COVID-19: prevention and future initiative within nursing homes

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ABSTRACT
The high COVID-19 mortality rate in nursing homes in the United States and internationally prompted a comprehensive mini literature review concerning the prevalence, preventative protocol, and proactive initiatives against the highly infectious COVID-19. PubMed articles published between January and June 2020 and data sourced from government ministries of health concerning COVID-19 in nursing homes were used for this review. The prevalence and mortality rate in seven countries were compared. The underlying theme of the articles reviewed addressed four focus areas for the prevention of infectious disease spread: diagnostics, protection of residents in nursing facilities, administration and staff protection, and legislative advocacy. Adaptations and solutions may reduce the current transmission of COVID-19 within nursing homes, as well as in the future.

Introduction
An unexpected demographic group that has been significantly impacted by the coronavirus disease 2019 (COVID-19) pandemic are the elderly in nursing homes and long-term facilities. The rapid spread within a long-term skilled facility was highlighted by the first report published on 28th February 2020 in King County, Washington [1]. For the most part, COVID-19 cases in nursing homes are related to the facility location and size, not quality metrics [2]. The illness caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) affects the elderly far more severely due to the multiple comorbidities, cognitive and behavioural issues, and living situations [3]. The focus of this literature review is to highlight the prevalence and mortality rate of COVID-19 within nursing facilities, and in turn, review which preventative measures could lower the transmission of an infectious outbreak in the future.
Material and Methods

Prevalence and mortality rates within nursing homes were collected from countries' government health ministry COVID-19 data pages. The selected countries had data on COVID-19 cases within nursing facilities.

A literature review was performed using the PubMed database, focusing on preventative measures against COVID-19 within nursing homes. The search criteria were limited to articles and data published between January 2020 to June 2020 using the following keyword(s): nursing home(s), long-term living facility, elderly, older individual(s), COVID-19, SARS-CoV-2, prevalence, mortality rate. An article was excluded if it had no substantial protocol for infection prevention or failed to address the nursing facility population. Articles were selected for review if they identified an issue regarding infection spread or proposed a protocol to preserve the health of residents and the workforce.

Results

Table 1 summarises data collected from seven countries: Belgium, Spain, Germany, Singapore, Australia, Canada, and the United States. The data comprised of the number of cases and deaths in affected long-term care facilities (LTCF) and showed that the population within care facilities in these countries had been significantly affected by COVID-19, with deaths among residents.

| Country       | Report date | Affected facilities                                                                 | Total number of COVID-19 cases | Confirmed COVID-19 cases in LTCF | COVID-19 related deaths in LTCF | Total number of COVID-19 deaths | % of LTCF deaths |
|---------------|-------------|------------------------------------------------------------------------------------|--------------------------------|---------------------------------|---------------------------------|--------------------------------|-----------------|
| Belgium [4]   | 15th June 2020 | Residential care centres                                                          | 60,100                         | N/A                             | 4,472                           | 9,661                           | 46%             |
| Spain [5]     | 15th June 2020 | Residential care centres                                                          | 246,272                        | N/A                             | 19,549                          | 28,323                          | 69%             |
| Germany [6]   | 15th June 2020 | Facilities for the care of older, dabbled, or other persons in need of care, homeless shelters, community facilities for asylum | 186,461                        | 17,300                          | 3,439                           | 8,791                           | 39%             |
| Singapore [7] | 3rd May 2020  | LTCF run by governments, non-profit organisations, and the private sector      | 18,205                         | N/A                             | 2                               | 18                             | 11%             |
| Australia [8] | 21st June 2020 | Australian government subsidised residential aged care facilities               | 7,461                          | 71                              | 29                              | 102                            | 28%             |
| Canada [9]    | 22nd April 2020 | Long-term care or other residential care settings (including retirement homes and assisted living facilities) | 40,179                        | 6,519                           | 1,240                           | 1,974                           | 62%             |
| United States [10] | 14th May 2020 | Medicare skilled nursing facility/Medicaid nursing facility | 1,480,873                     | 107,389                         | 29,497                          | 89,219                          | 33%             |

