Register-based surveillance of COVID-19 in nursing homes

SHORT REPORT

ANDERS SKYRUD DANIELSEN

andersskyrud.danielsen@fhi.no
Section for Antibiotic Resistance and Infection Prevention
Department for Infection Control and Preparedness
Norwegian Institute of Public Health
and
Department of Microbiology
Oslo University Hospital
Author contribution: design, data analysis and interpretation, and drafting and revision of the manuscript.
Anders Skyrud Danielsen, PhD fellow in epidemiology and associated researcher.
The author has completed the ICMJE form and declares no conflicts of interest.

PASCALE-RENÉE CYR

Cluster for Health Services Research
Norwegian Institute of Public Health
Author contribution: design, data collection, analysis and interpretation.
Pascale-Renée Cyr, advisor.
The author has completed the ICMJE form and declares the following conflicts of interest: He has received research funding from the Research Council of Norway (unrelated to the content of this article).

THALE CATHRINE BERG

Section for Antibiotic Resistance and Infection Prevention
Department for Infection Control and Preparedness
Norwegian Institute of Public Health
Author contribution: revision and approval of the submitted manuscript.
Thale Cathrine Berg, senior advisor.

The author has completed the ICMJE form and declares no conflicts of interest.

EIRIK JØNSBERG

Department of Health Registries
Norwegian Directorate of Health
Author contribution: data interpretation, revision and approval of the submitted manuscript.
Eirik Jønsberg, senior advisor.
The author has completed the ICMJE form and declares no conflicts of interest.

HANNE-MERETE ERIKSEN-VOLLE

Section for Antibiotic Resistance and Infection Prevention
Department for Infection Control and Preparedness
Norwegian Institute of Public Health
Author contribution: idea, revision and approval of the submitted manuscript.
Hanne-Merete Eriksen-Volle, PhD in epidemiology and head of section.
The author has completed the ICMJE form and declares no conflicts of interest.

OLIVER KACELNIK

Section for Antibiotic Resistance and Infection Prevention
Department for Infection Control and Preparedness
Norwegian Institute of Public Health
Author contribution: idea, revision and approval of the submitted manuscript.
Oliver Kacelnik, MD, PhD and senior medical officer.
The author has completed the ICMJE form and declares no conflicts of interest.

BACKGROUND

This study describes results from the surveillance of COVID-19 infections in nursing homes in the first year of the COVID-19 pandemic.

MATERIAL AND METHOD

All data in the study are from Beredt C19, an emergency preparedness register that collects data from a wide range of sources. We used the data set 'Health and Care' in the Norwegian Registry for Primary Health Care to define a nursing home population and linked this to other sources in the emergency

preparedness register to estimate incidence rates, hospitalisations and deaths related to COVID-19 among nursing home residents in 2020. A log-binomial regression model was used to analyse the risk of death related to COVID-19.

RESULTS

Of the 83 114 persons who were included in the study, 35 758 (43 %) were older than 80 years. We found that 570 persons (0.69 %) tested positive for SARS-CoV-2 in 2020. A total of 19 041 residents died during the study period, whereof 248 (1.3 %) deaths were related to COVID-19. The relative risk of dying from COVID-19 rose with age and was highest for long-term nursing home residents.

INTERPRETATION

Nursing home residents have a high background mortality, so despite the high lethality of SARS-CoV-2 infection and the high proportion of the COVID-19-related deaths that have occurred in nursing homes, COVID-19-related deaths accounted for a relatively minor proportion of all deaths among nursing home residents.

Main findings

By linking multiple data sources in the Beredt C19 emergency preparedness register, it was possible to monitor COVID-19 among residents in Norwegian nursing homes.

In the first year of the pandemic, 0.69 % of all nursing home residents became infected by SARS-CoV-2, and 1.3 % of all deaths in nursing homes were related to COVID-19.

Globally, nursing homes have borne a large part of both the intervention burden and the disease burden during the COVID-19 pandemic [1]. Nursing homes, in Norway, are specialised medical institutions, admission to which presupposes a need for around-the-clock medical care, meaning that the residents often have complex multimorbidity as well as advanced age [2]. Nursing home residents are at a high risk of a serious outcome in cases of COVID-19. The Norwegian Institute of Public Health has therefore sought to establish infection surveillance for this population. This work has been enabled by the establishment of an emergency preparedness register, Beredt C19, which collates various publicly owned data sources. In this study, we have used data from this register. We show how the register can be used to define a nursing home population and present the results that this surveillance yielded in the first year of the pandemic.

Material and method

The Beredt C19 emergency preparedness register is established pursuant to Section 2 - 4 of the Health Preparedness Act and is described in more detail on the website of the Norwegian Institute of Public Health. The register contains data from a wide range of sources (3, 4). The Norwegian Institute of Public Health manages and operates the register and has undertaken a data protection impact assessment in this regard.

