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Brief report

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High incidence of COVID-19 at nursing homes in Madrid, Spain, despite preventive measures

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ABSTRACT

Objective. To assess the impact of COVID-19 at nine nursing homes in Madrid, Spain, during the first wave of COVID-19 infection and lockdown period when preventive measures were taken to avoid transmission among residents.

Methods. Nine hundred forty-two residents and 846 staff members from nine nursing homes participated in the study (April 18 to June 20, 2020). All participants were tested for SARS-CoV-2 in the nasopharynx by PCR and for IgG antibodies detection. Microbiological status at sampling was defined as active infection (positive PCR ± presence of antibodies), past infection (negative PCR + presence of antibodies), or naïve participants (negative PCR + absence of antibodies).

Results. Laboratory results helped classify the residents as having active infection (n=224; 23.8%), past infection (n=462; 49.1%), or being naïve (n=256; 27.1%); staff members were actively infected (n=127; 15.1%), had had a past infection (n=290; 34.2%), or were naïve (n=429; 50.7%). Overall, the percentage of participants with COVID-19 was significantly higher in residents than in staff members (72.8% *vs* 49.2%; *P*=0.001). The clinical situation of residents *vs* staff at sampling was as follows: acute manifestations compatible with COVID-19 (7.3% *vs* 3.9%; *P*<0.01) and no manifestations of infection (92.7% *vs* 96.0%; *P*<0.01). A large proportion of both asymptomatic and symptomatic residents (69.4% *vs* 86.6%; *P*=0.015) had positive PCR results (mostly alongside positive IgG determinations).

Conclusions. COVID-19 affects 75% of the residents in nursing homes in Madrid. The high impact in these settings, despite the strict restrictions adopted during the lockdown, demonstrates the ability of SARS-CoV-2 to cause outbreaks.

Keywords: COVID-19, nursing home, PCR, antibody, IgG

Elevada incidencia de COVID-19 en residencias de ancianos en Madrid, España, a pesar de las medidas de prevención

RESUMEN

Objetivo. Evaluar el impacto de la COVID-19 en nueve residencias de ancianos en Madrid (España) durante la primera ola de infección y el período de confinamiento, cuando se tomaron medidas preventivas para evitar la transmisión en estos centros.

Métodos. Se tomaron muestras de 942 residentes y 846 miembros del personal de nueve residencias de ancianos (del 18 de abril al 20 de junio de 2020). A todos los participantes se les realizó una prueba PCR en muestra nasofaríngea, y detección de anticuerpos IgG en sangre. El estado microbiológico en el momento del muestreo se definió como infección activa (PCR positiva ± presencia de anticuerpos), infección pasada (PCR negativa + presencia de anticuerpos) o sin infección (PCR negativa + ausencia de anticuerpos).

Resultados. Los residentes tuvieron infección activa (n=224; 23,8%), infección pasada (n=462; 49,1%) o no infección (n=256; 27,1%); el personal presentó infección activa (n=127; 15,1%), infección pasada (n=290; 34,2%) o no tuvieron infección (n=429; 50,7%). En general, el porcentaje de participantes con COVID-19 fue significativamente mayor entre los residentes que entre los miembros del personal (72,8% *vs* 49,2%; *P*=0,001). La situación clínica de los residentes *vs* el personal en el momento del muestreo fue: manifestaciones agudas compatibles con COVID-19 (7,3% *vs* 3,9%; *P*<0,01) y sin manifestaciones de infección (92,7% *vs* 96,0%; *P*<0,01). Una elevada proporción de residentes tanto asintomáticos co-

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mo sintomáticos (69,4% vs 86,6%; *P*=0,015) tuvieron resultados positivos de PCR (principalmente junto con determinaciones positivas de IgG).

Conclusiones. La COVID-19 afectó al 75% de los ancianos de las residencias de mayores de Madrid. El alto impacto en este entorno, a pesar de las estrictas restricciones adoptadas durante el confinamiento, demuestra la capacidad del SARS-CoV-2 para provocar brotes.

