from 16 January to 9 May 2020'. Geriatrics & gerontology international, 2020. 20(7): p. 715-719. | Outcome |

| Excluded reference | Reason |
|---|---|
| Jatt, L.P and others., Widespread SARS-CoV-2 laboratory surveillance program to minimize asymptomatic transmission in high-risk inpatient and congregate living settings'. Infection Control and Hospital Epidemiology., 2020. | Outcome |
| Kemenesi, G and others., 'Nursing homes and the elderly regarding the COVID-19 pandemic: situation report from Hungary'. GeroScience, 2020: p. 1-7. | Publication type |
| Khan, A.A., V.P. Singh, and D. Khan, 'The Care Home Pandemic - What Lessons Can We Learn for the Future?' J Gerontol Soc Work, 2020: p. 1-2. | Publication type |
| Khosravani, H and others., 'Symptom management and end-of-life care of residents with COVID-19 in long-term care homes'. Canadian Family Physician, 2020. 66(6): p. 404-406. | Publication type |
| Kim, J.J and others., 'Lessons learned - Outbreaks of COVID-19 in nursing homes'. American Journal of Infection Control, 2020. 31: p. 31. | Publication type |
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# Annexe C. Data extraction

**Table C.1: Factors associated with transmission in care homes**

Acronyms used: CHO = Community Health Organisation, CI = confidence interval, CMS = Centers for Medicare & Medicaid Services, IRR = incidence rate ratio, LTC = long term care NH = nursing home, PPE = personal protective equipment, RR = risk ratio, RN = registered nurse, RT-PCR = reverse transcriptase polymerase chain reaction

| Reference, country | Study design | Methods | Findings | Comments |
|---|---|---|---|---|
| Brainard and others 2020 (17)<br><br>UK<br><br>PREPRINT<br><br>'Introduction to and spread of COVID-19 in care homes in Norfolk, UK' | Design: Modelling study - a secondary analysis of care home capacity tracker data, and two stage modelling.<br><br>Objectives: to explore which identifiable care home risk factors could be linked to ingression or spread of COVID-19 after ingression.<br><br>Setting and period: 248 care homes in Norfolk, during 6 April to 6 May 2020<br><br>Participants: residents and staff in care homes.<br><br>Outcome measures: counts of residents with COVID-19, access to PPE in care homes, linking increases in cases in care homes to PPE access. | An analysis of all operational care homes within the county boundaries during the monitoring period of 30 days. The data included infection prevalence from COVID-19, staffing and residents counts and PPE provision in care homes.<br><br>The authors then used a two step modelling approach to assess the extent to which cases of COVID-19 were associated with employed number of staff in the care home broken down by category of worker, and the availability of PPE on presence and rate of spread of disease. | The useable data set was 248 Norfolk care homes of which 25 had had any COVID-19 cases (133 cases at end of monitoring period).<br><br>A generalised linear model demonstrated that risk of any infection was significantly related to the number of non-care workers (those not directly involved in personal care) (t =4.38 2, p < 0.001) employed in each care home.<br><br>Timing to infection was significantly related to number of non-care workers employed. Risk of infection was 6.502 times higher (CI: 2.614 to 16.1) in care homes employing one to 20 non-care workers, 9.870 times higher (CI: 3.224 to 30.22) with 21 to 30 non-care workers and 18.927 times higher (CI: 2.358 to 151.90) with more than 30 workers.<br><br>The daily increment in cases (spread) was 1.04. Reduced availability of PPE for eye protection and for facemasks had the greatest impact on spread with coefficients increasing case load by 1.66 and 1.26 (both p < 0 .001) per increment on top of staff counts and daily increment effects. Spread also increased with higher staff levels. | Limitations noted by the authors: Lack of ethnic diversity in Norfolk meant that they could not consider whether the minority ethnic composition was a factor in disease spread or severity.<br><br>Improvements in PPE procurement may have changed the balance of future risk factors from what was seen in this April 2020 data.<br><br>Spatial and social network data interaction between homes were not available but would strengthen any future modelling efforts.<br><br>Limitations noted by the reviewer: none<br><br>Inequalities impact: see above |
| Brown and others 2020 (18)<br><br>Canada<br><br>PREPRINT<br><br>'Association Between Nursing Home Crowding and COVID-19 Infection and Mortality in Ontario, Canada' | Design:<br>retrospective cohort study<br><br>Objectives: to develop a reproducible index of nursing home crowding and to determine whether crowding was associated with incidence of COVID-19 in the first months of the COVID-19 epidemic.<br><br>Setting and period: 618 nursing homes in Ontario, Canada from March 29 to May 20, 2020.<br><br>Participants: over 78,000 residents of nursing homes | Data used for this study were obtained from the Ontario Ministries of Health and Long-Term Care and included information on characteristics of nursing homes, a COVID tracking tool, the integrated Public Health Information system and the Canadian Census Population estimate.<br><br>The nursing home crowding index was defined as the average number of occupants per room and bathroom across an entire home, following the equation: N residents ÷ (0.5 * N Bedrooms + 0.5 * N bathrooms).<br><br>This translated to:<br>single occupancy room with private bathroom = 1; single occupancy room | Of 623 homes in Ontario, the authors obtained complete information on 618 homes (99%) housing 78,607 residents.<br><br>A total of 5,218 residents (6.6%) developed COVID-19 infection, and 1,452 (1.8%) died with COVID-19 infection as of M ay 20, 2020. COVID-19 infection was distributed unevenly across nursing homes: 4,496 (86%) of infections occurred in just 63 (10%) of homes.<br><br>Incidence in high crowding index homes was 9.7%, versus 4.5% in low crowding index homes (p<0.001), while COVID-19 mortality was 2.7%, versus 1.3%. The likelihood of COVID-19 introduction did not differ (31.3% vs 30.2%, p=0.79).<br><br>Simulations suggested that converting all 4-bed rooms to 2-bed rooms would have averted 988 | Limitations noted by the authors: other design features (for example, cohorting, larger square footage per room occupant, and improved ventilation systems) may have played a role in driving COVID-19 incidence other than crowding.<br><br>Examination of crowding was at the nursing home level and the authors did not know which individual residents occupied single, double, or quadruple rooms.<br><br>The authors adjusted for aggregate characteristics of nursing home residents, but only had up to date |

| Reference, country | Study design | Methods | Findings | Comments |
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| | Outcome measures: the cumulative incidence of COVID-19 infection& mortality per 100 residents. | with a shared bathroom = 1.5; double occupancy room (with shared bathroom) = 2; and quadruple occupancy room = 4. In Ontario nursing homes, there are no rooms with a maximum occupancy of 3 or greater than 4. We defined homes with crowding index at least 2 as high crowding index homes, and homes under 2 as low. | (18.9%) infections of COVID-19 and 271 (18.7%) deaths. | information until August 2019, the time of the most recent resident assessment.<br><br>The authors did not have access to information on nursing home resident race, ethnicity, or socio-economic status.<br><br>Limitations noted by the reviewer: none<br><br>Inequalities impact: as above |
| Emmerson and others 2020 (19)<br><br>UK (Wales)<br><br>PREPRINT<br><br>'Risk factors for outbreaks of COVID-19 in care homes following hospital discharge: a national cohort analysis' | Design: Cohort analysis and data linkage<br><br>Objective: to test whether the risk of a COVID-19 outbreak in the period following a discharge from hospital to a care home was increased compared to other period.<br><br>Setting and period: 1,073 adult residential and nursing homes in Wales, 22 February 2020 to 27 June 2020.<br><br>Participants: all adults living in residential or nursing care homes in Wales.<br><br>Outcome measures: the time to the first laboratory confirmed case of COVID-19 in each care home. | The authors examined 3,115 hospital discharges to 1,068 Welsh adult care homes and the subsequent outbreaks of COVID-19 occurring over an 18 week period.<br><br>Data on notifications of COVID-19 cases and outbreaks were sourced from Tarian, the all Wales health protection case and incident management system. Data on hospital discharges were sourced from the Patient Episode Database for Wales.<br><br>A Cox proportional hazards regression model was used to assess the impact of time-dependent exposure to hospital discharge on the incidence of the first known outbreak, over a window of 7 to 21 days after discharge, and adjusted for care home characteristics, including size, type of provision and health board. | 330 homes experienced an outbreak of COVID-19, and 544 homes received a discharge from hospital over the study period.<br><br>The exposure to discharge from hospital was not associated with a significant increase in the risk of a new outbreak (hazard ratio = 1.15, 95% CI: 0.89, 1.47, p = 0.29) after adjusting for care home characteristics.<br><br>Care home size was by far the most significant predictor - large homes were at considerably greater risk of outbreaks throughout the epidemic. Hazard ratios in comparison to homes of less than 10 residents were: 3.40 (95% CI: 1.99 to 5.80) for 10 to 24 residents; 8.25 (95% CI: 4.93 to 13.81) for 25 to 49 residents; and 17.35 (95% CI: 9.65 to 31.19) for homes of at least 50 residents. | Limitations noted by the author: Not all discharges would have had COVID-19, so the effect of our defined risk factor would be diluted by non-risk discharges.<br><br>An analysis of the timeline of all cases is complicated by very limited information on the balance of internal and external exposure, as well as changing testing practices.<br><br>Limitations noted by the reviewer: none noted<br><br>Inequalities Impact: none addressed by author |
| Figueroa and others 2020 (24)<br><br>LETTER<br><br>US<br><br>'Association of Nursing Home Ratings on Health Inspections, Quality of Care, and Nurse Staffing With COVID-19 Cases' | Design: Data linkage<br><br>Objective: to evaluate whether nursing homes rated highly by the Centers for Medicare & Medicaid Services (CMS) across 3 unique domains- health inspections, quality measures, and nurse staffing- had lower COVID-19 cases than facilities with lower ratings. | Authors linked data from 8 state health departments to determine the total number of COVID-19 cases occurring in nursing homes between 1 January 2020, and 30 June 2020.<br><br>The data was linked with CMS Nursing Home Compare, which includes star ratings (range, 1 [low] to 5 [high]) that characterize performance across the 3 domains.<br><br>The health inspection rating is based on the number of deficiencies | Of the 4,254 NHs across the 8 states, 4,254 (100%) had star ratings for health inspection; 4,241 (99.7%), quality measures; and 4,225 (99.3%), nurse staffing domains.<br><br>Within each domain, 1,451 (34.1%) were considered high performing for health inspection; 2,974 (70.1%) for quality measures; and 1,517 (35.9%) for nurse staffing.<br><br>High-performing nursing homes were less likely to have had more than 30 COVID-19 cases than were low-performing facilities across each domain (health inspections, 348 [24.0%] vs 948 [33.8%]; quality | Limitations noted by the author: It included data from only 8 states; however, these states rank among those with the highest COVID-19 burden.<br><br>High-performing nursing homes may have greater capacity to test and diagnose cases, which may lead to an underestimate of the association between low performance on the staffing domain and higher COVID-19 cases. |

