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Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-060276
Article Type:	Original research
Date Submitted by the Author:	20-Dec-2021
Complete List of Authors:	Dujmovic, Morgane; Epicentre, Roederer, Thomas; Epicentre Frison, Severine; Epicentre Melki, Carla; Médecins Sans Frontières Lauvin, Thomas; Médecins Sans Frontières Grellety, Emmanuel; Epicentre
Keywords:	COVID-19, Public health < INFECTIOUS DISEASES, Epidemiology < TROPICAL MEDICINE, GERIATRIC MEDICINE

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COVID-19 in French Nursing Homes during the Second Pandemic Wave: A Mixed-Methods Cross-Sectional Study

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Abstract : 288/300
Text : 4110/4500

ABSTRACT

Introduction

French nursing homes were deeply affected by the first wave of the COVID-19 pandemic, with 38% of all residents infected and 5% dying. Yet, little was done to prepare these facilities for the second pandemic wave, and subsequent outbreak response strategies largely duplicated what had been done in the spring of 2020, regardless of the unique needs of the care home environment.

Methods

A cross-sectional, mixed-methods study using retrospective, quantitative data from residents of 14 nursing homes between November 2020 and mid-January 2021. Four facilities were purposively selected as qualitative study sites for additional in-person, in-depth interviews in January and February 2021.

Results

The average attack rate in the 14 participating nursing facilities was 39% among staff and 61% among residents. One-fifth (20) of infected residents ultimately died from COVID-19 and its complications. Failure-to-Thrive-Syndrome (FTTS) was diagnosed in 23% of COVID-positive residents. Those at highest risk of death were men (HR=1.78; IC95: 1.18 – 2.70; p=0.006) with FTTS (HR=4.04; IC95: 1.93 – 8.48; p<0.001) in facilities with delayed implementation of universal FFP2 masking policies (HR=1.05; IC95: 1.02 – 1.07; p<0.001). The lowest mortality was found in residents of facilities with a partial (HR=0.30; IC95: 0.18 – 0.51; p<0.001) or full-time physician on staff (HR=0.20; IC95: 0.08 – 0.53; p=0.001). Significant themes emerging from qualitative analysis centered on (i) the structural, chronic neglect of nursing homes, (ii) the negative effects of the top-down, bureaucratic nature of COVID-19 crisis response, and (iii) the counterproductive effects of lockdowns on both residents and staff.

Conclusion

Despite high resident mortality during the first pandemic wave, French nursing homes were ill-prepared for the second, with risk factors (especially staffing, lack of medical support, isolation/quarantine policy etc) that affected case fatality and residents' and caregivers' overall well-being and mental health.

ARTICLE SUMMARY - Strengths and limitations of this study'

What are the strengths of this study?

- Our study is one of the first mixed-methods investigation of nursing homes during the COVID-19 pandemic in Europe, reporting face-to-face interviews of residents themselves, in contrast to most other qualitative investigations of the geriatric population during the COVID period, which have usually been conducted remotely or via surrogates (caregiving staff or family members).
- Our study is also of the first in the world to describe the second wave of the pandemic in this setting, both quantitatively and qualitatively.
- We report in-depth quantitative data analysis of 585 COVID-19 cases from 14 nursing homes while 47 qualitative interviews were conducted in-person; from December 2020 to February 2021.

What are the limitations?

- Study site selection was not random, thus, comparing the included facilities to others in Provence and Occitania (or France) should be made with care.
- Moreover, only residents who were fully capable of interacting with investigators and were able to give informed consent could be interviewed, thus excluding anyone with major cognitive disorders (a relatively frequent condition in nursing homes).

INTRODUCTION

In France, state-funded nursing and care homes are the most common living arrangement for both independent seniors and those who need daily care and support. These institutions were deeply affected by the first wave of the COVID-19 pandemic, with an estimated 38% of all residents (247,000 cases) infected with SARS-CoV-2 and 5% (30,395) succumbing to the disease from March-July 2020. The workforce that staffs these facilities was also seriously affected, with an estimated 22% of all workers (90,000 cases) testing COVID-19 positive from late February to late May 2020 [1,2].

In October of 2020, when rising caseloads suggested a second pandemic wave, nursing homes again braced for the worst, since no vaccine was yet approved in France (this occurred in December 2020) and some variants had begun circulating. In November of that year, the non-governmental organization (NGO) Médecins Sans Frontières (MSF) began partnering with select nursing homes in Provence and Occitania provinces, in southern France, to bolster their COVID-19 prevention and care procedures in the midst of rapidly growing medical needs, strained facilities, and understaffing (often aggravated by absenteeism spurred by workplace-acquired infections). As nursing homes transformed into places providing hospital-level care, staff were required to perform more advanced technical procedures and increased disease surveillance at a moment when human resources were depleted due to illness and overwork. Concurrently, health authorities recommended strong lockdown measures for elderly care home residents, including bans on going outside, prohibiting family visits, and confining residents to their rooms.

Despite the devastating mortality rates seen in care homes around the world throughout the pandemic, scientific literature has not yet described the second wave of COVID-19 in this environment. Published research is mostly focused on the first pandemic wave period, almost exclusively quantitative studies or systematic reviews on specific topics. Several articles report best practices for infection prevention and control (IPC) (i.e. frequent testing for staff, residents, and visitors, staff cohorting, and strict isolation policies), or recommended better evaluation of the consequences of lockdown restrictions [3-13,14, 15]. Other lessons from the initial crisis period were that more staff [6,8], support [8,9], protective equipment, and overall preparation [8-10] could prevent or reduce outbreaks. Lately, articles focused only on the impact of vaccination on transmission among staff and residents [16,17]. The little qualitative research conducted during the first wave was rarely able to conduct in-

person interviews [12, 18-24], but found that lockdowns had a significant and deleterious impact on residents, staff well-being, and staff turnover [20,21].

Our research attempts to understand the risk factors that influenced the second pandemic wave, the impact of that wave, and how staff and residents experienced this period of the pandemic in a nursing home setting.

METHODS

In this mixed-methods, cross-sectional study, we analyze retrospective COVID-19 data from 14 nursing homes being reinforced by support from MSF to assess the impact of the second pandemic wave as well as the effects of prevention measures on resident mortality and comorbidity. These results are given depth and detail through a qualitative investigation into staff and resident experiences.

Definitions

Autonomy Evaluation Score (AES) measures a care home resident's level of autonomy. An AES of 1 reflects the lowest level of autonomy (i.e. confinement to a bed or armchair, serious mental function impairment, continuous caregiving required), while an AES of 6 refers to people who have fully retained their autonomy in their daily lives. *The Average Weighted Autonomy Score (AWAS)* is the overall AES score for a facility. This score is a proxy for the financial and human resources that a nursing home needs and has access to: the higher the AWAS, the more resources needed (staff-to-residents ratio, equipment, etc.) and the more dependent the residents. *Failure to Thrive Syndrome (FTTS)* is specific to elderly individuals and characterized by a rapid deterioration after a physical or psychological event (Supplementary material, Appendix 1).

Study Design and Population

This cross-sectional, mixed-methods study used retrospective, quantitative data from residents living in 14 nursing homes between November 2020 to mid-January 2021. Four nursing facilities were purposively selected as qualitative study sites for additional in-person, in-depth interviews conducted between January and February 2021. Qualitative study sites were selected based on whether they had passed their epidemic peak, had high attack and fatality rates, were public or private facilities, and their geographic location.

Data Collection

Facilities' administrative data (number of beds and staff, staff-to-resident ratios, etc), COVID-related data (confirmed cases among residents and staff, episode duration, deaths, etc) and individual, anonymized patient data (demographics, comorbidities, etc) were used for quantitative analysis.

Qualitative data was gathered using semi-structured, in-depth interviews (IDIs) during one-week ethnographic immersions in each of the four qualitative study sites. The lead investigator targeted four groups of actors, including facility administrators (directors, coordinating physicians, and nurses), clinical and facilities staff (nurses, caregivers, educators, physical therapists, maintenance crews), the residents themselves, and the residents' visiting family members. Participants were purposively selected to obtain a maximally heterogeneous sample of interview participants and reflect the spectrum of opinions and experiences of everyday life nursing homes. Across the 4 qualitative study sites, a total of 47 IDIs were conducted with facility directors (4), staff members (36), and residents (7). Among the 36 staff members, 29 were caregivers and 7 provided other support functions (human resources, maintenance, cleaning, cooking). All interviewed residents were women, as were the majority of study participants overall (82.9%). Interview length varied from 12-171 minutes (54-minute average). (Supplementary Material, Appendix 2).

Telephone and face-to-face interviews were also conducted with 10 residents' family members, though family interviews are not included here to focus on experiences from within the nursing homes during the lockdown. Nine residents refused to participate (due to fatigue, discomfort with interviewing, or COVID-19 related reasons). Caregiver participation was constrained by understaffing, overwork, fatigue, or disease, which left them with very little time or energy for interviewing.

Vulnerable residents were pre-selected under the advisement of the coordinating nurse on the permanent caregiver teams. Participants had to be able to give informed consent, capably interact, and have no major cognitive disorders. Level of autonomy (AES) did not constitute an a priori criteria for participant selection. Whenever a legal guardian or curator was designated, the latter was contacted prior to the interview to verify that consent could be obtained from the interviewee.

Question guides focused on three primary topics: the outbreak chronology, adaptation to the crisis, and the individual experience of the second pandemic wave (Appendix 3). Individual guides were adapted for those living

in the nursing home (residents) or working there (facility administrators and staff). All interviews were voice recorded and direct observations were written in the investigator's field book. All written data were anonymized upon collection. Participants' personal data was assigned a study number that was set on a correspondence table kept separately from other data. Written informed consent was obtained prior to each interview.

Preventive measures were implemented with all participants to decrease COVID-19 disease transmission risk: systematic FFP2 face mask use, social distancing, hand and space disinfection, and weekly Rt-PCR tests for the two field investigators.

Statistical Analysis

Patient data were explored using univariate analysis to highlight possible mortality risks. Univariate unadjusted Cox Hazard Ratios, Kaplan-Meier estimations, and Log-Rank tests were used for multivariate analysis. A stepwise procedure was followed, retaining factors with a log-rank test value <0.3. COVID-19 mortality was estimated using a multilevel mixed-effects Cox model using selected factors identified in the univariate analysis. Random effects on individual variables were considered and nested at the facility level [25]. Interactions between potentially correlated factors (comorbidities, failure-to-thrive syndrome, autonomy level, time-related variables) were accounted for while robust standard errors were computed (Appendix 4). 95% confidence intervals are presented and a significance threshold of 5% was chosen for p-values. Statistical analyses were conducted with Stata 15® and R Studio 1.4®.

Qualitative Analysis

Data analysis was performed from January to March 2021, similar to the fieldwork period (January-February) and reporting phase (March-April). Qualitative analysis combined grounded theory and hypothetico-deductive analysis. Preliminary observation in five nursing homes and MSF-team reports were used to create an initial checklist for systematic direct observation. In January and February 2021, 36 semi-structured IDIs were conducted in three nursing homes, in combination with "external participatory observation" [26]. Questions were adjusted iteratively after preliminary analysis was conducted on these initial interviews. Data saturation was sought throughout the interview process and discussed within the research team on a weekly basis. In February 2021, 11 semi-structured IDIs were conducted in a fourth nursing home to assess data saturation.

Interview data were processed gradually through professional transcription and verified with the interviewees when necessary. De-identification occurred during transcription (names, places, dates, distinctive personal data, etc). Interview data were written, analyzed, and coded in Excel spreadsheets. A first codebook with 39 data codes emerged from interview transcripts. Five themes were initially analyzed and refined into a final set of 33 across four key categories. Three of these were cross-cutting and had up to three sub-themes (Table 3). Results are reported in accordance with the Standards for Reporting Qualitative Research (SRQR) guidelines [27] and the COnsolidated criteria for REporting Qualitative research (COREQ) checklist.

Patient and Public involvement

Administrators and coordinating physicians from 14 nursing homes were actively involved in collecting and anonymizing study data from their residents/patients. During the exploratory phase of research (December 2020 to January 2021), any feedback from qualitative study site administrators was included in the study protocol. During data collection (January to February 2021), the research methodology was discussed with MSF nurses and facilities staff and adapted to each nursing home's context and caregiver guidance. At the beginning of each IDI, caregivers and residents were encouraged to further participate in the research by contacting the lead investigator with any suggestions. In the reporting phase (from the 1st March to June 2021), internal reporting was sent to interviewees who wanted to be contacted for this purpose. This report was sent to prominent political COVID-19 crisis management actors (such as the French Ministry of Health). A summary letter will be brought to resident study participants and facility staff to inform them of the results and gather their comments on possible follow-up.

Ethics

This study received approval from the MSF Ethical Review Board (ERB) ID 2703 and the Commission Nationale de l'Informatique et des Libertés (CNIL) in France. Patient data and qualitative observations were fully anonymized. All study procedures were in line with the Declaration of Helsinki.

RESULTS

22 nursing homes were originally included in the study, though data was available for only 14 of them (the others did not send data in time for analysis or the data were not electronically recorded). The 14 participating nursing facilities were largely state-supported entities (79%) with an average of 68 residents (median=65; IQR: 58-73).

Results varied considerably from one nursing home to another. COVID-19 outbreak duration averaged 39 days (median=40; IQR: 30-50 days) while Infected residents' individual COVID-19 episodes averaged 24 days (median=30; IQR: 14-51 days). The average attack rate was 39% (median=39%; IQR: 29%-54%) among staff and 61% (median=60%; 50%-73%) among residents. One-fifth (median=20%; IQR: 17%-23%) of the residents who were infected ultimately succumbed to COVID-19 and its complications. The mean Average Weighted Autonomy Score (AWAS) was 770 (median=763 ; IQR: 722-804) and the average staff-to-resident ratio was 0.82 (median=0.86 ; IQR: 0.72-0.90). The average time to universal masking policies being implemented was 9.6 days (median=6.5; IQR: 2-15 days) and the average time until a facility was bolstered with MSF support (staff or resources) was 17.5 days (median=15; IQR: 13-28 days). (Appendix 5).

Patient Risk factors

Retrospective COVID-19 data were obtained for 14 nursing homes, finding 585 COVID-19 cases among 930 residents (61% attack rate) (Table 1). Cases were mostly women (78%) who were >85 years old (68%). Individual Autonomy Scores (IAS) were low (<2) in a majority of cases (60%), indicating a very low level of autonomy overall. One-fifth (21%) of cases were transferred to a hospital, while half (46%) were put on oxygen therapy. One-tenth (12%) of COVID-cases received palliative care, and nearly one-quarter (22%) died. Failure-to-Thrive Syndrome was diagnosed in nearly one-quarter (23%) of COVID-positive residents. At least one other comorbidity was found in over half (61%) of infected residents. AWAS, nursing home size, and staff-to-resident ratios were all strongly correlated, as were time-related variables (time until external MSF support was received, time until universal masking policies were applied, and duration of COVID episode) (Table 1).

Table 1. Univariate Analysis of Nursing Home Resident and Facility Data, Provence and Occitania Provinces, France, 2021

Figure 1. Likelihood of survival by resident and nursing facility characteristic, Univariate (Kaplan-Meier) Analysis, Provence and Occitania Provinces, France, 2021

Univariate analysis using Cox modeling (Table 1) and Kaplan-Meier estimations (Figure 1) suggested that individual characteristics like gender (log-rank p<0.001) and IAS (p=0.008) were associated with COVID-19 mortality, while age and specific comorbidities were not. Survival curves also suggested that facility characteristics like low AWAS (p<0.001), the absence of a permanent physician on-site (<0.001), larger nursing home size (>70 residents) (p=0.036), and a high staff attack rate (p=0.025) were also associated with resident mortality. Predictably, hospitalization (p<0.001), palliative care (p<0.001), and oxygen therapy (p<0.001) were all strongly correlated with the risk of death, as was the presence of FTTS (p<0.001) and the presence of more than 4 co-morbidities (risk increased with the number of co-morbidities present, p=0.045). Additional Kaplan-Meier Curves for non-significant factors can be found in the supplementary information (Appendix 6).

Multilevel Cox Hazard modeling highlighted mortality associated factors adjusted for potential confounders (Figure 2). Those at highest risk of death were men (HR=1.78; IC95: 1.18 - 2.70; p=0.006) with an FTTS diagnosis (HR=4.04; IC95: 1.93 - 8.48; p<0.001) in facilities with delayed implementation of universal masking policies (HR=1.05; IC95: 1.02 - 1.07; p<0.001). The lowest mortality risk was found in residents of facilities with a partial (HR=0.30; IC95: 0.18 - 0.51; p<0.001) or full-time physician on staff (HR=0.20; IC95: 0.08 - 0.53; p=0.001), with individual AES scores >3 (HR=0.38; IC95: 0.16 - 0.89; p=0.026). Noticeably, higher AWAS (a proxy for staff-to-resident ratios and a nursing home's overall means) was associated with a lower risk of death (HR=0.99; IC95: 0.99 - 1.00; p=0.020) (Table 2). Sensitivity analysis can be found in the supplementary information (Appendix 7).

Table 2. Multivariate Cox Hazard adjusted analysis of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021 (Information Criteria: AIC*=1171; BIC=1226)

Figure 2. Final Cox Model: Forest Plot of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021

Qualitative Results

The qualitative approach richly described interviewees' lived experiences during the COVID-19 crisis, revealing difficult-to-quantify social influences on the outbreak's evolution and impact. Three significant themes emerged from our discussions (Table 3).

Structural, Chronic Neglect of Nursing Homes

Staff members described a long-standing lack of physicians in nursing homes, exacerbated by lockdowns and growing medical needs during a period of rising COVID-19 infections. One nurse explained, "the nursing home was almost like a hospital ward at one point…There was more supervision [needed], more care…We didn't have the staff to do all that." All groups of interviewees emphasized that working in precarious and understaffed conditions was a substantial difficulty that became a critical risk during the COVID-19 outbreak and compromised the response. Assistant nurses described extremely challenging working conditions: "When they ask you to help 13 people to bath before noon, you don't work well." This situation was worse during the second pandemic wave when, as one psychologist explained, "no one counted the hours. We had to be there, we put our private lives on hold, but it was important to do it." All directors described a structural lack of a "permanent medical presence" and the need for a "strict staffing ratio."

Top-down Crisis Management

Personnel highlighted the "top-down" approach of French health authorities, including a lack of communication and time-consuming processes for staff and administrators alike, "The ARS [Regional Health Authorities] have been absent during the whole crisis. (…) Since March, I haven't seen the authorities giving us any support, nor any real help, except for claiming statistics back." These officials worked far from the frontline environment of a nursing home and were removed from the suffering of residents and staff. As a result, it was felt that they encouraged ill-informed, unrealistic, and inconsistent crisis-response measures: limiting contact with residents, confining them to their (small) rooms, abruptly relocating them to new rooms (very disturbing for them), or even physically restraining residents in distress. A psychologist described how "some people had to be uprooted from

their rooms“ where they had “spatial-temporal and autobiographical markers”, while others “had to be restrained” by assistant nurses. All of these were deeply disheartening to staff and residents, creating feelings of shame and guilt among caregivers and the potential for cognitive disorders among residents. A resident explained that “it was hard, staying in the room for a whole day, without going out,” and that “anyone would become nuts!” Weak crisis response mechanisms also manifested as poor prevention measures (a lack of universal masking requirements initially, facemask shortages during the first wave), lack of state medical relief staff, and such an extreme lack of preparedness that assistance from a non-state humanitarian actor like MSF was needed. As a director told us, calling MSF, a disaster-response organization “showed what a disaster we were experiencing.”

Counterproductive Effects of Lockdowns

Finally, participants described the counterproductive effects of lockdowns, including negative medical outcomes and even violence. Physiotherapists described “a decline in motor skills, but even more in cognitive skills” and “completely accelerated failure-to-thrive syndrome” which corroborates other descriptions of “bedridden patients, depressive states, failure-to-thrive” because “the residents haven't gone out for a year.” Participants were discouraged that lessons from the first pandemic wave did not translate into better preparedness and smoother, more nuanced, and less restrictive lockdown policies during the second. Despite feeling secure in their nursing home environment during the pandemic period, interviews with residents revealed the depth of their dislike for the extreme physical and social isolation they faced while alone in their rooms, especially when facilities’ social activities, family visits, and outings were suspended or strictly supervised with social distancing measures. Extreme fatigue occurred after a year of lockdown and social restrictions, as one nursing home’s 90-year-old resident explained “if we could go out, we would bear it better.” Since facility administrators were urged to follow the ARS recommendations, only a few directors or staff were willing to soften lockdown measures, allow family visits, or take residents’ end-of-life wishes or needs for social interaction into account.

These interviews show some overlap with the risk factors that were highlighted in the quantitative data (mortality risks linked to understaffing, the absence of a permanent staff physician, low staff-to-resident ratios, lockdowns linked to FTTS). Other qualitative factors associated with better pandemic management also appeared in interviews, such as reliable communication with local health authorities, the presence of an effective national health strategy, and collaboration with other medical sectors.

271 Table 3. Representative quotes for the 3 themes

DISCUSSION

Our study is the first mixed-methods investigation of nursing homes during the COVID-19 pandemic in France, and one of the first in Europe. MSF staff's close, in-person work with these care facilities gave investigators privileged access during a challenging period and lead to particularly rich interviews. This lies in contrast to most other qualitative investigations of the geriatric population during the COVID period, which have usually been conducted remotely or via surrogates (caregiving staff or family members), without being able to interview residents themselves. These results show clearly that the second wave looked largely similar to the first wave in French nursing homes, in both response and impact, and that these facilities were not sufficiently prepared and supported when facing subsequent threats to their vulnerable tenants.

Nursing home data is not routinely collected by French national health information services because residents are considered to "live at home." Thus, considering how difficult it is to access even the most basic data from these facilities (such as number of cases or deaths), we managed to construct a large dataset containing detailed information about COVID-19 cases, which affected 30% of all residents in the 14 participating nursing homes. The study also allowed a thorough examination of COVID-19 as experienced by the staff and residents who most suffered from the pandemic. To the best of our knowledge, French crisis management measures during the second pandemic wave were never informed by qualitative data. In this study, patients' risk factors could be explored in relation to influential social and structural determinants of health, such as understaffing, strict lockdown measures, isolation from other medical actors/lack of medical support, or the top-down and bureaucratic crisis management by health authorities.