Palabras clave: COVID-19, residencias de ancianos, PCR, anticuerpos, IgG

INTRODUCTION

Spain has been one of the hardest hit countries by the COVID-19 pandemic [1] and the elderly population has been the most affected [2]. COVID-19 disproportionately affected residents and care workers at nursing homes during the first wave of infections that started late-February 2020 and lasted for three months [3]. The exponential increase of cases overwhelmed the Spanish healthcare system and, during the lockdown (from March 15 to June 21), family visits to nursing homes were forbidden. Despite the measures, SARS-CoV-2 kept spreading, causing multiple outbreaks with high-associated mortality rate [4].

The real impact of COVID-19 in nursing homes may be underestimated given the high number of residents or staff members who were asymptomatic and/or the lack of proper testing at the beginning of the pandemic. Epidemiological studies combining both clinical and laboratory data can help to better understand the extent and spreading of SARS-CoV-2 infections in critical settings during the pandemic. The combination of PCR testing and antibody determination helped us to describe that up to 92% and 48% of residents and staff members, respectively, were infected with COVID-19 in a nursing home in Madrid [5]. We here assessed the impact of COVID-19 at nursing homes in Madrid, Spain, during the first wave of COVID-19 infection, when first strict lockdown period and initial preventive measures were implemented.

MATERIAL AND METHODS

All surviving residents and health care workers who consented to participate in the present study were included. A total of 1,788 residents and staff members from nine nursing homes located in Madrid, Spain, participated in the study between April 18 and June 20, 2020. Subjects were assessed with both a nasopharynx PCR sample for PCR testing (TaqManTM 2019-nCoV assay, Applied Biosystems, Pleasanton, CA, USA). Positive PCR results were defined as simultaneous amplification of ORF, S and N genes with Ct values lower than 37. Detection of serum IgG antibodies against the SARS-CoV-2 nucleocapsid protein was carried out in the Architect analyser using Abbott's SARS-CoV-2 IgG assay (Abbott, Abbott Park, IL, USA) following manufacturer´s instructions. The assay is based on a chemiluminescent microparticle immunoassay and determinations were considered negative or positive depending if

results were < 1.4 or ≥ 1.4, respectively (cut-off index value) [6]. All samples were processed in the Microbiology and Infectious Disease Department at the Hospital General Universitario Gregorio Marañón.

Microbiological status at the time of sampling was defined as active infection (positive nasal PCR ± presence of antibodies), past infection (negative nasal PCR + presence of antibodies), or naïve participants (negative nasal PCR + absence of antibodies); participants with active or past infections were all together considered infected. Proportions were compared with Epidat v.4.2 (Consellería de Sanidade, Xunta de Galicia, Spain).

Ethics statement. This study was approved by the Ethics Committee of Hospital Gregorio Marañón (CEim; MICRO.HGUGM.2020-019).

A

	18 Ap	28 Ap	28 Ap	12 May	19 May	22 May	4 Jun	11 Jun	20 Jun
	NH-1	NH-2	NH-3	NH-4	NH-5	NH-6	NH-7	NH-8	NH-9
PCR- IgG-	4	100	29	15	25	14	50	12	7
PCR- IgG+	16	115	9	37	69	36	105	32	43
PCR+ IgG+	30	65	5	35	33	10	6	6	13
PCR+ IgG-	0	4	2	4	2	0	3	5	1

