Assessment of the Andorran response to SARS-Cov-2 Pandemic

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Summary

Background: This research article aims to describe the evolution of the pandemic and the public health strategies implemented to prevent and control Covid-19 in Andorra.
Methods: Andorra is a small country between France and Spain and is the sixth-smallest state in Europe. The cumulative incidence, the case fatality rate, the mortality rate, the percentage of hospitalizations and the intensive care unit (ICU) bed occupancy were calculated. We describe the main characteristics of the strategies implemented in combination such as molecular testing using Transcription-Mediated-Amplification (TMA) and Rapid Antigen Test (RAT).
Results: During the period 10 March 2020- 25 April 2021 a total of 13,086 confirmed cases have been diagnosed which represents 16.9% of the total population. During the first wave, older people were affected, especially ones coming from nursing homes while during the second and fourth wave, the average age decreased. The global case fatality rate is 0.9%. A total of 894 (6.8%) required hospitalization, of which 107 (11.9%) were admitted into the ICU, and 188 (54.4%) residents in nursing homes were infected. Andorra's Government quickly established measures that have determined the extent of the pandemic, such as early diagnosis of COVID-19, early detection of asymptomatic cases while they were in isolation and therefore preventing the virus transmission.
Conclusion: The implementation of the different public health strategies for COVID-19 in Andorra have helped mitigate its impact in various groups. Proactive testing strategies using different tools had a significant impact in a small country such as Andorra in order to effectively find, trace and isolate cases, lowering the economical and social impact in the country.

Key words:
SARS-Cov-2 pandemic.
Public health strategies.
Preventative measures.
Government actions. Andorra.

Valoración de la respuesta de Andorra a la pandemia causada por el virus SARS-CoV-2

Resumen

Antecedentes: El objetivo es describir la evolución de la pandemia y las estrategias de salud pública implementadas para prevenir y controlar la Covid-19 en Andorra.
Material y método: Andorra es un pequeño país entre Francia y España; el sexto estado más pequeño en Europa. Se calcularon la incidencia acumulada, la tasa de letalidad, la tasa de mortalidad, el porcentaje de hospitalizaciones y la ocupación de la unidad de curas intensivas (UCI). Se describen las principales características de las estrategias implementadas.
Resultados: Entre el 10 de marzo de 2020 y el 25 de abril de 2021 se diagnosticaron 13.086 casos (16,9% de la población total). Durante la primera ola se afectó la gente mayor, especialmente la residente en centros sociosanitarios, mientras en la segunda y cuarta la media de edad fue menor. La tasa de letalidad global es del 0,9%. El 6,8% (894) de los casos requirió atención hospitalaria; de estos, el 11,9% (107) ingresó en UCI. En los centros sociosanitarios el 54,4% (188) de las personas residentes se infectó. El Gobierno de Andorra aplicó medidas para conocer la extensión de la pandemia, como el diagnóstico precoz de Covid-19 y la detección precoz de casos asintomáticos en personas aisladas para prevenir la transmisión del virus.
Conclusiones: La implementación de diferentes estrategias de salud pública ha ayudado a mitigar el impacto de la Covid-19 en diversos grupos. Testar proactivamente ha permitido identificar, trazar y aislar a los casos y así reducir el impacto socioeconómico en un pequeño país como Andorra.

Palabras clave:
Pandemia SARS-CoV-2.
Estrategias de Salud Pública.
Medidas preventivas. Andorra.

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Introduction

The novel coronavirus SARS-CoV-2 that originated in China caused a devastating pandemic. It has quickly spread to over 200 countries causing 145,129,547 COVID-19 cases and 3,090,381 deaths by 25th April 2021. On 24th January 2020, the first European case was reported in France, originated by a traveller who had recently been in China. Six days later, the World Health Organization (WHO) declared the novel coronavirus a 'public health emergency of international concern'. During the following week, several European countries reported cases of COVID-19 in travellers related and unrelated to initially affected areas[1].