Our multivariate analyses confirmed mortality trends seen in other settings. Similar to other studies, we found that men died more often despite being a minority of nursing home residents and that residents' autonomy was a strong factor in their survival, with those who were more reliant on staff for daily support most likely to succumb to their disease [8-10, 28-32]. Living with multiple comorbidities (especially diabetes and dementia) was also strongly predictive of COVID-mortality in our group [8, 10, 28-32]. The negative effects of understaffing (seen as sick leave or AWAS in our data) were similar to those reported in the United States [8], Spain [32], and the United Kingdom [33-34], and constitute a vicious cycle: during periods of high transmission, more staff

needed sick leave. Yet, the medical and staffing needs of residents were simultaneously surging, forcing many sick (and infectious) caregivers back into the workplace. The cycle was compounded by the destructive effects that an enormous workload and an anxiety-producing work environment are known to have on caregivers' wellbeing [12, 18, 20, 21, 36].

The efficacy of universal masking to prevent respiratory disease is well established [37,38], though we were not able to measure the impact of staff/resident masking because mask mandates were often put in place at the same time that extra resources and support from MSF arrived and bolstered the nursing facility overall. Nevertheless, our results do suggest that higher transmission and case fatality were associated with delays in mandatory mask requirements for staff, confirming the utility of these rules in uniquely vulnerable and high-risk nursing home settings. The facemask issue is not easy, however, in a nursing home context. The health benefits of masking have trade-offs with other social needs: care home residents may live with hearing or cognitive disorders, and masking may prevent voice and facial recognition or communication. The absence of others' daily smiles or expressions may have led to cognitive decline, a point that has been shown in previous research and was emphasized in our interviews with caregivers, managers, and residents alike [39, 40].

Finally, the benefit of confining residents to their rooms is strongly questioned by these results. While such measures undeniably reduce virus transmission among residents [6-10, 14-15, 33, 37-38, 41-43]; the consequences for their mental health and nutritional status have also been shown to be considerable [12, 13,20-24, 36, 44-48]. Strict lockdowns in our cohort were associated with higher FTTS incidence, triggered by individuals' difficult living conditions over multiple months (the long duration of the crisis, an anxiety-provoking atmosphere, social isolation, other residents' deaths, etc.). We found a strong statistical association between COVID-19 case fatality and FTTS diagnoses, a result that was triangulated by qualitative interview data and is consistent with other research from France [41], the United Kingdom [42], Finland [46], Spain [48,50], Italy [49], and the United States [47].

Limitations

Our study is limited by the fact that study site selection was not random but was instead steered by discussions with MSF. Moreover, since MSF targeted mostly struggling nursing homes, the study included only a small number that did not have major outbreaks (or contained their outbreaks early). As a result, comparing these

facilities to others in Provence and Occitania (or France) should be made with care. Participant selection was biased by the fact that only residents who were fully capable of interacting with investigators and were able to give informed consent could be interviewed, thus excluding anyone with major cognitive disorders (a relatively frequent condition in nursing homes). Quantitative data were neither exhaustive nor always electronically recorded. Associations between COVID-19 deaths and FTTS were complicated by the co-morbidities that many residents also lived with, though adjusted analysis attempted to control for potential confounding.

CONCLUSION

These results raise questions about French health authorities' approach to managing the second wave of the COVID-19 pandemic, as seen through the lens of those living through the crisis. If institutional management of older ager, loss of autonomy, and end of life is a chronic issue for a long time in France, solutions exist to support nursing homes in times of acute crisis. Future debates about a pandemic response in this setting should take into account things like the social needs of residents, understaffing as a risk factor for higher COVID-related deaths, and should refine general health policies and prevention measures in nursing homes.

Moreover, once an outbreak has occurred, tough questions must be asked: Are restrictive measures for all residents worth the personal and mental health toll? How can facilities improve residents' end-of-life conditions in a controlled, safe way that will allow them (and their families) dignity and care? Is this reasonable to do if it involves a modicum of increased risk exposure for the facility overall? These results remind us that effective COVID-19 response should be context-adapted, patient-centered, and humane.

TABLES

Table 1. Univariate Analysis of Nursing Home Resident and Facility Data, Provence and Occitania Provinces, France, 2021

		Deceased N=131 (22%)		Survived N=454 (78%)		Hazard Ratio (non-adj.)	IC 95%	Log-Rank Test p-value
		n	%	n	%			
Individual Data								
Gender	Female	89	19.5	368	80.5	Ref		<0.001
	Male	42	33.1	85	66.9	2.06***	1.41 - 3.02	
Age (cat.)	65-75 y	10	20	40	80	Ref		0.971
	75-85 y	29	22	103	78	1.14	0.74 - 1.76	
	85-95 y	65	23	218	77	1.19	0.62 - 2.28	
	>95 y	27	22.7	92	77.3	1.14	0.67 - 1.93	
Autonomy Score	1	33	29.2	80	70.8	Ref		0.008
	2	62	26.2	175	73.8	0.96	0.58 - 1.59	
	3	24	20.9	91	79.1	0.71	0.35 - 1.45	
	4	11	10.9	90	89.1	0.38***	0.19 - 0.75	
	5	0	0	11	100	0.00***	0.00 - 0.00	
	6	1	14.3	6	85.7	0.52	0.08 - 3.55	
Autonomy Score (cat.)	AES=1	33	29.2	80	70.8	Ref		<0.001
	2	62	26.2	175	73.8	0.96	0.59 - 1.59	
	3	24	20.9	91	79.1	0.71	0.35 - 1.46	
	>=4	12	10.1	107	89.9	0.35	0.19 - 0.65	
Hospitalization		60	56.6	46	43.4	5.11***	3.57 - 7.30	<0.001
Oxygene Therapy		97	41.5	137	58.5	5.69***	3.17 - 10.22	<0.001
Palliative Care		33	86.8	5	13.2	8.11***	3.77 - 17.45	<0.001
Failure-to-thrive Syndrome		74	61.2	47	38.8	9.45***	3.09 - 28.89	<0.001
Number of Comorbidities	0	43	19	183	81	Ref		0.187
	1	30	20.5	116	79.5	1.05	0.65 - 1.69	
	2	35	26.3	98	73.7	1.25	0.81 - 1.93	
	3	16	27.6	42	72.4	1.42	0.85 - 2.37	
	>=4	7	31.8	15	68.2	1.85**	1.05 - 3.25	
Cancer		9	30	21	70	1.36	0.87 - 2.12	0.294
Obesity		4	26.7	11	73.3	0.87	0.51 - 1.49	0.887
Cardiovasc. Disease		32	28.6	80	71.4	1.30	0.84 - 2.00	0.257

High Blood Pressure		50	24.4	155	75.6	0.89	0.65 - 1.24	0.927
Dementia		41	24.1	129	75.9	1.00	0.74 - 1.35	0.522
Denutrition		9	39.1	14	60.9	1.97*	0.91 - 4.23	0.098
Diabetes		15	31.9	32	68.1	1.23	0.73 - 2.07	0.217
Respiratory Dis.		5	20.8	19	79.2	1.04	0.43 - 2.51	0.753
Other comorbidities		4	20	16	80	1.19	0.29 - 4.83	0.875
Facility-Level Data								
Facility Type	Private	21	18.6	92	81.4	Ref		0.287
	Public	95	24.9	287	75.1	1.07	0.62 - 1.85	
	Public NH within Hospital	15	16.7	75	83.3	0.73	0.42 - 1.29	
AWAS (cat.)	High (>=800)	73	29.1	178	70.9	1.54**	1.05 - 2.28	<0.001
	Medium (750-800)	13	12	95	88	0.56	0.23 - 1.39	
	Low (<750)	45	19.9	181	80.1	Ref		
Time to FFP2 use (cat)	Immediate (<=1 day)	27	22.9	91	77.1	Ref		0.525
	Late (1-7 days)	32	18.9	137	81.1	0.90	0.53 - 1.53	
	Very Late (>=7 days)	72	24.2	226	75.8	1.03	0.52 - 2.06	
Staff to Resident Ratio (cat)	Good (>0.9)	67	27.8	174	72.2	1.56**	1.02 - 2.38	0.018
	Medium (0.8-0.9)	34	17.9	156	82.1	0.95	0.59 - 1.55	
	Low (<0.8)	30	19.5	124	80.5	Ref		
Presence of a Physician (cat)	None/Absent	39	35.8	70	64.2	Ref		<0.001
	Half-Time	61	18.6	267	81.4	0.50***	0.31 - 0.80	
	Full Time	31	20.9	117	79.1	0.43***	0.24 - 0.75	
NH Size	>=70 residents	81	25.6	235	74.4	1.43	0.83 - 2.44	0.036
	<70	50	18.6	219	81.4	Ref		
Staff Sick Leave Proportion (cat)	High (>50%)	61	27.5	161	72.5	Ref		0.030
	Low (<=50%)	47	20.7	180	79.3	0.62**	0.41 - 0.95	
Staff Attack Rate (cat)	High (>50%)	75	27,5	198	72,5	2.23**	1.13 - 4.39	0.025
	Medium (25-50%)	46	19,7	188	80,3	1.56	0.77 - 3.14	
	Low (<25%)	10	12,8	68	87,2	Ref		
Time to MSF	Long (>20 days)	45	24.9	136	75.1	Ref		0.234

Intervention (cat)	Medium (10 to 20d)	73	22.4	253	77.6	0.78	0.47 - 1.28	
	Short (<10d)	13	16.7	65	83.3	0.57**	0.37 - 0.89	
	<14 days	26	14.6	152	85.4	Ref		
COVID outbreak during the first wave	Yes	24	19.4	100	80.6	0.76	0.30 - 1.93	0.336

* p <0.1 ** p<0.05 *** p<0.01

Table 2. Multivariate Cox Hazard adjusted analysis of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021 (Information Criteria: AIC*=1171; BIC=1226)

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.98 - 1.03	0.876
Autonomy Score	2 vs 0	0.66	0.35 - 1.27	0.216
	3 vs 0	0.38	0.16 - 0.89	0.026
	≥4 vs 0	0.22	0.07 - 0.66	0.007
Gender	M vs F	1.78	1.18 - 2.70	0.006
Comorbidities	1 vs 0	1.92	1.04 - 3.57	0.038
	2 vs 0	1.76	0.93 - 3.32	0.081
	3 vs 0	2.08	0.98 - 4.42	0.056
	>=4 vs 0	2.51	0.96 - 6.59	0.061
Failure-to-thrive Syndrome	Y v N	4.04	1.93 - 8.48	<0.001
Presence of a physician	Half Time vs None/Absent	0.30	0.18 - 0.51	<0.001
	Full Time vs None/Absent	0.20	0.08 - 0.53	0.001
Time to FFP2 use (in days)	continuous	1.05	1.02 - 1.07	<0.001
AWAS	continuous	0.99	0.99 - 1.00	0.020
Staff Attack Rate (%)	continuous	2.71	0.59 - 12.42	0.198
Interaction Terms	AES=2#FTTS=1	2.26	0.90 - 5.67	0.083
	AES =3#FTTS=1	3.10#	1.00 - 9.58	0.050
	AES =4#FTTS=1	4.79#	1.16 - 19.87	0.031

interaction term significant -> FTTS effect amplified at each level of AES effect. *Akaike Information Criteria

272 Table 3. Representative quotes for the 3 themes

Subthemes	N	Quotes (*translated from French*)
THEME 1. The Structural and Chronic Neglect of Nursing Homes		
Long-Standing Medical Isolation	1	The problem is that we no longer have enough physicians in our areas: the older ones are retiring without being replaced and those who are still there, they're overloaded with work. *(Director 1)*
	2	In March 2020, businesses closed, shops closed, hospitals deprogrammed. (...) However, in the NHs, our activity stayed the same, we remained full, even with a much higher nervous intensity than usual. *(Director 49)*
	3	What was tough was that the Nursing Home turned to a medical service. And before that it wasn't a medical service at all, it was more of a living space. *(Coordinating Physician 10)*
	4	The nursing home was almost like a hospital ward at one point. Blood tests, all the time, sometimes 12 a day. There was more supervision, more care. It was weird because we didn't have the staff to do all that. *(Nurse 23)*
Working in Precarious and Understaffed Conditions	5	Right now, we have 1 nurse for 50 [residents]. So it's not enough! (...) I am convinced that the key issue for nursing homes is strict staffing ratios. *(Director 49)*
	6	My fellow caregivers are telling me, outside of the COVID crisis: "When I go home, I'm not happy with what I did because I could have done more, but I can't afford to do more, I don't have enough time". I think that's pretty pathetic. *(Psychologist 20)*
	7	Working in a Nursing Home, I did it, but it's not by choice. It's too hard, it's not a question of vocation, but that the work is too hard. They ask you to do 15 toilets...Connections with people are rich, you learn a lot. But the working conditions are hard. When they ask you to help 13 people to bathe before noon, you don't work well. I see people who were there for 30 years and who say "we have no choice". Nursing homes are hard. *(Ass Nurse 21)*
	8	You see, the nurses: when I first came in, there were two of them, each taking a round. But now...They only pass by, they don't even stay. I didn't think this could be to that extent. *(Mrs E. Resident 3)*
	9	I think that what's structurally lacking in nursing homes is permanent medical presence. The attending physicians come whenever they can. But even then, we trigger hospitalizations way too late... I don't think that attending physicians can deal with crisis management. (...) From the moment the staff started to get sick, in terms of organization and functioning, it became very complicated. (...) We managed to recruit, but there were so many sick leaves for COVID that the replacement staff just filled the gaps. A cluster of residents, plus a cluster of employees. (*Director 31)*
	10	Yes, there were days when we worked 11 and a half hours. Just one missing person and that was finished: we'd have our lunch break between noon and two, and we couldn't take an afternoon break. *(Ass Nurse 11)*
	11	No one counted the hours. We had to be there, we put our private lives on hold but it was important to do it. (...) We have no life anymore, since March. *(Psychologist 20)*
THEME 2. Top-down crisis management		
A "top-down" approach to crisis management	12	The ARS [Regional Health Authorities] have been absent during the whole crisis. (...) Since March, I haven't seen the authorities giving us any support, nor any real help, except for claiming statistics back. Ah, "Data"! That was very important: entering data on the national online reporting platform. (...) The ARS implemented teleworking [for their staff], and you couldn't reach them for a while. (...)Imagine, you are looking for a contact, anybody, but email address is not personalized at all. *(Director 24)*
Inconsistent and guilt-laden recommendations	13	This morning, that's all I did: tracking of the COVID vaccine doses. First, the HAS [National Scientific Authority] told us that a recovered from COVID could only get a single booster dose. Then the MoH just told us that they did not agree and that they needed two booster doses. So I had to reorganize the entire vaccination schedule in light of this setback. *(Coordinating Physician 10)*
	14	We see that the people who make these recommendations don't know the field. That's what made me angry, I think. Hey, bureaucrats, come and see what a nursing home is like, when you lower the ratio of caregivers to elderly people, saying that they should be given 10 minutes, no more. (...) They should first give us more help, those who write the protocols and texts, they should come and see what's like for elderly people in institution, with or without cognitive disorders. *(Psychologist 20)*
	15	We are in an environment where we touch each other all the time. You touch them to change them, to handle them, to feed them. You spend your time touching! And from one day to the next, you are told: "don't touch, you'll spread the virus". (...) See, they [the residents] were in jail. They were in a cell. Really, when the rooms were closed, the nursing homes was empty. And that must have disturbed the residents but also the caregivers, who were used to touching. (*Director 24)*
	16	Look, some people had to be uprooted from their rooms. Our residents have cognitive disorders; they are very attached to their rooms. They have spatial-temporal and autobiographical markers inside. And suddenly, we had to remove everything, to put them in a different room, without their belongings, because they were potentially contaminated. This was difficult, I opposed it. I said we couldn't do that. Okay, there is COVID, but we are a Nursing Home! (...) Here, I have seen colleagues, assistant nurses, crying while tying people up, telling them: "I'm sorry I have to tie you up, because it is to protect you, in fact". (...) It was really a war, they told me: "but we have to do this". Just like me, I said to myself: "but at some point, we haven't signed up for this", we are Nursing Home! *(Psychologist 20)*
	17	For example, I remember in the service I was in, two people had a very hard time with the confinement, who had to be restrained, and it was really not easy for us and for the residents. *(Ass Nurse 16)*
	18	At one point, during the first lockdown, we had to stay in our room. We had dinner in the rooms. Then it was hard. It lasted for a long time. We were not allowed to go out anymore. Even those who were not sick! The time to get everything sorted. It was hard, staying in the room for a whole day, without going out...Anyone would become nuts! *(Mrs C, Resident)*
Weakly armed mechanisms and actors for crisis situations	19	We experienced successive stresses. The masks, which we could not find! We had to beg, practically. (...) I remember going to the pharmacies to find overcoats on Saturdays. (...) It wasn't a lack of foresight, it was that we couldn't find them, people were rushing to stock them, there were no supplies. *(Director 24)*
	20	I had already warned the ARS about the shortage of caregivers. I asked them to activate the health reserve, and I never got any help in managing the situation. We feel very lonely in dealing with given situations. (...) No matter how many times I called the ARS, they sent me to platforms that don't work. The national recruitment platform. And we've lost a lot of time. (...) Staff turnover was also an infection risk. Many of the people we took on as replacements got sick later on. *(Director 31)*
	21	You can feel that the fatigue of the first lockdown is still here [for the staff]. Because it is still an overload. The teams are reinforced, but it's still a lot of work. *(Mrs C, Resident)*

	22	We were so paranoid that we disinfected everything. At first, I would even disinfect the lunch tray as soon as I left the room, I would smear disinfectant all over it [laughs]. Once we had a good protocol, it was smoother. When MSF arrived and told us: "This is how you do it, like this, like that". They helped us tremendously, in the organization, in the daily work, otherwise we would have gotten lost. *(Ass Nurse 11)*
	23	Well, it's sad, in a way. Because MSF intervenes in places of disaster, in Haiti, in countries at war. So, calling for your help because you have know-how is positive. But calling you because you intervene in places of disaster showed what a disaster we were experiencing. *(Director 49)*
	24	Fortunately, I had the help of [the MSF doctor]. I don't know if I could have managed it on my own. Being only part-time in two establishments, it would have been very complicated. (...) The workload was huge, alone it was not feasible. And when I was in the other nursing home, he [the MSF doctor] was there, so at least the residents had a doctor every day. (...) It's also reassuring to be able to share about a new disease, all these discussions between colleagues, on an unknown disease. *(Coordinating Physician 10)*
THEME 3. Counterproductive effects of the confinement of residents		
Impacts of lockdowns during the first wave	25	We had a lot of containment-related impacts, which we still have today, even among COVID-negative residents. A lot of degradation, deaths. (...) Bedridden patients, depressive states, failure-to-thrive syndromes. We've been locked up for a year now. Can you imagine? The residents haven't gone out for a year! It is terrible. *(Coordinating Physician 10)*
	26	They had to stay without anything [in terms of physiotherapy care]. 15 days, it's still feasible, but a month and a half! This was very long for them, and we saw the difference. (...) For all of them, there was a decline in motor skills, but even more in cognitive skills. The patients who already had a little difficulty at the cognitive level suddenly have fallen into mutism, with a completely accelerated failure-to-thrive syndrome. (...) Regarding pathologies, we've lost so much. In a month and a half, patients whom I used to make walk, now they are in an armchair. (...) It's not just a few points on a vigilance scale, no, it's quite massive. *(Physiotherapist 33)*
	27	This protocol we put in place was shocking, stressful at first. We saw a family climbing up to come hug their mother. Yeah, there were moments during the first wave, a little...a little violent. Yeah, violent, outright. *(Psychologist 20)*
The silenced opinions of nursing home residents	28	Finally, we did not ask the residents their opinion. We confined as recommended. We didn't have much choice. (...) We have residents here who never had any symptoms, so it's a bit of a double whammy: I'm sick, I'm fine, but then I'm stuck in my room. *(Director 1)*
	29	What bothered me about the lockdown was that the resident's opinion was never asked. (...) The only things I was hearing of was disaster scenarios, with many deaths, many sick staff. A lot of confinements in rooms, and in the end the results were not necessarily conclusive. *(Director 49)*
	30	Finally, I'm glad I arrived here before, because I was in a fragile period before, it would have been even more difficult. So I'm glad I came. Right now I'm in the right place at the right time. *(Mrs C, residen)t*
	31	When this microbe is gone, as soon as we can go out, my daughter will come and get me, because her house is in [the same village]. (...) I would like us to be able to go out again at some point, but we have to bring the staff back. And with the disease....This microbe is always there, we can't live normally. *(Mrs E, Resident)*
The courage to lift the containment measures	32	The room, we stayed in there for a few days straight, you see! Can you tell? From breakfast to supper, in a room! It is not in my nature. (...) It was not fun. Especially since these rooms are small; they can't be 40m2. *(Mrs Q, Resident)*
	33	These activities we used to have, these games, twice a week. It was a nice break during a week. I miss that. Now, every day of the week looks the same. *(Mrs C, Resident)*
	34	(Mme A.) When this illness happened, we were no longer allowed to do anything. We no longer have outings, we have nothing, nothing, nothing. (...) The COVID period, there, it hurts because you don't see anybody. You only see those who are inside [the nursing homes]. (Mme O.) We are isolated, left to ourselves. (...) Now I can only see my daughter behind a Plexiglas. So the mask, the glass... We don't understand a lot. (Mme A.) We have to speak a bit louder than normal. And we can't touch each other, we only kiss from far away. This is annoying, not being able to hug them! (Mme O.) We can't kiss hello or goodbye, nothing! We are separated by a Plexiglas. (Investigator) And you would prefer that people could come in the nursing homes? (Mme A.) Of course! We should see them a little more!
	35	If I could go out on Sunday, I would be the happiest. (...) If we could go out, we would bear it better. (...) Things should go back to normal again. Just because there's a virus out there doesn't mean that everything should stop! *(Mrs Q, Resident)*
	36	We followed the recommendations, to the letter. After that, there is the reality of the field. (...) If I applied the recommendations, I would put everyone in isolation, because there is still active virus circulation, and visits would not have resumed here. It is not acceptable to ban visits. But it is the director's responsibility. *(Director 31)*
	37	We decided to open the visits for families again, including for those suffering from failure-to-thrive syndrome, and not only for the "end of life" ones. Because our job is to be human. So at some point, people need to see their parents, their parents need to see their children. We have to be able to do all that, while respecting public health measures and so on. *(Director 1)*
	38	With this decision, to not confine them in their room, this year we really did what they wanted. And I think we'd never done it, actually, exactly what they wanted. (...) When you know that COVID is coming in, you accept that there will be deaths. The question is the conditions around the death. *(Director 49)*
	39	We're not here to generate failure-to-thrive syndromes or severe depressive states either. So I told the girls: "you wash his hands well when he comes out of the room, but we set him free!". Because that was really the point: the impression of locking people even more. They are 91 years old, 92 years old, so that's enough! *(Coordinating Physician 10)*
	40	When we reopened the dining room, we saw residents expressing a desire to eat with this or that other resident. Relationships, loving couples forming. All of that, it didn't exist anymore, they were isolated in their rooms, and there was no relationship between them anymore. *(Director 1)*

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FIGURES

Figure 1 Legend: On the X axis: Number of weeks from Oct 15th, 2020 ; On the Y axis: probability of resident'survival.