B

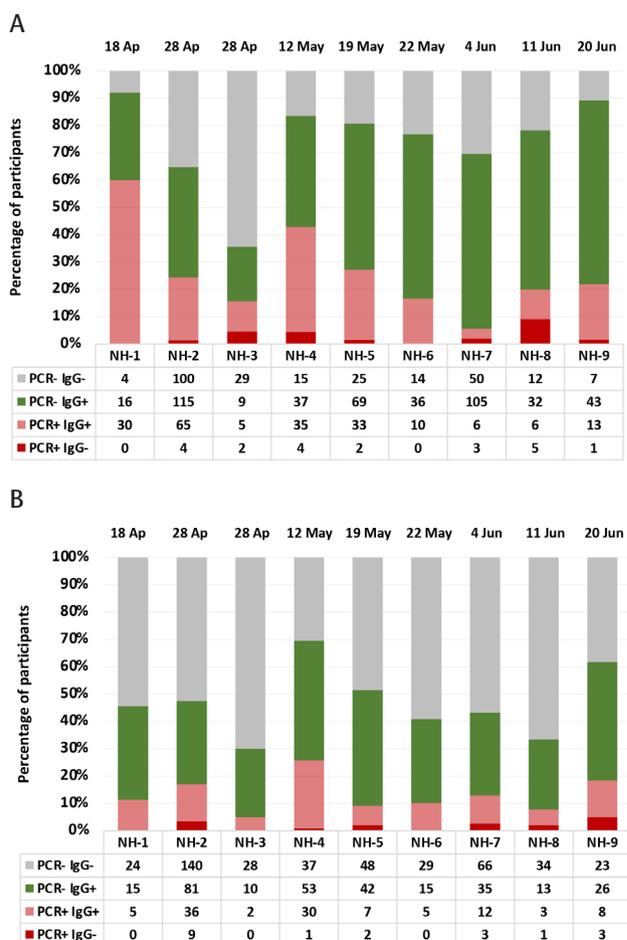|	18 Ap	28 Ap	28 Ap	12 May	19 May	22 May	4 Jun	11 Jun	20 Jun
	NH-1	NH-2	NH-3	NH-4	NH-5	NH-6	NH-7	NH-8	NH-9
PCR- IgG-	24	140	28	37	48	29	66	34	23
PCR- IgG+	15	81	10	53	42	15	35	13	26
PCR+ IgG+	5	36	2	30	7	5	12	3	8
PCR+ IgG-	0	9	0	1	2	0	3	1	3

Figure 1 Percentage of residents (1A) and staff workers (1B) at each nursing home grouped as either having active infection (positive PCR ± IgGs), past and cured infection (negative PCR and positive IgGs), and naïve patients (negative PCR and negative IgGs). Dates of sample collection are also shown.
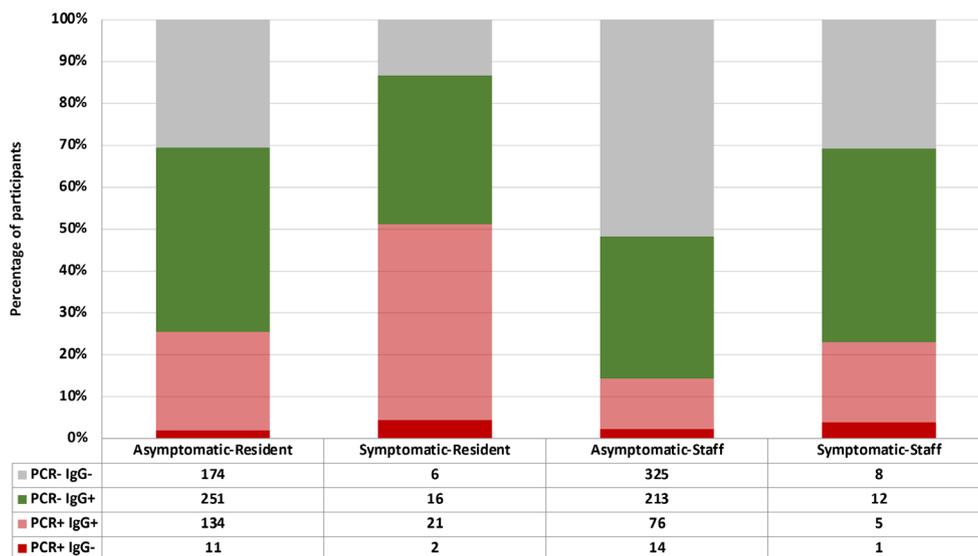
	Asymptomatic-Resident	Symptomatic-Resident	Asymptomatic-Staff	Symptomatic-Staff
■ PCR- IgG-	174	6	325	8
■ PCR- IgG+	251	16	213	12
■ PCR+ IgG+	134	21	76	5
■ PCR+ IgG-	11	2	14	1

Figure 2 | **Percentage of symptomatic and asymptomatic residents and staff workers, grouped as being actively infected (positive PCR ± IgGs), past and cured infection (negative PCR and positive IgGs), and naïve patients (negative PCR and negative IgGs) at the sampling.**

RESULTS

At sampling, 942 surviving residents and 846 staff members were assessed. Median age of the residents was 89 years (IQR: 83.7-92); 77% were female; in the case of staff workers, median age was 46 years (IQR: 38-55); 82.6% were female. The number of residents/staff workers in each nursing home was as follows: NH1 (n=50/44), NH2 (n=284/266), NH3 (n=40/40), NH4 (n=91/121), NH5 (n=129/99), NH6 (n=60/49), NH7 (n=164/116), NH8 (n=55/51), and NH9 (n=64/60). Overall, 224 (23.7%) residents and 127 (15.1%) staff members resulted positive for SARS-CoV-2 by PCR, whereas IgG determination was positive in 665 (70.6%) residents and 398 (47.0%) staff members.