| Reference, country | Study design | Methods | Findings | Comments |
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| | Setting and period: 4254 nursing homes in California, Connecticut, Florida, Illinois, Maryland, Massachusetts, New Jersey Between 1 Jan 2020 and 30 June 2020.<br><br>Participants:<br><br>Outcomes measures: total number of COVID-19 cases occurring, ratings for health inspections, quality measures and nurse staffing. | identified in the 3 most recent state surveys across several areas; the quality measures rating is based on the weighted mean of performance across 15 quality measures; the nurse staffing domain is based on the mean staffing hours per resident by qualified nursing staff.<br><br>Author's grouped nursing homes into 3 categories: 10 or fewer, 11 to 30, or more than 30 COVID-19 cases. They performed 3 separate ordinal logistic regression models to assess the odds of high-performing facilities (4 or 5-star facilities) having more than 30cases vs 11 to 30 cases vs 10 cases or fewer relative to low-performing facilities (1- to 3-star facilities), adjusting for the number of certified beds and including county fixed effects. | measures, 897 [30.2%] vs 397 [31.3%]; nurse staffing, 382 [25.2%] vs 907 [33.5%]).<br><br>High-performing nursing homes had a lower median number of certified beds. After adjustment, nursing homes with high ratings on nurse staffing were less likely to have more than 30 COVID-19 cases vs facilities with 11 to 30 and vs facilities with 10 or fewer cases than were low-performing NHs (OR = 0.82; 95% CI: 0.70 to 0.95; p=0.01). | Limitations noted by reviewer: none noted<br><br>Inequalities impact: none assessed |
| Gorges and others, 2020 (27)<br><br>USA<br><br>Article<br><br>'Staffing Levels and COVID-19 Cases and Outbreaks in U.S. Nursing Homes' | Design: Retrospective cohort?<br><br>Objective: to understand whether baseline nurse staffing is associated with the presence of COVID-19 in nursing homes and whether staffing impacts outbreak severity.<br><br>Setting and period: 13,167 nursing homes in the CMS COVID-19 Nursing Home Dataset with reports that passed the CMS Quality Assurance Check as of June 25, 2020.<br><br>Participants:<br>Residents of nursing homes that met COVID-19 reporting requirements.<br><br>Outcome measures: whether facilities had any COVID-19 cases, and among facilities with at least one case, the size of the outbreak (defined as confirmed cases per certified beds more than 10% or total confirmed, and suspected cases per beds more | The authors analysed Centers for Medicare & Medicaid Services (CMS) facility-level data on COVID-19 cases and deaths merged with nursing home and county characteristics.<br><br>They used logistic regressions to examine the associations of staffing levels from Nursing Home Compare with the outcomes of any COVID-19 cases and, conditional on at least one case, an outbreak.<br><br>Among facilities with at least one case, they modelled count of deaths using hurdle negative binomial-2 regressions. | A total of 9,352 nursing facilities, or 71.0% of the sample, reported at least one COVID-19 case. Of those, 27% experienced an outbreak.<br><br>Larger facilities, non-profit ownership, fewer White residents, metropolitan county, and more county-level cases are associated with a higher probability of having any cases.<br><br>Registered nurse-hours are higher among facilities with cases than those without, but among facilities with cases, nurse aide hours and total nursing hours are higher among facilities without outbreaks than facilities with outbreaks.<br><br>The effect sizes of staffing are relatively small. The strongest predictor of cases and outbreaks in nursing homes is per capita cases in the county. | Limitations noted by the author: the CMS data on total cases and deaths represent an undercount, especially in states that experienced early outbreaks.<br><br>Limitations noted by reviewer: unclear if the 13,167 nursing homes are in one US state, many states or whole of US.<br><br>Inequalities impact: the authors found that nursing homes with fewer White residents had a higher probability of having any COVID-19 cases. |

| Reference, country | Study design | Methods | Findings | Comments |
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| | than 20% or more than 10 deaths, and the total number of deaths attributed to COVID-19 among residents and staff). | | | |
| Harrington and others 2020 (26)<br><br>ARTICLE<br><br>US<br><br>'Nurse Staffing and Coronavirus Infections in California Nursing Homes' | Design: Data linkage<br><br>Objective:<br>to compare nurse staffing in California nursing homes with and without residents with COVID-19 infections; also to examine the relationship of nurse staffing to nursing home infection control deficiencies, total health deficiencies, bed size and ownership.<br><br>Settings and period: 1,091 licensed and Medicare-Medicaid certified nursing homes in California that had reported COVID-19 infections in staff and residents between 15 March 2020 and 4 May 2020.<br><br>Participants: staff and residents in Californian nursing homes.<br><br>Outcomes measures: nursing hours per resident, number of COVID-19 resident infections, nursing home infection control deficiencies, total health deficiencies, bed size and ownership. | This study relied on three data sources to identify nursing homes that had COVID-19: (a) the LA County Department of Public Health reports and (b) California Department of Public Health reports; and California nursing home outbreaks reported by news organizations.<br><br>The study included a total of 819 nursing homes that did not report residents with COVID-19 and 272 nursing homes reporting one or more COVID-19 residents, for a total of 1,091 certified nursing homes.<br><br>Secondary data from CMS data were used. These included RN and total nurse staffing data, CMS five-star rating for RNs and for total staffing, total health deficiencies, infection control deficiencies, number of licensed beds and ownership data.<br><br>The authors conducted bivariate, correlation and logistic regression analyses. The bivariate analyses compared the nursing homes with COVID-19 residents to nursing homes reporting no COVID-19 residents.<br><br>Four logistic regressions analyses were performed to ascertain the effects of staffing, health deficiencies, number of beds, and ownership on the likelihood that a facility would have COVID-19 residents compared with those without COVID-19 residents. | Almost 80% of California nursing homes did not meet the recommended RN staffing levels and 55% did not meet the minimum recommended total nursing standard.<br><br>Nursing homes with total RN staffing levels under the recommended minimum standard (0.75 hours per resident day) had a two times greater probability of having COVID-19 resident infections.<br><br>A higher proportion of nursing homes with COVID-19 residents had one or more deficiencies for infection control violations (64% of all facilities had one or more infection control violations in the most recent survey period). A higher proportion of nursing homes with COVID-19 residents were for-profit owners.<br><br>Nursing homes with lower Medicare five-star ratings on total nurse and RN staffing levels (adjusted for acuity), higher total health deficiencies, and more beds had a higher probability of having COVID-19 residents. | Limitations noted by the author:<br>The study was limited to only one state and may not applicable to other states, although staffing levels in California nursing homes are similar to the national statistics.<br><br>The identification of facilities with and without COVID-19 was based largely on facility self reports with delays in the state collection of data that could have resulted in both incomplete and inaccurate data.<br><br>The lack of wide-spread testing of nursing home staff and residents during the period probably resulted in an undercounting of facilities that had COVID-19 staff and residents because the virus was known to often be asymptomatic.<br><br>Author stated that if additional data were available on the number of tests performed, the extent that PPE were available, whether staff received emergency preparedness training to address pandemics and better data on staff and resident infections and deaths, it would be easier to study variations and draw better conclusions.<br><br>The time periods from the CMS five-star rating and the staffing values were from the third quarter of 2019 and may have been different from the ratings and staffing at the time of the COVID-19 study period.<br><br>Limitations noted by the reviewer: none noted.<br><br>Inequalities impact: none assessed |

