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Impact assessment of COVID-19 non-pharmaceutical interventions in long term care facilities in Cyprus: Safety improvement strategy

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ABSTRACT

The current COVID-19 crisis has changed our everyday lives almost in every aspect. Many people worldwide have died or hospitalised due to the severe impact of COVID-19 on the vulnerable population, and in particular to the elderly residents of long term care facilities (LTCF). The problem is amplified due to the fact that many of those occupants also suffer from comorbidities (e.g. respiratory and cardiovascular diseases, hypertension, etc.) and are therefore regarded as a susceptible host to severe COVID-19 disease. Impacts can be felt in the wider societal safety level.

The aim of the present study is, therefore, to present the first National multimodal quality and safety improvement strategy plan for the LTCF in the Republic of Cyprus. The current program focused on the intensification of COVID-19 epidemiological surveillance, the promotion of educational training on best practices in infection control and prevention, and the implementation of additional non-pharmaceutical interventions (NPIs), according to the recommendations of ECDC (European Centre for Disease Prevention and Control) and WHO (World Health Organization). This innovative program fostered the interconnectivity and collaboration among the local authorities, academia and the local leaders of the LTCF. In addition, this program reinforced the importance of volunteerism and active participation of medical students in the National initiatives against the COVID-19 pandemic. The effectiveness of the adopted multimodal advanced care-safety planning program is appraised based on the reported new confirmed COVID-19 cases among LTCF healthcare workers and occupants, after the introducing and implementation of the selected NPIs. This multimodal strategy plan seems to be capable of reducing significantly the number of new cases of COVID-19 infections in LTCF and as a result, to also affect the residents’ death number.

1. Introduction

In December 2019, the first confirmed case of COVID-19 in human was reported by Chinese authorities in Wuhan, China, and since then the virus has spread rapidly over the entire world, with tremendous impact on our daily lives and habits (Bruinen de Bruin et al., 2020), as well as the way we interact among each others (Huynh, 2020). Moreover, the unique COVID-19 pandemic outburst has also indicated the high
importance of preparedness and response for coping with the outbreak crisis, and the perpetual struggle of healthcare personnel, working day and night to provide care for patients with COVID-19, while new confirmed cases and deaths are continuously reported worldwide (Dong et al., 2020).

Many of these reported deaths are among elderly people, a high percentage of which occupants in long term care facilities (LTCF) (Gardner et al., 2020; McMichael et al., 2020) and also suffered from serious respiratory illnesses (e.g. asthma, Chronic Obstructive Pulmonary Disease (COPD) and emphysema) (Cohen and Tavares, 2020). It is important to note that in the EU/EEA and UK there are approximately 3.5 million occupants in 62,000 LTCF, who represent ~ 0.7% of the total population (ECDC, 2020). According to data collected from 21 countries in the report of Comas-Herrera et al. (2020), the share of deaths for occupants in LTCF was estimated to be 46% of the total COVID-19 deaths, while the percentage of occupants who have died due to COVID-19 in different countries as percentage of all occupants ranges from 0.01% (Korea) to over 4% (Ireland, Belgium, Spain, UK and USA). By February 3, 2021, in the USA the reported number for the COVID-19 cases and deaths, among the staff and occupants in LTCF, was 1,238,599 (5% of the total state COVID-19 cases) and 146,888 (37% of total deaths), respectively (KFF, 2021). Furthermore, it is estimated that the frontline healthcare personnel are exposed to 3.4-times higher risk of coronavirus infection compared to the people in general population, while the percentage of reported cases of COVID-19 in healthcare personnel are up to 10% in China and 11.4% in Ireland of all cases, respectively (ECDC, 2021).

The size of “outbreaks” and the large number of deaths due to COVID-19 in LTCF can be attributed to many factors such as the asymptomatic healthcare and working personnel (Hoxha et al., 2021), the number of residents in congested rooms (e.g. 2–4 beds) and sharing bathroom (Brown et al., 2021), insufficient training of staff to conduct effective infection control and monitoring practices for COVID-19 cases (ECDC, 2020), and deficiency of infection control precautions (e.g. hand hygiene, face masks, effective staff cohorting, etc.), among others.