Andorra is a small country in the Pyrenees with about 78.000 inhabitants, yet it attracts around 8 million visitors annually. It is among the countries with the highest life expectancies in the world, reaching 80.3 years of age for men and 85.4 for women[2,3] and is ranked one of the best healthcare systems in the world according to Forbes[4] and The Lancet with HAQ score of 95/100[5].

Located between France and Spain, two of the most affected countries by COVID-19 in Europe, Andorra has also been hardly hit by the pandemic[6]. The first COVID-19 case in Andorra was identified on 2nd March 2020. This first patient was a young adult, presenting very mild symptoms, who was coming back from a trip to northern Italy. The second case was identified 10 days later, after which there was a steady increase in the number of COVID-19 diagnoses.

Since the beginning of the pandemic, Andorra has implemented several strategies which have eventually contributed to control the epidemic. In this article, we describe the evolution of the COVID-19 pandemic, as well as the preventative measures and public health actions implemented between 10th March 2020 and 25th April 2021.

Methods

Study design

This is a longitudinal descriptive analysis of relevant epidemiological data and health system indicators of the COVID-19 pandemic response in Andorra from March 2020 to April 2021.

Setting and population

Andorra has about 77,543 inhabitants, as well as approximately 1500 cross-border workers. Andorra's Health System network consists of one main health service provider, the *Servei Andorra d'Atenció Sanitària* (SAAS). It manages the sole hospital in the country: *Hospital Nostra Senyora de Meritxell* with a capacity of 200 beds, 1 nursing home and 11 Primary Care Centers that are distributed throughout the country. Andorra also has numerous medical specialties and general practitioners that cover different fields. There is also a network of Nursing Homes (3 private centers and 1 public center called "Cedre") which have a total capacity of over 300 beds.

A specific COVID-19 department called 'COVID Office' was created by the Ministry of Health, staffed with health technicians, contact tracers and other public health professionals. The COVID office was responsible for isolating all affected residents, tracing their contacts, and organizing screenings.

Information sources

Positive COVID-19 test results must be notified by physicians, laboratories, pharmacies and other testing sites throughout the country. All results are then incorporated into a national database created for this purpose.

Daily health statistics are daily published by the SAAS, including the number of new cases, incidence deaths and relevant information about hospital's beds occupancy and intensive care unit (ICU) rates among others. The number of diagnostic tests and vaccination coverage are also updated in the Ministry of health's webpage (www.govern.ad/coronavirus), together with the latest restriction and mitigation measures related to COVID.

Main indicators

The main indicators used to monitor the epidemic are the cumulative incidence, the case fatality rate, the mortality rate, the percentage of hospitalizations that are due to COVID-19, and the intensive care unit (ICU) bed occupancy. The COVID-19 impact in nursing homes is monitored by the percentage of infected residents and the case fatality rate in them. The cumulative incidence refers from the beginning of the pandemic to 25th April. The cumulative incidence and the mortality rate were calculated per 100,000 inhabitants and stratified by sex, age and parish (region). The case fatality rate was calculated as the percentage of deaths related to the number of confirmed cases.

The ICU's bed capacity was expanded from 10 to 37 beds while hospitalization beds increased up to 80 beds.

Timeline of public health measures

Since the beginning of the pandemic, Andorra's Government and Andorra's Health Services have had a pivotal role in the control of the pandemic, quickly implementing pandemic containment strategies.

Andorra was locked down on 13th March 2020 and a voluntary quarantine was put in place for the entire population. The

government ordered schools to close on 16th March. In addition, all cultural activities planned by the government were cancelled. The country's borders remained open, but transit in neighboring countries was heavily restricted and controlled. Only personnel providing essential services such as grocery stores, pharmacies, special security forces and healthcare workers who provide services at the Hospital were allowed to cross the border. On 17th April, the population was allowed to walk outside for an hour within a 2 km radius every two days.