| Reference, country | Study design | Methods | Findings | Comments |
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| He, M. and others, 2020 (25)<br><br>ARTICLE<br><br>USA<br><br>'Is There a Link between Nursing Home Reported Quality and COVID-19 Cases? Evidence from California Skilled Nursing Facilities' | Design:<br>Cross-sectional and longitudinal data combination.<br><br>Objectives:<br>to explore the impact of nursing home reported quality on COVID-19 cases and deaths.<br><br>Setting and period:<br>California skilled nursing facilities (N= 1223).<br><br>COVID-19 data through 2 June 2020<br><br>Participants:<br>None<br><br>Outcome measures:<br>COVID-19 residents' cases and deaths (dependent variables).<br><br>Nursing home reported quality (independent variable). | Univariate analyses of the independent variables yielded the average number of nursing homes in each category of: no COVID-19 cases, less than 11 COVID-19 cases, and more than 11 cases. A multivariate logistic regression model was fitted with whether or not there were any confirmed cases by 2 June 2020, using as reference points three-star nursing homes, Not For Profit and government-owned nursing homes. Trend analysis revealed how the rate of confirmed cases adjusted by facility size changed over time from 23 April 2020 to 2 June 2020. | For the 5-star group compared with the 3-star group, OR of COVID-19 cases was 0.41 (95% CI: 0.27 to 0.62) and OR of residents' deaths was 0.3 (95% CI: 0.18 to 0.48). A similar pattern was observed for the 4-star ratings group (Cases: OR = 0.66, 95% CI: 0.44 to 0.98; Deaths: OR = 0.65, 95% CI: 0.42 to 1.01).<br><br>Compared with nursing homes with higher percentage of white residents, nursing homes with below state average white residents had a higher odds in having COVID-19 cases (OR = 1.95, 95% CI: 1.49 to 2.55) and deaths (OR = 1.64, 95% CI: 1.21 to 2.23).<br><br>Compared with not for profit and government-owned nursing homes, for profit nursing homes were more likely to have COVID-19 infection (OR = 1.49, 95% CI: 0.97 to 2.34) and COVID-19 related deaths (OR = 1.69, 95% CI: 1.01 to 3.00).<br><br>There was a positive relationship between nursing home size (measured by bed occupancy) and COVID-19 cases (OR = 1.009, 95% CI: 1.006 to 1.012) and deaths (OR = 1.006, 95% CI: 1.003 to 1.009).<br><br>A trend analysis of confirmed COVID-19 cases adjusted by bed occupancy at each nursing facility among different quality ratings revealed that 5-star quality nursing homes had the lowest increasing rate of COVID-19 cases, followed by nursing homes with 4-star quality ratings. Compared with not for profit nursing homes, the development rate of COVID-19 cases was higher in for profit nursing homes. | Limitations noted by the authors:<br>Data were limited to the state of California because of data availability and standardization.<br><br>For SNFs with less than 11 COVID-19 cases, the actual number of cases and deaths was not available.<br><br>Without testing data, they were unable to link testing capacity to COVID-19 cases at each nursing facility.<br><br>They did not include nursing home staffing patterns, location, and patient comorbidities, which could potentially contribute to the relationship between nursing home quality and COVID-19 cases.<br><br>Limitations noted by the reviewer:<br>None<br><br>Inequalities impact:<br>Reported results confirm differences in infection rates and deaths between white and ethnic minority populations. |
| Kennelly and others 2020 (20)<br><br>Ireland<br><br>PREPRINT<br><br>'Asymptomatic carriage rates and case-fatality of SARS-CoV-2 infection in residents and staff in Irish nursing homes' | Design:<br>Survey<br><br>Objectives:<br>examine characteristics of Nursing Homes (NHs) across three Community Health Organisations (CHOs) in Ireland, proportions with COVID-19 outbreaks, staff and resident, symptom-profile and resident case-fatality<br><br>Setting and period: | Information sheet and survey distributed to lead nursing or medical officer, followed by a telephone call to obtain consent and aid consent and aid completion.<br><br>Responses anonymised<br><br>Outbreak definition for analyses: at least 1 resident with laboratory-confirmed COVID-19.<br><br>NHS categorised based on size & occupancy: (size: less than 50 beds, 51 to 100 beds, over 100 beds; | No association between single room occupancy standards and outbreak occurrence ($\chi 2=1.37$, p=0.24).<br><br>Non-COVID-19 mortality was similar in outbreak-affected NHs and unaffected NHs (5.1% [89 of 1,741] vs 4.0% [12 of 300] $\chi 2 =0.71$, p=0.40).<br><br>Significantly more residents with confirmed or suspected COVID-19 in the four public (106 of 157; 67.5%) versus seventeen private (620 of 1,500; 41.3%) NHs experiencing an outbreak ($\chi 2=39.6$; p<0.001). | Limitations noted by the authors:<br><br>Strengths:<br>largest epidemiological study of NHs, residents, and staff reported in the literature to date, demonstrating the disproportionate impact of COVID-19 on this part of the health sector<br><br>Limitations noted by the reviewers:<br><br>Recall bias.<br><br>Observer bias - Interviewer assisted survey completion. |

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| | 45 NHs across three Community Health Organisations (CHOs) in Ireland<br><br>29 February 2020 to 22 May 2020<br><br>Participants:<br>Survey response rate: 62.2%, 28 of 45 of NHs (2,043 residents, 2,303 beds)<br><br>Outcome measures:<br>Incidence and prevalence | occupancy; less than 75%, 75% to 85%, 86% to 95% and over 95%)<br><br>Analysis: Chi square test for between group comparison of proportions. Spearman Rank correlations for correlations between variable. | Case-fatality attributable to COVID-19 was significantly higher in public NHs (35 of 157; 22.3% vs 168 of 1500; 11.2%; $\chi2=16.2$; $p<0.001$).<br><br>Across sites, there was a significant correlation between the proportion of staff with symptomatic COVID-19 and the number of residents with confirmed or suspected COVID-19 (Spearman's rho=0.81, $p<0.001$).<br><br>There was no significant correlation between the proportion of asymptomatic staff and number of residents with confirmed or suspected COVID-19 (Spearman's rho=0.18, $p=0.61$).<br><br>A lower proportion of residents in NHs with early outbreaks had recovered compared to those with late outbreaks (37.4% vs 61.7%; $\chi2=56.9$, $p<0.001$). | Short deadline for completion during expectedly pressured outbreak management period – one week after phone call. |
| Ladhani and others 2020 (21)<br><br>UK<br><br>ARTICLE IN PRESS<br><br>'Increased risk of SARS-CoV-2 infection in staff working across different care homes enchanced CoVID-19 outbreak investigations in London care Homes' | Design: Cross-sectional study<br><br>Objective:<br>To assess occupational risk factors for SARS-CoV-2 infection among London care home staff, focussing on associations with the degree of exposure to residents and working across different care homes.<br><br>Setting and period:<br>6 London care homes reporting a suspected COVID-19 outbreak (at least 2 suspected cases) to PHE during 10 to 13 April 2020.<br><br>Participants:<br>N=254 staff working during the investigation days.<br><br>Outcome measures:<br>SARS-CoV-2 positivity in staff working in one care home compared to multiple care homes. | Positive SARS-CoV-2 nasal self-swab tested by RT- PCR assay.<br><br>Whole genome sequencing was performed on all RT-PCR positive samples.<br><br>Staff reports of symptoms, their contact with residents and if they worked in different care homes. | Positive RT-PCR tests<br>53 of 254 staff (21%) working during the study period tested positive for SARS-CoV-2 (12 were symptomatic at the time of swabbing).<br><br>In staff working in a single care home, SARS-CoV-2 positivity was 15% (2 of 13), 16% (7 of 45) and 18% (30 of 169) among those who reported no, occasional and regular contact with residents.<br><br>In permanent staff who had regular contact with residents and occasionally worked across different care homes, positivity was 47% (7 of 15), and 58% (7 of 12) in staff with regular resident contact who frequently worked across different care homes.<br><br>Compared to staff working in a single care home (39 of 227, 17%), those working in different care homes (14 of 27, 52%) had a 3.0-fold (95% CI: 1.9 to 4.8; $p<0.001$) higher risk of SARS-CoV-2 positivity.<br><br>Whole genome sequencing<br>Analysis of all positive samples and samples from 61 residents and 31 staff across all care homes revealed that in individual care homes experiencing large outbreaks, there were multiple introductions of the virus and evidence of clustering between staff and residents which would support cross-infection in individual care homes.<br><br>Within SARS-CoV-2 positive staff, two pairs of samples were not separated when placed in the | Limitations noted by the authors:<br>Inability to identify the source of infection among participants.<br><br>Directionality of infection cannot be inferred from whole genome sequencing analysis.<br><br>Limitations noted by the reviewer:<br>The study was conducted in London when infection rates were peaking in the capital. This setting, together with no information about the sources of infection, may limit generalisability to other UK locations.<br><br>Inequalities impact: None |