Figure 1 Title: Likelihood of survival by resident and nursing facility characteristic, Univariate (Kaplan-Meier) Analysis, Provence and Occitania Provinces, France, 2021

Figure 2 Legend: On the X axis: adjusted Hazard Ratios are represented by a diamond. Full-lines in red for 95% Confidence Intervals of significant risk factors (HR>1), full-lines in green for protective factors (HR<1) and dashed-lines in grey for CI95% of non-significant factors.

Figure 2 title: Final Cox Model: Forest Plot of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021

CONTRIBUTORS

CM, TR, MD, TL and EG conceived the study (literature search, study design, etc). MD, SF, TR, CM, TL and EG developed the study protocol. MD performed field data collection (qualitative interviews) and SF collected epidemiological data. TR and SF performed data management and statistical data analysis. MD performed interview transcription and qualitative analysis. MD and TR performed literature search and wrote the first version of the manuscript. TR and EG verified the underlying data and performed additional analyses. All authors interpreted the results, contributed to writing the manuscript, and approved the final version for submission.

ACKNOWLEDGMENTS

First and foremost, authors are very grateful and thank Janet Ousley for her help on article editing. Authors also thank Marie Thomas, Tommaso Fabbri, Klaudia Porten, Michel-Olivier Lacharité, Marc Gastelly-Etchegorry, and the whole MSF team in the field. This study would not have been possible without the collaboration of the nursing home managers, staff, and residents. A very special thanks go to each and every one of them.

COMPETING INTERESTS

Authors declare having no competing interests.

FUNDING AND ALL OTHER REQUIRED STATEMENTS

This study was entirely funded by Médecins Sans Frontières-France.

DATA SHARING

Anonymized data collected for the study and a data dictionary will be made available to other researchers Following approval of a study proposal by TR (thomas.roederer@epicentre.msf.org) for 5 years from publication. The study protocol, statistical analysis plan and informed consent forms are also available from TR.

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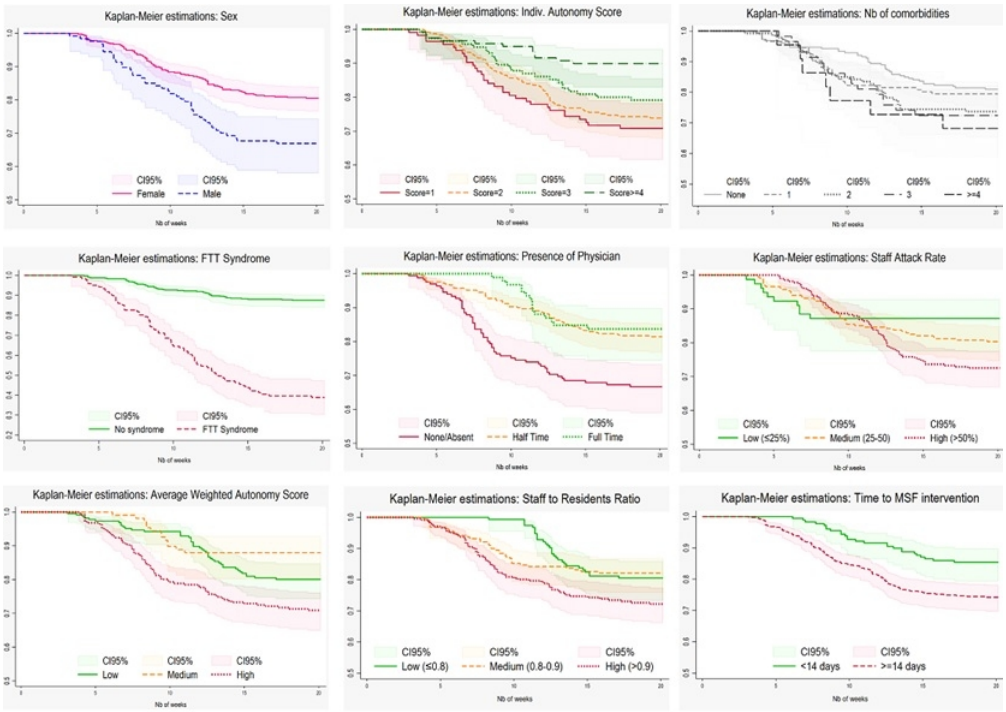
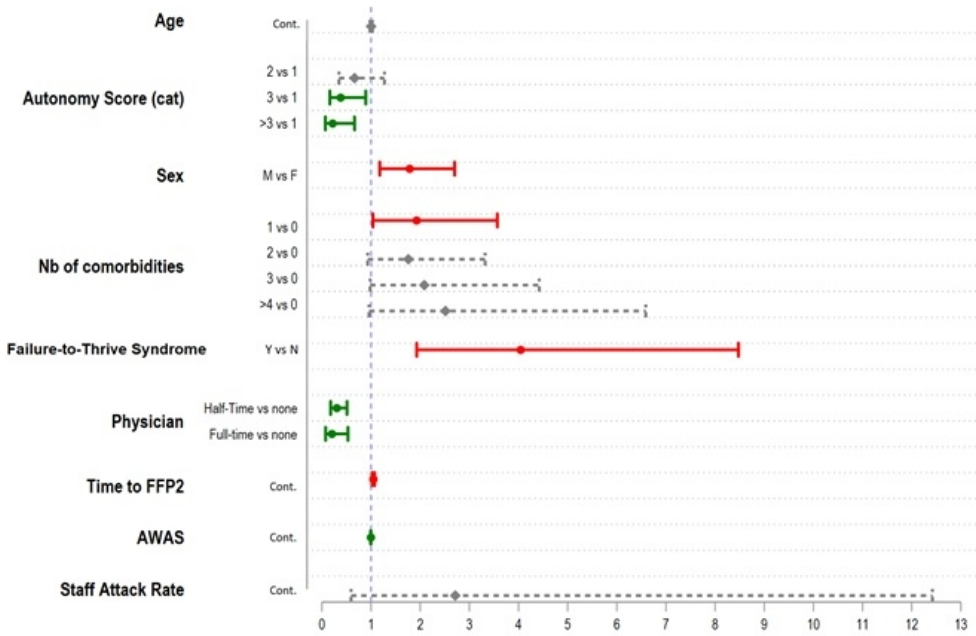


Legend: On the X axis: Number of weeks from Oct 15th, 2020 ; On the Y axis: probability of resident'survival.

146x104mm (144 x 144 DPI)



Legend: On the X axis: adjusted Hazard Ratios are represented by a diamond. Full-lines in red for 95% Confidence Intervals of significant risk factors (HR>1), full-lines in green for protective factors (HR<1) and dashed-lines in grey for CI95% of non-significant factors.

118x78mm (144 x 144 DPI)

Supplementary materials

Appendix 1. Definitions

Autonomy Evaluation Score (Groupement Iso-Resources or GIR)

The GIR score is a measurement of autonomy loss based on a series of questions and observations, a team assesses a person's level of dependency. In the Nursing Homes context, this evaluation is done by the coordinating physician upon admission of a new resident. The GIR score ranges from 1 to 6, from highest dependency (lowest level of autonomy) to lowest dependency.

GIR 1: includes elderly people confined to a bed or armchair, whose mental functions are seriously impaired and needing the continuous presence of caregivers.

GIR 2 reflects 2 categories:

-People confined to bed or a chair, whose mental functions are NOT totally impaired, and who need care for most activities of daily living;

-People whose mental functions are severely impaired but who have retained their ability to move around.

GIR 3 includes people who have retained their mental autonomy but who need help every day and several times a day to carry out everyday activities (getting up, going to bed, getting dressed, going to the bathroom, etc.).

GIR 4 reflects 2 categories:

-People in need of help to get up and go to bed, but able to move around the home on their own. They sometimes need assistance to dress and wash themselves;

-People who do not have motor impairment but need help with physical activities and meals.

Gir 5 groups together people who need occasional help with washing, preparing meals and cleaning.

Gir 6 refers to people who have fully retained their autonomy in the acts of daily life.

Reference for this definition (in French): https://www.service-public.fr/particuliers/vosdroits/F1229#:~:text=La%20grille%20Aggir%20est%20utilis%C3%A9e,et%20sociales%2C%20dites%20activit%C3%A9s%20illustratives

Average Weighted Autonomy Score (GIR Moyen Pondéré or GMP)

This score is calculated at the Nursing Home level and summarizes the overall level of residents' dependency. Each resident requires X minutes of caregivers attention per day, X varying with the Autonomy score level (for ex. X=210 min for GIR 1; 88 min for GIR 4). The AWAS is then the average X residents need for the overall facility.

The higher the AWAS score, the more dependent the residents are. In other terms, the score is a proxy of the financial and human resources a Nursing Home can need and get: the higher the AWAS, the more resources the NH needs (higher staff-to-residents ratio, better equipment etc.).

Reference for this definition (in French): https://assurance-dependance.ooreka.fr/astuce/voir/655507/gir-moyen-pondere

Failure to thrive Syndrome[1]:

Specific to old age, this syndrome is defined by the rapid deterioration of the general state with anorexia, disorientation, social withdrawal, alongside a more or less directly expressed will to die, a passive give-up on life, an active refusal of care, of food. It evolves towards death in a few days to a few weeks. It is triggered by physical events (acute illnesses, surgery, trauma) or psychological events (death of a loved one, social isolation, hospitalization).

FFP2 (or N95 or KC95) Facemasks

The EN 149 standard defines performance requirements for three classes of particle-filtering half masks: FFP1, FFP2 and FFP3.

A FFP2 facemask filters at least 94% of airborne particles and has an internal leak rate of maximum 8%.

[1] Palmer RM. 'Failure to thrive' in the elderly: diagnosis and management. Geriatrics. 1990 Sep;45(9):47-50, 53-5. PMID: 2204587.

Appendix 2. Description of Study Participants and Interviews

Participant characteristic				Interview characteristic		
Study n°	Function		Sex	Duration	Type	Place
1	Directors		Woman	95	individual	direction desk
24			Man	119	individual	direction desk
31			Man	133	individual	direction desk
49			Woman	65	individual	coordinator's desk
10	Coordinating doctors		Woman	45	individual	coordinator's desk
12			Woman	171	individual	research desk
48			Woman	55	individual	infirmary
2	Coordinating nurses		Woman	71	individual	direction desk
13			Woman	32	individual	coordinator's desk
30			Woman	107	individual	coordinator's desk
56			Woman	68	individual	coordinator's desk
4	Psychologists		Woman	35	individual	coordinator's desk
20			Woman	54	individual	animators desk
9	Caregivers (internal permanent staff)	Assistant Nurse	Woman	29	individual	animators desk
11		Assistant Nurse	Woman	28	individual	collective room
15		Assistant Nurse	Woman	37	grouped (4 people)	animators desk
16		Assistant Nurse	Woman			animators desk
17		Animator	Woman			animators desk
18		Assistant Nurse	Woman			animators desk
22		Assistant Nurse	Woman	21	individual	infirmary
23		Nurse	Woman	36	individual	collective room
27		Assistant Nurse	Woman	61	grouped (2 people)	research desk
28		Assistant Nurse	Woman			research desk
29		Animator	Man	67	individual	research desk
34		Nurse	Woman	46	individual	research desk
35		Assistant Nurse	Woman	48	individual	collective room
45		Assistant Nurse	Woman	55	individual	infirmary
46		Assistant Nurse	Woman	26	individual	collective room
51		Nurse	Man	49	grouped (2 people)	infirmary
5	Caregivers (external staff)	Nurse	Woman			infirmary
21		Assistant Nurse	Woman	25	individual	rest room
33		Physiotherapist	Man	37	individual	private house
44		Physiotherapist	Man	20	individual	collective room
47	Other Staff	HRD manager	Woman	56	individual	coordinator's desk
7		Agent for Maintenance	Man	48	grouped (2 people)	maintenance desk
8		Agent for Maintenance	Man			maintenance desk
25		Cook	Woman	38	grouped (2 people)	kitchen
26		Cook	Woman			kitchen
32		Cleaner	Woman	17	individual	collective room
52		Cook	Woman	12	individual	kitchen
3	Residents		Woman	63	individual	bedroom
6			Woman	28	individual	collective room
14			Woman	24	individual	bedroom
19			Woman	34	individual	collective room
36			Woman	95	grouped (2 people)	collective room
37			Woman			collective room
57			Woman	41	individuel	bedroom

Appendix 3. Interview Topic Guide for Caregivers and Residents

Questions to caregivers	***Objectives***
1/ Outbreak Chronology (Subjective Narratives)	
-Introduction *-Can you tell me how the epidemic has started and evolved in your institution?*	-identification of subjective phases -qualification of temporalities -information level assessment
-What have been the most difficult times ?	-assessing the impact of the epidemic
2/Adaptations in Relation to the Crisis Management	
-The organisation of the NH was disrupted for a few weeks, how were practices reorganised in relation to : colleagues/ residents/ families ?	-description of crisis effect
-Have you received any external aid? In what areas?	-networks, actors' schemes
-What permitted a return to normal activity? *-What could be enhanced in terms of crisis management?*	-return to normal activity
3/ Individual Experience of the Second Pandemic Wave	
-How did you become [function: a director, coordinating physician, nurse, assistant nurse, etc.] ?	-socio-demographic profile -University and professional trajectory
-Did you receive any help in your work position?	-networks, actors' schemes -collective participation -description of isolation, understaffing
-As a [function], how did you experience this period?	-ethical questionings -individual variables (personal, family, emotional)

Questions to residents	***Objectives***
1/Outbreak Chronology (Subjective Narratives)	
-Introduction *-Can you tell me about the period of COVID in the NH?* *-What were the differences compared to other periods in the past year?*	-identification of subjective phases -qualification of temporalities -information level assessment
-What have been the most difficult times ?	-assessing the impact of the epidemic
2/Adaptations in Relation to the Crisis Experience	
-Have you been contaminated with COVID? Have you been hospitalized? *-Have you been particularly worried about this disease? (isolation, containment)*	-situation and positioning of the individual in relation to the epidemic -description of crisis effect

-Did you see other neighbours/friends of the NH? *-Did you see relative/ family members outside the NH? In the NH?* *-Were there any activities?*	-networks, actors' schemes -links with the outside world
-Were you moved during COVID? *-What do you think about the organisation of the NH staff during COVID? What could have been improved?*	-identification of novelty -return to normal activity
3/Individual Experience of the Second Pandemic Wave	
-In what year were you born? In what year did you enter the NH? *-Before the NH, what did you do? Where did you live?*	-geographic trajectory before the NH -trajectory within NH -socio-demographic profile -University and professional trajectory
-(in normal times) Do you prefer to stay in your room? To participate in group activities? *-Have you received any support apart from the assistant nurses/ nurses? In what areas?* *-Did your attending physician come?* *-Have you had contact with your relatives?*	-networks, actors' schemes -collective participation -description of isolation
-Do you have family members in the area, elsewhere? *-Do you have relatives who have had COVID?*	-individual variables (personal, family, emotional)

Appendix 4. Mixed Methods

Multidisciplinary Research and Collective Protocols

Both quantitative and qualitative data collection stem from an iterative reflexive process within the interdisciplinary research team, comprising: a social geographer (M.D.) and a public health expert (S.F.) present on the fieldwork (both are PhD female researchers employed at Epicentre for this research project and trained in fieldwork methods with vulnerable populations in crisis contexts); a lead epidemiologist (T.R.), a medical doctor (T.L.), a MSF project coordinator (C.M.), a nurse (C.S.) and a psychologist (M.T.) partly present on the research fieldwork; and two coordinating epidemiologists working at Epicentre (E.G. and K.P.).

During the exploratory phase (from 1st December 2020 to 22 January 2021), several focus groups were organised within the MSF-team, in order to define the research objectives, the strategy for selecting research sites for qualitative analysis, and key resource interlocutors. Regular informal and semi-structured meetings with MSF nurses, and analytical reading of their monitoring reports from emergency interventions, both helped in drafting the research protocol and fieldwork priorities. The interview topic guide (Appendix 3) and a checklist for systematic observation were conceived by M.D. and commented by MSF coordinators on the fieldwork (C.M., T.L., C.S.). Throughout this collective process and preliminary analyses, the public health expert (S.F.) conceived a database. The social geographer (M.D.) and the public health expert (S.F.) both visited a few nursing homes with the MSF coordinators before formally beginning the research.

On the fieldwork (from 22 January to 26 February 2021), the public health expert (S.F.) collected most epidemiological data, as well as individual data for retrospective linelist analyses. The social geographer (M.D.) gathered most qualitative data, including direct observation notes and semi-structured interviews, for 4 nursing homes. However, the two fieldwork researchers worked together narrowly. They managed together first contacts with the directors and/or coordinating physicians of the studied nursing homes, they visited together 2 nursing homes out of the 4 comprised in the qualitative study, they compared their results on a daily basis and organised their data commonly.

In the phase of reporting (from the 1st March to the 21st April 2021), an internal report was written and sent for proofreading to the interdisciplinary research team. In the following month, a synthetic report was written. Corrections after proofreading were incorporated in May and June 2021. The final reports were sent to interviewees in June and September 2021 for comments. Only few feedbacks were received, mostly on formal aspects.

Statistical Methods

We first performed a descriptive analysis of the data collected by the MSF team from NH managers: facility-level information and linelists (COVID-19 cases among residents). We crossed several factors with the resident's final status and computed Kaplan-Meier estimations of the probability of dying from COVID-19 in parallel with univariate Cox model for each factor. Log-Rank Test was used to assess potential association of each factor with death. Date of entry in the study was set to October 25th, 2020 (date of the new prevention measured announced by the French government and start of the second wave in France). Date of exit was set to March 15th, 2021 (official end of the study), in case of death, to the exact date of death (if available).

We then explored the probability of dying from COVID-19 according to the factors identified in the univariate analysis with Cox models (multivariate analysis).

The challenge with multivariate analyses stems from the fact that various individual and structural factors may possibly be associated, and some of them can also be considered as confusion factors.
Variables reflecting a notion of temporality, such as the time to FFP2 use and time to MSF intervention or attack rate among residents/staff and duration of the COVID-19 episode may be correlated and may not all be included in a single model. In a similar fashion, proportion of sick leaves in staff and characterization of the physician presence are obviously correlated.

We thus built several Cox models depending on the factors we wanted to include. We decided to control for age, autonomy level and gender in all models.

One model analyzed detailed comorbidities (cancer, high blood pressure etc.) in order to highlight potential risk/protective factors of death. Another model analyzed a summary of comorbidities (absence/presence of >1 comorbidity or total number of comorbidities).

We then tested alternate models analyzing either quantitative factors as continuous variables or transformed versions of the same factors as categorical variables (using cutoffs).

Choice of variables to finally retain in each model followed a classical Stepwise selection process, starting from a model gathering factors for which p-values (association with mortality according to Log-Rank Test) were < 0.3.

We have taken into account the many interactions that come into play between several factors: hospitalization with oxygene therapy and/or palliative care, interrelated comorbidities (high blood pressure with cardiovascular disease, obesity and diabetes etc.), Failure-to-thrive syndrome with comorbidities, AES with comorbidities or Failure-to-thrive syndrome, time-reflecting factors (as seen previously: time to FFP2 use, time to MSF intervention, duration of COVID episode, attack rates).

We fitted mixed-effects three-level random-slope exponential survival models. To account for individual heterogeneity, we included a random effect at the individual level, and to account for clustering, we included a random effect at the nursing home level (individuals are nested within each nursing home). Robust Standard Errors were computed and presented (clustered at the highest level in the multilevel model, here the nursing home).

Qualitative Study Context

Qualitative methods are interrelated with the context of the research. The interviews followed MSF interventions and epidemic peaks in the NH. The relative respite after the outbreaks favoured data collection: interviewees were more eager to give time to the study than during the outbreaks' peaks.

The major interests expressed in the research topics were that the participants were thankful to MSF teams, saw research as a way to step back from the traumatic experience of high fatality cases in their NH, to express a silenced point of view, or to contribute to general knowledge on the issue of COVID-19.

The access to the fieldwork through MSF helped organising rapidly a confident environment for the interviews to take place, since MSF support was mostly very welcomed and appreciated, as participants reported to the lead investigator (M.D.). For the same reason, the lead investigator could be considered as a member of MSF, which could have resulted in possible biases; therefore, the distinction between MSF interventions and Epicentre research had to be underlined before each interview.

Objectives, risks and benefices of the study were explained thanks to information letters for participation in the study and informed consent forms that were read and signed before the interviews. Each participant was informed that participation to the study is free, can be interrupted without justification and at any time without consequences. Each participant had a time for thinking, questioning and possibly obtaining explanations from the interviewer.