During the first wave, the de-escalation period consisted of 3 phases. Phase 1 started 20th April when 1,000 people returned to work. On May 4th, Phase 2 started with the reopening process, which allowed an additional 4,760 workers to return to normal activity. Isolation and lockdown restrictions were completely lifted on June 1st (phase 3), and on June 15th, French and Spanish borders were reopened (Figure 1).

In the following COVID-19 waves, different restrictions and measures were also implemented. Among them, restriction of visits to nursing homes, regular staff and residents' screenings, limitations on restaurants' opening times and number of diners per table. These restrictions were modified according to the COVID-19 incidence risk. Certain sectors, like the nightclub industry, recreational party rooms and parks remained closed, whereas others (gyms and after school clubs for example) could open as long as they limited their capacity and followed recommended health protocols. The most restrictive preventative measures were implemented during the first and second wave, but a state of alarm or curfew was never declared. Figure 2 shows the chronology of the pandemic in Andorra and the main measures established to control the pandemic.

Mass SARS-CoV-2 serological screening

In order to know the COVID-19 baseline infection rate, a mass serological screening was performed. This screening was one of the first preventative strategies utilized by Andorra along with isolating positive cases and establishing quarantines among contacts to prevent virus transmission. Starting 4th May until 28th May, 2020, two cross-sectional serological surveys were conducted using a rapid serological test (nCOV IgG/IgM) on a finger prick blood sample in 59 drive-through or walk-through checkpoints, called "StopLabs", located across Andorra.

Drive-through or walk-through test sites "StopLabs"

To facilitate easy access to diagnostic tests and cope with the increased demand drive-through or walk-through test sites "StopLabs" stayed in place since July 15th 2020 to mainly perform fully automated and scalable Transcription-Mediated Amplification (TMA, Aptima SARS-CoV-2, Hologic, USA) testing or to a lower extend PCR (Genexpert, Cepheid, Sunnyvale). A rapid logistical turnover between stoplabs and central lab was set up for a time to result notified by mobile phone or email in less than 24 h.

All residents with COVID-19 compatible symptoms or having had a positive close contact could get tested, by appointment without the need of medical prescription. A call center was enabled to attend all voluntary appointments. Simultaneously, cases followed by contact tracing, screenings performed by COVID office and suspicious cases arising from primary care are also tested in StopLabs.

Figure 1. De-escalations phases in Andorra.