| Reference, country | Study design | Methods | Findings | Comments |
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| | | | context of SARS-CoV-2 genomic samples from across greater London, indicating a higher likelihood of transmission between the individuals.<br><br>Staff-only paired samples from staff working in single care homes yielded one pair of identical sequences which was separated on comparison with the large background set, reducing the likelihood of transmission between these individuals.<br><br>One other staff member who reported no contact with residents formed part of a large cluster (n=28) that included other SARS-CoV-2 positive staff.<br><br>The authors concluded that staff should be incentivised to work in single care homes and movement of staff across multiple care homes should be limited. Regular testing for SARS-CoV-2 should be considered, and infection prevention and control measures should not be restricted to contact with residents but extended for all contact on care home premises. | |
| Li and others 2020 (28)<br><br>ARTICLE<br><br>USA<br><br>'COVID-19 Infections and Deaths among Connecticut Nursing Home Residents: Facility Correlates' | Design:<br>Cross-sectional analysis on Connecticut nursing home (n=215) COVID-19 report; modelling study.<br><br>Objectives:<br>To determine the associations of nursing home registered nurse (RN) staffing, overall quality of care, and concentration of Medicaid or racial and ethnic minority residents with 2019 coronavirus disease (COVID-19) confirmed cases and deaths.<br><br>Setting and period: All Connecticut nursing homes (n=215), data collected through 16 April 2020.<br><br>Participants:<br>None<br><br>Outcome measures:<br>COVID-19 laboratory-confirmed cases and associated deaths. | Multivariable two-part models determined the associations of key nursing home characteristics with the likelihood of at least one confirmed case or death in the facility, and with the count of cases and deaths among facilities with at least one confirmed case or death. | The average number of confirmed cases was 8 per nursing home (interquartile range: 0 to 12), ranging from 0 for 107 nursing homes to 69 in one nursing home.<br><br>There was an average of 1.7 confirmed deaths per nursing home (interquartile range: 0 to 2), ranging from 0 for 131 nursing homes to 15 in two nursing homes.<br><br>In facilities with at least one confirmed case, every 20 minute increase in RN staffing (per resident day) was associated with a 22% reduction in confirmed cases (IRR = 0.78; 95% CI: 0.68 to 0.89; p<0.001).<br><br>Compared with one to three-star facilities, four or five-star facilities showed 13% fewer confirmed cases (IRR = 0.87; 95% CI: 0.78 to 0.97; p<0.015).<br><br>Nursing homes with a high concentration of Medicaid residents (IRR = 1.16; 95% CI: 1.02 to 1.32; p=0.025) or racial and ethnic minority residents (IRR = 1.15; 95% CI: 1.03 to 1.29; p=0.026) had 16% and 15% fewer confirmed cases, respectively, compared with their counterparts.<br><br>In facilities with at least one death, every 20-minute increase in RN staffing significantly predicted 26% fewer COVID19 deaths (IRR = 0.74; 95% CI: 1.55 to | Limitations noted by the authors:<br><br>Analyses focused on Connecticut nursing homes, limiting generalizability.<br><br>Observational study design risks bias by unmeasured confounders such as limited number of tests done in the nursing home and infection control and prevention practices in individual facilities.<br><br>Lack of significance in the associations of nursing home star ratings and concentrations of disadvantaged residents with predicted COVID-19 deaths may reflect insufficient power in multivariable analyses.<br><br>Limitations noted by the reviewer:<br>None<br><br>Inequalities impact:<br>None – in this study, homes with a higher concentration of Medicaid or racial and ethnic minority residents had lower rates of confirmed cases |

| Reference, country | Study design | Methods | Findings | Comments |
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| | | | 1.00; p=0.047). Other focused characteristics did not show statistically significant associations with deaths. | and no significant association with deaths. |
| Office for National Statistics (22)<br><br>July 2020<br><br>REPORT<br><br>England<br><br>'Impact of coronavirus in care homes in England: 26 May to 19 June 2020' | Design:<br>Cross-sectional study<br><br>Objectives:<br>To measure the prevalence of COVID-19 in care homes and the use of disease control measures in each setting, to inform decisions around the best approach to care home testing in the future.<br><br>Setting and period:<br>N=9,081 care homes in England providing dementia care or care for residents at least 65 years old.<br><br>26 May 2020 to 20 June 2020; reference period was 'since 1 March 2020'<br><br>Participants:<br>5,126 (56%) of the 9,081 care homes.<br><br>Outcome measures:<br>Number of residents and staff testing positive for COVID-19, as reported by care home managers. | Methods:<br>Telephone survey<br>Multivariable analysis | An estimated 56% (95% CI: 55% to 56%) of the 9,081 care homes included in the study reported at least one confirmed case of coronavirus (staff or resident), and within those, an estimated 20% of residents (95% CI: 19% to 21%) and 7% of staff (95% CI: 6% to 8%) tested positive for COVID-19 as reported by care home managers, since the start of the pandemic.<br><br>Across all 9,081 care homes, an estimated 11% (95% CI: 10% to 11%) of residents and 4% (95% CI: 4% to 4%) of staff had tested positive for COVID-19.<br><br>An estimated 15,606 residents had died having contracted COVID-19 (95% CI: 15,566 to 15,647).<br><br>Risk of infection in care home residents increased by 11% (95% CI: 10% to 11%) for each additional member of infected staff, and the likelihood of infection was higher in care homes using bank or agency staff most or all days (OR = 1.58, 95% CI: 1.50 to 1.65), compared with those who never use bank or agency staff.<br><br>Chances of infection were lower for residents who were at care homes in most regions outside London, the sole exception being care homes in the West Midlands, where the odds of infection for residents were increased by 9% compared with London (95% CI: 0% to 17%).<br><br>Care homes in which staff receive sick pay were less likely to have cases of coronavirus in residents (OR = 0.87, 95% CI: 0.82 to 0.93).<br><br>Risk of infection in care home staff increased by 4% (95% CI: 4% to 4%) for each additional infected resident, and in care homes using bank or agency nurses or carers most or every day the odds of infection in staff were higher (OR = 1.88, 95% CI: 1.77 to 2.00), compared with those not using bank or agency staff.<br><br>Care homes where staff regularly work elsewhere increase the odds of infection in staff (OR = 2.40, 95% CI: 1.92 to 3.00) compared with those whose staff never work elsewhere<br>. | Limitations noted by the authors:<br>Care home managers were asked to report the total number of confirmed cases of infection in their staff and residents since the start of the pandemic, which may exclude anyone who had COVID-19 but had not been tested at the time of reporting. Estimates are therefore likely to underestimate the proportion of staff and residents who were infected.<br><br>Results focus only on the results obtained from telephone interviews with care home managers rather than confirmed test results or diagnoses of COVID-19 infections.<br><br>Non-response bias is countered by weighting data.<br><br>Limitations noted by the reviewer:<br>Risk of recall bias, as results rely on care home managers' replies to questions.<br><br>Small risk of overestimation of effect sizes, due to 'minimal' quantity of missing responses – no imputation deemed necessary.<br><br>Potential causal effects are assumed to be negligible in the estimates and modelling.<br><br>Inequalities impact:<br>Risks of COVID-19 infection, for both staff and residents, vary with a number of factors in the management of care homes, as well as locality. |

| Reference, country | Study design | Methods | Findings | Comments |
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| | | | Staff in care homes in all regions outside London had higher odds of infection than those in London, with highest odds in the North East (OR = 3.86, 95% CI: 3.38 to 4.41) and Yorkshire and The Humber (OR = 2.88, 95% CI: 2.54 to 3.28). | |
| Stall and others 2020 (23)<br><br>ARTICLE<br><br>Canada<br><br>'For-profit long-term care homes and the risk of COVID-19 outbreaks and resident deaths' | Design: Retrospective cohort<br><br>Objectives: to examine association between for-profit status and risk of COVID-19 outbreaks and death.<br><br>Setting and period: Ontario, Canada, from 29 March 2020 to 20 May 2020 ('peak' of epidemic).<br><br>Participants:<br>All 623 Ontario LTC homes (75,676 residents).<br><br>Outcome measures:<br>1. COVID-19 outbreaks (at least one case).<br>2. Cumulative COVID-19 cases and deaths in residents.<br>3. Cumulative COVID-19 incidence in PH unit regions surrounding each LTC home.<br><br>Data source:<br>COVID-19 Ontario Census Modelling Table collated by Ontario Ministries of Health and Long-Term Care. | COVID-19 outbreak database maintained by the Ontario Ministry of Long-Term Care.<br><br>Hierarchical logistic and count-based methods to model the associations between profit status of LTC homes (for-profit, non-profit or municipal) and COVID-19 outbreaks in LTC homes, the extent of COVID-19 outbreaks (number of residents infected), and deaths of residents from COVID-19.<br><br>Other care home factors considered:<br>Number of beds, number of residents, occupancy bed type mix, staff ratios, size of home chain, and age of design of the home.<br><br>Sensitivity Analysis:<br>Reanalysing model 3 for all 3 outcomes by entering average occupancy rather than age of the design standard yielded similar effect estimates for the associations with for-profit status | Outbreaks & Extent of outbreak:<br>Amongst homes with outbreaks: 23.8% of all residents in for-profit homes had COVID-19, whereas on average 17.2% and 7.1% of all residents in non-profit and municipal homes had COVID-19, respectively.<br><br>In both unadjusted (risk ratio [RR] = 1.83, 95% CI: 1.18 to 2.84) and health region characteristics–adjusted quasi-Poisson regression models (adjusted RR = 1.96, 95% CI: 1.26 to 3.05), for-profit status was significantly associated with the extent of the outbreak of COVID19 in the home. The risk associated with for-profit status was even greater when municipal homes were the referent group in the model.<br><br>In the fully adjusted explanatory model, the relationship with for-profit status was attenuated (adjusted RR = 0.96, 95% CI: 0.57 to 1.61), whereas both the number of COVID-19 cases per thousand in the public health unit region surrounding the LTC home (adjusted RR = 1.65, 95% CI: 1.02 to 2.67), older design standards of LTC homes (adjusted RR = 1.88, 95% CI: 1.27 to 2.79), and chain ownership (adjusted RR = 1.84, 95% CI: 1.08 to 3.15) were significantly associated with the extent of an outbreak of COVID-19 in an LTC home, whereas total number of active residents was protective (adjusted RR = 0.84, 95% CI: 0.73 to 0.95; per 50 beds).<br><br>Deaths:<br>Amongst homes with an outbreak<br>6.5% of all residents in for-profit homes died of COVID-19, whereas on average 5.5% and 1.7% of all residents in nonprofit and municipal homes died of COVID-19, respectively<br><br>Quasi-Poisson regression modelling showed that for-profit status was associated with the total number of COVID-19 deaths among LTC home residents in the health region characteristics–adjusted model (adjusted RR = 1.78, 95% CI: 1.03 to 3.07) but not the unadjusted model (RR = 1.67, 95% CI: 0.99 to 2.73). This risk was greater when | Limitations noted by the authors:<br>lack of individual-level data on the sociodemographic and clinical characteristics of residents (centralised admission process may mitigate or prevent differences in resident case mix between homes).<br><br>No a priori sample size calculations but used maximum sample available. post hoc simulations of outbreaks based on the observed distribution of cases among homes confirmed that our analyses had adequate power.<br><br>Staffing data limited to number of rostered FTE and not head count.<br><br>Imprecise estimates of regional prevalence for homes on borders of regions with differing incidence.<br><br>Data for the Long-Term Care Inspections Branch not independently validated.<br><br>Right censoring – as outbreaks were still ongoing post study end point.<br><br>Unable to account for temporal changes in access to PPE or chance to provincial IPC policies.<br><br>Did not account for testing rates<br><br>Limitations noted by the reviewer:<br>None additional. |