* official data on COVID-19 related deaths among home care residents is not available for all countries due to discrepancies among testing availability and polices in documenting deaths
| Study | Objective | Method | Preventative Action | Results | Summary |
|-------|-----------|--------|---------------------|---------|---------|
| McMichael et al [1] | Investigation of confirmed cases of COVID-19 in a skilled nursing facility in King County, Washington on 28th February 2020 | Public Health-Seattle and King County, aided by the CDC launched an investigation; contact tracing initiated where COVID-19 positive individuals were interviewed to collect information regarding symptoms, severity, other chronic illnesses, travel history, and close contacts; diagnostic testing; survey to assess clusters of influenza-like illness among residents, staff, transfers, and other facilities in the area; survey assessed issues that may have contributed to infection spread | Diagnostic broad testing and adjusting screening criteria; administration and staffing cluster scheduling, personal protective equipment | 4 cases confirmed at Facility A within King County with 45 residents and staff displaying symptoms on 28th February 2020 | COVID-19 rapidly spreads once introduced into a skilled nursing facility, which has many negative consequences |
| Kimball et al [11] | Investigation of asymptomatic, presymptomatic SARS-CoV-2 cases in long-term care skilled nursing facility | 1st case with a long-term care skilled nursing facility occurred on 28th February 2020; On 13th March, CDC performed system assessments and SARS-CoV-2 testing to assess utilisation of symptoms screen as a clinical assessment of COVID-19; residents categorised as asymptomatic or symptomatic at the time of testing and preceding 14 days | Diagnostic broad testing and adjusting screening criteria | 76 of 82 residents tested positive; among 23 (30%) residents with positive results, 10 (43%) had symptoms and 13 (57%) were asymptomatic | Symptom-based screening misses the identification of all COVID-19 cases, even a person who is asymptomatic or presymptomatic can have a high quantity of viral RNA |
| Dora et al [12] | Investigation of confirmed cases of COVID-19 | During 29th March 29–23rd April, all staff and residents were tested every week by reverse transcription-polymerase chain reaction (RT-PCR) testing of nasopharyngeal specimens | Diagnostics broad testing and contact tracing | 99 residents (19%) and eight of 136 (6%) staff members tested positive; isolation protocol implemented; additional testing on 13th, 22nd & 23rd April showed no new positive cases | Broad testing of residents and staff members of a long-term care skilled nursing facility aided in the rapid identification of hotspots |

Steps against infection spread need to be implemented quickly

Broad testing, staff management, PPE supply should be practised

Survey identified that vulnerability of facilities, staff who worked while symptomatic, staff working in multiple facilities, issues with PPE, and delayed recognition of cases

Symptom-based screening misses the identification of all COVID-19 cases, even a person who is asymptomatic or presymptomatic can have a high quantity of viral RNA

Isolation and grouping of these residents lead to a reduction in transmission within the facility

Serial testing of residents performed until all were negative
### Table 2. Continued

| Study | Objective | Method | Preventative Action | Results | Summary |
|-------|-----------|--------|---------------------|---------|---------|
| Banakota et al [13] | Show benefits of using mobile technology such as application to better quality of life during isolation of older adults | Apps review categorised as: social networking, medical, health and fitness, food and drinks, and visual and hearing | Protection of residents within the nursing facility through the use of electrical devices | Top apps social networking: Facetime and Skype medical: teledicine (Teladoc, K Health Primary Care, Doctor on Demand), prescription management (GoodRx, Medisafe medication management) health and fitness: calm, headspace, MyFitnessPal, and Yoga: down dog food and drinks: Doordash and Instacart visual and hearing: Be my eyes- helping blind and Glide-live video messenger | Many apps available on many mobile device platforms can help older adults handle isolation by staying connected with others and maintain autonomy |
| Tan et al [14] | In Singapore, deaths of LTCF residents due to COVID-19 accounted for 14% of total fatalities as of 14th April 2020 | Following preventative strategies implemented rapidly across all LTCF: early management of LTCF residents with respiratory symptoms, transfer protocols between hospital and LTCF, increased temperature screening, restriction of visitors, social distancing, and segregation of staff and residents | Administration and staffing cluster scheduling, personal protective equipment | After a month, COVID-19 found in 6 nursing homes in Singapore; an increase in LTCF correlated with exponential community transmission meaning staff were at risk of catching the virus and spreading it to the residents | Staff management is very important in preventing the spread of infection |
| Quigley et al [15] | Preparedness of Nursing Homes across the nation | Emailed a 30-item survey to NH drawn from national surveys conducted in 2013 and 2015 (N=942); first email sent on 30th March 2020 and reminder on 5th April 2020 | Administration and staff personal protective equipment and legislative allocation of funds | Fifty-six NH responded nationwide, representing 29 states within the United States Guidance and Preparedness: NH used 2–5 guidance documents by CDC, WHO, local government Greatest COVID-19 preparedness concern: lack of supplies (43%), especially PPE, staff shortages (34%), and resident health and safety (14%) Financial effects: most indicated increased costs for supplies (58%) and employee hours (38%), or fewer admissions (27%) | Results indicate further need for NHS to continue preparedness, with a particular focus on the lack of supplies, especially PPE |
accounting for 11–69% of all COVID-19 related deaths (Table 1). Of the seven countries, Spain had the highest percentage of LTCF deaths, with the percentage of deaths in LTCF in Belgium, Germany, Australia, and the United States between 28–45%, highlighting the vulnerability of LTCF communities. Examples of effective preventative measures can be drawn from Singapore, where the percentage of deaths in LTCF was 11%.