Methods of anonymization et confidentiality were applied for all participants, following the good practices identified by the Institute for Human and Social Research of the French National Center for Scientific Research (InSHS-CNRS)

Appendix 4. Additional Descriptive Results

Table S1. General and epidemiological characteristics of 22 nursing homes (aggregated data)

Facility Data	N	Mean	Std Dev	Min	Max
Number of beds	22	80.32	19.1	50	121
Average Weighted Autonomy Score	20	775	44.7	686	870
Time to FFP2 use (days)	22	8.7	8.7	0	28
Time to MSF Intervention (days)	22	18.9	9.7	5	37
Staff-to-residents Ratio	22	0.81	.14	.53	1.09
Number of Staff	22	61.3	18.9	32	109
Number of Residents	22	74.7	17.0	44	106
COVID-19 episode duration (days)	22	37.8	14.9	6	81
Attack Rate in Staff (%)	22	38.1	18.4	23.8	71.4
Attack Rate in Residents (%)	22	65.6	20.0	13.8	96.0
Case Fatality Rate in residents (%)	22	19.4	10.0	0	39.7

Table S2. Comorbidities vs FTTS (Fischer Exact Test p-value= 0.051)

	Failure to thrive syndrome		
Comorbidities	No 410 (77.2%)	Yes 121 (22.8%)	Total 531
	N (row %)	N (row %)	
None	159 (71.9%)	62 (28.1%)	221
1	116 (85.3%)	20 (14.7%)	136
2	84 (79.2%)	22 (20.8%)	106
3	37 (75.5%)	12 (24.5%)	49
>=4	14 (76.7%)	5 (26.3%)	19

Table S3. Pearson pairwise correlation matrix for Average Weighted Autonomy Score, Nursing Home Size and Staff-to-Resident Ratio (continuous) :

	AWAS	Number of residents
AWAS	1.0000	
Number of residents	0.5356*	1.0000
Staff-to-Resident Ratio	0.6617*	0.1776*

*p-value < 0.05

Table S4. AWAS vs Staff -to-Resident Ratio (categories): Fischer Exact Test p-value< 0.001)

	Staff to Resident Ratio (Cat.)			
AWAS (cat)	Low (<0.8)	Medium (0.8-0.9)	High (>=0.9)	*Total*
Low (<=750)	154	26	46	*226*
Medium (750-800)	0	84	24	*108*
High (>=800)	0	80	171	*251*
Total	*154*	*190*	*241*	*585*

Table S5. AWAS vs Nursing Home Size (categories): Fischer Exact Test p-value< 0.001)

	Nursing Home Size (cat)			
AWAS (cat)	<70 res.	70-90	>=90	*Total*
Low (<=750)	170	56	0	*226*
Medium (750-800)	108	0	0	*108*
High (>=800)	27	115	109	*251*
Total	*305*	*171*	*109*	*585*

Table S6. Staff to Resident Ratio vs Nursing Home Size (categories): Fischer Exact Test p-value < 0.001)

	Nursing Home Size (cat.)		
Staff to Resident Ratio (Cat.)	<70 res.	>=70 res.	*Total*
Low (<0.8)	98	56	*154*
Medium (0.8-0.9)	101	89	*190*
High (>=0.9)	70	171	*241*
Total	*269*	*316*	*585*

Table S7. Pearson correlation matrix for Time to FFP2 use, Time to MSF intervention and duration of COVID-19 episode

	Time to FFP2 use	Time to MSF intervention
Time to FFP2 use (cont.)	-	
Time to MSF intervention (cont.)	0.0989	-
Duration of COVID-19 episode (cont.)	0.5523*	0.5250*

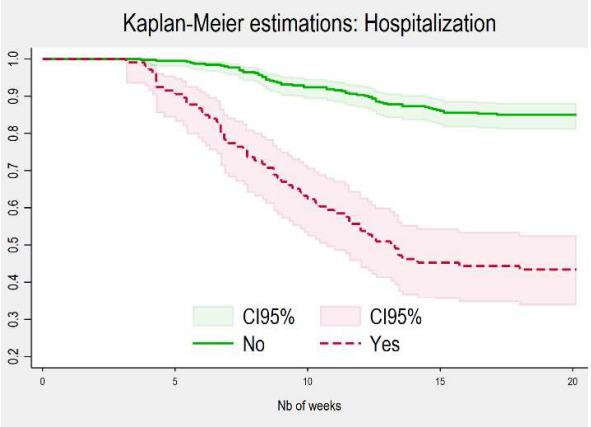
*p-value < 0.05

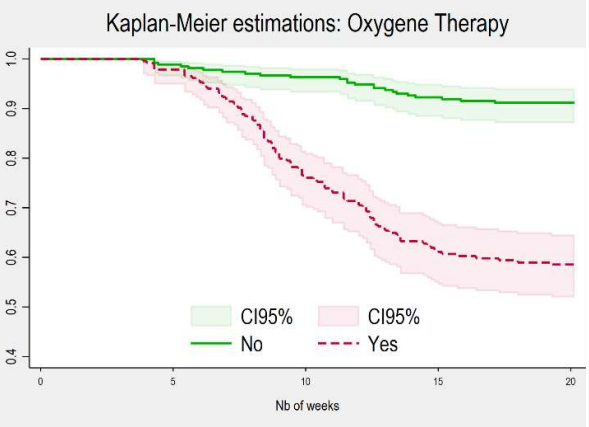
Table S8. Time to FFP2 use vs Time to MSF (categories): Fischer Exact Test p-value < 0.001)

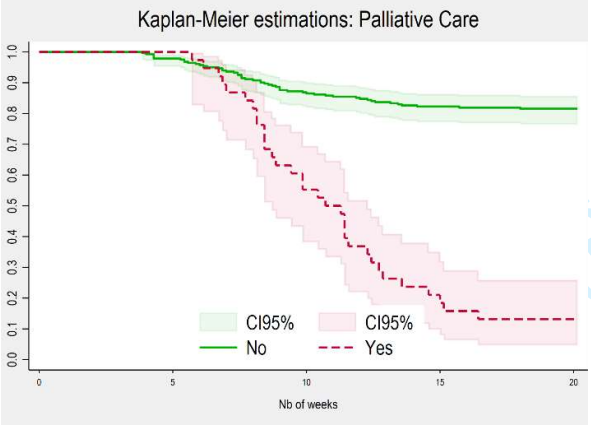
	Time to MSF intervention (cat)			
Time to FFP2 use (cat)	Short (<10 days) 78 (13.3%)	Medium (10-20 days) 326 (55.7%)	Long (>20 days) 181 (30.9%)	*Total*
Instant.(<=1day)	8 (6.8%)	54 (45.8%)	56 (47.4%)	*118*
Late (2-7 days)	70 (41.4%)	53 (31.3%)	46 (27.2%)	*169*
Very Late (>=7 days).	0	219 (73.5%)	79 (26.5%)	*298*

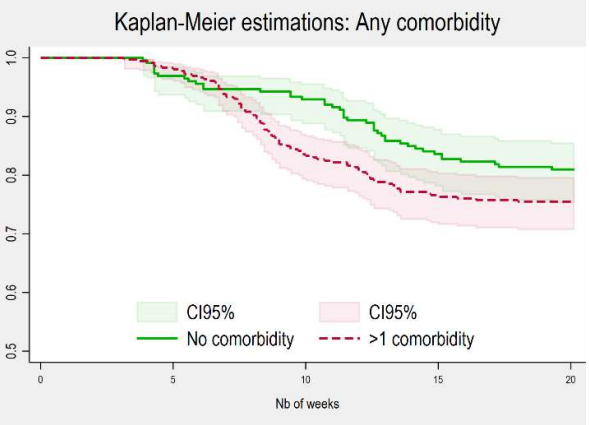
Appendix 5. Additional Kaplan-Meier Curves – full list (for Log Rank Tests results, see Table 1 in main manuscript)

Individual Data (Linelist)

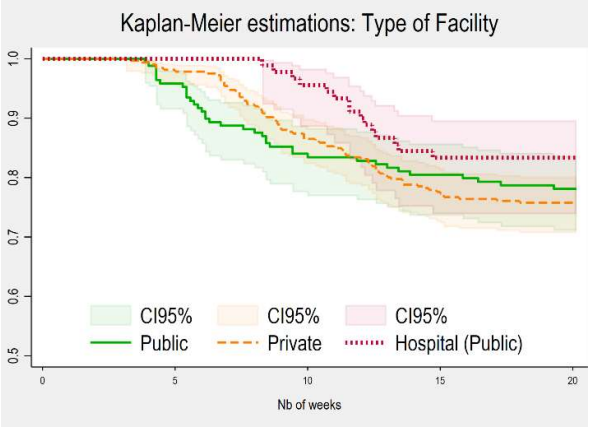


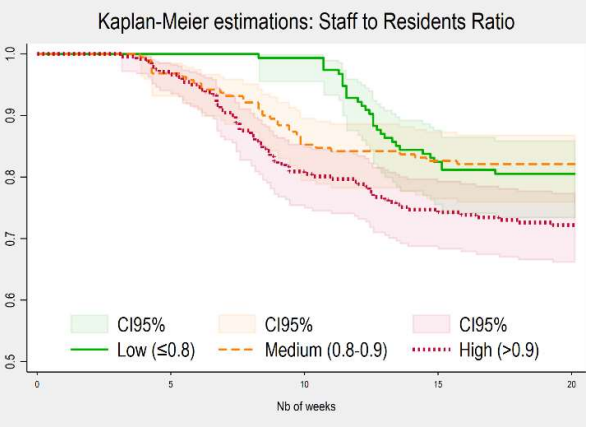


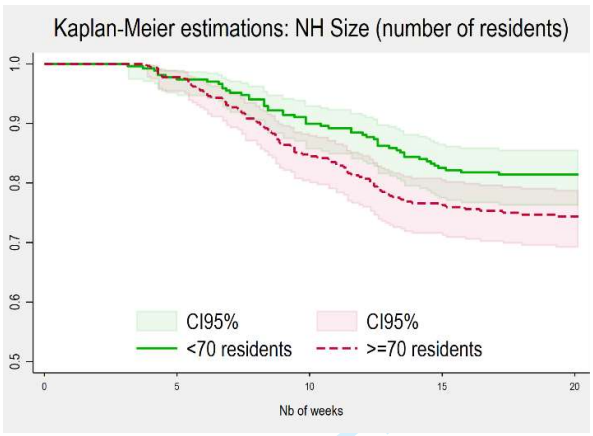


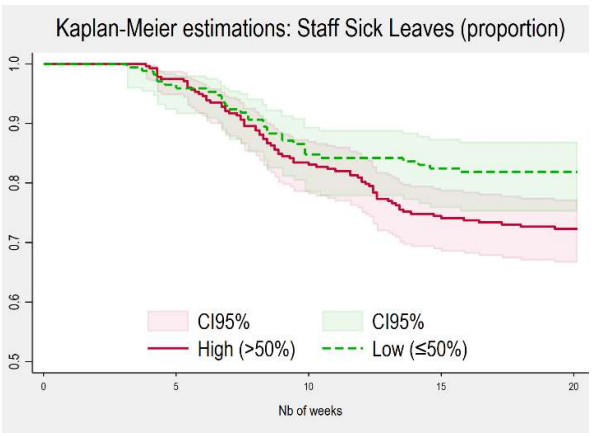


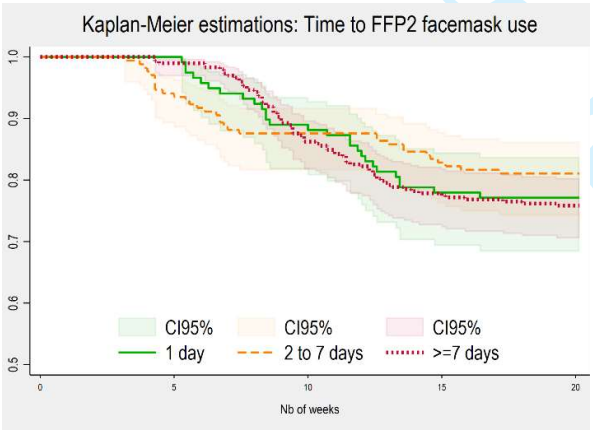
Facility Data (aggregated)

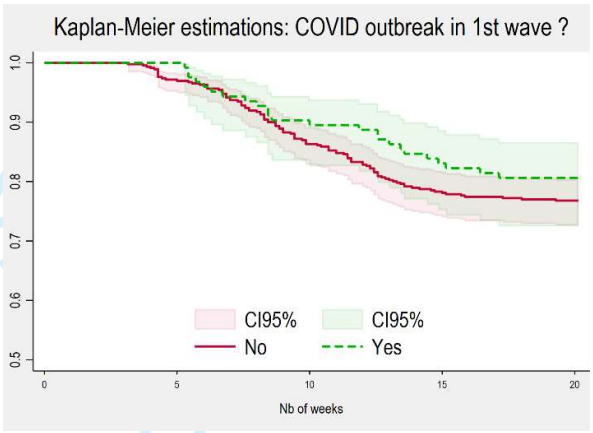












Appendix 6. Additional Cox models (Sensitivity Analysis)

Table S10. Model 1. Only individual data with 'obvious' covariates (hospitalization, palliative care etc)

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.97 - 1.03	0.921
Autonomy Score	2 vs 0	0.89	0.48 - 1.66	0.715
	3 vs 0	0.53*	0.26 - 1.09	0.085
	>=4 vs 0	0.40*	0.14 - 1.11	0.078
Gender	M vs F	1.62*	0.93 - 2.84	0.088
Comorbidities	1 vs 0	1.83	0.46 - 7.29	0.391
	2 vs 0	1.64	0.42 - 6.39	0.473
	3 vs 0	2.02	0.48 - 8.53	0.340
	>=4 vs 0	2.73	0.50 - 15.06	0.248
Hospitalization	Y v N	4.19***	2.53 - 6.91	0.000
Oxygene Therapy	Y v N	3.08***	1.42 - 6.64	0.004
Palliative Care	Y v N	3.09***	1.69 - 5.63	0.000
Failure-to-thrive Syndrome	Y v N	3.22**	1.14 - 9.09	0.027
Interaction terms	Comorb=1#FTTS=1	0.84	0.17 - 4.05	0.824
	Comorb=2#FTTS=1	0.72	0.18 - 2.90	0.648
	Comorb=3#FTTS=1	0.77	0.14 - 4.22	0.763
	Comorb=4#FTTS=1	1.02	0.13 - 8.13	0.982
	Hospitalization=1#Oxygene=1	0.39	0.04 - 3.31	0.389
	Oxygene=1#Palliative=1	0.14#	0.07 - 0.28	0.000

interaction term significant > oxygene effect amplified by palliative care effect

Information Criteria (model selection)	AIC	BIC
	696.215	722.30

Table S11. Model 2. Only individual data with detailed comorbidities

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.97 - 1.03	0.921
Autonomy Score	2 vs 0	0.89	0.48 - 1.66	0.715
	3 vs 0	0.53*	0.26 - 1.09	0.085
	>=4 vs 0	0.40*	0.14 - 1.11	0.078
Gender	M vs F	1.79*	1.16 - 2.74	0.008
Diabetes	Y v N	2.81**	1.17 - 6.76	0.021
Denutrition	Y v N	2.54	0.55 - 11.82	0.235
Dementia	Y v N	0.91	0.40 - 2.08	0.822
Cardiovascular Disease	Y v N	1.24	0.75 - 2.06	0.409
Cancer	Y v N	0.96	0.42 - 2.19	0.919
Obesity	Y v N	1.37	0.46 - 4.04	0.571
Respiratory Disease	Y v N	0.68	0.22 - 2.15	0.514
High Blood Pressure	Y v N	0.91	0.56 - 1.48	0.712
Failure-to-thrive Syndrome	Y v N	4.79***	1.52 - 15.06	0.007
Interaction terms	AES=2#FTTS=1	2.54	0.80 - 8.10	0.114
	AES=3 # FTTS=1	3.21	0.78 - 13.16	0.105
	AES=4# FTTS=1	4.94	0.51 - 48.01	0.169
	FTTS=1#Diabetes=1	0.20#	0.04 - 1.05	0.057
	FTTS=1#Denutrition=1	0.15#	0.03 - 0.86	0.033
	FTTS=1#Dementia=1	1.21	0.44 - 3.31	0.717
	Diabetes=1# Denutrition=1	0.40	0.03 - 4.61	0.461
	Diabetes=1# Dementia=1	0.75	0.16 - 3.38	0.703
	Denutrition =1# Dementia=1	1.24	0.24 - 6.34	0.792
	HBP=1#Cardiovasc=1	1.19	0.45 - 3.18	0.723

interaction term significant > FTTS effect amplified by Denutrition effect and by diabetes effect

Information Criteria (model selection)

AIC	BIC
770.399	803.8226

Table S12. Model 3. Individual and structural data with Staff-to-Resident Ratio and NH Size instead of AWAS

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.99 - 1.01	0.635
Autonomy Score	2 vs 0	0.70	0.31 - 1.58	0.388
	3 vs 0	0.40**	0.17 - 0.95	0.038
	>=4 vs 0	0.23***	0.08 - 0.66	0.006
Gender	M vs F	1.78**	1.12 - 2.81	0.014
Comorbidities	1 vs 0	1.28	0.52 - 3.16	0.590
	2 vs 0	1.20	0.63 - 2.25	0.580
	3 vs 0	1.40	0.51 - 3.82	0.517
	>=4 vs 0	1.67	0.51 - 5.46	0.396
Failure-to-thrive Syndrome	Y v N	4.07***	1.94 - 8.54	0.000
Presence of a physician	Half Time vs None/Absent	0.26***	0.13 - 0.53	0.000
	Full Time vs None/Absent	0.26***	0.10 - 0.64	0.004
Time to FFP2 use (in days)	continuous	1.01	0.95 - 1.07	0.681
Staff to Resident Ratio	continuous	1.17	0.84 - 1.35	0.586
NH Size (number of residents)	continuous	1.03	0.93 - 1.14	0.545
Staff Attack Rate (%)	continuous	2.18	0.29 - 16.49	0.450
Interaction terms	AES=2#FTTS=1	2.30#	0.91 - 5.78	0.077
	AES=3#FTTS=1	2.93#	0.95 - 9.05	0.061
	AES=4#FTTS=1	4.80#	1.16 - 19.92	0.031
	NR_Ratio#NH Size	0.95	0.83 - 1.08	0.402

interaction term significant > FTTS effect amplified at each level of AES effect

Information Criteria (model selection)	AIC	BIC
	1172.544	1227.964

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COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	App.3
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	App.3
Occupation	3	What was their occupation at the time of the study?	App.3
Gender	4	Was the researcher male or female?	App.3
Experience and training	5	What experience or training did the researcher have?	App.3
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	p.1+App.3
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	App.1
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	App.3
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	p.4
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	p.3
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	p.3
Sample size	12	How many participants were in the study?	p.6
Non-participation	13	How many people refused to participate or dropped out? Reasons?	p.6
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	Table 4
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	Table 4
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	Table 4
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	p4+App.1&4
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	Table 4
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	p.6+App.1&3
Field notes	20	Were field notes made during and/or after the inter view or focus group?	App.3
Duration	21	What was the duration of the inter views or focus group?	p.6+Table4
Data saturation	22	Was data saturation discussed?	p.4
Transcripts returned	23	Were transcripts returned to participants for comment and/or	App.3

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	p.4
Description of the coding tree	25	Did authors provide a description of the coding tree?	p.4+App6
Derivation of themes	26	Were themes identified in advance or derived from the data?	p.3+p.4
Software	27	What software, if applicable, was used to manage the data?	App 3
Participant checking	28	Did participants provide feedback on the findings?	App.3
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	p.6-7, Table 5
Data and findings consistent	30	Was there consistency between the data presented and the findings?	p.7
Clarity of major themes	31	Were major themes clearly presented in the findings?	p.6-7
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	p.7, p.10

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

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COVID-19 in French Nursing Homes during the Second Pandemic Wave: A Mixed-Methods Cross-Sectional Study

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2021-060276.R1
Article Type:	Original research
Date Submitted by the Author:	30-May-2022
Complete List of Authors:	Dujmovic, Morgane; Epicentre, Roederer, Thomas; Epicentre Frison, Severine; Epicentre Melki, Carla; Médecins Sans Frontières Lauvin, Thomas; Médecins Sans Frontières Grellety, Emmanuel; Epicentre
Primary Subject Heading:	Public health
Secondary Subject Heading:	Qualitative research
Keywords:	COVID-19, Public health < INFECTIOUS DISEASES, Epidemiology < TROPICAL MEDICINE, GERIATRIC MEDICINE, QUALITATIVE RESEARCH

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COVID-19 in French Nursing Homes during the Second Pandemic Wave: A Mixed-Methods Cross-Sectional Study

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Abstract : 288/300
Text : 4400/4500

ABSTRACT

Introduction

French nursing homes were deeply affected by the first wave of the COVID-19 pandemic, with 38% of all residents infected and 5% dying. Yet, little was done to prepare these facilities for the second pandemic wave, and subsequent outbreak response strategies largely duplicated what had been done in the spring of 2020, regardless of the unique needs of the care home environment.

Methods

A cross-sectional, mixed-methods study using a retrospective, quantitative data from residents of 14 nursing homes between November 2020 and mid-January 2021. Four facilities were purposively selected as qualitative study sites for additional in-person, in-depth interviews in January and February 2021.

Results

The average attack rate in the 14 participating nursing facilities was 39% among staff and 61% among residents. One-fifth (20) of infected residents ultimately died from COVID-19 and its complications. Failure-to-Thrive-Syndrome (FTTS) was diagnosed in 23% of COVID-positive residents. Those at highest risk of death were men (HR=1.78; IC95: 1.18 – 2.70; p=0.006) with FTTS (HR=4.04; IC95: 1.93 – 8.48; p<0.001) in facilities with delayed implementation of universal FFP2 masking policies (HR=1.05; IC95: 1.02 – 1.07; p<0.001). The lowest mortality was found in residents of facilities with a partial (HR=0.30; IC95: 0.18 – 0.51; p<0.001) or full-time physician on staff (HR=0.20; IC95: 0.08 – 0.53; p=0.001). Significant themes emerging from qualitative analysis centered on (i) the structural, chronic neglect of nursing homes, (ii) the negative effects of the top-down, bureaucratic nature of COVID-19 crisis response, and (iii) the counterproductive effects of lockdowns on both residents and staff.

Conclusion

Despite high resident mortality during the first pandemic wave, French nursing homes were ill-prepared for the second, with risk factors (especially staffing, lack of medical support, isolation/quarantine policy, etc) that affected case fatality and residents' and caregivers' overall well-being and mental health.

ARTICLE SUMMARY - Strengths and limitations of this study

What are the strengths of this study?

- Our study is one of the first mixed-methods investigation of nursing homes during the COVID-19 pandemic in Europe, reporting face-to-face interviews of residents themselves, in contrast to most other qualitative investigations of the geriatric population during the COVID period, which have usually been conducted remotely or via surrogates (caregiving staff or family members).
- Our study is also of the first in the world to describe the second wave of the pandemic in this setting, both quantitatively and qualitatively.
- We report in-depth quantitative data analysis of 585 COVID-19 cases from 14 nursing homes while 47 qualitative interviews were conducted in person; from December 2020 to February 2021.

What are the limitations?

- Study site selection was not random, thus, comparing the included facilities to others in Provence and Occitania (or France) should be made with care.
- Moreover, only residents who were fully capable of interacting with investigators and were able to give informed consent could be interviewed, thus excluding anyone with major cognitive disorders (a relatively frequent condition in nursing homes).

INTRODUCTION

In France, state-funded nursing and care homes are the most common living arrangement for both independent seniors and those who need daily care and support. These institutions were deeply affected by the first wave of the COVID-19 pandemic, with an estimated 38% of all residents (247,000 cases) infected with SARS-CoV-2 and 5% (30,395) succumbing to the disease from March-July 2020. The workforce that staffs these facilities was also seriously affected, with an estimated 22% of all workers (90,000 cases) testing COVID-19 positive from late February to late May 2020 [1,2].

In October of 2020, when rising caseloads suggested a second pandemic wave, nursing homes again braced for the worst, since no vaccine was yet approved in France (this occurred in December 2020) and some variants had begun circulating. In November of that year, the non-governmental organization (NGO) Médecins Sans Frontières (MSF) began partnering with select nursing homes in Provence and Occitania provinces, in southern France, to bolster their COVID-19 prevention and care procedures in the midst of rapidly growing medical needs, strained facilities, and understaffing (often aggravated by absenteeism spurred by workplace-acquired infections). As nursing homes transformed into places providing hospital-level care, staff were required to perform more advanced technical procedures and increased disease surveillance at a moment when human resources were depleted due to illness and overwork. Concurrently, health authorities recommended strong lockdown measures for elderly care home residents, including bans on going outside, prohibiting family visits, and confining residents to their rooms.