No register contains complete real-time information on residents in Norwegian nursing homes. By using Beredt C19 we established a register definition that was mainly based on the 'Health and Care' data set in the Norwegian Registry for Primary Health Care, which is included in Beredt C19. Local authorities annually report data on nursing home admissions to this register, which was previously called IPLOS (Individually Based Nursing and Care Statistics). In addition, we have used data available in Beredt C19 from the National Population Register and the State Register of Employers and Employees, as well as information on clinical outcomes from the Norwegian Patient Registry (NPR), the Norwegian Surveillance System for Communicable Diseases (MSIS), the National Microbiology Laboratory Database and the Causes of Death Registry in our surveillance and analysis of the course of the COVID-19 pandemic in Norwegian nursing homes.

Since the register does not use the term 'nursing home', we defined nursing home residents as persons who had been reported with a long-term or temporary residence in an 'institution' in a Norwegian municipality in 2020. In addition, the service user had to be older than 65 years and not registered as deceased, emigrated or missing before January 2021 in the National Population Register. We only included persons who were registered as resident in a unit that according to the Standard Industrial Classification was engaged in health-oriented business activities or municipal administration. Persons who were receiving services from other types of units, such as social services, were excluded. Through Beredt C19, these data were linked to hospitalisations registered in the Norwegian Patient Registry before and after the stay at the nursing home, in addition to infection by SARS-CoV-2 in MSIS or COVID-19-related death in the Causes of Death Registry during a stay in a nursing home.

We describe incidence rates, hospitalisations and deaths in this population. Unless otherwise specified, all outcomes date from the period when the person was resident in a nursing home. The risk of COVID-19-related death by age in the population was investigated using a log-binomial regression model, where the external infection rate was adjusted for through fixed effects for county, months of residence and urban place of residence. The data in this study has been processed pursuant to Section 2 - 4 of the Health Preparedness Act.

Results

We identified 83 114 residents, of whom 35 758 (43 %) were older than 80 years (Table 1). The majority (52 155, 63 %) were women. Most of the residents were Norwegian-born (80 223, 97 %) and lived in the cities of Oslo, Bergen, Trondheim and Stavanger (65 690, 79 %). In the nursing home population, 570 (0.69 %) persons were registered with a positive nucleic acid amplification test (PCR test) for SARS-CoV-2 during two epidemic peaks, in weeks 15 and 47 respectively (Figure 1).

Table 1

Characteristics of Norwegian nursing home residents (N = 83 114) in 2020, by type of residence, i.e. long-term and temporary residence respectively.

	Long-term residence		Temporary residence	
	Number	Per cent	Number	Per cent
Age (years)				
65–79	8 549	23.3	17 260	37.2
80–89	15 637	42.7	20 121	43.3
≥ 90	12 477	34.0	9 070	19.5
Sex				
Female	24 897	67.9	27 258	58.7
Male	11 766	32.1	19 193	41.3
Country of birth				
Norway	35 502	96.8	44721	96.3
Outside Norway	1 161	3.2	1730	3.7
County				
Oslo	4 003	10.9	3 614	7.8
Rogaland	2 836	7.7	3 622	7.8
Møre og Romsdal	2 123	5.8	2 603	5.6
Nordland	2 245	6.1	2 518	5.4
Viken	7 190	19.6	10 790	23.2
Innlandet	3 211	8.8	4 256	9.2
Vestfold og Telemark	2 818	7.7	4 586	9.9
Agder	1 995	5.4	2 684	5.8
Vestland	4 604	12.6	5 951	12.8
Trøndelag	3 486	9.5	3 985	8.6

	Long-term residence		Temporary residence	
	Number	Per cent	Number	Per cent
Troms og Finnmark	2 152	5.9	1 842	4.0
Urbanity				
Rural	28 076	76.6	37 614	81.0
Urban	8 587	23.4	8 837	19.0
Total	**36 663**	100.0	**46 451**	100.0