To address those issues, many countries recognized the urgent need for introducing several public health measures and policies (Chen et al., 2020; Fan et al., 2021), namely non-pharmaceutical interventions (NPIs), in order to reduce the severe impact of COVID-19 on the occupants of LTCF (Rios et al., 2020) and the healthcare staff. NPIs for mitigating the risk of coronavirus transmission in LTCF include: a) the adoption of practical guidelines, procedures and ensuring continuous communication (Dosa et al., 2020) for tackling with COVID-19 infected occupants (e.g. patient’s isolation, training, implementation of infection prevention and control (IPC) practices, awareness of prevalent symptoms of COVID-19); b) mitigation strategies for reducing the cross-infection risk in confined spaces (e.g. physical distancing, wearing facial masks, adequate ventilation and hand hygiene); c) utilising polices for diagnostic testing and screening of residents and healthcare personnel, d) limiting the risk of virus transmission in the LTCF through restricting visitors’ access. However, it is important to mention that many of the adopted measures for the protection of elderly occupants in LTCF led to social isolation, depression and loneliness posing additional health risks (Simard and Volicer, 2020; Verbeek et al., 2020; Wu, 2020).

Dolveck et al. (2021) presented results of the activation of a task force using an urgent intervention for the limitation of COVID-19 infections in eight French nursing facilities. The adopted intervention was based on four type of actions: a) daily update of deaths; b) inspection for suspicious COVID-19 cases and assessment of the provided nursing facility care; c) emergency team actions for the implementation of nursing and medical policies; d) visits of a geriatric team. Their results showed that the mortality among elderly residents is not only due to COVID-19 but is also associated with the “confined disease”, while the task force’s intervention decreased significantly the number of deaths (83/770; 11% vs 35/687; 5%, p = 0.0001) and new COVID-19 cases for staff and residents (348/770; 45% vs 123/422; 29%, p < 0.001). Recently, more studies are conducted to investigate the COVID-19 outbreaks in LTCF, with the aim of detecting early SARS-CoV-2 infections (Graham et al., 2020; Roxby et al., 2020), preventing the spread of virus (Feaster and Goh, 2020; McMichael et al., 2020; Patel et al., 2020; Rios et al., 2020), avoiding crowding (Brown et al., 2021), appraising the presence of comorbidities (Gmelin and Munoz-Price, 2020), appraising healthcare deficiencies and containment intervention (Arons et al., 2020; Blackman et al., 2020; Blain et al., 2020; Escobar et al., 2021).

Undoubtedly, the current COVID-19 pandemic has revealed and highlighted several gaps and deficiencies, while little attention has been given to NPIs concerning outbreaks in LTCFs (Rainwater-Lovett et al., 2014; Simard and Volicer, 2020). Therefore, it is essential to understand the transmission mechanisms and protect occupants and healthcare personnel (Greene and Gibson, 2021). In this study, the adopted term “LTCF” includes institutions for elderly people with disabilities, chronic illness, nursing homes, assisted-living facilities and rehabilitation centers.

The purpose of the present effort is to exhibit the implementation of the first national multimodal safety and quality improvement strategy against COVID-19 pandemic implemented in all LTCFs in the Republic of Cyprus, as well as to present the effectiveness of the program in reducing the number of new confirmed COVID-19 cases and deaths among the residents and healthcare personnel. Gaps and limitations are identified and presented, while a number of recommendations gained from the experience of the national program is outlined.

2. Materials and methods

The present National initiative started on mid-November 2020 as a collaborative effort of the Ministry of Health Cyprus, the Medical School of the European University of Cyprus, the Innovation Center CERIDES – Excellence in Innovation and Technology, and the Office of Volunteers Actions with the common aim to apply an innovative safety and quality multimodal strategy against COVID-19 in LTCF. The strategy comprised of 5 components implemented in an integrated way with the common aim of improving the COVID-19 notification/infection rates and decreasing indirectly the attributable COVID-19 deaths inside the LTCFs. The program was additionally supported by the Medical students of the EUC as volunteers and liaisons.

Based on the WHO (https://www.who.int/infection-prevention/publications/core-components/en/) infection control and prevention multimodal strategies the pillars were the following:

1. Continuous Monitoring: epidemiological COVID-19 surveillance: The program included regular (weekly) testing to all working staff and bi-weekly testing of residents of the LTCFs in Cyprus with rapid antigen testing that was performed by 23 mobile testing units across the country. Weekly timeline and dates were provided to the local Heads of the LTCF. Upon identification of a confirmed COVID-19 case all staff members and residents were retested with rapid antigen testing in day 3 and 7 and 14.

2. Harmonisation of standardized operating procedures (SOP) for LTCF: The program included revision of the existing national emergency preparedness protocol against COVID-19 for LTCF, with emphasis on developing an emergency plan and promotion of best practices in infection control and prevention, based on the report of ECDC (ECDC, 2020). A standardized checklist based on the revised guidelines was also completed (see Appendix) in order to observe, assess and audit the compliance rates of the LTCF in a standardized manner.