Considering both laboratory results we were able to classify residents as either having active infection (n=224; 23.8%), past infection (n=462; 49.1%), or naïve (n=256; 27.1%); regarding staff members, 127 (15.1%) had active infection, 290 (34.2%) past infection, and 429 were naïve (50.7%). Overall, the percentage of infected participants was significantly higher in residents than in staff members (72.8% *vs* 49.2%; *P*=0.001). Remarkable differences in terms of infected residents among nursing homes were found (residents among 35.6% and 92.0%; staff workers among 30.0% to 69.4%; Figure 1A and 1B). As the first pandemic wave progressed, the number of affected residents increased, a pattern that was not as clear for staff workers (Figure 1).

The clinical situation at sampling for the 1,269 participants (data was unavailable in 519 participants), residents and staff workers, respectively, was as follows: acute manifestations compatible with COVID-19 (7.3% *vs* 3.9%; *P*<0.01)

and no manifestations of infection (92.7% *vs* 96.0%; *P*<0.01). Notably, a large proportion of both asymptomatic and symptomatic residents (69.4% *vs* 86.6%; *P*=0.015) had PCR positive results (mostly alongside positive IgG determinations) (Figure 2). Out of the naïve resident participants (n=174), only two had had proven COVID-19 and four had had probable COVID-19 (clinically suspected but not demostrated microbiology); regarding naïve staff members (n=325) three had had proven COVID-19 and 15 had had probable COVID-19.

DISCUSSION

COVID-19 hardly hit Spain during the first wave of the pandemic starting in late February 2020. It had a profound and uneven impact in residents in nursing homes in Madrid, the epicentre of the pandemic in Spain at that time [7]. These institutions represent a setting at a high risk of COVID-19 transmission due to the advanced age of residents and their underlying conditions. SARS-CoV-2 spreading has been deeply described in nursing homes around the world, including other Spanish regions [8], other European countries [9-13], China [14] or the USA [15].

PCR testing for nursing homes residents was implemented in mid-April 2020, which makes impossible to assess COVID-19 attributable mortality before that time. Some estimates suggest that 87% of COVID-19 attributable deaths in Spain occurred among individuals aged 70 years old and above; during the first wave, 13% of all residents died from COVID-19 in Spain [16,17], such a figure rises to 22% in residents over the age of 80 years. In Madrid, 18% of nursing homes residents died from March to May 2020 [18].

Despite the strict restrictions taken during the lockdown, three quarters of the surviving residents in nursing homes in Madrid had some evidence of past or active COVID-19 disease. In contrast, the disease affected staff workers to a lesser extent. As the first wave of cases progressed, the proportion of residents affected also increased. Specific aspects of nursing homes (shared rooms or bathrooms, physically or cognitively impaired residents requiring high-demand care, rotating staff working in several facilities) may have facilitated the rapid spread of viral infections. Unfortunately, restriction policies for visitors in nursing homes implemented as part of the state of emergency declared on March 14 were insufficient to halt further transmissions [19]. The percentage of residents and staff workers who were asymptomatic at the time of sampling illustrates how insufficient the clinical presentation of the disease to control outbreaks resulted, since those asymptomatic cases could have had an important role in transmission [20].

Our study has limitations. First, not all the nursing homes were assessed at the same sampling time; second, clinical situation were not available for all participants; third, clinical situation was recorded at the sample time point and not on previous days. Finally, some nursing homes characteristics such as the proportion of care staff/residents ratio, proportion of shared rooms, among others, was not provided due to the overwhelming situation during the first wave.

In conclusion, COVID-19 affected three quarters of the surviving residents in nursing homes in Madrid, showing how devastating COVID-19 was in such facilities. The high impact suffered in these settings, despite the strict restrictions adopted during the lockdown, demonstrates the ability of SARS-CoV-2 to cause outbreaks.

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CONFLICT OF INTEREST

All authors declare no conflicts of interest.

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