Incidence rate for SARS-CoV-2 per 10 000

Week in 2020
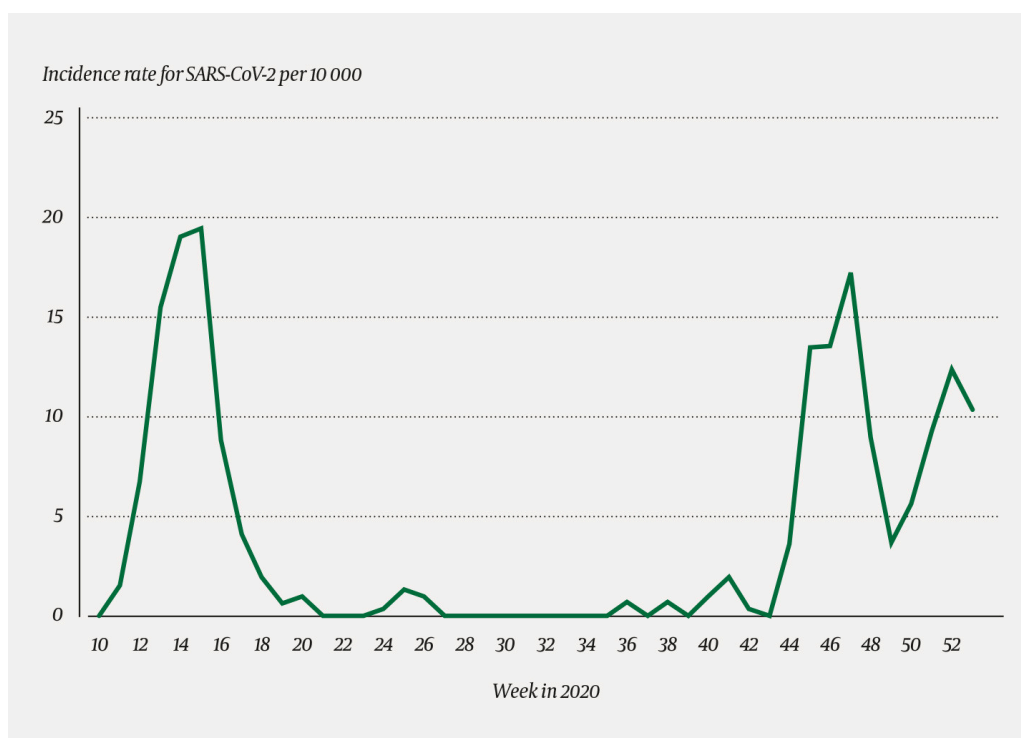
Figure 1 Incidence rate for SARS-CoV-2 infections per 10 000 among Norwegian nursing home residents in 2020.

During 2020, altogether 238 persons in our sample were hospitalised with COVID-19 as the main reason for admission before their stay in the nursing home, and 37 were admitted during the stay. In the course of the entire period, 19 041 residents died, and 248 (1.3 %) of these deaths were related to COVID-19 (Figure 2). Of these, 201 persons (81 %) were older than 80 years.
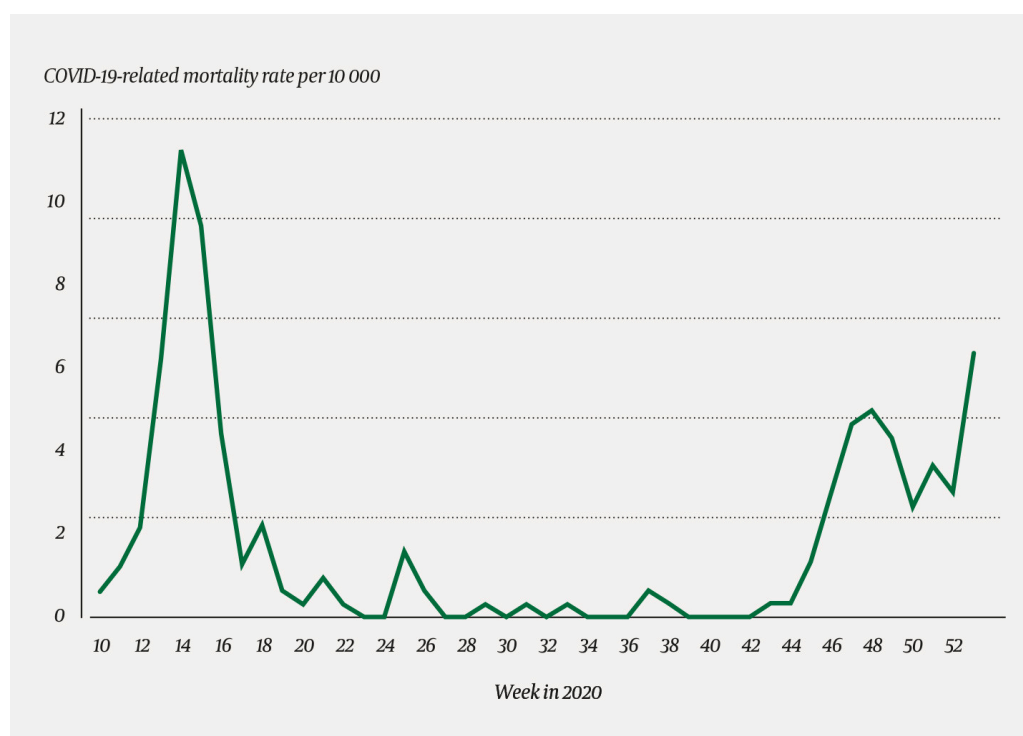
COVID-19-related mortality rate per 10 000

Week in 2020

Figure 2 COVID-19-related mortality rate per 10 000 among Norwegian nursing home residents in 2020.