Sixty-two articles matched keywords, but only six articles are summarised in Table 2, and Figure 1 quantitatively addresses COVID-19 issues within nursing homes and provides preventative guidelines.

Discussion
The purpose of this literature review was to comprehensively address the high number of cases and deaths within nursing homes, the issue of infection prevention, and future mitigation of infectious spread. The underlying theme of the articles addressed four areas: diagnostics, protection of residents in nursing facilities, administration and staff protection, and legislative advocacy.

Diagnostics
The initial screening for COVID-19 is usually based on clinical presentation, with the most common symptoms being fever, cough, and shortness of breath [11]. Many elderly individuals present with atypical symptoms of satiety or altered mental status that can be confused as a symptom of age or a chronic illness [16]. Adjusting the screening criteria for COVID-19 to include these atypical symptoms needs to be implemented for the timely identification of cases. Furthermore, asymptomatic individuals can also have a high viral load [11]. Broad facility testing and serial testing of residents and staff should be implemented to identify clusters of infection [12], as the early identification of hotspots and initiation of infection protocols can significantly reduce the transmission within facilities [12]. Furthermore, an investigation of positive individuals can help identify weaknesses in the prevention protocol.

Protection of residents in nursing facilities
COVID-19 can rapidly spread among residents and staff once introduced into a skilled nursing facility, which may have many negative consequences. Hence, many facilities implemented social distancing to slow down the communicable spread of COVID-19, with residents isolated from each other, restricted family visitation, and limited interaction with staff [12]. Though isolation reduces the spread of infection, it has some negative ramifications. The loss of communication with others, especially loved ones, lack of information, and loss of autonomy can psychologically impact a resident in a nursing home leading to depression [13]. However, the use of devices can help address this issue, as various apps that focus on social networking, telemedicine, prescription management, health and fitness, and food and drink can be utilised to improve the residents’ quality of life [13]. Many residents of nursing homes are considered vulnerable COVID-19 due to their underlying health conditions, so telemedicine can be used to provide continuity of care by limiting the cross interaction with health care providers that may have been exposed to COVID-19 [16].

Administration and Staff Protection
Staff management is essential in preventing the spread of infection, as there is the potential for staff to acquire the virus through community transmission, then spread it to the facility residents [14]. To minimise cross interaction between residents and their multidisciplinary care team, cluster care scheduling of staff should be implemented whereby the staff are assigned to specific patients for the duration of their shift [17]. To protect the staff members who are putting themselves at risk, an adequate supply of personal protective equipment and additional resources need to be accessible. In addition, if the supply chain is limited, staff need to be educated on how to reuse resources throughout their shift in a safe manner [15].

Legislative advocacy
Unfortunately, often the elderly demographic is forgotten during a health crisis, therefore, emphasis needs to be placed on public health planning by collaborating with geriatric health experts, nursing home leadership, and government [18]. Reform and policies focusing on funding allocation need to be made so that resources, like personal protective gear, testing supplies, wages for increased staff, and smart device purchases, can be used within a nursing home to minimise the negative outcomes of an infectious outbreak.
If implemented, the above solutions can reduce the transmission of COVID-19 and help prepare facilities for future outbreaks.

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