| Reference, country | Study design | Methods | Findings | Comments |
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| | | | municipal homes were the referent group in the model.<br><br>In the fully adjusted explanatory model, the relationship with for-profit status was attenuated (adjusted RR = 0.82, 95% CI: 0.44 to 1.54). Older design standards in LTC homes (adjusted RR = 2.08, 95% CI: 1.28 to 3.36) and chain ownership (adjusted RR = 1.89, 95% CI: 1.00 to 3.59) were significantly associated with the risk of the total number of deaths from COVID-19 among LTC home residents, whereas number of active residents was protective (adjusted RR = 0.81, 95% CI: 0.70 to 0.95; per 50 beds). | |
| White and others 2020 (29)<br><br>U.S.A<br><br>'Variation in SARS-CoV-2 Prevalence in U.S. Skilled Nursing Facilities' | Design:<br>Cross-sectional<br><br>Objective:<br>Identify county and facility factors associated with SARS-CoV-2 outbreaks.<br><br>Setting and period:<br>Skilled Nursing Homes (SNFs)<br><br>Participants:<br>341 Genesis Healthcare (SNFs) in 25 States, 3,016 Non-Genesis Healthcare SNFs in 12 States. COVID-only SNFs excluded.<br><br>Outcome measures:<br>Outbreaks (at least 1 case), number of confirmed cases, Case Fatality Rate, Prevalence post Universal Testing. | Publicly available State data as at 21 April 2020.<br><br>Genesis Healthcare data as at 4 May 2020.<br><br>Independent Variables:<br>SNF Characteristics:<br>Mean resident age, percentage residents of Black ethnicity, percentage residents with dementia, most recent Nursing Home Compare Five-Star ratings, SNF infection prevention and control citation in previous year.<br><br>County Characteristics:<br>Population size, population density, percentage population of Black ethnicity, SARS-CoV-2 prevalence, date of first case in county<br><br>Analyses:<br>Association of SNF and county characteristics with occurrence of SARS-CoV-2 case or outbreak - Linear probability fixed effects model, multivariate analyses.<br><br>Genesis and Non-Genesis SNF characteristics also compared separately for association with outcome measures.<br><br>Genesis SNFs only; association between SNF cases per 100 beds and county prevalence per 100,000 | SNFs with outbreaks were larger, had higher ratings for overall and registered nurse staffing, and had greater proportions of Black residents, compared with facilities without outbreaks. Tended to be in counties with higher prevalence, higher population density, and larger Black populations.<br><br>SNF demographics and prior infection control deficiency citations were unrelated to occurrence of outbreaks.<br><br>A 1% variation in county prevalence was associated with a 33-percentage point difference (95% CI: 9.6 to 57.7 percentage point; P = 0.008) in the probability of an SNF outbreak.<br><br>Five-Star staffing ratings were unrelated to the likelihood of outbreak. 4-5 star rated SNFs had lower probability of outbreaks relative to 3-star SNFs. No significant difference between 1-2 star rated SNFs relative to 3-star rated SNFs.<br><br>Strong positive correlation (Spearman's ρ = 0.64) between county prevalence and SNF cases per 100 beds.<br><br>Higher, but non-statistically significant median case fatality rate for SNFs in counties with higher prevalence.<br><br>Among those SNFs that underwent universal testing, SNFs with at least one prior case and located in higher prevalence counties (top 5%), had higher percentage of residents with SARS-CoV-2 infection relative to those located in low prevalence counties. | Limitations noted by the author:<br>Geographical variation in testing capacity may underrepresent case counts and case fatality rates in SNFs without universal testing. Analyses in a subset of SNFs with universal testing showed no difference in patterns of associations found.<br><br>Limitations noted by the reviewer:<br><br>Inequalities Impact:<br>Study assessed likelihood of outbreaks in SNFs located in counties with higher percentage of Black ethnicity population |

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| | | population; estimation of case fatality rates among SNFs with at least 5 cases, Poisson regression for association between SNF characteristics and number of cases amongst those with at least one case.<br><br>Subset of 64 SNFs that underwent universal testing, analysed for variation in SNF prevalence by county prevalence. | | |

**Table C.2: interventions to minimise transmission**

Acronyms used: CCE = Chalfont Centre for Epilepsy, CHO = Community Health Organisation, CI = confidence interval, CMS = Centers for Medicare & Medicaid Services, HCP = healthcare personnel, IRR = incidence rate ratio, LTC = long term care NH = nursing home, PPE = personal protective equipment, RR = risk ratio, RN = registered nurse, RT-PCR = reverse transcriptase polymerase chain reaction, STE = St Elizabeth, TM = The Meath

| Reference, country | Study design | Methods | Findings | Comments |
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| Balestrini and others 2020 (30)<br><br>Preprint<br><br>UK<br><br>'Clinical outcomes of SARS-CoV-2 pandemic in long-term care facilities for people with epilepsy: observational study' | Design:<br>Retrospective cohort<br><br>Objective:<br>To assess the relative effectiveness of surveillance and early preventative strategies<br><br>Setting and period:<br>London, 16 March 2020 to 5 June 2020<br><br>Participants:<br>N=286 long-term residents (age range: 19 to 91 years), 740 carers who had been in contact with the residents.<br><br>Outcome measures:<br>Number of residents with COVID-19.<br><br>Number of carers with COVID-19. | Compares 3 facilities with different modes of primary and specialist care: 1) Chalfont Centre for Epilepsy (CCE), 2) St Elizabeth (STE), 3) The Meath (TM).<br><br>Intervention: CCE implemented a program of isolation and on-site testing of suspected cases of COVID-19 (temperature of more than 37.8°C, or a temperature rise of 1.5°C above their long-term average, or new persistent cough or shortness of breath). Suspected cases were isolated while waiting for results and cared for by dedicated caregivers working 12 hour shifts (to reduce staff contacts). Those testing positive were isolated. If the first test was negative a second test was performed 24 to 48 hours later. De-isolation of negative cases occurred 48 hours after the symptoms were resolved. After 3 weeks of the intensive shielding and pragmatic surveillance described above, residents were tested weekly. Tracing and testing caregivers who had been in contact with positive cases but were asymptomatic was started within 12 hours of the original positive test. Routine surveillance of all asymptomatic caregivers working on-site commenced 30 April 2020.<br><br>Comparison: At STE and TM early preventative measures were implemented to different degrees but there was no on-site testing initially. Residents with symptoms were isolated within their rooms or transferred to dedicated units once returned from hospital if COVID-19 was confirmed. There was no asymptomatic screening. Testing symptomatic caregivers was available at testing stations from mid-April. On-site testing was available for residents from early May. | CCE:<br>2 of 98 (2%) residents were symptomatic and tested positive. Five other residents with symptoms were isolated and repeatedly tested as negative.<br><br>7 of 9 (78%) asymptomatic residents were positive.<br><br>Of the 150 carers to accepted testing only one was positive. No resident to carer transmission. Infections were contained within 3 weeks.<br><br>STE:<br>3 of 146 (2%) residents were symptomatic and tested positive. Eight other residents with symptoms were isolated; 6 were tested once and all were negative. All 8 were de-isolated.<br><br>One asymptomatic resident tested positive at hospital when attending for another condition.<br><br>Out of 215 carers, 105 were tested once and 14 were positive. An additional asymptomatic carer was identified after introducing contact tracing. Infections continued throughout the 12 week observation period.<br><br>TM:<br>8 out of 80 (10%) residents were symptomatic and none were tested.<br><br>26 of 250 of carers were symptomatic and 2 tested positive.<br><br>Authors concluded that infection outbreaks can be contained quickly in long-term care facilities but only if asymptomatic cases are identified through enhanced surveillance for individuals and carers. The low rate of morbidity and mortality confirmed that preventative measures with isolation of suspected and confirmed cases can reduce transmission between residents and between carers and residents. | Limitations noted by the authors:<br>none identified.<br><br>Limitations noted by the reviewer:<br>differences between the 3 settings (the interventions being delivered and their timings, degree of support from other organisations, the organisational set up of each setting, the characteristics of resident, amongst others) mean it is difficult to determine if the intervention was successful.<br><br>Inequalities impact: none identified. |