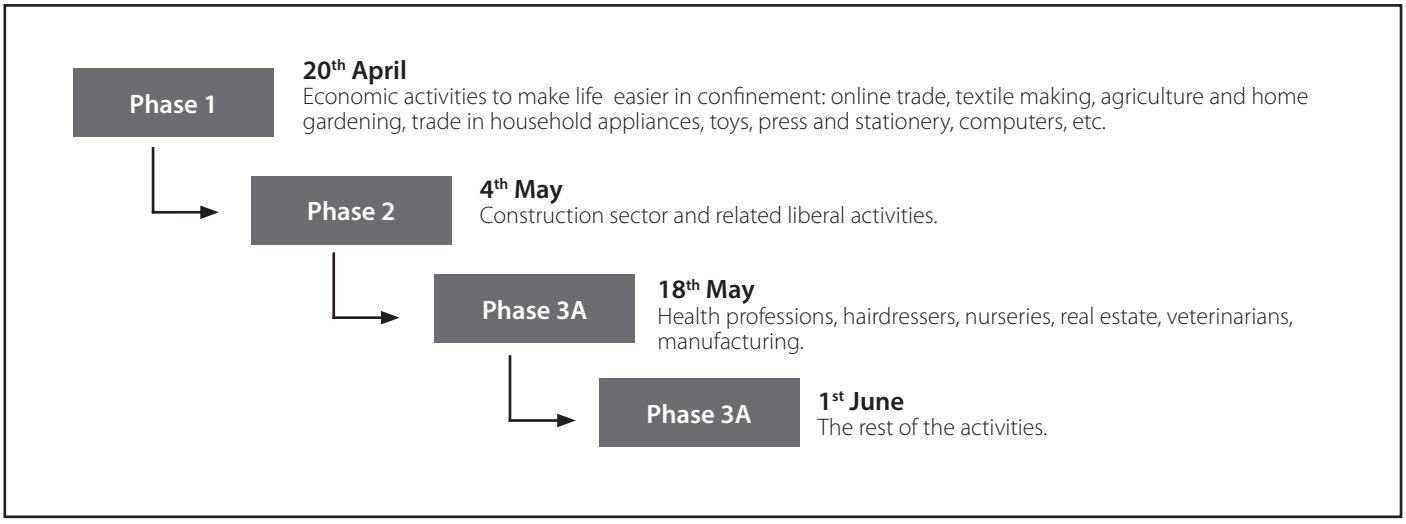
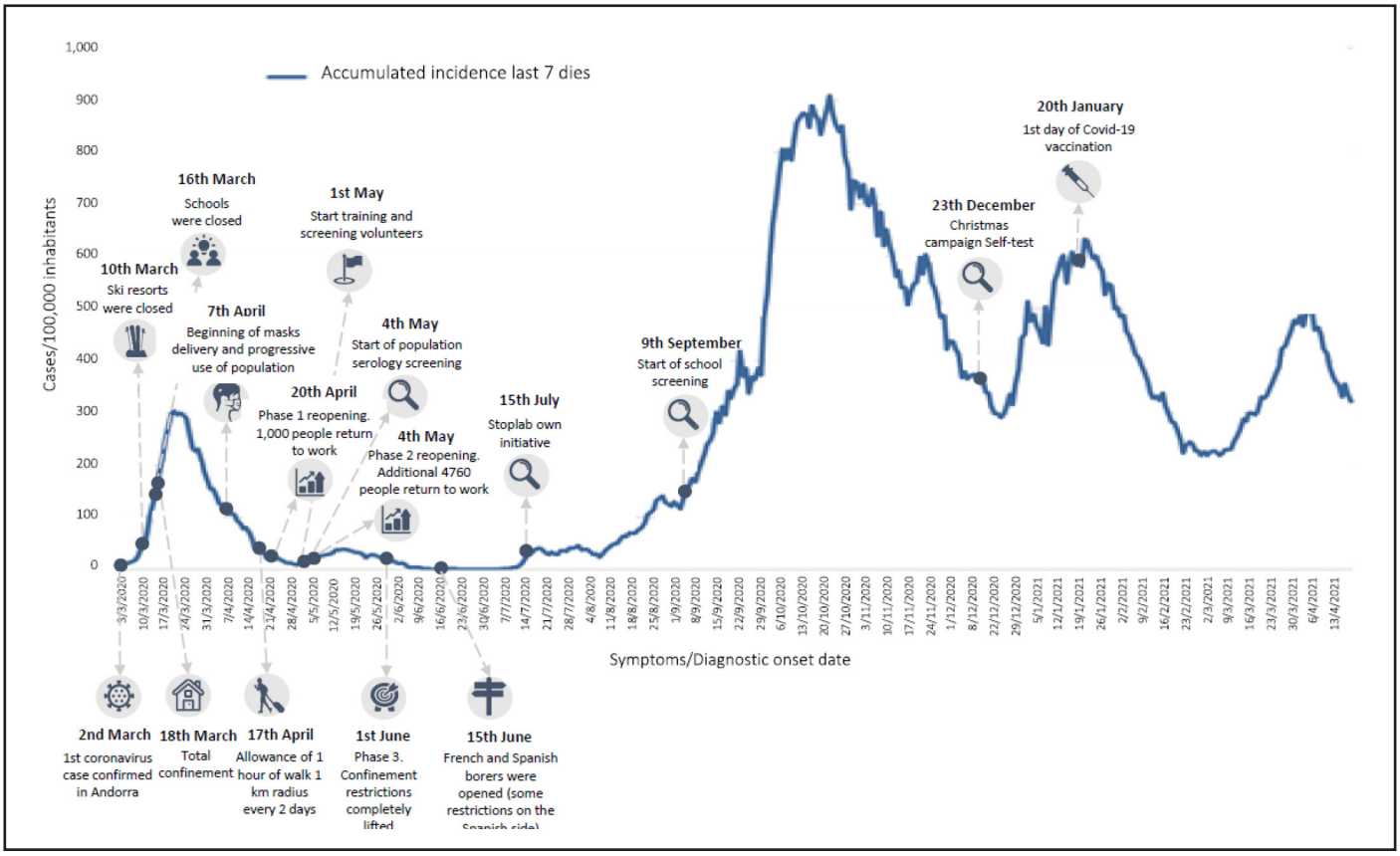