High age was a risk factor for death, with an adjusted relative risk of 1.53 (95 % confidence interval (CI) 1.06 to 2.21) in the oldest age group (≥ 90 years) when compared to the youngest age group (65–79 years) (Table 2). Long-term nursing home residents had a higher relative risk of infection by SARS-CoV-2 during their stay and COVID-19-related death compared to temporary residents, with a relative risk of 2.84 (95 % CI 2.07 to 3.89) and 3.78 (95 % CI 2.40 to 5.96) respectively.

Table 2

Relative risk (RR) with a 95 % confidence interval (CI) for SARS-CoV-2-positivity and COVID-19-related death respectively among Norwegian nursing home residents (N = 83 114) in 2020. Estimates from multivariable, log-binomial regression models adjusted for month, county, urban place of residence and sex.

	SARS-CoV-2-positivity		COVID-19-related death	
	Adjusted RR	95 % CI	Adjusted RR	95 % CI
Age (years)				
65–79	Ref.	-	Ref.	-
80–89	0.93	0.76 to 1.15	1.45	1.02 to 2.08
≥ 90	0.89	0.71 to 1.12	1.56	1.07 to 2.29
Country of birth				
Outside Norway	Ref.	-	Ref.	-

	SARS-CoV-2-positivity		COVID-19-related death	
	Adjusted RR	95 % CI	Adjusted RR	95 % CI
Norway	1.07	0.71 to 1.60	0.83	0.46 to 1.53
Type of residence				
Temporary residence	Ref.	-	Ref.	-
Long-term residence	3.31	2.48 to 4.43	4.33	2.72 to 6.89

Discussion

In this study, which is based on surveillance data from Beredt C19, we have shown that 0.69 % of residents in Norwegian nursing homes were infected in the first year of the pandemic during their stay in a nursing home, and that 1.3 % of all deaths among nursing home residents were related to COVID-19.

High age has previously been shown to be the strongest predictor of death after contracting COVID-19 (5). Norwegian nursing home residents have a high rate of multimorbidity and require a high level of care (6). However, we also find that high age increases the risk of death in this population. The fact that most of the deaths were observed before or during the peak infection levels may indicate that infection rates were higher than reflected in the testing. This further indicates that the external infection rate is the main factor behind the number of deaths in nursing homes, which is consistent with previous research (7). This is also corroborated by the observation that the incidence rate for SARS-CoV-2 infections appears to follow the incidence rate in society as a whole.

In 2020, approximately one-half of all COVID-19-related deaths in Norway occurred in nursing homes (8). This must be seen in light of the nursing home population's high background mortality and the fact that approximately one-half of all deaths normally occur in nursing homes (9). Guidelines from the Norwegian Directorate of Health stipulated that nursing home residents with COVID-19 should not be transferred to hospitals (10). Accordingly, we found that few residents were transferred to hospitals. However, many temporary residents had recently been discharged from hospital, which may indicate that the nursing homes constitute a key link in the patient chain for COVID-19 and thus for health preparedness, since patients may need a prolonged stay at a different treatment level after the acute phase. In other words, full nursing homes may impede hospital discharges.

The strength of our analyses lies in the quality and scope of the Beredt C19 emergency preparedness register. There are some weaknesses, however. The data set 'Health and Care' in the Norwegian Registry for Primary Health Care has not previously been used in this manner, and no validation studies are

therefore available to indicate whether our register definition is correct or not. A register definition will rarely cover the general definition of a concept precisely. By including all units engaged in health-oriented business activities or municipal administration, in addition to temporary stays, we are likely to have included more persons than what many would consider to be 'nursing home residents'. Moreover, many residents who were granted temporary residence actually stayed in the nursing home for the entire year, as the original stay was extended. Therefore, it is not necessarily the case that long-term residents have poorer health than temporary residents. Long-term residents also have a longer follow-up time in the cohort and thus a higher cumulative risk of experiencing one of the outcomes. In addition, the interpretation needs to take into account that testing regimes did not detect all infections. Nor have we had access to clinical data for the residents.

Norwegian nursing home residents have borne a large proportion of the mortality burden from COVID-19 during the pandemic, but due to the high background mortality, COVID-19-related deaths accounted for a relatively minor proportion of these. In this brief report, we have shown how the 'Health and Care' data set in the Norwegian Registry for Primary Health Care can be combined with other data sources to monitor the Norwegian nursing home population. The nursing home population constitutes a group that also has a high disease burden under normal circumstances, but in spite of this fact, little surveillance and research are undertaken in relation to this group. Future register-based research on nursing home residents should be based on and further develop this register definition.

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