Despite the devastating mortality rates seen in care homes around the world throughout the pandemic, scientific literature has not yet described the second wave of COVID-19 in this environment. Published research is mostly focused on the first pandemic wave period, almost exclusively on quantitative studies or systematic reviews on specific topics. Several articles report best practices for infection prevention and control (IPC) (i.e. frequent testing for staff, residents, and visitors, staff cohorting, and strict isolation policies), or recommended better evaluation of the consequences of lockdown restrictions [3-13,14, 15]. Other lessons from the initial crisis period were that more staff [6,8], support [8,9], protective equipment, and overall preparation [8-10] could prevent or reduce outbreaks. Lately, articles focused only on the impact of vaccination on transmission among staff and residents [16,17]. The little qualitative research conducted during the first wave was rarely able to conduct in-

person interviews [12, 18-24], but found that lockdowns had a significant and deleterious impact on residents, staff well-being, and staff turnover [20,21].

Our research attempts to understand the risk factors that influenced the second pandemic wave, the impact of that wave, and how staff and residents experienced this period of the pandemic in a nursing home setting.

METHODS

In this mixed-methods, cross-sectional study, we analyze retrospective COVID-19 data from 14 nursing homes being reinforced by support from MSF to assess the impact of the second pandemic wave as well as the effects of prevention measures on resident mortality and comorbidity. These results are given depth and detail through a qualitative investigation into staff and resident experiences. Quantitative data were collected, cleaned, and primarily analyzed by a senior field epidemiologist who joined the MSF team for three months, while the qualitative survey was conducted by a social geographer working alongside MSF in nursing homes from December 2020 to March 2021.

Definitions

Autonomy Evaluation Score (AES) measures a care home resident's level of autonomy. An AES of 1 reflects the lowest level of autonomy (i.e. confinement to a bed or armchair, serious mental function impairment, continuous caregiving required), while an AES of 6 refers to people who have fully retained their autonomy in their daily lives. *The Average Weighted Autonomy Score (AWAS)* is the overall AES score for a facility. This score is a proxy for the financial and human resources that a nursing home needs and has access to: the higher the AWAS, the more resources needed (staff-to-residents ratio, equipment, etc.) and the more dependent the residents. AES and AWAS are mandatory metrics required by French authorities to allocate funds and evaluate nursing homes needs. (Further details and references in Supplementary material, Appendix 1).

Geriatric Failure to Thrive Syndrome (FTTS): Specific to old age, this syndrome is defined by the rapid deterioration of the general state with anorexia, disorientation, and social withdrawal, alongside a more or less directly expressed will to die, a passive giving-up on life, an active refusal of care and/or food. It usually evolves towards death in a few days to a few weeks (80% of cases). It is triggered by physical events (acute illnesses, surgery, trauma) or psychological events (death of a loved one, social isolation, hospitalization).

(Further details and references are in the Supplementary material, Appendix 1).

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Death (outcome for quantitative analysis): Death as an outcome in the linelists is either a resident's death directly linked to COVID-19 or death while the resident was a confirmed COVID-19 case. Death was validated by the NH coordinating physician and recorded in the NH registries as well as in the online national COVID-19 database put in place during the crisis by the French Ministry of Health.

Study Design and Population

This cross-sectional, mixed-methods study used a fixed convergent design [25]. The use of qualitative and quantitative methods was predetermined: the procedures for collecting and merging data were planned at the start of the study according to the identified problem. Quantitative and qualitative data were simultaneously collected during fieldwork, separately analyzed, and then brought together for interpretation. However, the interaction between qualitative and quantitative components occurred during study implementation. Data were integrated through data transformation (codebook of qualitative findings), multi-disciplinary team discussions, and comparative writing (Supplementary material, Appendix 2). The study used a unique dataset that was made accessible thanks to the operational role of MSF in the field. The study used quantitative data from residents living in 14 nursing homes from November 2020 to mid-January 2021. The 14 nursing homes were not randomly selected but retained for analysis if they could provide a full COVID-19 linelist (out of the 22 facilities that MSF supported during this period). Four nursing facilities were purposively selected as qualitative study sites for additional in-person, in-depth interviews conducted between January and February 2021. Qualitative study sites were selected based on whether they had passed their epidemic peak, had high attack and fatality rates, were public or private facilities, and their geographic location.

Data Collection

Administrative data about the facilities (number of beds and staff, job categories, staff-to-resident ratios, AWAS score, resident mean age, etc.) and COVID-related data at the facility level (dates and magnitude of COVID-19 outbreaks, confirmed cases among residents and staff, attack rates, episode duration, number of deaths, resident fatality ratios, etc.) were retrieved by the field epidemiologist from NH managers. Individual, anonymized, COVID-19 case data gathered into linelists (age, sex, AES score, date of COVID-19 positive confirmation, outcome, date of death, date of transfer to hospital, oxygen therapy, palliative care, comorbidities such as dementia, neurodegenerative diseases, diabetes, cancer, cardiovascular diseases, etc.) were collected by the field

epidemiologist. Sources of these data were residents' electronic records and registries maintained by head nurses and coordinating physicians. Diagnoses of all comorbidities followed national guidelines and were operationalized by NH clinicians and coordinating physicians. Diagnoses were then recorded in resident registries and transferred to the linelists by the field epidemiologist with the help of the head nurses. Facilities and linelists data were used for quantitative analysis.Qualit ative data was gathered using semi-structured, in-depth interviews (IDIs) during one-week ethnographic immersions in each of the four qualitative study sites. The lead investigator targeted four groups of actors, including facility administrators (directors, coordinating physicians, and nurses), clinical and facilities staff (nurses, caregivers, educators, physical therapists, maintenance crews), the residents themselves, and the residents' visiting family members. Participants were purposively selected to obtain a maximally heterogeneous sample of interview participants and reflect the spectrum of opinions and experiences of everyday life in nursing homes. Across the 4 qualitative study sites, a total of 47 IDIs were conducted with facility directors (4), staff members (36), and residents (7). Among the 36 staff members, 29 were caregivers and 7 provided other support functions (human resources, maintenance, cleaning, cooking). All interviewed residents were women, as were the majority of study participants overall (82.9%). Interview length varied from 12-171 minutes (54-minute average). (Supplementary Material, Appendix 3).

Telephone and face-to-face interviews were also conducted with 10 residents' family members, though family interviews are not included here to focus on experiences from within the nursing homes during the lockdown. Nine residents refused to participate (due to fatigue, discomfort with interviewing, or COVID-19-related reasons). Caregiver participation was constrained by understaffing, overwork, fatigue, or disease, which left them with very little time or energy for interviewing.

Vulnerable residents were pre-selected under the advisement of the coordinating nurse on the permanent caregiver teams. Participants had to be able to give informed consent, capably interact, and have no major cognitive disorders. The level of autonomy (AES) did not constitute an a priori criteria for participant selection. Whenever a legal guardian or curator was designated, the latter was contacbeforer to the interview to verify that consent could be obtained from the interviewee.

Question guides focused on three primary topics: the outbreak chronology, adaptation to the crisis, and the individual experience of the second pandemic wave (Appendix 4). Individual guides were adapted for those living in the nursing home (residents) or working there (facility administrators and staff). All interviews were voice

recorded and direct observations were written in the investigator's field book. All written data were anonymized upon collection. Participants' data was assigned a study number that was set on a correspondence table kept separately from other data. Written informed consent was obtained prior to beforeerview.

Preventive measures were implemented with all participants to decrease COVID-19 disease transmission risk: systematic FFP2 face mask use, social distancing, hand and space disinfection, and weekly Rt-PCR tests for the two field investigators.

Statistical Analysis

Patient data were explored using univariate analysis to highlight possible mortality risks. Univariate unadjusted Cox Hazard Ratios, Kaplan-Meier estimations, and Log-Rank tests were used for multivariate analysis. A stepwise procedure was followed, retaining factors with a log-rank test value <0.3. COVID-19 mortality was estimated using a multilevel mixed-effects Cox model using selected factors identified in the univariate analysis. Random effects on individual variables were considered and nested at the facility level [26]. Interactions between potentially correlated factors (comorbidities, failure-to-thrive syndrome, autonomy level, time-related variables) were accounted for while robust standard errors were computed (Appendix 2). 95% confidence intervals are presented and a significance threshold of 5% was chosen for p-values. Statistical analyses were conducted with Stata 15® and R Studio 1.4®.

Qualitative Analysis

Data analysis was performed from January to March 2021, similar to the fieldwork period (January-February) and reporting phase (March-April). The qualitative analysis combined grounded theory and hypothetico-deductive analysis. Preliminary observation in five nursing homes and MSF-team reports were used to create an initial checklist for systematic direct observation. In January and February 2021, 36 semi-structured IDIs were conducted in three nursing homes, in combination with "external participatory observation" [27]. Questions were adjusted iteratively afa ter preliminary analysis was conducted on these initial interviews. Data saturation was sought throughout the interview process and discussed within the researchevery week basis. In February 2021, 11 semi-structured IDIs were conducted in a fourth nursing home to assess data saturation.

Interview data were processed gradually through professional transcription and verified with the interviewees when necessary. De-identification occurred during transcription (names, places, dates, distinctive personal data,

etc). Interview data were written, analyzed, and coded in Excel spreadsheets. The first codebook with 39 data codes emerged from interview transcripts. Five themes were initially analyzed and refined into a final set of 33 across four key categories. Three of these were cross-cutting and had up to three sub-themes (Table 3). Results are reportefollowingth the Standards for Reporting Qualitative Research (SRQR) guidelines [28] and the COnsolidated criteria for REporting Qualitative research (COREQ) checklist.

Patient and Public involvement

Administrators and coordinating physicians from 14 nursing homes were actively involved in collecting and anonymizing study data from their residents/patients. During the exploratory phase of research (December 2020 to January 2021), any feedback from qualitative study site administrators was included in the study protocol. During data collection (January to February 2021), the research methodology was discussed with MSF nurses and facilities staff and adapted to each nursing home's context and caregiver guidance. At the beginning of each IDI, caregivers and residents were encouraged to further participate in the research by contacting the lead investigator with any suggestions. In the reporting phase (from the 1st of March to June 2021), internal reporting was sent to interviewees who wanted to be contacted for this purpose. This report was sent to prominent political COVID-19 crisis management actors (such as the French Ministry of Health). A summary letter will be brought to resident study participants and facility staff to inform them of the results and gather their comments on possible follow-up.

Ethics

This study received approval from the MSF Ethical Review Board (ERB) ID 2703 and the Commission Nationale de l'Informatique et des Libertés (CNIL) in France. Patient data and qualitative observations were fully anonymized. All study procedures were in line with the Declaration of Helsinki.

RESULTS

22 nursing homes were originally included in the study, though data was available for only 14 of them (the others did not send data in time for analysis or the data were not electronically recorded). The 14 participating nursing facilities were largely state-supported entities (79%) with an average of 68 residents (median=65; IQR: 58-73). Results varied considerably from one nursing home to another. COVID-19 outbreak duration averaged 39 days (median=40; IQR: 30-50 days) while Infected residents' individual COVID-19 episodes averaged 24 days

(median=30; IQR: 14-51 days). The average attack rate was 39% (median=39%; IQR: 29%-54%) among staff and 61% (median=60%; 50%-73%) among residents. One-fifth (median=20%; IQR: 17%-23%) of the residents who were infected ultimately succumbed to COVID-19 and its complications. The mean Average Weighted Autonomy Score (AWAS) was 770 (median=763 ; IQR: 722-804) and the average staff-to-resident ratio was 0.82 (median=0.86 ; IQR: 0.72-0.90). The average time to universal masking policies being implemented was 9.6 days (median=6.5; IQR: 2-15 days) and the average time until a facility was bolstered with MSF support (staff or resources) was 17.5 days (median=15; IQR: 13-28 days). (Appendix 5).

Patient Risk factors

Retrospective COVID-19 data were obtained for 14 nursing homes, finding 585 COVID-19 cases among 930 residents (61% attack rate) (Table 1). Cases were mostly women (78%) who were >85 years old (68%). Individual Autonomy Scores (IAS) were low (<2) in a majority of cases (60%), indicating a very low level of autonomy overall. One-fifth (21%) of cases were transferred to a hospital, while half (46%) were put on oxygen therapy. One-tenth (12%) of COVID cases received palliative care, and nearly one-quarter (22%) died. Failure-to-Thrive Syndrome was diagnosed in nearly one-quarter (23%) of COVID-positive residents. At least one other comorbidity was found in over half (61%) of infected residents. AWAS, nursing home size, and staff-to-resident ratios were all strongly correlated, as were time-related variables (time until external MSF support was received, time until universal masking policies were applied, and duration of COVID episode) (Table 1).

Table 1. Univariate Analysis of Nursing Home Resident and Facility Data, Provence and Occitania Provinces, France, 2021

228 Figure 1. Likelihood of survival by resident and nursing facility characteristic, Univariate (Kaplan-Meier) Analysis, Provence and Occitania Provinces, France, 2021

Univariate analysis using Cox modeling (Table 1) and Kaplan-Meier estimations (Figure 1) suggested that individual characteristics like gender (log-rank p<0.001) and IAS (p=0.008) were associated with COVID-19 mortality, while age and specific comorbidities were not. Survival curves also suggested that facility characteristics like low AWAS (p<0.001), the absence of a permanent physician on-site (<0.001), larger nursing home size (>70 residents) (p=0.036), and a high staff attack rate (p=0.025) were also associated with resident mortality. Predictably, hospitalization (p<0.001), palliative care (p<0.001), and oxygen therapy (p<0.001) were all strongly correlated with the risk of death, as was the presence of FTTS (p<0.001) and the presence of more than 4 co-morbidities (risk increased with the number of co-morbidities present, p=0.045). Additional Kaplan-Meier Curves for non-significant factors can be found in the supplementary information (Appendix 6).

Multilevel Cox Hazard modeling highlighted mortality associated factors adjusted for potential confounders (Figure 2). Those at highest risk of death were men (HR=1.78; IC95: 1.18 - 2.70; p=0.006) with an FTTS diagnosis (HR=4.04; IC95: 1.93 - 8.48; p<0.001) in facilities with delayed implementation of universal masking policies (HR=1.05; IC95: 1.02 - 1.07; p<0.001). The lowest mortality risk was found in residents of facilities with a partial (HR=0.30; IC95: 0.18 - 0.51; p<0.001) or full-time physician on staff (HR=0.20; IC95: 0.08 - 0.53; p=0.001), with individual AES scores >3 (HR=0.38; IC95: 0.16 - 0.89; p=0.026). Noticeably, higher AWAS (a proxy for staff-to-resident ratios and a nursing home's overall means) was associated with a lower risk of death (HR=0.99; IC95: 0.99 - 1.00; p=0.020) (Table 2). Sensitivity analysis can be found in the supplementary information (Appendix 7).

Table 2. Multivariate Cox Hazard adjusted analysis of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021 (Information Criteria: AIC*=1171; BIC=1226)

Figure 2. Final Cox Model: Forest Plot of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021

Qualitative Results

The qualitative approach richly described interviewees' lived experiences during the COVID-19 crisis, revealing difficult-to-quantify social influences on the outbreak's evolution and impact. Three significant themes emerged from our discussions (Table 3).

Structural, Chronic Neglect of Nursing Homes

Staff members described a long-standing lack of physicians in nursing homes, exacerbated by lockdowns and growing medical needs during a period of rising COVID-19 infections. One nurse explained, "the nursing home was almost like a hospital ward at one point…There was more supervision [needed], more care…We didn't have the staff to do all that." All groups of interviewees emphasized that working in precarious and understaffed conditions was a substantial difficulty that became a critical risk during the COVID-19 outbreak and compromised the response. Assistant nurses described extremely challenging working conditions: "When they ask you to help 13 people to bath before noon, you don't work well." This situation was worse during the second pandemic wave when, as one psychologist explained, "no one counted the hours. We had to be there, we put our private lives on hold, but it was important to do it." All directors described a structural lack of a "permanent medical presence" and the need for a "strict staffing ratio."

Top-down Crisis Management

Personnel highlighted the "top-down" approach of French health authorities, including a lack of communication and time-consuming processes for staff and administrators alike, "The ARS [Regional Health Authorities] have been absent during the whole crisis. (…) Since March, I haven't seen the authorities giving us any support, nor any real help, except for claiming statistics back." These officials worked far from the frontline environment of a nursing home and were removed from the suffering of residents and staff. As a result, it was felt that they encouraged ill-informed, unrealistic, and inconsistent crisis-response measures: limiting contact with residents, confining them to their (small) rooms, abruptly relocating them to new rooms (very disturbing for them), or even physically restraining residents in distress. A psychologist described how "some people had to be uprooted from

their rooms“ where they had “spatial-temporal and autobiographical markers”, while others “had to be restrained” by assistant nurses. All of these were deeply disheartening to staff and residents, creating feelings of shame and guilt among caregivers and the potential for cognitive disorders among residents. A resident explained that “it was hard, staying in the room for a whole day, without going out,” and that “anyone would become nuts!” Weak crisis response mechanisms also manifested as poor prevention measures (a lack of universal masking requirements initially, facemask shortages during the first wave), lack of state medical relief staff, and such an extreme lack of preparedness that assistance from a non-state humanitarian actor like MSF was needed. As a director told us, calling MSF, a disaster-response organization “showed what a disaster we were experiencing.”

Counterproductive Effects of Lockdowns

Finally, participants described the counterproductive effects of lockdowns, including negative medical outcomes and even violence. Physiotherapists described “a decline in motor skills, but even more in cognitive skills” and “completely accelerated failure-to-thrive syndrome” which corroborates other descriptions of “bedridden patients, depressive states, failure-to-thrive” because “the residents haven't gone out for a year.” Participants were discouraged that lessons from the first pandemic wave did not translate into better preparedness and smoother, more nuanced, and less restrictive lockdown policies during the second. Despite feeling secure in their nursing home environment during the pandemic period, interviews with residents revealed the depth of their dislike for the extreme physical and social isolation they faced while alone in their rooms, especially when facilities’ social activities, family visits, and outings were suspended or strictly supervised with social distancing measures. Extreme fatigue occurred after a year of lockdown and social restrictions, as one nursing home’s 90-year-old resident explained “if we could go out, we would bear it better.” Since facility administrators were urged to follow the ARS recommendations, only a few directors or staff were willing to soften lockdown measures, allow family visits, or take residents’ end-of-life wishes or needs for social interaction into account.

These interviews show some overlap with the risk factors that were highlighted in the quantitative data (mortality risks linked to understaffing, the absence of a permanent staff physician, low staff-to-resident ratios, and lockdowns linked to FTTS). Other qualitative factors associated with better pandemic management also appeared in interviews, such as reliable communication with local health authorities, the presence of an effective national health strategy, and collaboration with other medical sectors.

302 Table 3. Representative quotes for the 3 themes

DISCUSSION

Our study is the first mixed-methods investigation of nursing homes during the COVID-19 pandemic in France, and one of the first in Europe. MSF staff's close, in-person work with these care facilities gave investigators privileged access during a challenging period and lead to particularly rich interviews. This lies in contrast to most other qualitative investigations of the geriatric population during the COVID period, which have usually been conducted remotely or via surrogates (caregiving staff or family members), without being able to interview residents themselves. These results show clearly that the second wave looked largely similar to the first wave in French nursing homes, in both response and impact, and that these facilities were not sufficiently prepared and supported when facing subsequent threats to their vulnerable tenants.

Nursing home data is not routinely collected by French national health information services because residents are considered to "live at home." Thus, considering how difficult it is to access even the most basic data from these facilities (such as the number of cases or deaths), we managed to construct a large dataset containing detailed information about COVID-19 cases, which affected 30% of all residents in the 14 participating nursing homes. The study also allowed a thorough examination of COVID-19 as experienced by the staff and residents who most suffered from the pandemic. To the best of our knowledge, French crisis management measures during the second pandemic wave were never informed by qualitative data. In this study, patients' risk factors could be explored about influential social and structural determinants of health, such as understaffing, strict lockdown measures, isolation from other medical actors/lack of medical support, or the top-down and bureaucratic crisis management by health authorities.

Our multivariate analyses confirmed mortality trends seen in other settings. Similar to other studies, we found that men died more often despite being a minority of nursing home residents and that residents' autonomy was a strong factor in their survival, with those who were more reliant on staff for daily support most likely to succumb to their disease [8-10, 29-33]. Living with multiple comorbidities (especially diabetes and dementia) was also strongly predictive of COVID mortality in our group [8, 10, 29-33]. The negative effects of understaffing (seen as sick leave or AWAS in our data) were similar to those reported in the United States [8], Spain [33], and the United Kingdom [34-35], and constitute a vicious cycle: during periods of high transmission, more staff

needed sick leave. Yet, the medical and staffing needs of residents were simultaneously surging, forcing many sick (and infectious) caregivers back into the workplace. The cycle was compounded by the destructive effects that an enormous workload and an anxiety-producing work environment are known to have on caregivers' well-being [12, 18, 20, 21, 36, 37].

The efficacy of universal masking to prevent respiratory disease is well established [38,39], though we were not able to measure the impact of staff/resident masking because mask mandates were often put in place at the same time that extra resources and support from MSF arrived and bolstered the nursing facility overall. Nevertheless, our results do suggest that higher transmission and case fatality were associated with delays in mandatory mask requirements for staff, confirming the utility of these rules in uniquely vulnerable and high-risk nursing home settings. The facemask issue is not easy, however, in a nursing home context. The health benefits of masking have trade-offs with other social needs: care home residents may live with hearing or cognitive disorders, and masking may prevent voice and facial recognition or communication. The absence of others' daily smiles or expressions may have led to cognitive decline, a point that has been shown in previous research and was emphasized in our interviews with caregivers, managers, and residents alike [40, 41].

Finally, the benefit of confining residents to their rooms is strongly questioned by these results. While such measures undeniably reduce virus transmission among residents [6-10, 14-15, 34, 38-39, 42-44]; the consequences for their mental health and nutritional status have also been shown to be considerable [12, 13,20-24, 37, 45-49]. Strict lockdowns in our cohort were associated with higher FTTS incidence, triggered by individuals' difficult living conditions over multiple months (the long duration of the crisis, an anxiety-provoking atmosphere, social isolation, other residents' deaths, etc.). We found a strong statistical association between COVID-19 case fatality and FTTS diagnoses, a result that was triangulated by qualitative interview data and is consistent with other research from France [42], the United Kingdom [43], Finland [47], the United States [48], Spain [49, 50] and Italy [51].