| Reference, country | Study design | Methods | Findings | Comments |
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| Belmin and others 2020 (33)<br><br>France<br><br>'Coronavirus Disease 2019 Outcomes in French Nursing Homes That Implemented Staff Confinement With Residents' | Design:<br>Retrospective cohort<br><br>Objective:<br>To investigate COVID-19-related outcomes in French nursing homes that implemented voluntary staff confinement with residents.<br><br>Setting and period:<br>France, 1 March to 11 May 2020.<br><br>Participants:<br>17 nursing homes in which 794 staff confined themselves to the facilities with 1,250 residents. National survey: 9,513 facilities with 385,290 staff members and 695,060 residents.<br><br>Outcome measures:<br>Number of nursing homes with COVID-19 cases. Number of residents with COVID-19. Number of staff with COVID-19. | Compared data from 17 nursing homes where staff voluntarily confined themselves to the facility with data from a population-based survey of nursing homes conducted by French health authorities.<br><br>Homes were self-confinement was occurring were identified through the media and a telephone survey.<br><br>The number of confirmed or possible COVID-19 cases in nursing homes with staff who self-confined was compared with that obtained from the national survey using odds ratios (OR) and 95% confidence intervals, chi square test and Fisher exact test. P values were 2-sided. | 1 facility with self-confinement (5.8%) had cases of COVID-19 vs. 4,599 facilities (48.3%) in the national survey (p<0.001).<br><br>5 residents in facilities with self-confinement (0.4%; all in the same facility) had confirmed COVID-19, versus 30,569 residents (4.4%) with confirmed COVID-19 from the national survey (p<0.001).<br><br>No residents in facilities with self-confinement had possible COVID-19 vs 31,799 (4.6%) with possible COVID-19 from the national survey (p<0.001).<br><br>6 members of staff (0.8%) in facilities with self-confinement had confirmed COVID-19 (none of these staff participated in self-confinement) versus 14,645 staff (3.8%) in the national survey (p<0.001).<br><br>6 members of staff (0.8%) in facilities with self-confinement had possible COVID-19 (only one of these staff participated in self-confinement) versus 14,806 staff (3.8%) in the national survey (p<0.001).<br><br>Authors concluded that facilities where staff confined themselves with residents saw a significantly lower incidence of COVID-19 among residents and staff compared to that reported in the national survey. | Limitations noted by the authors: 1) It is not possible to assert a causal link between confinement and incidence of COVID-19. 2) The type and size of nursing homes varied. 3) Confinement might be related to other improved hygiene practices. 4) The possibility of differences in completeness of data on COVID-19 cases from the 2 sources.<br><br>Limitations noted by the reviewer: none.<br><br>Inequalities impact: none identified. |
| Dora and others 2020 (36)<br><br>Universal and Serial Laboratory Testing<br><br>US<br><br>ARTICLE<br><br>'Universal and Serial Laboratory Testing for SARS-CoV-2 at a Long-Term Care Skilled Nursing Facility for Veterans - Los Angeles, California, 2020' | Design: Outbreak Investigation<br><br>Objectives: to describe an outbreak of COVID-19 in a skilled nursing facility (SNF), with case identification accomplished by implementing several rounds of RT-PCR testing, permitting rapid isolation of both symptomatic and asymptomatic residents with COVID-19.<br><br>Setting and period: a Long-Term Care SNF (wards A and B are in building 1, and ward C is in building 2. Buildings 1 and 2 do not share common areas, but residents might have indirect contact with outside persons) for Veterans in Los Angeles, California, during 29 March 2020 to 23 April 2020. | All SNF residents, regardless of symptoms, underwent serial (approximately weekly) nasopharyngeal SARS-CoV-2 RT-PCR testing, and positive results were communicated to the county health department.<br><br>All SNF clinical and nonclinical staff members were also screened for SARS-CoV-2 by RT-PCR during 29 March 2020 to 23 April 2020 | RT-PCR testing of all residents, conducted during March 29–March 31 in wards A, B, and C, identified SARS-CoV-2 in four (13%) of 30 residents on ward A, none of 30 residents on ward B, and 10 (28%) of 36 residents on ward C. All infected residents were transferred to the affiliated hospital for isolation and clinical management.<br><br>The Infection Control team implemented serial weekly RT-PCR testing among residents of wards A and C until no additional residents received a positive test result. On April 3, all 22 remaining ward A residents received negative test results and were transferred to wards B and C. Ward A was converted into a COVID-19 recovery unit to cohort patients with continued RT-PCR–positive test results.<br><br>On April 6, the 28 residents on ward C were retested; two had positive test results and were transferred to the COVID-19 recovery unit. A third round of testing was performed on ward C on April 13; all 27 residents had negative test results. During | Limitations noted by the authors: Residents' recall might be limited by cognitive disorders or recall bias, over- or underreporting of symptoms was possible.<br><br>Symptom data obtained from medical records might have been incomplete, because the daily symptom screening only included fever and respiratory symptoms and did not include symptoms more recently recognized as being associated with COVID-19, such as loss of sense of smell or taste.<br><br>The all-male cohort of patients with laboratory-confirmed COVID-19 might have comorbidity profiles that differ from other groups, these findings might not be generalizable to other SNFs. |

| Reference, country | Study design | Methods | Findings | Comments |
|---|---|---|---|---|
| | Participants: 99 SNF residents and 136 staff members<br><br>Outcome measures: number of positive RT-PCR tests | | April 22–23, a final round of testing conducted on wards B and C identified no positive test results among the remaining 83 residents.<br><br>Fourteen of the 19 (74%) residents with COVID-19 reported no symptoms at the time of testing; among these residents, eight were presymptomatic, developing symptoms 1 to 5 days after the date of specimen collection<br><br>8of 136 staff members (6%) had covid-19 infections: three in registered nurses and five in licensed vocational nurses, all of whom worked in wards A or C. 4of 8 infected staff members were symptomatic and were tested within 2 days after symptom onset; one developed fever at work and was sent home. None of the others worked during or after symptom onset. | Limitations noted by the reviewer: none<br><br>Inequalities impact: there is a table of characteristics of residents testing positive. |
| Echeverría and others 2020 (37)<br><br>Spain<br><br>ARTICLE<br><br>'COVIDApp as an Innovative Strategy for the Management and Follow-Up of COVID-19 Cases in Long-Term Care Facilities in Catalonia: Implementation Study' | Design:<br>Descriptive study.<br>Intervention study using COVIDApp?<br><br>Objective: to report the implementation of this innovative tool for the management of long-term care facility residents, specifically for early identification and self-isolation of suspected cases, remote monitoring of mild cases, and real-time monitoring of the progression of the infection.<br><br>Setting and period: 169 nursing homes and 27 institutions for people with physical and mental disabilities participated in collaboration with 64 primary care teams from the northern area of Barcelona, Catalonia.<br><br>Participants:<br>10,347 institutionalised individuals.<br><br>Outcome measures:<br>Signs and symptoms; diagnosis by RT-PCR; absence of symptoms for at least 14 days; total deaths; and number of | The authors describe the implementation of a mobile app (COVIDApp) for the management of COVID-19 in institutionalized persons in long-term care facilities.<br><br>COVIDApp provides information on facility residents in real time, including vital signs (for example, temperature, heart and respiratory rate, blood pressure, and oxygen saturation rate) and symptoms.<br><br>The COVIDApp tool was optimized to meet the following objectives: early identification and self-isolation of persons suspected of having COVID-19 for rapid diagnosis of positive cases by RT-PCR, thus minimizing the risk of transmission in long-term care facilities; remote treatment and monitoring of mild cases of COVID-19 self-isolating at nursing homes when indicated; and real-time monitoring of the progression of the infection and its consequences in these at-risk facilities.<br><br>The parameters reported by health care staff at each institution with respect to all residents and caregivers were the number of persons with signs or symptoms of | During 30 days of follow-up using the platform, the authors managed data from more than 10,000 institutionalized individuals and up to 4,000 health care workers.<br><br>A rapid increase in the number of suspected cases was seen until day 6; this number remained stable until day 14 and decreased during the last 2 weeks.<br><br>The number of confirmed COVID-19 individuals increased progressively until day 22 and remained stable during the last week. Over the 30 days, the number of residents asymptomatic for more than 14 days was stable (5,090 of 10,347, 49.2%).<br><br>Long-term care facilities reported a total of 854 of 10,347 (8.3%) institutionalized deaths during the 30 days; of these, 383 (44.8%) were suspected or confirmed cases. Increases were observed in both the total number of deaths and the deaths among suspected and confirmed cases during the first 2 weeks, followed by a progressive decrease. This decrease was more marked from the third week onward.<br><br>The number of isolated health care workers (suspected or confirmed cases or contact with a confirmed case) remained high over the 30 days, although the number of suspected cases decreased during the last 2 weeks; this decrease became more apparent during the last week. | Limitations noted by the authors: data must be interpreted with caution because they are reported and registered by long-term care facility staff for use in clinical care planning, although the data were validated by the primary care teams.<br><br>Implementation of the tool was difficult to consolidate due to the complexity of reporting the clinical status of individuals, especially in long-term care facilities experiencing multiple difficulties managing the crisis.<br><br>Limitations noted by the reviewer: none<br><br>Inequalities impact: none |