3. Promotion of volunteerism and active participation: The program included the volunteer recruitment of more than 30 EUC medical students in Cyprus to perform weekly “on site” anonymously observership (compliance rates to the local guidelines based on the existing checklist) and simultaneously education to best practices to the LTCFs staff (emphasis on donning and doffing, use of masks, use of social bubbles, avoid crowding indoors etc.) during their visits.
The students received remotely educational courses and were tested weekly with antigen rapid testing before entering the LTCF. Weekly timelines and schedule (visits in pairs under the guidance of a senior inspector) was provided to the students’ liaison by the Ministry of Health. The results of the observation were assessed in order to target and adopt the following educational seminars and communication with the Head of the LTCF.

Preliminary-pilot volunteer study: Period mid-November to 1st of December 2020: The volunteer weekly initiative with anonymous observership (risk assessment) of the nursing homes in the geographic area of Nicosia (Nr. 30, pilot study). This effort was based on a standardized checklist to track the compliance rates to the basic practices and protective measures according to ECDC and to the local protocol for nursing homes of the Ministry of Health.

4. Continuous education, communication, feedback to the Heads of the LTCF: The program included weekly remotely educational seminars (four in total) on NPIs and emergency planning to the local heads of the LTCFs. During the meetings Questions & Answers session followed to discuss together the current COVID-19 issues and to enhance communication and engagement of the heads in the LTCF.

In addition, during the week, the Heads of the LTCF had continuous communication via emails and personal communication either with the local authorities or with the designated EUC academic members.

The seminars focused on promoting to the head’s awareness on the COVID-19 situation, better preparedness planning/management taking into account the particularities of each LTCF, and continuous feedback with weekly reports on the epidemiological situation in the LTCF in Cyprus.

5. Intensification of audits to the LTCF: The program included weekly schedule of audits based on the checklist of the designated Inspectors to monitor LTCF’s infrastructures, practices, processes, outcomes and providing data feedback as weekly report to the Ministry of Health.

6. Task force activation on confirmed case identification and cluster events: A task force of doctors was deployed in the identification of clusters in LTCF. On site visits helped implement appropriate public health measures and identify people in need of hospitalization. All LTCF had access to a Ministry of Health appointed coordinator who would remotely direct all needed actions and solve any inquiries. Furthermore, Personal Protective Equipment (PPE) was centrally provided freely if needed to ensure that public health measures were upheld.

2.1. Checklists

The aim of the checklist is to address the current situation regarding the management of COVID-19 pandemic in LTCF. Originally, there are two version of checklists. The first one is for the health and safety inspectors and the second one is for the volunteers who participated in audits. The version presented in Appendix is a merged version which has been used for the purpose of this study.

The checklist is divided into nine sections as can be seen in Appendix. The first and second sections are dealing with the overall health and safety management along with the applied health protocols. The third section is specifically about the cleaning and disinfection procedures. The next two sections (4th and 5th) are focused on the nursing homes’ occupants and employees. The proper use of suitable Personal Protective Equipment (PPE) is also important to be addressed. The last four sections (6th, 7th, 8th and 9th) are monitoring whether the right procedures are taken when dealing with confirmed or suspicious COVID-19 cases.

2.2. Data collection and statistical analysis

The data regarding the demographics of the LTCF in the Republic of Cyprus are collected by the Health Monitoring Unit, Ministry of Health, Nicosia, Cyprus, from a total number of 165 LTCF including residents and working personnel (summarized in Table 1). The weekly rapid antigen testing data of the LTCF (personnel and residents) were collected by the Unit for Surveillance and Control of Communicable Diseases, Ministry of Health, Nicosia, Cyprus. The epidemiological data were then weekly shared and analysed as final weekly National Reports by Health Monitoring Unit in collaboration with the European University of Cyprus, respectively.

All statistics were calculated and presented for three populations of LTCF, i.e. Residents, Personnel and Total (Residents and Personnel). In addition, statistics were calculated and presented separately for each District of the Republic of Cyprus i.e. Nicosia, Limassol, Larnaca, Paphos and Famagusta, as well as in the whole of Cyprus.

Descriptive statistics were calculated for the data, where COVID-19 cases were presented, for each 10-day period, as absolute frequencies of new incidences of COVID-19 cases. Relative frequencies were also calculated and presented as the prevalence of COVID-19 cases, for the population under risk. These were calculated by dividing the new incidences of COVID-19 cases, for each 10-day period, by the population under risk i.e. the population under investigation (Residents, Staff and Total) adjusting them by subtracting all the COVID-19 cases confirmed in previous periods.