Limitations

Our study is limited by the fact that study site selection was not random but was instead steered by discussions with MSF. Moreover, since MSF targeted mostly struggling nursing homes, the study included only a small number that did not have major outbreaks (or contained their outbreaks early). As a result, comparing these

facilities to others in Provence and Occitania (or France) should be made with care. Participant selection was biased by the fact that only residents who were fully capable of interacting with investigators and were able to give informed consent could be interviewed, thus excluding anyone with major cognitive disorders (a relatively frequent condition in nursing homes). Quantitative data were neither exhaustive nor always electronically recorded. Associations between COVID-19 deaths and FTTS were complicated by the co-morbidities that many residents also lived with, though adjusted analysis attempted to control for potential confounding.

CONCLUSION

These results raise questions about French health authorities' approach to managing the second wave of the COVID-19 pandemic, as seen through the lens of those living through the crisis. If institutional management of older ager, loss of autonomy, and end of life is a chronic issue for a long time in France, solutions exist to support nursing homes in times of acute crisis. Future debates about a pandemic response in this setting should take into account things like the social needs of residents, understaffing as a risk factor for higher COVID-related deaths, and should refine general health policies and prevention measures in nursing homes.

Moreover, once an outbreak has occurred, tough questions must be asked: Are restrictive measures for all residents worth the personal and mental health toll? How can facilities improve residents' end-of-life conditions in a controlled, safe way that will allow them (and their families) dignity and care? Is this reasonable to do if it involves a modicum of increased risk exposure for the facility overall? These results remind us that an effective COVID-19 response should be context-adapted, patient-centered, and humane.

TABLES

Table 1. Univariate Analysis of Nursing Home Resident and Facility Data, Provence and Occitania Provinces, France, 2021

		Deceased N=131 (22%)		Survived N=454 (78%)		Hazard Ratio (non-adj.)	IC 95%	Log-Rank Test p-value
		n	%	n	%			
Individual Data								
Gender	Female	89	19.5	368	80.5	Ref		<0.001
	Male	42	33.1	85	66.9	2.06	1.41 - 3.02	
Age (cat.)	65-75 y	10	20	40	80	Ref		0.971
	75-85 y	29	22	103	78	1.14	0.74 - 1.76	
	85-95 y	65	23	218	77	1.19	0.62 - 2.28	
	>95 y	27	22.7	92	77.3	1.14	0.67 - 1.93	
Autonomy Score	1	33	29.2	80	70.8	Ref		0.008
	2	62	26.2	175	73.8	0.96	0.58 - 1.59	
	3	24	20.9	91	79.1	0.71	0.35 - 1.45	
	4	11	10.9	90	89.1	0.38	0.19 - 0.75	
	5	0	0	11	100	0.00	0.00 - 0.00	
	6	1	14.3	6	85.7	0.52	0.08 - 3.55	
Autonomy Score (cat.)	AES=1	33	29.2	80	70.8	Ref		<0.001
	2	62	26.2	175	73.8	0.96	0.59 - 1.59	
	3	24	20.9	91	79.1	0.71	0.35 - 1.46	
	>=4	12	10.1	107	89.9	0.35	0.19 - 0.65	
Hospitalization		60	56.6	46	43.4	5.11	3.57 - 7.30	<0.001
Oxygene Therapy		97	41.5	137	58.5	5.69	3.17 - 10.22	<0.001
Palliative Care		33	86.8	5	13.2	8.11	3.77 - 17.45	<0.001
Failure-to-thrive Syndrome		74	59.2	47	12.6	9.45	3.09 - 28.89	<0.001
Number of Comorbidities	0	43	19	183	81	Ref		0.187
	1	30	20.5	116	79.5	1.05	0.65 - 1.69	
	2	35	26.3	98	73.7	1.25	0.81 - 1.93	
	3	16	27.6	42	72.4	1.42	0.85 - 2.37	
	>=4	7	31.8	15	68.2	1.85	1.05 - 3.25	
Cancer		9	30	21	70	1.36	0.87 - 2.12	0.294
Obesity		4	26.7	11	73.3	0.87	0.51 - 1.49	0.887
Cardiovasc. Disease		32	28.6	80	71.4	1.30	0.84 - 2.00	0.257

High Blood Pressure		50	24.4	155	75.6	0.89	0.65 - 1.24	0.927
Dementia		41	24.1	129	75.9	1.00	0.74 - 1.35	0.522
Denutrition		9	39.1	14	60.9	1.97*	0.91 - 4.23	0.098
Diabetes		15	31.9	32	68.1	1.23	0.73 - 2.07	0.217
Respiratory Dis.		5	20.8	19	79.2	1.04	0.43 - 2.51	0.753
Other comorbidities		4	20	16	80	1.19	0.29 - 4.83	0.875
Facility-Level Data								
Facility Type	Private	21	18.6	92	81.4	Ref		0.287
	Public	95	24.9	287	75.1	1.07	0.62 - 1.85	
	Public NH within Hospital	15	16.7	75	83.3	0.73	0.42 - 1.29	
AWAS (cat.)	High (>=800)	73	29.1	178	70.9	1.54	1.05 - 2.28	<0.001
	Medium (750-800)	13	12	95	88	0.56	0.23 - 1.39	
	Low (<750)	45	19.9	181	80.1	Ref		
Time to FFP2 use (cat)	Immediate (<=1 day)	27	22.9	91	77.1	Ref		0.525
	Late (1-7 days)	32	18.9	137	81.1	0.90	0.53 - 1.53	
	Very Late (>=7 days)	72	24.2	226	75.8	1.03	0.52 - 2.06	
Staff to Resident Ratio (cat)	Good (>0.9)	67	27.8	174	72.2	1.56	1.02 - 2.38	0.018
	Medium (0.8-0.9)	34	17.9	156	82.1	0.95	0.59 - 1.55	
	Low (<0.8)	30	19.5	124	80.5	Ref		
Presence of a Physician (cat)	None/Absent	39	35.8	70	64.2	Ref		<0.001
	Half-Time	61	18.6	267	81.4	0.50	0.31 - 0.80	
	Full Time	31	20.9	117	79.1	0.43	0.24 - 0.75	
NH Size	>=70 residents	81	25.6	235	74.4	1.43	0.83 - 2.44	0.036
	<70	50	18.6	219	81.4	Ref		
Staff Sick Leave Proportion (cat)	High (>50%)	61	27.5	161	72.5	Ref		0.030
	Low (<=50%)	47	20.7	180	79.3	0.62	0.41 - 0.95	
Staff Attack Rate (cat)	High (>50%)	75	27,5	198	72,5	2.23	1.13 - 4.39	0.025
	Medium (25-50%)	46	19,7	188	80,3	1.56	0.77 - 3.14	
	Low (<25%)	10	12,8	68	87,2	Ref		
Time to MSF Intervention (cat)	Long (>20 days)	45	24.9	136	75.1	Ref		0.234
	Medium (10 to 20d)	73	22.4	253	77.6	0.78	0.47 - 1.28	

	Short (<10d)	13	16.7	65	83.3	0.57	0.37 - 0.89	
	<14 days	26	14.6	152	85.4	Ref		
COVID outbreak during the first wave	Yes	24	19.4	100	80.6	0.76	0.30 - 1.93	0.336

* p <0.1 p<0.05 p<0.01

Table 2. Multivariate Cox Hazard adjusted analysis of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021 (Information Criteria: AIC*=1171; BIC=1226)

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.98 - 1.03	0.876
Autonomy Score	2 vs 0	0.66	0.35 - 1.27	0.216
	3 vs 0	0.38	0.16 - 0.89	0.026
	≥4 vs 0	0.22	0.07 - 0.66	0.007
Gender	M vs F	1.78	1.18 - 2.70	0.006
Comorbidities	1 vs 0	1.92	1.04 - 3.57	0.038
	2 vs 0	1.76	0.93 - 3.32	0.081
	3 vs 0	2.08	0.98 - 4.42	0.056
	>=4 vs 0	2.51	0.96 - 6.59	0.061
Failure-to-thrive Syndrome	Y v N	4.04	1.93 - 8.48	<0.001
Presence of a physician	Half Time vs None/Absent	0.30	0.18 - 0.51	<0.001
	Full Time vs None/Absent	0.20	0.08 - 0.53	0.001
Time to FFP2 use (in days)	continuous	1.05	1.02 - 1.07	<0.001
AWAS	continuous	0.99	0.99 - 1.00	0.020
Staff Attack Rate (%)	continuous	2.71	0.59 - 12.42	0.198
Interaction Terms	AES=2#FTTS=1	2.26	0.90 - 5.67	0.083
	AES =3#FTTS=1	3.10#	1.00 - 9.58	0.050
	AES =4#FTTS=1	4.79#	1.16 - 19.87	0.031

interaction term significant -> FTTS effect amplified at each level of AES effect. *Akaike Information Criteria

382 Table 3. Representative quotes for the 3 themes

Subthemes	N	Quotes (*translated from French*)
THEME 1. The Structural and Chronic Neglect of Nursing Homes		
Long-Standing Medical Isolation	1	The problem is that we no longer have enough physicians in our areas: the older ones are retiring without being replaced and those who are still there, they're overloaded with work. *(Director 1)*
	2	In March 2020, businesses closed, shops closed, and hospitals deprogrammed. (...) However, in the NHs, our activity stayed the same, we remained full, even with a much higher nervous intensity than usual. *(Director 49)*
	3	What was tough was that the Nursing Home turned to a medical service. And before that it wasn't a medical service at all, it was more of living space. *(Coordinating Physician 10)*
	4	The nursing home was almost like a hospital ward at one point. Blood tests, all the time, sometimes 12 a day. There was more supervision, more care. It was weird because we didn't have the staff to do all that. *(Nurse 23)*
Working in Precarious and Understaffed Conditions	5	Right now, we have 1 nurse for 50 [residents]. So it's not enough! (...) I am convinced that the key issue for nursing homes is strict staffing ratios. *(Director 49)*
	6	My fellow caregivers are telling me, outside of the COVID crisis: "When I go home, I'm not happy with what I did because I could have done more, but I can't afford to do more, I don't have enough time". I think that's pretty pathetic. *(Psychologist 20)*
	7	Working in a Nursing Home, I did it, but it's not by choice. It's too hard, it's not a question of vocation, but that the work is too hard. They ask you to do 15 toilets...Connections with people are rich, you learn a lot. But the working conditions are hard. When they ask you to help 13 people to bathe before noon, you don't work well. I see people who were there for 30 years and who says "we have no choice". Nursing homes are hard. *(Ass Nurse 21)*
	8	You see, the nurses: when I first came in, there were two of them, each taking a round. But now...They only pass by, they don't even stay. I didn't think this could be to that extent. *(Mrs. E. Resident 3)*
	9	I think that what's structurally lacking in nursing homes is a permanent medical presence. The attending physicians come whenever they can. But even then, we trigger hospitalizations way too late... I don't think that attending physicians can deal with crisis management. (...) From the moment the staff started to get sick, in terms of organization and functioning, it became very complicated. (...) We managed to recruit, but there were so many sick leaves for COVID that the replacement staff just filled the gaps. A cluster of residents, plus a cluster of employees. *(Director 31)*
	10	Yes, there were days when we worked 11 and a half hours. Just one missing person and that was finished: we'd have our lunch break between noon and two, and we couldn't take an afternoon break. *(Ass Nurse 11)*
	11	No one counted the hours. We had to be there, we put our private lives on hold but it was important to do it. (...) We have no life anymore, since March. *(Psychologist 20)*
THEME 2. Top-down crisis management		
A "top-down" approach to crisis management	12	The ARS [Regional Health Authorities] have been absent during the whole crisis. (...) Since March, I haven't seen the authorities giving us any support, nor any real help, except for claiming statistics back. Ah, "Data"! That was very important: entering data on the national online reporting platform. (...) The ARS implemented teleworking [for their staff], and you couldn't reach them for a while. (...)Imagine, you are looking for a contact, anybody, but email address is not personalized at all. *(Director 24)*
Inconsistent and guilt-laden recommendations	13	This morning, that's all I did: tracking the COVID vaccine doses. First, the HAS [National Scientific Authority] told us that a recovered from COVID could only get a single booster dose. Then the MoH just told us that they did not agree and that they needed two booster doses. So I had to reorganize the entire vaccination schedule in light of this setback. *(Coordinating Physician 10)*
	14	We see that the people who make these recommendations don't know the field. That's what made me angry, I think. Hey, bureaucrats, come and see what a nursing home is like, when you lower the ratio of caregivers to elderly people, saying that they should be given 10 minutes, no more. (...) They should first give us more help, those who write the protocols and texts, should come and see what it's like for elderly people in institutions, with or without cognitive disorders. *(Psychologist 20)*
	15	We are in an environment where we touch each other all the time. You touch them to change them, to handle them, to feed them. You spend your time touching! And from one day to the next, you are told: "don't touch, you'll spread the virus". (...) See, they [the residents] were in jail. They were in a cell. Really, when the rooms were closed, the nursing homes were empty. And that must have disturbed the residents but also the caregivers, who were used to touching. (*Director 24)*
	16	Look, some people had to be uprooted from their rooms. Our residents have cognitive disorders; they are very attached to their rooms. They have spatial-temporal and autobiographical markers inside. And suddenly, we had to remove everything, to put them in a different room, without their belongings, because they were potentially contaminated. This was difficult, I opposed it. I said we couldn't do that. Okay, there is COVID, but we are a Nursing Home! (...) Here, I have seen colleagues, and assistant nurses, crying while tying people up, telling them: "I'm sorry I have to tie you up, because it is to protect you, in fact". (...) It was really a war, they told me: "but we have to do this". Just like me, I said to myself: "but at some point, we haven't signed up for this", we are Nursing Home! *(Psychologist 20)*
	17	For example, I remember in the service I was in, two people had a very hard time with the confinement, who had to be restrained, and it was really not easy for us and the residents. *(Ass Nurse 16)*
	18	At one point, during the first lockdown, we had to stay in our room. We had dinner in the rooms. Then it was hard. It lasted for a long time. We were not allowed to go out anymore. Even those who were not sick! The time to get everything sorted. It was hard, staying in the room for a whole day, without going out...Anyone would become nuts! *(Mrs. C, Resident)*
Weakly armed mechanisms and actors for crisis situations	19	We experienced successive stresses. The masks, which we could not find! We had to beg, practically. (...) I remember going to the pharmacies to find overcoats on Saturdays. (...) It wasn't a lack of foresight, it was that we couldn't find them, people were rushing to stock them, and there were no supplies. *(Director 24)*
	20	I had already warned the ARS about the shortage of caregivers. I asked them to activate the health reserve, and I never got any help in managing the situation. We feel very lonely in dealing with given situations. (...) No matter how many times I called the ARS, they sent me to platforms that don't work. The national recruitment platform. And we've lost a lot of time. (...) Staff turnover was also an infection risk. Many of the people we took on as replacements got sick later on. *(Director 31)*
	21	You can feel that the fatigue of the first lockdown is still here [for the staff]. Because it is still an overload. The teams are reinforced, but it's still a lot of work. *(Mrs. C, Resident)*
	22	We were so paranoid that we disinfected everything. At first, I would even disinfect the lunch tray as soon as I left the room, I would smear disinfectant all over it [laughs]. Once we had a good protocol, it was smoother. When MSF arrived and told us: "This is how you do it, like this,

		like that". They helped us tremendously, in the organization, and in the daily work, otherwise, we would have gotten lost. *(Ass Nurse 11)*
	23	Well, it's sad, in a way. Because MSF intervenes in places of disaster, in Haiti, in countries at war. So, calling for your help because you have know-how is positive. But calling you because you intervene in places of the disaster showed what a disaster we were experiencing. *(Director 49)*
	24	Fortunately, I had the help of [the MSF doctor]. I don't know if I could have managed it on my own. Being only part-time in two establishments, it would have been very complicated. (...) The workload was huge, alone it was not feasible. And when I was in the other nursing home, he [the MSF doctor] was there, so at least the residents had a doctor every day. (...) It's also reassuring to be able to share about a new disease, all these discussions between colleagues, on an unknown disease. *(Coordinating Physician 10)*
THEME 3. Counterproductive effects of the confinement of residents		
Impacts of lockdowns during the first wave	25	We had a lot of containment-related impacts, which we still have today, even among COVID-negative residents. A lot of degradation, and deaths. (...) Bedridden patients, depressive states, failure-to-thrive syndromes. We've been locked up for a year now. Can you imagine? The residents haven't gone out for a year! It is terrible. *(Coordinating Physician 10)*
	26	They had to stay without anything [in terms of physiotherapy care]. 15 days, it's still feasible, but a month and a half! This was very long for them, and we saw the difference. (...) For all of them, there was a decline in motor skills, but even more in cognitive skills. The patients who already had a little difficulty at the cognitive level suddenly have fallen into mutism, with a completely accelerated failure-to-thrive syndrome. (...) Regarding pathologies, we've lost so much. In a month and a half, patients whom I used to make a walk, now they are in an armchair. (...) It's not just a few points on a vigilance scale, no, it's quite massive. *(Physiotherapist 33)*
	27	This protocol we put in place was shocking, and stressful at first. We saw a family climbing up to come to hug their mother. Yeah, there were moments during the first wave, a little...a little violent. Yeah, violent, outright. *(Psychologist 20)*
The silenced opinions of nursing home residents	28	Finally, we did not ask the residents their opinion. We confined as recommended. We didn't have much choice. (...) We have residents here who never had any symptoms, so it's a bit of a double whammy: I'm sick, I'm fine, but then I'm stuck in my room. *(Director 1)*
	29	What bothered me about the lockdown was that the resident's opinion was never asked. (...) The only things I was hearing of were disaster scenarios, with many deaths, and many sick staff. A lot of confinements in rooms, and in the end, the results were not necessarily conclusive. *(Director 49)*
	30	Finally, I'm glad I arrived here before because I was in a fragile period before, it would have been even more difficult. So I'm glad I came. Right now I'm in the right place at the right time. *(Mrs. C, resident)t*
	31	When this microbe is gone, as soon as we can go out, my daughter will come and get me, because her house is in [the same village]. (...) I would like us to be able to go out again at some point, but we have to bring the staff back. And with the disease....This microbe is always there, we can't live normally. *(Mrs. E, Resident)*
	32	The room, we stayed in there for a few days straight, you see! Can you tell? From breakfast to supper, in a room! It is not in my nature. (...) It was not fun. Especially since these rooms are small; they can't be 40m2. *(Mrs. Q, Resident)*
The courage to lift the containment measures	33	These activities we used to have, these games, twice a week. It was a nice break during the week. I miss that. Now, every day of the week looks the same. *(Mrs. C, Resident)*
	34	(Mme A.) When this illness happened, we were no longer allowed to do anything. We no longer have outings, we have nothing, nothing, nothing. (...) The COVID period, there, it hurts because you don't see anybody. You only see those who are inside [the nursing homes]. (Mme O.) We are isolated, left to ourselves. (...) Now I can only see my daughter behind a Plexiglas. So the mask, the glass... We don't understand a lot. (Mme A.) We have to speak a bit louder than normal. And we can't touch each other, we only kiss from far away. This is annoying, not being able to hug them! (Mme O.) We can't kiss her to or goodbye, nothing! We are separated by a Plexiglas. (Investigator) And you would prefer that people could come to the nursing homes? (Mme A.) Of course! We should see them a little more!
	35	If I could go out on Sundays, I would be the happiest. (...) If we could go out, we would bear it better. (...) Things should go back to normal again. Just because there's a virus out there doesn't mean that everything should stop! *(Mrs. Q, Resident)*
	36	We followed the recommendations, to the letter. After that, there is the reality of the field. (...) If I applied the recommendations, I would put everyone in isolation, because there is still active virus circulation, and visits would not have resumed here. It is not acceptable to ban visits. But it is the director's responsibility. *(Director 31)*
	37	We decided to open the visits for families again, including for those suffering from failure-to-thrive syndrome, and not only for the "end of life" ones. Because our job is to be human. So at some point, people need to see their parents, and their parents need to see their children. We have to be able to do all that while respecting public health measures and so on. *(Director 1)*
	38	With this decision, to not confine them in their room, this year we really did what they wanted. And I think we'd never done it, actually, exactly what they wanted. (...) When you know that COVID is coming in, you accept that there will be deaths. The question is the conditions around the death. *(Director 49)*
	39	We're not here to generate failure-to-thrive syndromes or severe depressive states either. So I told the girls: "you wash his hands well when he comes out of the room, but we set him free!". Because that was really the point: the impression of locking people even more. They are 91 years old, and 92 years old so that's enough! *(Coordinating Physician 10)*
	40	When we reopened the dining room, we saw residents expressing a desire to eat with this or that other resident. Relationships, loving couples forming. All of that, it didn't exist anymore, they were isolated in their rooms, and there was no relationship between them anymore. *(Director 1)*

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FIGURES

Figure 1 Legend: On the X-axis: Number of weeks from Oct 15th, 2020; On the Y-axis: the probability of resident survival.

Figure 1 Title: Likelihood of survival by resident and nursing facility characteristic, Univariate (Kaplan-Meier) Analysis, Provence and Occitania Provinces, France, 2021

Figure 2 Legend: On the X-axis: adjusted Hazard Ratios are represented by a diamond. Full lines in red for 95% Confidence Intervals of significant risk factors (HR>1), full lines in green for protective factors (HR<1), and dashed-lines in grey for CI95% of non-significant factors.

Figure 2 title: Final Cox Model: Forest Plot of mortality associated factors in French nursing facilities, Provence and Occitania provinces, 2021

CONTRIBUTORS

CM, TR, MD, TL, and EG conceived the study (literature search, study design, etc). MD, SF, TR, CM, TL, and EG developed the study protocol. MD performed field data collection (qualitative interviews) and SF collected epidemiological data. TR and SF performed data management and statistical data analysis. MD performed interview transcription and qualitative analysis. MD and TR performed the literature search and wrote the first version of the manuscript. TR and EG verified the underlying data and performed additional analyses. All authors interpreted the results, contributed to writing the manuscript, and approved the final version for submission.

ACKNOWLEDGMENTS

First and foremost, the authors are very grateful and thank Janet Ousley for her help with article editing. The authors also thank Marie Thomas, Tommaso Fabbri, Klaudia Porten, Michel-Olivier Lacharité, Marc Gastelly-Etchegorry, and the whole MSF team in the field. This study would not have been possible without the collaboration of the nursing home managers, staff, and residents. A very special thanks go to each and every one of them.

COMPETING INTERESTS

The authors declare having no competing interests.

FUNDING AND ALL OTHER REQUIRED STATEMENTS

This study was entirely funded by Médecins Sans Frontières-France. Award/Grant number is not applicable.