| Reference, country | Study design | Methods | Findings | Comments |
|---|---|---|---|---|
| | health care workers isolated with suspected COVID-19. | COVID-19 (suspected and symptomatic cases), number of persons with a diagnosis of SARS-CoV-2 by RT-PCR, number of residents remaining asymptomatic for more than 14 days, total number of deaths and deaths in suspected cases, number of suspected cases in health care workers, and number of isolated health care workers (confirmed cases, suspected cases, or contacts). | | |
| Eckardt and others 2020 (34)<br><br>US<br><br>ARTICLE<br><br>'Hospital affiliated long term care facility COVID-19 containment strategy by using prevalence testing and infection control best practices' testing and infection control best practices' | Design: prospective cohort study<br><br>Objective: to interrupt a potential outbreak of COVID-19 using a point prevalence testing containment strategy and applying infection prevention and control best practices.<br><br>Setting and period: a 120 bed long-term care facility in Florida, 7 April 2020 to 6 May 2020<br><br>Participants:<br><br>Outcome measures: | Infection prevention and control best practices were implemented on 4 March 2020. This strategy included: screening HCP and all facility residents twice daily for symptoms; banning of visitors and group activities; offering more shifts at the facility in order to incentivise working in one facility only; instituting telemedicine for virtual patient consultations; universal masking; sanitising and establishment of a cohort unit to avoid placing unexposed residents into a shared space with previously exposed residents.<br><br>Following the diagnosis of the first COVID-19 positive case, on 8 April 2020, all staff and residents were tested for COVID-19 using RT-PCR every 14 days for 6 weeks. | Serial point prevalence testing of all staff and residents was implemented every 14 days.<br><br>A total of 9 patients were positive at the facility during the period of 7 April 2020 to 6 May 2020.Of the 9 patients, only 2 had symptoms.<br><br>11 employees (nurses and nursing assistants) and 5 contracted staff (environmental services and security) were positive; all of them were asymptomatic. Employees were immediately quarantined and educated on home isolation and were not allowed back to the facility until 2 nasopharyngeal swabs collected 24 hours apart both tested negative.<br><br>Employees were quarantined if they had a household member positive for COVID-19. All positive staff were asymptomatic and self-isolated at home. Positive staff were self-quarantined for 14 days and returned once asymptomatic for 72 hours and after 2 negative SARS-CoV-2 RT PCR tests of nasopharyngeal specimens 24 hours apart.<br><br>Over 6 weeks, the spread of the disease was contained, shown by the prevalence decreasing from 5.4% (April 7) to 3.6% (April 22) to 0.41% (May 6).<br><br>Overall, the facility has conducted 769 tests of which only 3.3% have tested positive. | Limitations noted by the authors: none acknowledged<br><br>Limitations noted by the reviewer: there were so many different infection prevention interventions, it is difficult to know what effect each one had<br><br>Inequalities impact: none |
| Escobar and others 2020 (31)<br><br>USA<br><br>PREPRINT | Design: Case study (outbreak investigation)<br><br>Objective:<br>to describe the management of a COVID-19 outbreak in a | After a widespread outbreak in the nursing home on 12 April 2020 SARS-CoV-2 screening of all staff who were either stationed at the nursing home or moved back and forth between the nursing home and the medical facility was implemented. | By 30 April 2020, 212 asymptomatic staff were screened and 67 were tested due to symptoms. Twenty-six symptomatic and six asymptomatic staff members tested positive. All SARS-CoV-2 positive employees were kept off site and returned to work based on the CDC symptom-based strategy. | Limitations noted by the author: Universal testing of staff allowed for identification of positive presymptomatic staff members, but there are limitations to this approach - challenges include lack of access to rapid testing, |

| Reference, country | Study design | Methods | Findings | Comments |
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| 'Mitigation of a COVID-19 Outbreak in a Nursing Home Through Serial Testing of Residents and Staff' | nursing home and describe a strategy involving serial testing of residents and staff that led to its successful, rapid containment.<br><br>Setting and period:<br>A nursing home in eastern Pennsylvania, March to end April 2020.<br><br>Participants: 84 residents (83 male) in a nursing home.<br><br>Outcomes measures: positive tests and new cases of COVID-19. | On 14 April 2020 a dedicated SARS -CoV-2 isolation unit was opened in the nursing home for positive residents. All routine care was provided in the resident rooms. Residents were not allowed to travel between units.<br><br>Universal masking of all residents was implemented, and the residents were encouraged to quarantine in their rooms. Concurrently, use of eye shields for clinical staff was made mandatory and efforts were made to cohort the staff to work on specific units.<br><br>Serial testing of residents occurred approximately every 3 to 5 days, to capture as many early asymptomatic cases as possible. | By 20 April 2020, 21 residents tested positive and a second dedicated SARS-CoV-2 unit was opened.<br><br>In total, 27 residents tested positive, with an attack rate of 37%. Among the positive residents, 14 were asymptomatic at the time of identification, and 13 developed symptoms after diagnosis.<br><br>As of 1 July 2020, no new cases have been identified among the residents. | inadequate staffing, including infection control experts, and lack of an affiliation with a medical centre.<br><br>Limitations noted by the reviewer: many interventions were implemented and it is difficult to know the effect each individual one may have had.<br><br>There is not much detail about the interventions used, for example, how cohorting was done and when.<br><br>Inequalities impact: None assessed |
| Hatfield and others 2020 (35)<br><br>ARTICLE<br><br>US<br><br>'Facility-Wide Testing for SARS-CoV-2 in Nursing Homes - Seven U.S. Jurisdictions, March-June 2020' | Design: Cross-sectional<br><br>Objective: to compare statewide testing with targeted testing in order to control transmission of COVID-19 among residents and health care personnel in nursing homes.<br><br>Settings and period: 288 nursing homes in seven state or local health departments in US during 24 March 2020 to 14 June 2020<br><br>Participants: nursing home residents and staff members.<br><br>Outcome measures: number of positive COVID-19 cases in residents and staff. | CDC compiled data from seven state or local health departments that conducted facility-wide testing in nursing homes.<br><br>Two health departments conducted initial facility-wide testing in all nursing homes in the state (that is, statewide testing strategy).<br><br>Five health departments targeted initial facility-wide testing to facilities with a newly reported case in a resident or HCP (that is, targeted testing strategy).<br><br>For facilities using the targeted testing strategy, a linear generalized estimating equation was used to estimate the association between the number of days from identification of the first COVID-19 case in the nursing home until completion of the facility-wide testing and the cumulative number of persons with positive SARS-CoV-2 test results, adjusting for the number of persons tested and the surrounding county incidence. | In two of the seven health departments universal testing was conducted in 195 nursing homes in low incidence areas. 125 of the 195 nursing homes had not reported any COVID-19 cases before the testing. Ninety-five of 22,977 (0.4%) persons tested in 29 (23%) of these 125 facilities had positive SARS-CoV2 test results.<br><br>The other five health departments targeted facility-wide testing to 93 nursing homes, where 13,443 persons were tested, and 1,619 (12%) had positive SARS-CoV-2 test results.<br><br>In regression analyses among 88 of the nursing homes with a documented case before facility-wide testing occurred, each additional day between identification of the first case and completion of facility-wide testing was associated with identification of 1.3 additional cases.<br><br>Among 62 facilities that could differentiate results by resident and HCP status, an estimated 1.3 HCP cases were identified for every three resident cases. In contrast, facility-wide testing in low-incidence areas without a case has a lower proportion of test positivity. | Limitations noted by the author: Symptoms at the time of testing were not systematically collected; thus, determining what proportion of cases might have been identified using symptom screening methods is not possible.<br><br>It was not possible to describe variations in infection prevention and control, other interventions that might affect COVID-19 spread, or follow-up over time.<br><br>Cases might be missed if the patient was no longer shedding virus, still incubating disease, or if less sensitive tests, such as point-of-care tests, are used<br><br>The estimates of the relationship between cases identified and delays in conducting testing might only be relevant for the period examined (that is, 1 to 41 days); this relationship might not be valid for longer delays as the number |