The standard error of the prevalence for the population under risk was calculated using the modified Wald method, for computing the confidence interval of a proportion and thus, using the resulting margin of error, the 95% Confidence Intervals for the prevalence for the population under risk were constructed. For inferential statistical analysis, the $\chi^2$-test was performed with the statistical significance level set at $p < 0.05$ adjusting with Yates correction.

3. Results and discussions

3.1. Epidemiological surveillance of the introducing NPIs in the Republic of Cyprus

Overall 5115 people were included in the study (3100 residents and 2015 staff) distributed over 165 LTCF facilities, as shown in Table 1. During the study period, the number of new COVID-19 cases peaked at 138 in the first decade of December (Table 2) reaching 2.83% of population at risk as shown in Table 3. The preliminary study started on mid-November and the actual interventional part of the study with all six pillars was implemented at the beginning of December. Fig. 1 shows the evolution of new COVID-19 total cases in LTCF facilities every ten days throughout November and December as well as individually for residents and staff throughout December.

The comparison of new COVID-19 cases before and after the interventional multimodal program were measured using the $\chi^2$-test adjusting with Yates correction. These comparisons were performed between the first and second decade of December 2020, as the full interventional program took place on 1st December 2020. Thus, the given delay of the decreasing trend for the confirmed cases during the first 5 days of December could be explained by the incubation period of the virus and the tracking of the infected persons before the advent of the program.

The comparison was performed individually for Cyprus LTCF

### Table 1

| Districts (number of LTCF) | Staff | Residents |
|---------------------------|-------|-----------|
| Nicosia (61)              | 1033  | 1567      |
| Limassol (54)             | 522   | 874       |
| Larnaca (21)              | 252   | 410       |
| Paphos (18)               | 125   | 136       |
| Famagusta (11)            | 83    | 113       |
| **Total (165)**           | 2015  | 3100      |
Residents, Cyprus LTCF Staff and Cyprus LTCF Total. The results indicated a statistically significant decrease in COVID-19 cases ($\chi^2 = 19.42$, $p < .001$) between the first and second decade of December 2020 for Cyprus LTCF Total (from 138/4878; 2.83% 95 %CI [2.40% - 3.33%] to 71/4740; 1.5% 95 %CI [1.19% - 1.89%]), as well as a significant decrease ($\chi^2 = 19.29$, $p < .001$) for Cyprus LTCF Residents (from 107/2928; 3.65% 95 %CI [3.03% - 4.40%] to 49/2817; 1.74% 95 %CI [1.31% - 2.30%]) but a non-statistically significant difference ($\chi^2 = 1.41$, $p = .24$) for Cyprus LTCF Staff (from 31/1950; 1.59% 95 %CI [1.11% - 2.26%] to 22/1923; 1.14% 95 %CI [0.75% - 1.74%]) (Table 4).

4. Conclusions and recommendations

This study presented the first National COVID-19 quality and safety improvement strategy plan for the LTCFs in the Republic of Cyprus for the period of 1.5 months (mid-November to end of December 2020). The current program was focused on a multimodal approach to enhance the culture change within the establishment or strengthening of a safety climate and to reduce the risk of COVID-19 infection transmission inside the LTCF.

The standardization of procedures (checklists) promoted a comparable risk assessment among the different LTCF in Cyprus revealing initially qualitative data (monitoring infrastructures, practices and processes). The initial assessment reported significant heterogeneity among LTCF in terms of: the size of the nursing homes (>50 occupants to <10 occupants per estate), the occupants and their underlying diseases, the infrastructure, the compliance rates on personal protection measures/health protocols and the educational level of the staff on COVID-19 related issues.

Based on the initial qualitative assessment the following measures were recommended and adapted nationally: a) limiting the use of shared common areas at the nursing home; b) recommendation on the use only of a plain surgical face mask by the staff (especially those who have close and continuous contact with the occupants); c) also, for the tenants who do not fall under the exceptions to wear mask, were able we recommended the use of a mask especially in commonly shared areas; d) intensification of educational courses for the staff personnel to promote awareness, preparedness and engagement, outbreak management and best practices e) knowledge sharing through lessons learnt from other LTCF cases and providing feedback to the LTCF leaders.