DATA SHARING

Anonymized data collected for the study and a data dictionary will be made available to other researchers Following approval of a study proposal by TR (thomas.roederer@epicentre.msf.org) for 5 years from publication. The study protocol, statistical analysis plan, and informed consent forms are also available from TR.

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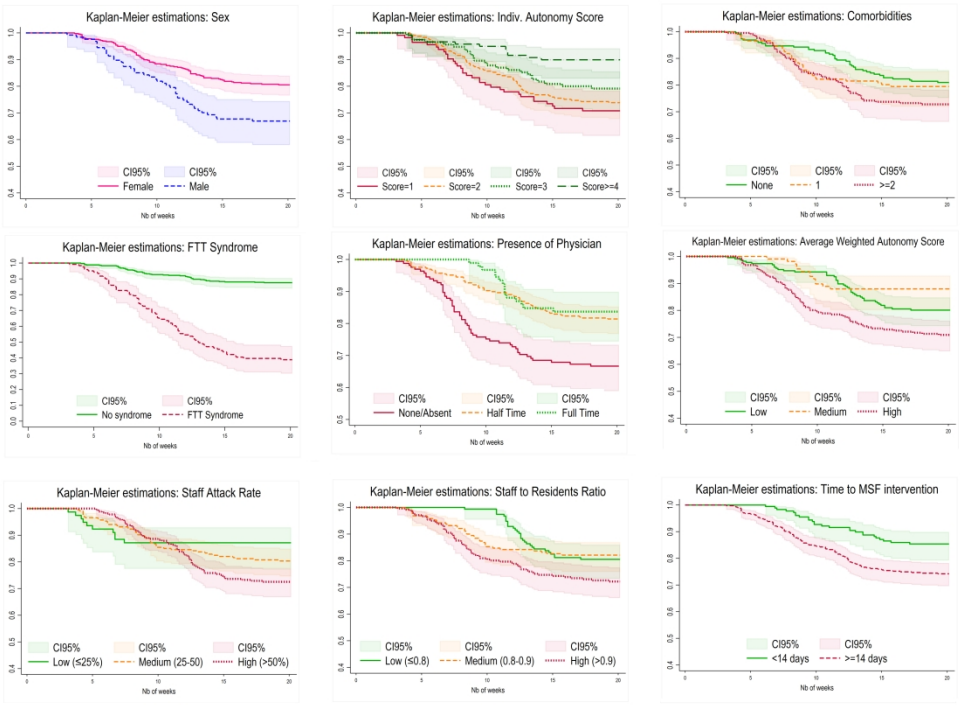
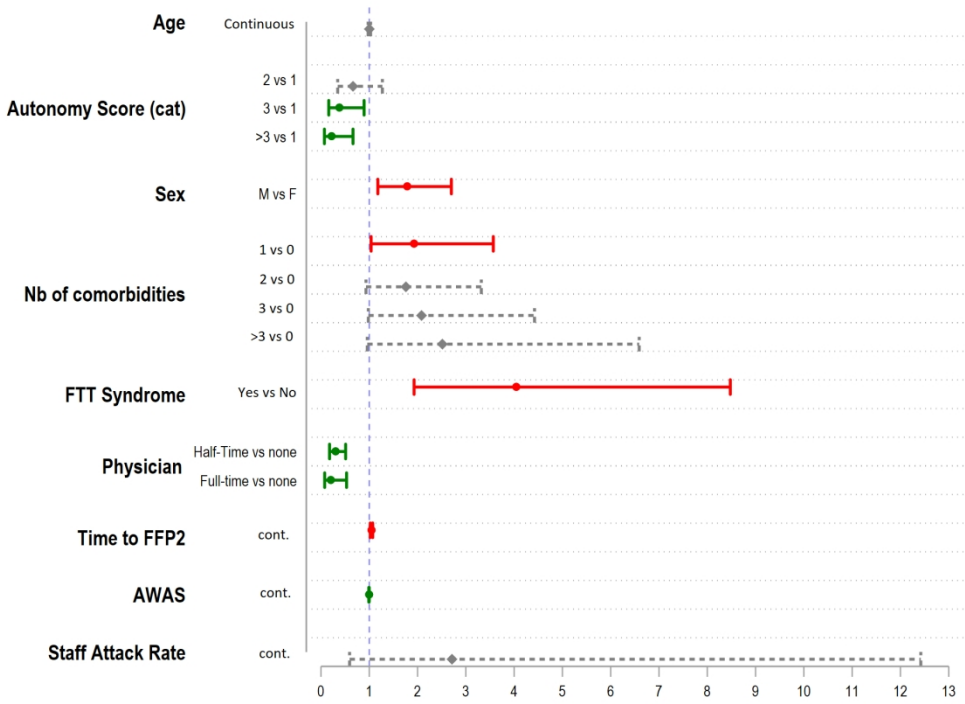


On the X-axis: number of weeks from Oct. 15th, 2020 ; On the Y-axis: probability of resident' survival

286x210mm (300 x 300 DPI)



On the X-avis: Adjusted Hazard Ratios are represented with diamonds. Full-lines in red for 95% Confidence Intervals of significant risk factors of mortality (AHR>1), full-lines in green for 95%CIs of significant protective factors (AHR<1) and dashed-lines in grey for 95%CI of non-significant factors.

423x317mm (120 x 120 DPI)

Supplementary materials

Appendix 1. Additional Definitions

Autonomy Evaluation Score (Iso-Resources Group or GIR)

Since 1995, the AGGIR grid (Autonomy, Gerontology, Iso-Resources Group) is the national instrument for measuring the state of an elderly person's dependence, from which the necessary level of assistance is derived.

The AES (GIR) score is a measure of autonomy loss based on a series of questions and observations to assess a person's level of dependency. In the nursing home context, this evaluation is conducted by the coordinating physician at the time of admission of a new resident.

Before grouping people into GIR, the first step is to assess the individual's condition using two sets of variables:

-10 discriminant (or classification) variables (Coherence, Orientation, Grooming, Dressing, Feeding, Elimination, Transfers, Indoor Movement, Outdoor Movement, Remote Communication) that are used to calculate the AES (GIR);

-7 descriptive variables (Management, Cooking, Household, Transportation, Purchasing, Treatment follow-up, Free time activities) which are not used to calculate the GIR but are essential to the development of the assistance plan, especially for people living at home.

Each of these 17 variables offers three response categories: A (able to do alone, totally, usually and correctly), B (able to do partially, or not usually or not correctly) and C (not able). 'Usually' refers to time. 'Correctly' refers to the environment following habits and culture.

The AES (GIR) score is computed from the responses to the 17 variables and ranges from 1 to 6, from highest dependency (lowest level of autonomy) to lowest dependency.

AES (GIR) 1 includes elderly people confined to a bed or armchair, whose mental functions are seriously impaired, and who need the continuous presence of caregivers.

AES (GIR) 2 reflects 2 categories:

-People confined to a bed or an armchair whose mental functions are NOT totally impaired, and who need care for most activities of daily living;

-People whose mental functions are severely impaired but who have retained their ability to move around.

AES (GIR) 3 includes people who have retained their mental autonomy but who need help every day, and several times a day, to carry out everyday activities (getting up, going to bed, getting dressed, going to the bathroom, etc.).

AES (GIR) 4 reflects 2 categories:

-People who need help to get up and go to bed, but who are able to move around the home on their own. They sometimes need assistance to dress and wash themselves;

-People who do not have motor impairment, but who need help with physical activities and meals.

AES (GIR) 5 groups together people who need occasional help with washing, preparing meals, and cleaning.

AES (GIR) 6 refers to people who have fully retained their autonomy in the acts of daily life.

Reference for this definition (in French): *Coutton, V. (2001). Évaluer la dépendance à l'aide de groupes iso-ressources (GIR): une tentative en France avec la grille AGGIR. Gérontologie et société, 24(99), 111-129. https://doi.org/10.3917/gs.099.0111*

The AES (GIR) classification system originates from the case-mix classification systems (CMCS) developed in the USA in the 1960s, and further refined with the Resource Utilization Groups in the 1990s, created for nursing home payment. For further details, see *Fries BE, Schneider DP, Foley WJ, Gavazzi M, Burke R, Cornelius E. Refining a case-mix measure for nursing homes: Resource Utilization Groups (RUG-III). Med Care. 1994;32(7):668-685. doi:10.1097/00005650-199407000-00002*

In 2005, the RUG (III) payment system inspired the PATHOS payment system in France, which is based on the Average Weighted Autonomy Score (GIR Moyen Pondéré or GMP), which we define below.

Average Weighted Autonomy Score (GIR Moyen Pondéré or GMP)

This score is calculated at the Nursing Home level and summarizes the overall level of residents' autonomy (AES or GIR). Each resident requires X minutes of caregivers attention per day, X varying with the Autonomy score level (for ex. X=210 min for GIR 1; 88 min for GIR 4). The AWAS is then the average X residents need for the overall facility.

The higher the AWAS score, the more dependent the residents are. In other terms, the score is a proxy of the financial and human resources a Nursing Home can need and get: the higher the AWAS, the more resources the NH needs (higher staff-to-residents ratio, better equipment, etc.).

Reference for this definition (in French): https://solidarites-sante.gouv.fr/IMG/pdf/Rapport_final-Pathos-MEP-BAT-2.pdf

Geriatric Failure to thrive Syndrome:

Specific to old age, this syndrome is defined by the rapid deterioration of the general state with anorexia, disorientation, and social withdrawal, alongside a more or less directly expressed will to die, a passive give-up on life, an active refusal of care, of food. It evolves towards death in a few days to a few weeks. It is triggered by physical events (acute illnesses, surgery, trauma) or psychological events (death of a loved one, social isolation, hospitalization).

This syndrome is not very well-understood and is still controversial. However, it is still used often in the French nursing home setting.

References (in English):

Palmer RM. 'Failure to thrive' in the elderly: diagnosis and management. Geriatrics. 1990 Sep;45(9):47-50, 53-5. PMID: 2204587.

In French:

Weimann Péru N, Pellerin J. Le syndrome de glissement : description clinique, modèles psychopathologiques, éléments de prise en charge ["Syndrome de glissement": clinical description, psychopathological models, and care management]. *Encephale*. 2010;36 Suppl 2:D1-D6. doi:10.1016/j.encep.2008.08.006

https://www.larevuedupraticien.fr/article/le-syndrome-de-glissement
https://theconversation.com/confinement-des-personnes-agees-attention-au-syndrome-de-glissement-136934

International Classification of Disease 10 (2022): R62.7: Approximate Synonyms

Adult failure to thrive syndrome

Failure to thrive syndrome, adult

Clinical Information

Progressive functional deterioration of a physical and cognitive nature. The individual's ability to live with multisystem diseases, cope with ensuing problems, and manage his/her care are remarkably diminished.

ICD-10-CM R62.7 is grouped within Diagnostic Related Group(s) (MS-DRG v39.0):

640 Miscellaneous disorders of nutrition, metabolism, fluids, and electrolytes with MCC

641 Miscellaneous disorders of nutrition, metabolism, fluids, and electrolytes without MCC

https://www.icd10data.com/ICD10CM/Codes/R00-R99/R50-R69/R62-/R62.7#:~:text=15%2D124%20years)-,R62.,a%20diagnosis%20for%20reimbursement%20purposes

Other sources about this syndrome:

https://www.drugs.com/cg/failure-to-thrive-in-older-adults.html#overview

Robertson RG, Montagnini M. Geriatric failure to thrive. Am Fam Physician. 2004;70(2):343-350.

Identifying Failure to Thrive in the Long Term Care Setting https://doi.org/10.1016/j.jamda.2012.05.018

FFP2 (or N95 or KC95) Facemasks

The EN 149 standard defines performance requirements for three classes of particle-filtering half masks: FFP1, FFP2, and FFP3.

An FFP2 facemask filters at least 94% of airborne particles and has an internal leak rate ofa maximof um 8%.

Appendix 2. Mixed Methods

Multidisciplinary Research and Collective Protocols

Both quantitative and qualitative data collection stem from an iterative reflexive process within the interdisciplinary research team, comprising: a social geographer (M.D.) and a public health expert (S.F.) present on the fieldwork (both are Ph.D. female researchers employed at Epicentre for this research project and trained in fieldwork methods with vulnerable populations in crisis contexts); a lead epidemiologist (T.R.), a medical doctor (T.L.), an MSF project coordinator (C.M.), a nurse (C.S.) and a psychologist (M.T.) partly present on the research fieldwork; and two coordinating epidemiologists working at Epicentre (E.G. and K.P.).

During the exploratory phase (from 1st December 2020 to 22 January 2021), several focus groups were organized within the MSF-team, to define the research objectives, the strategy for selecting research sites for qualitative analysis, and key resources, interlocutors. Regular informal and semi-structured meetings with MSF nurses, and analytical reading of their monitoring reports from emergency interventions, both helped in drafting the research protocol and fieldwork priorities. The interview topic guide (Appendix 3) and a checklist for systematic observation were conceived by M.D. and commented by MSF coordinators on the fieldwork (C.M., T.L., C.S.). Throughout this collective process and preliminary analyses, the public health expert (S.F.) conceived a database. The social geographer (M.D.) and the public health expert (S.F.) both visited a few nursing homes with the MSF coordinators before formally beginning the research.

On the fieldwork (from 22 January to 26 February 2021), the public health expert (S.F.) collected most epidemiological data, as well as individual data for retrospective linelist analyses. The social geographer (M.D.) gathered most qualitative data, including direct observation notes and semi-structured interviews, for 4 nursing homes. However, the two fieldwork researchers worked together narrowly. They managed together first contact with the directors and/or coordinating physicians of the studied nursing homes, they visited together 2 nursing homes out of the 4 comprised in the qualitative study, they compared their results daily and organized their data commonly.

In the phase of reporting (from the 1st of March to the 21st of April 2021), an internal report was written and sent for proofreading to the interdisciplinary research team. In the following month, a synthetic report was written. Corrections after proofreading were incorporated in May and June 2021. The final reports were sent to interviewees in June and September 2021 for comments. Only a few feedbacks were received, mostly on formal aspects.

Statistical Methods

We first performed a descriptive analysis of the data collected by the MSF team from NH managers: facility-level information and linelists (COVID-19 cases among residents). We crossed several factors with the resident's final status and computed Kaplan-Meier estimations of the probability of dying from COVID-19 in parallel with a univariate Cox model for each factor. Log-Rank Test was used to assess the potential association of each factor with death. The date of entry in the study was set to October 25th, 2020 (the date of the new prevention measure announced by the French government and the start of the second wave in France). The date of exit was set to March 15th, 2021 (the official end of the study), in case of death, to the exact date of death (if available).

We then explored the probability of dying from COVID-19 according to the factors identified in the univariate analysis with Cox models (multivariate analysis).

The challenge with multivariate analyses stems from the fact that various individual and structural factors may possibly be associated, and some of them can also be considered confusion factors.
Variables reflecting a notion of temporality, such as the time to FFP2 use and time to MSF intervention or attack rate among residents/staff and duration of the COVID-19 episode may be correlated and may not all be included in a single model. Similarly, the proportion of sick leaves in staff and the characterization of the physician presence are obviously correlated.

We thus built several Cox models depending on the factors we wanted to include. We decided to control for age, autonomy level and gender in all models.

One model analyzed detailed comorbidities (cancer, high blood pressure, etc.) to highlight potential risk/protective factors of death. Another model analyzed a summary of comorbidities (absence/presence of >1 comorbidity or total number of comorbidities).

We then tested alternate models analyzing either quantitative factors as continuous variables or transformed versions of the same factors as categorical variables (using cutoffs).

Choice of variables to finally retain in each model followed a classical Stepwise selection process, starting from a model gathering factors for which p-values (association with mortality according to Log-Rank Test) were < 0.3.

We have taken into account the many interactions that come into play between several factors: hospitalization with oxygene therapy and/or palliative care, interrelated comorbidities (high blood pressure with cardiovascular disease, obesity and diabetes etc.), Failure-to-thrive syndrome with comorbidities, AES with comorbidities or Failure-to-thrive syndrome, time-reflecting factors (as seen previously: time to FFP2 use, time to MSF intervention, duration of COVID episode, attack rates).

We fitted mixed-effects three-level random-slope exponential survival models. To account for individual heterogeneity, we included a random effect at the individual level, and to account for clustering, we included a random effect at the nursing home level (individuals are nested within each nursing home). Robust Standard Errors were computed and presented (clustered at the highest level in the multilevel model, here the nursing home).

Qualitative Study Context

Qualitative methods are interrelated with the context of the research. The interviews followed MSF interventions and epidemic peaks in the NH. The relative respite after the outbreaks favoured data collection: interviewees were more eager to give time to the study than during the outbreaks' peaks.

The major interests expressed in the research topics were that the participants were thankful to MSF teams, saw research as a way to step back from the traumatic experience of high fatality cases in their NH, express a silenced point of view, or contribute to general knowledge on the issue of COVID-19.

The access to the fieldwork through MSF helped organize rapidly a confident environment for the interviews to take place, since MSF support was mostly very welcomed and appreciated, as participants reported to the lead investigator (M.D.). For the same reason, the lead investigator could be considered a member of MSF, which could have resulted in possible biases; therefore, the distinction between MSF interventions and Epicentre research had to be underlined before each interview.

Objectives, risks, and benefices of the study were explained thanks to information letters for participation in the study and informed consent forms that were read and signed before the interviews. Each participant was informed that participation in the study is free, and can be interrupted without justification, and at any time without consequences. Each participant had time for thinking, questioning, and possibly obtaining explanations from the interviewer.

Methods of anonymization et confidentiality were applied for all participants, following the good practices identified by the Institute for Human and Social Research of the French National Center for Scientific Research (InSHS-CNRS)

Appendix 3. Description of Study Participants and Interviews

Participant characteristic				Interview characteristic		
Study n°	Function		Sex	Duration	Type	Place
1	Directors		Woman	95	individual	direction desk
24			Man	119	individual	direction desk
31			Man	133	individual	direction desk
49			Woman	65	individual	coordinator's desk
10	Coordinating doctors		Woman	45	individual	coordinator's desk
12			Woman	171	individual	research desk
48			Woman	55	individual	infirmary
2	Coordinating nurses		Woman	71	individual	direction desk
13			Woman	32	individual	coordinator's desk
30			Woman	107	individual	coordinator's desk
56			Woman	68	individual	coordinator's desk
4	Psychologists		Woman	35	individual	coordinator's desk
20			Woman	54	individual	animators desk
9	Caregivers (internal permanent staff)	Assistant Nurse	Woman	29	individual	animators desk
11		Assistant Nurse	Woman	28	individual	collective room
15		Assistant Nurse	Woman	37	grouped (4 people)	animators desk
16		Assistant Nurse	Woman			animators desk
17		Animator	Woman			animators desk
18		Assistant Nurse	Woman			animators desk
22		Assistant Nurse	Woman	21	individual	infirmary
23		Nurse	Woman	36	individual	collective room
27		Assistant Nurse	Woman	61	grouped (2 people)	research desk
28		Assistant Nurse	Woman			research desk
29		Animator	Man	67	individual	research desk
34		Nurse	Woman	46	individual	research desk
35		Assistant Nurse	Woman	48	individual	collective room
45		Assistant Nurse	Woman	55	individual	infirmary
46		Assistant Nurse	Woman	26	individual	collective room
51		Nurse	Man	49	grouped (2 people)	infirmary
5	Caregivers (external staff)	Nurse	Woman			infirmary
21		Assistant Nurse	Woman	25	individual	restroom
33		Physiotherapist	Man	37	individual	private house
44		Physiotherapist	Man	20	individual	collective room
47	Other Staff	HRD manager	Woman	56	individual	coordinator's desk
7		Agent for Maintenance	Man	48	grouped (2 people)	maintenance desk
8		Agent for Maintenance	Man			maintenance desk
25		Cook	Woman	38	grouped (2 people)	kitchen
26		Cook	Woman			kitchen
32		Cleaner	Woman	17	individual	collective room
52		Cook	Woman	12	individual	kitchen
3	Residents		Woman	63	individual	bedroom
6			Woman	28	individual	collective room
14			Woman	24	individual	bedroom
19			Woman	34	individual	collective room
36			Woman	95	grouped (2 people)	collective room
37			Woman			collective room

57			Woman	41	individuel	bedroom

Appendix 4. Interview Topic Guide for Caregivers and Residents

Questions to caregivers	***Objectives***
1/ Outbreak Chronology (Subjective Narratives)	
-Introduction *-Can you tell me how the epidemic has started and evolved in your institution?*	-identification of subjective phases -qualification of temporalities -information level assessment
-What have been the most difficult times?	-assessing the impact of the epidemic
2/Adaptations about the Crisis Management	
-The organization of the NH was disrupted for a few weeks, how were practices reorganized about: colleagues/ residents/ families?	-description of crisis effect
-Have you received any external aid? In what areas?	-networks, actors' schemes
-What permitted a return to normal activity? *-What could be enhanced in terms of crisis management?*	-return to normal activity
3/ Individual Experience of the Second Pandemic Wave	
-How did you become [function: a director, coordinating physician, nurse, assistant nurse, etc.]?	-socio-demographic profile -University and professional trajectory
-Did you receive any help in your work position?	-networks, actors' schemes -collective participation -description of isolation, understaffing
-As a [function], how did you experience this period?	-ethical questionings -individual variables (personal, family, emotional)

Questions to residents	***Objectives***
1/Outbreak Chronology (Subjective Narratives)	
-Introduction *-Can you tell me about the period of COVID in the NH?* *-What were the differences compared to other periods in the past year?*	-identification of subjective phases -qualification of temporalities -information level assessment
-What have been the most difficult times?	-assessing the impact of the epidemic
2/Adaptations to the Crisis Experience	

-Have you been contaminated with COVID? Have you been hospitalized? *-Have you been particularly worried about this disease? (isolation, containment)*	-situation and positioning of the individual about the epidemic -description of crisis effect
-Did you see other neighbors/friends of the NH? *-Did you see relatives/ family members outside the NH? In the NH?* *-Were there any activities?*	-networks, actors' schemes -links with the outside world
-Were you moved during COVID? *-What do you think about the organization of the NH staff during COVID? What could have been improved?*	-identification of novelty -return to normal activity
3/Individual Experience of the Second Pandemic Wave	
-In what year were you born? In what year did you enter the NH? *-Before the NH, what did you do? Where did you live?*	-geographic trajectory before the NH -trajectory within NH -socio-demographic profile -University and professional trajectory
-(in normal times) Do you prefer to stay in your room? To participate in group activities? *-Have you received any support apart from the assistant nurses/ nurses? In what areas?* *-Did your attending physician come?* *-Have you had contact with your relatives?*	-networks, actors' schemes -collective participation -description of isolation
-Do you have family members in the area, or elsewhere? *-Do you have relatives who have had COVID?*	-individual variables (personal, family, emotional)