Figure 2. Timeline of the COVID-19 pandemic in Andorra.



Screenings in schools and in strategic sectors

The reopening of schools was an important milestone during the pandemic. Strategies were put into place to ensure a safe environment for returning students and staff. Before the beginning of the school year, between August 31st and September 11th 2020, a new seroprevalence study was carried out, which included all students, teachers and support staff within the entire school system. In addition, this group also underwent a direct diagnostic test (TMA/PCR), which was used to detect positive COVID-19 cases before the start of the academic year in September 2020.

All staff and students over the age of 6 were required to wear face masks in class and on school perimeters with the exception of meal breaks. In order to contain the increased infection risk during meals, students were grouped into small cohorts that would stay the same throughout the school year. Our final effort in preventing disease transmission was to implement weekly screenings using Rapid Antigen Tests (RAT, Biocredit COVID-19 Ag, South Korea) to children over 8 years old and personnel in order to identify possible newly infected cases and properly isolate them to prevent further transmission.

Following the screenings in schools, screenings with RAT or TMA/PCR tests in those sectors that pose a greater infection risk were performed. In economic sectors related to tourism such as restaurants, retail trade, ski resorts and hotels workers have been tested every week with TMA/PCR since August 2020 and RATs since January 2021. In the same way, customer service and essential workers and national athletes are also tested with RATs every week. Residents and staff from nursing homes and healthcare professionals were also tested twice a week with RAT from January 2020.

Nursing homes

Early on, the main residence "Cedre" was transformed into an intermediate healthcare facility. COVID-19 positive older patients were admitted to the Cedre home, and the 35 remaining healthy Cedre's residents presenting low levels of functional and cognitive dependence, were moved to a hotel. None of the transferred patients died. One hundred COVID-19 older patients from the same center and other nursing homes were admitted to the Cedre's intermediate healthcare facility, where they received the same care as if they were in hospital wards.

COVID-19 vaccination campaign

COVID-19 vaccination in Andorra began on 20th January 2021, initially using the Pfizer-BioNTech mRNA vaccine. The Oxford-AstraZeneca vaccine was introduced into the program at the beginning of March. The distribution of the tax groups that were to receive the vaccination and their order of prioritization was decided by the Ministry of Health according to age criteria, comorbidities and risk factors. The front-line medical staff and people over the age of 80 were the first to receive the vaccine. Subsequently, the program was extended to older people over the age of 70, in addition to those with health risk factors in mid-February, those aged 60 or over in March and those aged 50 and over in April[8].

Genomic sequencing

Sequencing enabled the world to rapidly identify SARS-CoV-2 and provide new tools for outbreak management. Continued genome sequencing is a complementary technology and has been lately incorporated as a monitoring tool to track the appearance and spread of the virus. Sequencing of SARS-CoV-2 variants had a positive impact and is a useful guide to public health responses for the pandemic close to real time. In Andorra, it is currently used to randomly sequence samples, from clusters of symptomatic patients coming from high-risk countries that could be infected with concerning SARS-CoV-2 variants (such as South African, Brazilian and British) and those one related to an outbreak.

Results

Epidemiological data

Since the beginning of the epidemic, Andorra has experienced 4 COVID-19 waves: the first began on 12th March and lasted until 11th July 2020, the second from 12th July to 23rd December 2020, the third from 24th December 2020 to 1st March 2021 and the fourth from 2nd March 2021 until 25th April. By this date, a total of 13,086 laboratory confirmed COVID-19 cases (16.9% of the population) have been diagnosed. The different sociodemo-

Table 1. Sociodemographic characteristics by waves of the COVID-19 pandemic in Andorra. March 2020-April 2021. (N=13,086).