| Reference, country | Study design | Methods | Findings | Comments |
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| | | In the statewide testing strategy group, associations were assessed between the COVID-19 incidence in the surrounding county and the odds of identifying any cases at each facility testing event, adjusted for the number of persons tested in all facilities that did not have previous cases.<br><br>Logistic generalized estimating equation models with an exchangeable correlation structure accounting for clustering by jurisdiction were fitted. | | of persons susceptible to infection decreases.<br><br>Health departments contributing statewide testing data had a relatively low community incidence at time of testing; findings from jurisdictions with a higher community incidence might differ.<br><br>Limitations noted by the reviewer:<br><br>Inequalities impact: not assessed |
| Miller and others, 2020 (32)<br><br>PREPRINT<br><br>USA<br><br>'Implementing a Negative Pressure Isolation Space within a Skilled Nursing Facility to Control SARS-CoV-2 Transmission' | Design:<br>Descriptive report<br><br>Objectives:<br>To design, implement and validate an isolation space to minimize disease transmission between residents and staff.<br><br>Setting and period:<br>One ward in a skilled nursing facility (SNF) in Lancaster, PA, consisting of 13 beds within 7 rooms, each with single bathroom and self-contained heating and cooling.<br><br>14 May 2020 to 23 June 2020<br><br>Participants:<br>N=21 residents, including 14 with confirmed (PCR testing) SARS-CoV-2, and healthcare workers (n=not applicable)<br><br>Outcome measures:<br>Persistence of negative pressure.<br><br>SARS-CoV-2 transmission between residents and care workers. | An existing heating, ventilation and air conditioning system of the SNF was modified to create an isolation space.<br><br>Pressure on-site was measured, and computational fluid dynamics and Lagrangian particle-based modelling were used to test containment and possible transmission extent given the isolation space is considered negative rather than individual rooms. | Pressure data, computed and measured, showed the isolation space maintained an average hourly value of (standard deviation) -2.3 Pa (0.12 Pa) pressure differential between it and the external hallway connected to the rest of the facility.<br><br>Computational modelling of air flow patterns within the isolation space indicated that protective measures within the isolation space remain critical to prevent viral transmission among patients and healthcare workers within the space.<br><br>No transmission of SARS-CoV-2 between residents isolated to the space occurred, nor did any transmission to the staff or other residents occur.<br><br>The isolation space was successfully implemented and at the time of writing continued to be operational. | Limitations noted by the authors:<br>Staff need to wear PPE within the negative pressure area, due to the possibility of positive pressures within rooms and hallways.<br><br>Additional design and testing is needed to address this concern; possible strategies are identified.<br><br>Limitations noted by the reviewer:<br>Wearing of PPE within the negative pressure area is a possible confounder in assessing the sole impact of the negative pressure room on transmission.<br><br>No details provided as to staff numbers or PPE protocols.<br><br>Inequalities impact: None |
| Wilmink and others 2020 (38) | Design:<br>Susceptible, exposure, infected and recovered modelling | Wearable devices (Tempo) worn by study participants susceptible, exposure, infected and recovered | Five days after pre-symptomatic seeding, digital contact tracing yielded 5% and 7% fewer cases than PCR testing and manual contact tracing, | Limitations noted by the author: |

| Reference, country | Study design | Methods | Findings | Comments |
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| U.S.A<br><br>'Real-Time Digital Contact Tracing: Development of a System to Control COVID-19 Outbreaks in Nursing Homes and Long-Term Care Facilities' | <u>Objective:</u><br>Describe & assess a digital contact tracing system (CarePredict PinPoint) against conventional methods of identifying and containing SARS-CoV2 infections.<br><br><u>Setting and period:</u><br>Nursing Homes & LTC facilities<br><br><u>Participants:</u><br>Simulated 80 Residents and 40 Staff<br><br><u>Outcome measures:</u> | Compartmental model simulated transmission of SARS-CoV-2 infections Model based comparative assessment of:<br>• no intervention<br>• symptom mapping<br>• PCR testing<br>• manual contact tracing<br>• digital contact tracing | respectively. After 40 days, the digital contact tracing provided 6% and 12% fewer cases than PCR testing and manual contact tracing, respectively.<br><br>Direct contact tracing achieved 22%, 3%, and 2% fewer deaths than symptom-based monitoring, manual contact tracing, and PCR testing methods, respectively.<br><br>Under all scenarios - digital contact tracing achieved superior infection control performance compared with conventional methods.<br><br>Symptom-based monitoring alone was the least effective control method yielding 60% to 71% more cases and 10% to 20% more deaths than the other interventional groups.<br><br>Delays in time to intervention implementation resulted in increased cases and deaths in all simulated intervention groups, including yielding PCR testing less effective than manual contact tracing. Time delay was shown to have significantly more impact on successful control, than intervention efficacy once 60% intervention efficacy was met. | Model simulation does not account for underlying morbidities amongst participants<br><br>Computer simulated results not yet compared with existing data from digital system in use in several US LTC facilities.<br><br><u>Limitations noted by the reviewer:</u><br>Unassessed<br><br><u>Inequalities Impact:</u><br>None assessed by authors |

# Annexe D. Protocol

## Review questions

1. What factors are associated with the transmission of COVID-19 within care homes and domiciliary care?
2. What interventions (stand alone, or bundle of interventions) are effective in minimising care home or domiciliary care transmission?

**Table C.1: Inclusion and exclusion criteria**

| | Included | Excluded |
|---|---|---|
| Population | • staff<br>• residents of all ages receiving care in care homes or domiciliary care<br>• visitors | Non-human studies |
| Settings | • all residential care homes with and without nursing (not restricted to care homes for the elderly)<br>• domiciliary care settings | Healthcare settings |
| Context | COVID-19 outbreak | Other diseases |
| Intervention or exposure | • any intervention to reduce or minimise transmission, including those pertaining to movement of staff or residents.<br>• interventions may be stand-alone interventions or combinations | Effectiveness of PPE |
| Outcomes | • transmission of SARS-CoV-2 infection or COVID-19<br>• incidence or prevalence of SARS-COV-2 Infections or COVID-19<br>• reproduction number | |
| Language | English | |
| Date of publication | 1 January 2020 to present | |
| Study design | • experimental or observational studies<br>• case series and case reports<br>• modelling studies | • Systematic reviews<br>• Guidelines<br>• Opinion pieces |
| Publication type | Published and preprint | |

# Sources of evidence

Medline, Embase, medRxiv preprints, WHO COVID-19 Research Database and Social Care Online.

Reference lists of relevant papers and any relevant reviews (rapid, systematic) will also be searched.

**Search strategy for Ovid Medline**

1. (home adj3 (care or caring)).tw,kw.
2. (nurs* adj home*).tw,kw.
3. ((patient* or client* or resident* or elderly or disabled) adj3 home*).tw,kw.
4. (sheltered hous* or long term care or residential care* or residential home* or long term facilit*).tw,kw.
5. assisted living.tw,kw.
6. (old age home* or old people* home* or retirement home*).tw,kw.
7. Home Nursing/
8. Home Care Services/
9. exp Nursing Homes/
10. Residential Facilities/
11. Group Homes/
12. Homes for the Aged/
13. Hospice Care/
14. domicil*.tw,kw.
15. home visit*.tw,kw.
16. home monitor*.tw,kw.
17. community care.tw,kw.
18. health visitor*.tw,kw.
19. district nurs*.tw,kw.
20. community nurs*.tw,kw.
21. (patient* adj2 home*).tw,kw.
22. public health nurse*.tw,kw.
23. (care assistant* or healthcare assistant* or care staff* or home help* or carer or support worker* or rehabilitation worker* or care manager* or care worker*).tw,kw.
24. social care.tw,kw.
25. social worker*.tw,kw.
26. exp Home Care Services/
27. Caregivers/
28. exp Community Health Services/
29. House Calls/
30. Nurses, Community Health/
31. Social Workers/
32. Home Health Aides/
33. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32
34. exp coronavirus/

35. exp Coronavirus Infections/
36. ((corona* or corono*) adj1 (virus* or viral* or virinae*)).ti,ab,kw.
37. (coronavirus* or coronovirus* or coronavirinae* or CoV or HCoV*).ti,ab,kw.
38. covid*.nm.
39. (2019-nCoV or 2019nCoV or nCoV2019 or nCoV-2019 or COVID-19 or COVID19 or CORVID-19 or CORVID19 or WN-CoV or WNCoV or HCoV-19 or HCoV19 or 2019 novel* or Ncov or n-cov or SARS-CoV-2 or SARSCoV-2 or SARSCoV2 or SARS-CoV2 or SARSCov19 or SARS-Cov19 or SARSCov-19 or SARS-Cov-19 or Ncovor or Ncorona* or Ncorono* or NcovWuhan* or NcovHubei* or NcovChina* or NcovChinese* or SARS2 or SARS-2 or SARScoronavirus2 or SARS-coronavirus-2 or SARScoronavirus 2 or SARS coronavirus2 or SARScoronovirus2 or SARS-coronovirus-2 or SARScoronovirus 2 or SARS coronovirus2).ti,ab,kw.
40. (respiratory* adj2 (symptom* or disease* or illness* or condition*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw.
41. ((seafood market* or food market* or pneumonia*) adj10 (Wuhan* or Hubei* or China* or Chinese* or Huanan*)).ti,ab,kw.
42. ((outbreak* or wildlife* or pandemic* or epidemic*) adj1 (Wuhan* or Hubei or China* or Chinese* or Huanan*)).ti,ab,kw.
43. or/34-42
44. 33 and 43
45. limit 44 to yr="2020"

# Screening

Screening on title and abstract will be undertaken in duplicate by 2 reviewers for at least 10% of the eligible studies, with full screening conducted by one reviewer. Disagreement will be resolved by discussion.

Screening on full text will be undertaken by one reviewer and excluded articles will be checked by a second.

# Data extraction

Summary information for each study will be extracted and reported in tabular form. This will be undertaken by one reviewer and checked by a second.

# Risk of bias assessment

Due to the rapid nature of the work, validated tools will not be used for primary studies; however, papers will be evaluated based on study design and main source of bias (mainly population, selection, exposure and outcome).

# Synthesis

A narrative synthesis will be provided.
Variations across populations and subgroups, for example cultural variations or differences between ethnic, social or vulnerable groups will be considered, where evidence is available.

# About Public Health England

Public Health England exists to protect and improve the nation's health and wellbeing, and reduce health inequalities. We do this through world-leading science, knowledge and intelligence, advocacy, partnerships and the delivery of specialist public health services. We are an executive agency of the Department of Health and Social Care, and a distinct delivery organisation with operational autonomy. We provide government, local government, the NHS, Parliament, industry and the public with evidence-based professional, scientific and delivery expertise and support.

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