In addition based on the quantitative assessment we observed a significant reduction of the reported COVID-19 cases during the interventional study period. The comparison was performed individually for LTCF Residents, Staff and for the whole population in the LTCF. During the interventional period, a significant decrease of 47% in COVID-19 cases was observed in the LTCFs (reduction of the prevalence from

| Period                  | Staff | Residents | Total  |
|-------------------------|-------|-----------|--------|
| 1st Decade of November  | 1.06% | 1.38%     | 1.38%  |
| 2nd Decade of November  | 1.40% | 1.77%     | 1.77%  |
| 3rd Decade of November  | 2.24% | 2.70%     | 2.70%  |
| Full November           | 3.03% | 5.68%     | 4.63%  |
| 1st Decade of December  | 1.59% | 3.65%     | 2.83%  |
| 2nd Decade of December  | 2.26% | 4.40%     | 3.33%  |
| 3rd Decade of December  | 1.14% | 1.74%     | 1.50%  |
| 3rd Decade of December  | 1.42% | 1.63%     | 1.54%  |

Fig. 1. Total number of confirmed COVID-19 cases for the period November and December 2020, before (white shaded area) and after (grey shaded area) the introduction of the interventional multimodal program. The green solid line represents the total number of COVID-19 cases, the light blue short dash line represents the number of caretakers infected by COVID-19 and the grey long dash line the number of infected residents.
2.83% to 1.5%). This decrease was mainly attributed to a statistically significant reduction in the prevalence of COVID-19 resident cases among the facilities (from 3.65% to 1.74%, respectively).

These preliminary results indicate the importance of designing and implementing multimodal quality and safety strategies in the LTCFs that include regular COVID-19 testing and audits, simultaneously with the promotion of education, communication and engagement culture.

CRediT authorship contribution statement

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Health and Safety Measures/Health protocols

1.1 Measures taken to minimise the number of visitors.
1.2 Contact lists of visitors, occupants and employees.
1.3 Local Safety Officer at place.
1.4 Monitoring visitors/employee’s temperature, check for other symptoms, application of hygiene measures, background check (contact with COVID-19 patient, travelling during the last days).
1.5 Daily monitoring of occupants for COVID-19 symptoms.
1.6 Warnings about COVID-19 and proactive measures are announced at the entrance of the building.
1.7 Use of protective mask from employees.
1.8 Use of protective mask from visitors.
1.9 Measures of physical distancing and avoidance of crowding.
1.10 Adequate ventilation.

Management

2.1 Adequate information for personal protective measures and hygiene protocols for visitors, occupants and employees are in place (sanitisers, protective masks, tissues, respiratory etiquette, garbage bags, cleaning materials for surfaces, buckets waste).
2.2 Identify and gather the proper Personal Protective Equipment (protective gloves/masks/shields/googles/uniforms).

(continued on next page)
Health and Safety Measures/Health protocols

2.3 Preparedness and management plan for positive and suspected COVID-19 case(s) inside the facility.

Cleaning & Disinfection

3.1 Disinfection plan of rooms after a visit.

3.2 Cleaning and disinfecting plan of the facility (special attention should be given to frequently touched surfaces and objects).

3.3 Daily cleaning and disinfecting of the confined spaces.

3.4 Proper use of protective mask during cleaning procedures.

3.5 Proper use of protective uniform during cleaning procedures.

3.6 Proper use of protective gloves during cleaning procedures.

3.7 Training of cleaning personnel on the proper method of disinfection, identify and gather the proper PPE.

3.8 Disinfection of common use equipment.

Occupants

4.1 Awareness, information and education of occupants about COVID-19 (symptoms, adopted measures and use of PPE).

4.2 Proper use of protective mask by personnel and occupants during their room visits.

4.3 Proper use of sanitiser by personnel before their entrance at the room.

Personnel

5.1 Daily monitoring personnel for COVID-19 symptoms.

5.2 In case of COVID-19 symptoms, workers are not allowed to enter the building.

5.3 Employees are trained to inform the visitors about the H&S measures.

5.4 Employees are responsible for specific occupants (social bubbles).

5.5 Use of protective mask during work and during contact with visitors and occupants.

5.6 Applying the proper method of cleaning hands (20 s, use of soap and sanitiser).

COVID-19 screening for employees and occupants

6.1 COVID-19 screening for occupants (at the entrance).

6.2 COVID-19 screening for new employees 72 h before their arrival.

6.3 Regularly COVID-19 screening every 7 days for employees and occupants.

Management of suspected COVID-19 case

7.1 Daily COVID-19 screening for occupants.

7.2 Proper management of confirmed COVID-19 case.

Management of confirmed COVID-19 case

8.1 Clinical assessment of the cases from healthcare providers.

8.2 Prompt isolation and treatment of the cases.

8.3 Prompt isolation of positive occupant cases and close contacts at home according to the local national protocols and policies.

PPE of COVID-19 suspicious cases and COVID-19 confirmed cases

9.1 Proper use and removal of PPE (donning and doffing).

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