Characteristics	First wave (N=856)		Second wave (N=6842)		Third wave (N=3187)		Fourth wave (N=2200)		Total Cases (N=13,086)		Mortality		
	N	%	N	%	N	%	N	%	N	%	Accumulated incidence*	N	Rate*
Sex													
Female	445	57.87	3457	50.33	1623	51.41	1131	50.88	6656	51.13	17,390	51	133.2
Male	324	42.13	3412	49.67	1534	48.59	1092	49.12	6362	48.87	16,009	76	191.2
Age, years (mean, DS)	53,7	20.9	37,8	20.6	39,9	21.5	37,1	19.8	39,1	21.0			
< 15	6	0.78	1211	17.83	487	15.69	395	18.04	2099	16.33	20,319	0	0.0
15-29	98	12.74	1201	17.68	516	16.63	368	16.81	2183	16.98	16,754	0	0.0
30-44	152	19.77	1709	25.16	753	24.27	603	27.55	3217	25.03	17,929	1	5.4
45-59	256	33.29	1682	24.76	799	25.75	541	24.71	3278	25.50	15,930	4	19.8
60-74	109	14.17	718	10.57	360	11.60	219	10.00	1406	10.94	12,391	30	280.7
> 74	148	19.25	271	3.99	188	06.06	63	2.88	670	5.21	13,996	92	2129.1
Parish													
Canillo	37	4.81	245	3.61	43	1.38	44	02.01	369	2.87	11,850	2	45.2
Encamp	90	11.70	844	12.42	211	6.78	134	6.11	1279	9.94	15,016	11	93.7
Ordino	47	6.11	267	3.93	73	2.35	60	2.74	447	3.47	13,317	6	120.0
La Massana	61	7.93	536	7.89	118	3.79	156	7.12	871	6.77	11,934	7	67.6
Andorra la Vella	235	30.56	2007	29.54	396	12.73	305	13.91	2943	22.88	17,589	56	248.5
Sant Julià de Lòria	73	9.49	605	8.90	153	4.92	110	05.02	941	7.31	14,750	30	319.5
Escaldes-Engordany	186	24.19	1026	15.10	191	6.14	151	6.89	1554	12.08	14,353	15	102.9
No resident	11	1.43	35	0.52	.	.	.	.	46	0.36			
No available	29	3.77	1229	18.09	1925	61.90	1232	56.20	4415	34.32			

*per 100,000 inhabitants

graphic characteristics between cases according to the different waves are shown in Table 1.

Since the beginning of the pandemic, the overall cumulative incidence in Andorra is 16,876 per 100,000 inhabitants. As shown in Table 1, the average age of COVID-19 cases varied between the different waves. During the first one, older people were affected, especially those living at nursing homes. This was not the case during the second and fourth wave as schools reopened and therefore the average age decreased (Table 1). The global case fatality rate is 0.9%. This number also varies during the different waves, it is at its lowest during the last one compared to the others (Table 2). The comparison of the main epidemiological features with other small countries in Europe is described in Table 3.

Table 2. Deaths: cases, mean age and case fatality rate by sexe and waves of the COVID-19 pandemic in Andorra. March 2020-April 2021. Andorra (N=124).