Appendix 5. Additional Descriptive Results

Table S1. General and epidemiological characteristics of 22 nursing homes (aggregated data)

Facility Data	N	Mean	Std Dev	Min	Max
Number of beds	22	80.32	19.1	50	121
Average Weighted Autonomy Score	20	775	44.7	686	870
Time to FFP2 use (days)	22	8.7	8.7	0	28
Time to MSF Intervention (days)	22	18.9	9.7	5	37
Staff-to-residents Ratio	22	0.81	.14	.53	1.09
Number of Staff	22	61.3	18.9	32	109
Number of Residents	22	74.7	17.0	44	106
COVID-19 episode duration (days)	22	37.8	14.9	6	81
Attack Rate in Staff (%)	22	38.1	18.4	23.8	71.4
Attack Rate in Residents (%)	22	65.6	20.0	13.8	96.0
Case Fatality Rate in residents (%)	22	19.4	10.0	0	39.7

Table S2. Comorbidities vs FTTS (Fischer Exact Test p-value= 0.051)

	Failure to thrive syndrome		
Comorbidities	No 410 (77.2%)	Yes 121 (22.8%)	Total 531
	N (row %)	N (row %)	
None	159 (71.9%)	62 (28.1%)	221
1	116 (85.3%)	20 (14.7%)	136
2	84 (79.2%)	22 (20.8%)	106
3	37 (75.5%)	12 (24.5%)	49
>=4	14 (76.7%)	5 (26.3%)	19

Table S3. Pearson pairwise correlation matrix for Average Weighted Autonomy Score, Nursing Home Size, and Staff-to-Resident Ratio (continuous) :

	AWAS	Number of residents
AWAS	1.00	
Number of residents	0.53*	1.00
Staff-to-Resident Ratio	0.66*	0.17*

*p-value < 0.05

Table S4. AWAS vs Staff -to-Resident Ratio (categories): Fischer Exact Test p-value< 0.001)

	Staff to Resident Ratio (Cat.)			
AWAS (cat)	Low (<0.8)	Medium (0.8-0.9)	High (>=0.9)	*Total*
Low (<=750)	154	26	46	*226*
Medium (750-800)	0	84	24	*108*
High (>=800)	0	80	171	*251*
Total	*154*	*190*	*241*	*585*

Table S5. AWAS vs Nursing Home Size (categories): Fischer Exact Test p-value< 0.001)

	Nursing Home Size (cat)			
AWAS (cat)	<70 res.	70-90	>=90	*Total*
Low (<=750)	170	56	0	*226*
Medium (750-800)	108	0	0	*108*
High (>=800)	27	115	109	*251*
Total	*305*	*171*	*109*	*585*

Table S6. Staff to Resident Ratio vs Nursing Home Size (categories): Fischer Exact Test p-value < 0.001)

	Nursing Home Size (cat.)		
Staff to Resident Ratio (Cat.)	<70 res.	>=70 res.	*Total*
Low (<0.8)	98	56	*154*
Medium (0.8-0.9)	101	89	*190*
High (>=0.9)	70	171	*241*
Total	*269*	*316*	*585*

Table S7. Pearson correlation matrix for Time to FFP2 use, Time to MSF intervention, and duration of COVID-19 episode

	Time to FFP2 use	Time to MSF intervention
Time to FFP2 use (cont.)	-	
Time to MSF intervention (cont.)	0.0989	-
Duration of COVID-19 episode (cont.)	0.5523*	0.5250*

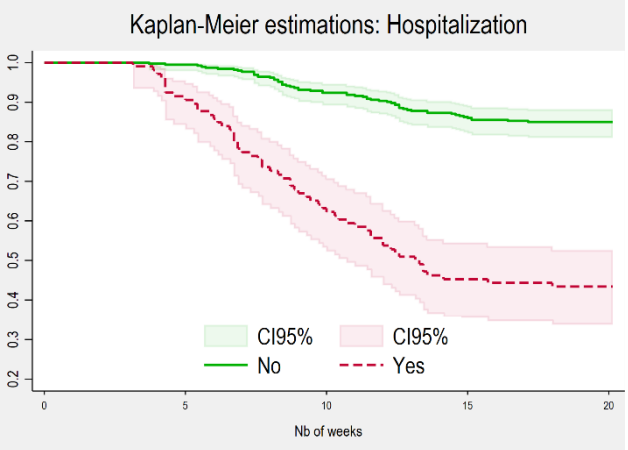
*p-value < 0.05

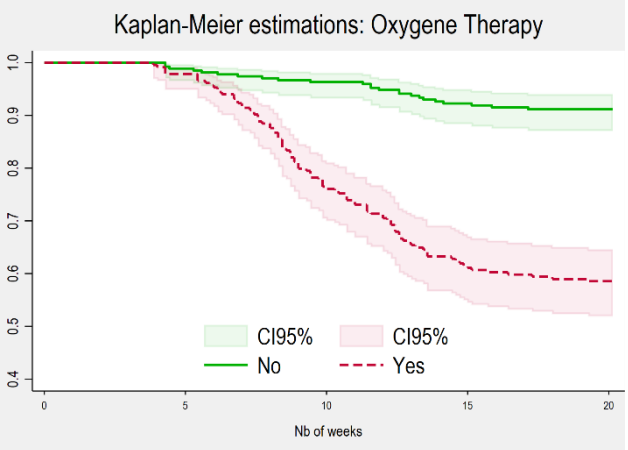
Table S8. Time to FFP2 use vs Time to MSF (categories): Fischer Exact Test p-value < 0.001)

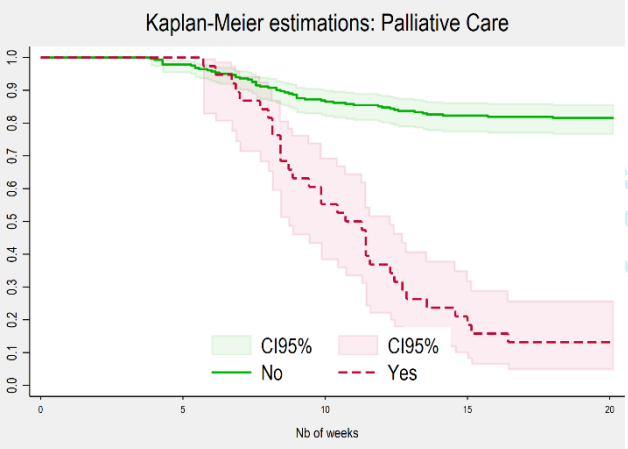
	Time to MSF intervention (cat)			
Time to FFP2 use (cat)	Short (<10 days) 78 (13.3%)	Medium (10-20 days) 326 (55.7%)	Long (>20 days) 181 (30.9%)	*Total*
Instant.(<=1day)	8 (6.8%)	54 (45.8%)	56 (47.4%)	*118*
Late (2-7 days)	70 (41.4%)	53 (31.3%)	46 (27.2%)	*169*
Very Late (>=7 days).	0	219 (73.5%)	79 (26.5%)	*298*

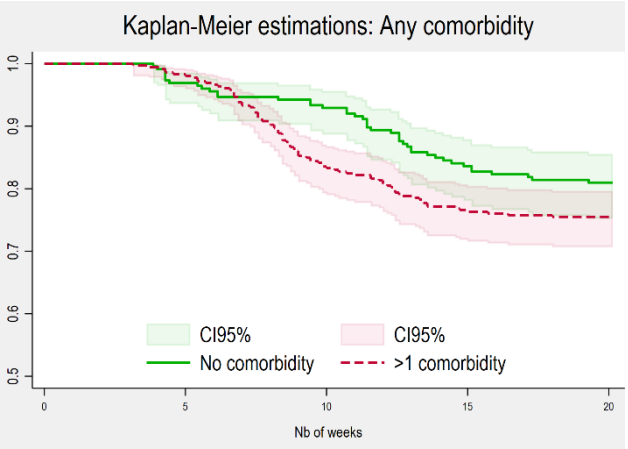
Appendix 6. Additional Kaplan-Meier Curves – full list (for Log Rank Tests results, see Table 1 in main manuscript)

Individual Data (Linelist)

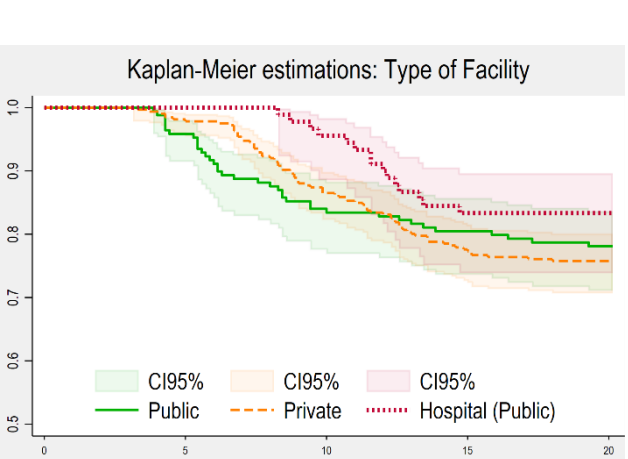


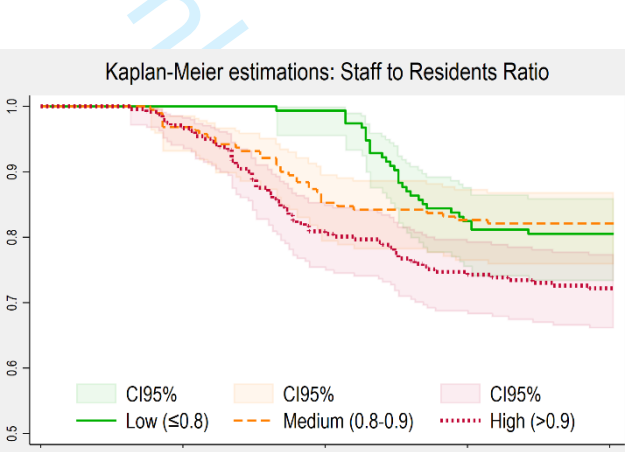


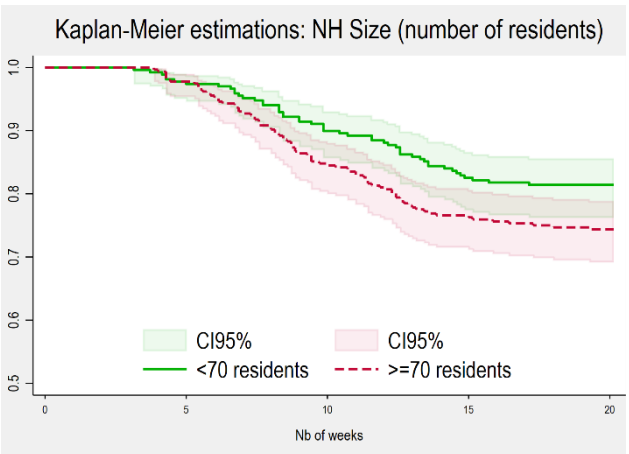


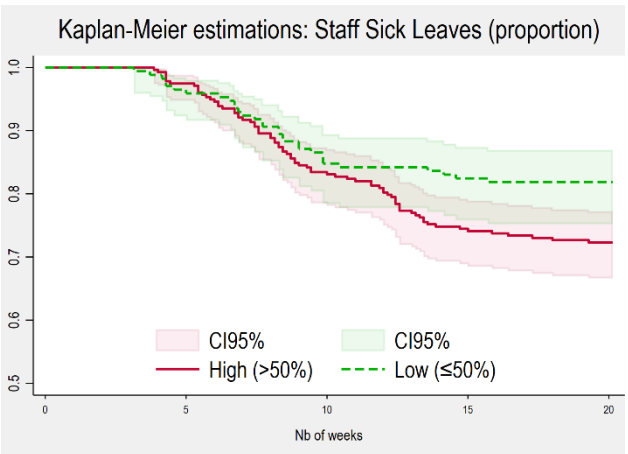


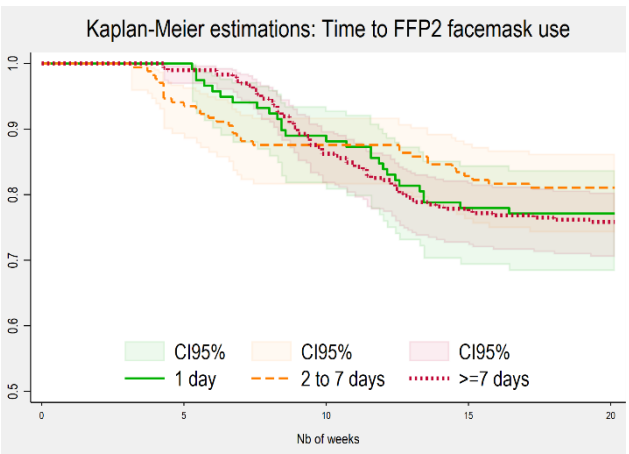
Facility Data (aggregated)

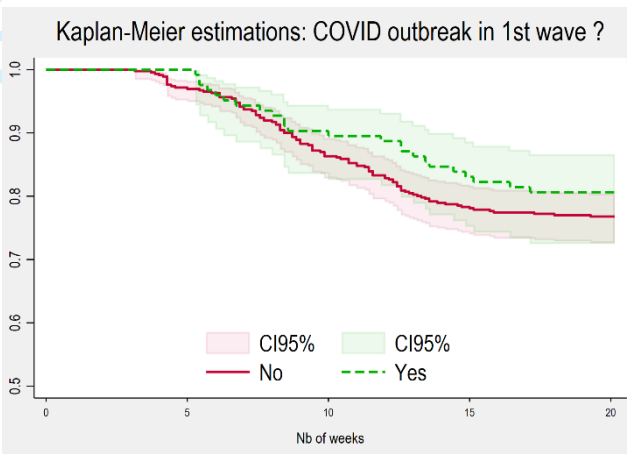












Appendix 7. Additional Cox models (Sensitivity Analysis)

Table S10. Model 1. Only individual data with 'obvious' covariates (hospitalization, palliative care, etc)

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.97 - 1.03	0.921
Autonomy Score	2 vs 0	0.89	0.48 - 1.66	0.715
	3 vs 0	0.53*	0.26 - 1.09	0.085
	>=4 vs 0	0.40*	0.14 - 1.11	0.078
Gender	M vs F	1.62*	0.93 - 2.84	0.088
Comorbidities	1 vs 0	1.83	0.46 - 7.29	0.391
	2 vs 0	1.64	0.42 - 6.39	0.473
	3 vs 0	2.02	0.48 - 8.53	0.340
	>=4 vs 0	2.73	0.50 - 15.06	0.248
Hospitalization	Y v N	4.19***	2.53 - 6.91	0.000
Oxygene Therapy	Y v N	3.08***	1.42 - 6.64	0.004
Palliative Care	Y v N	3.09***	1.69 - 5.63	0.000
Failure-to-thrive Syndrome	Y v N	3.22**	1.14 - 9.09	0.027
Interaction terms	Comorb=1#FTTS=1	0.84	0.17 - 4.05	0.824
	Comorb=2#FTTS=1	0.72	0.18 - 2.90	0.648
	Comorb=3#FTTS=1	0.77	0.14 - 4.22	0.763
	Comorb=4#FTTS=1	1.02	0.13 - 8.13	0.982
	Hospitalization=1#Oxygene=1	0.39	0.04 - 3.31	0.389
	Oxygene=1#Palliative=1	0.14#	0.07 - 0.28	0.000

interaction term significant > oxygene effect amplified by palliative care effect

Information Criteria (model selection)	AIC	BIC
	696.215	722.30

Table S11. Model 2. Only individual data with detailed comorbidities

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.97 - 1.03	0.921
Autonomy Score	2 vs 0	0.89	0.48 - 1.66	0.715
	3 vs 0	0.53*	0.26 - 1.09	0.085
	>=4 vs 0	0.40*	0.14 - 1.11	0.078
Gender	M vs F	1.79*	1.16 - 2.74	0.008
Diabetes	Y v N	2.81**	1.17 - 6.76	0.021
Denutrition	Y v N	2.54	0.55 - 11.82	0.235
Dementia	Y v N	0.91	0.40 - 2.08	0.822
Cardiovascular Disease	Y v N	1.24	0.75 - 2.06	0.409
Cancer	Y v N	0.96	0.42 - 2.19	0.919
Obesity	Y v N	1.37	0.46 - 4.04	0.571
Respiratory Disease	Y v N	0.68	0.22 - 2.15	0.514
High Blood Pressure	Y v N	0.91	0.56 - 1.48	0.712
Failure-to-thrive Syndrome	Y v N	4.79***	1.52 - 15.06	0.007
Interaction terms	AES=2#FTTS=1	2.54	0.80 - 8.10	0.114
	AES=3 # FTTS=1	3.21	0.78 - 13.16	0.105
	AES=4# FTTS=1	4.94	0.51 - 48.01	0.169
	FTTS=1#Diabetes=1	0.20#	0.04 - 1.05	0.057
	FTTS=1#Denutrition=1	0.15#	0.03 - 0.86	0.033
	FTTS=1#Dementia=1	1.21	0.44 - 3.31	0.717
	Diabetes=1# Denutrition=1	0.40	0.03 - 4.61	0.461
	Diabetes=1# Dementia=1	0.75	0.16 - 3.38	0.703
	Denutrition =1# Dementia=1	1.24	0.24 - 6.34	0.792
	HBP=1#Cardiovasc=1	1.19	0.45 - 3.18	0.723

interaction term significant > FTTS effect amplified by Denutrition effect and by diabetes effect

Information Criteria (model selection)

AIC	BIC
770.399	803.8226

Table S12. Model 3. Individual and structural data with Staff-to-Resident Ratio and NH Size instead of AWAS

VARIABLES		Adjusted Hazard Ratio	CI95	p-value
Age	Continuous	1.00	0.99 - 1.01	0.635
Autonomy Score	2 vs 0	0.70	0.31 - 1.58	0.388
	3 vs 0	0.40**	0.17 - 0.95	0.038
	>=4 vs 0	0.23***	0.08 - 0.66	0.006
Gender	M vs F	1.78**	1.12 - 2.81	0.014
Comorbidities	1 vs 0	1.28	0.52 - 3.16	0.590
	2 vs 0	1.20	0.63 - 2.25	0.580
	3 vs 0	1.40	0.51 - 3.82	0.517
	>=4 vs 0	1.67	0.51 - 5.46	0.396
Failure-to-thrive Syndrome	Y v N	4.07***	1.94 - 8.54	0.000
Presence of a physician	Half Time vs None/Absent	0.26***	0.13 - 0.53	0.000
	Full Time vs None/Absent	0.26***	0.10 - 0.64	0.004
Time to FFP2 use (in days)	continuous	1.01	0.95 - 1.07	0.681
Staff to Resident Ratio	continuous	1.17	0.84 - 1.35	0.586
NH Size (number of residents)	continuous	1.03	0.93 - 1.14	0.545
Staff Attack Rate (%)	continuous	2.18	0.29 - 16.49	0.450
Interaction terms	AES=2#FTTS=1	2.30#	0.91 - 5.78	0.077
	AES=3#FTTS=1	2.93#	0.95 - 9.05	0.061
	AES=4#FTTS=1	4.80#	1.16 - 19.92	0.031
	NR_Ratio#NH Size	0.95	0.83 - 1.08	0.402

interaction term significant > FTTS effect amplified at each level of AES effect

Information Criteria (model selection)	AIC	BIC
	1172.544	1227.964

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COREQ (COnsolidated criteria for REporting Qualitative research) Checklist

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

Topic	Item No.	Guide Questions/Description	Reported on Page No.
Domain 1: Research team and reflexivity			
Personal characteristics			
Interviewer/facilitator	1	Which author/s conducted the interview or focus group?	App.3
Credentials	2	What were the researcher's credentials? E.g. PhD, MD	App.3
Occupation	3	What was their occupation at the time of the study?	App.3
Gender	4	Was the researcher male or female?	App.3
Experience and training	5	What experience or training did the researcher have?	App.3
Relationship with participants			
Relationship established	6	Was a relationship established prior to study commencement?	p.1+App.3
Participant knowledge of the interviewer	7	What did the participants know about the researcher? e.g. personal goals, reasons for doing the research	App.1
Interviewer characteristics	8	What characteristics were reported about the inter viewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic	App.3
Domain 2: Study design			
Theoretical framework			
Methodological orientation and Theory	9	What methodological orientation was stated to underpin the study? e.g. grounded theory, discourse analysis, ethnography, phenomenology, content analysis	p.4
Participant selection			
Sampling	10	How were participants selected? e.g. purposive, convenience, consecutive, snowball	p.3
Method of approach	11	How were participants approached? e.g. face-to-face, telephone, mail, email	p.3
Sample size	12	How many participants were in the study?	p.6
Non-participation	13	How many people refused to participate or dropped out? Reasons?	p.6
Setting			
Setting of data collection	14	Where was the data collected? e.g. home, clinic, workplace	Table 4
Presence of non-participants	15	Was anyone else present besides the participants and researchers?	Table 4
Description of sample	16	What are the important characteristics of the sample? e.g. demographic data, date	Table 4
Data collection			
Interview guide	17	Were questions, prompts, guides provided by the authors? Was it pilot tested?	p4+App.1&4
Repeat interviews	18	Were repeat inter views carried out? If yes, how many?	Table 4
Audio/visual recording	19	Did the research use audio or visual recording to collect the data?	p.6+App.1&3
Field notes	20	Were field notes made during and/or after the inter view or focus group?	App.3
Duration	21	What was the duration of the inter views or focus group?	p.6+Table4
Data saturation	22	Was data saturation discussed?	p.4
Transcripts returned	23	Were transcripts returned to participants for comment and/or	App.3

Topic	Item No.	Guide Questions/Description	Reported on Page No.
		correction?	
Domain 3: analysis and findings			
Data analysis			
Number of data coders	24	How many data coders coded the data?	p.4
Description of the coding tree	25	Did authors provide a description of the coding tree?	p.4+App6
Derivation of themes	26	Were themes identified in advance or derived from the data?	p.3+p.4
Software	27	What software, if applicable, was used to manage the data?	App 3
Participant checking	28	Did participants provide feedback on the findings?	App.3
Reporting			
Quotations presented	29	Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number	p.6-7, Table 5
Data and findings consistent	30	Was there consistency between the data presented and the findings?	p.7
Clarity of major themes	31	Were major themes clearly presented in the findings?	p.6-7
Clarity of minor themes	32	Is there a description of diverse cases or discussion of minor themes?	p.7, p.10

Developed from: Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International Journal for Quality in Health Care*. 2007. Volume 19, Number 6: pp. 349 – 357

Once you have completed this checklist, please save a copy and upload it as part of your submission. DO NOT include this checklist as part of the main manuscript document. It must be uploaded as a separate file.