		Women	Men	Total
First wave	N (%)	20 (37.7)	33 (62.3)	53 (100.0)
	Age (years)*	84.6	80.6	82.2
	Case fatality rate	4.0	9.1	6.2
Second wave	N (%)	12 (37.5)	20 (62.5)	32 (100.0)
	Age (year)*	78.3	78.2	78.3
	Case fatality rate	0.3	0.6	0.5
Third wave	N (%)	15 (51.7)	14 (48.3)	29 (100.0)
	Age (year)*	88.0	79.3	83.8
	Case fatality rate	0.9	0.9	0.9
Fourth wave	N (%)	2 (20.0)	8 (80.0)	10 (100.0)
	Age (year)*	81.0	76.3	77.2
	Case fatality rate	0.2	0.7	0.4
Total	N (%)	49 (39.5)	75 (60.5)	124 (100.0)
	Age (year)*	84.1	79.3	81.1
	Case fatality rate	0.7	1.2	0.9

* Mean

Of all the cases, 894 (6.8%) required hospitalization, of which 107 (11.9%) were admitted into the ICU, 599 (67.0%) into the hospitalised ward and 188 (21.0%) in Cedre. The maximum ICU bed-occupation was 19/37 (51.3%) beds during the first wave, 59/80 (73.5%) inpatient bed-occupancy and 58/64 (90%) Cedre bed occupancy. The ICU average stay was 25 days and the case fatality rate among COVID-19 cases admitted at ICU was 31.1%.

Only one out of four nursing homes was unaffected by COVID-19. Globally, 218/354 (61.6%) residents in nursing homes were infected and the fatality rate was 39/218 (17.8%). In the main nursing home Cedre, a total of 88/125 (70.4%) residents have tested positive by April 25th 2021, being the biggest during the first wave which infected 40.8% of residents. During the second wave, 36/100 (36%) residents were affected. COVID-19 cases were also identified in the third nursing home only during the third wave, due to a massive outbreak that infected 54/55 (98.2%) residents.

Strategies implemented to control the COVID-19 pandemic

Determining factors identifying the extent of the Pandemic

Mass SARS-CoV-2 serological screening

A total of 77,543 inhabitants of Andorra were invited to voluntarily participate in the study, of them 70,494 inhabitants (90.9% of the population) participated in at least one survey. Overall seroprevalence was 11.0%. The most affected age groups were those over 90 years old (15.2%) and 80-89 (13.8%), followed by adults 50-59 (13.6%) and adolescents 10-19 (13.7%). Most seropositive participants, 6,061 (95.1%), were asymptomatic before the surveys. The multivariable analysis showed that the odds of being seropositive was higher among seasonal workers (OR 2.41;

Table 3. Comparison between Andorra and the other European microstates and small states.

Country	Andorra	Cyprus	Iceland	Liechtenstein	Luxembourg	Malta	Monaco	Montenegro	San Marino
Population	77,365	1,214,449	343,030	38,216	634,165	442,493	39,466	628,130	33,989
Cases	13,086	62,349	6,390	2,884	66,318	30,174	2,432	96,660	5,055
Deaths	124	301	29	57	790	413	32	1,465	89
Recovered	12,442	39,058	6,227	2,724	62.183	29,296	2,330	92,609	4,860
Cumulative incidence*	16,876	5,133.9	1,862.8	7,546.6	10,457.5	6,819.1	6,162.3	15,388.5	14,872.5
Case fatality rate	0.9	0.5	0.5	2.0	1.2	1.4	1.3	1.5	1.8

*per 100,000 inhabitants
Source: Worldmeter.info
Latest News: April 25th 2021

95% CI 1.07-5.45) or in people living in the La Massana parish (OR 2.66; 95% CI 2.44-2.89). A higher seroprevalence was observed in those whose family nucleus had a greater number of cohabitants[7].

Genomic sequencing

A shift from initial Wuhan strain towards the UK strain has been observed since January 2021. The British variant now represents 66.7% of the identified strains, inline with what is currently observed throughout Europe[9].

Early COVID-19 diagnosis strategies

Drive-through or walk-through test sites "StopLabs"

Since the launch of these StopLabs, 180,633 molecular diagnostic tests (PCR/TMA) have been performed, or 233,520 tests per 100,000 inhabitants, one of the highest testing rates in the world. More recently RAT could also be performed in StopLabs.

Asymptomatic early detection (find, test and isolate)

School Screenings

A total of 12,379 tests were carried out, of which 11,317 (91.4%) were considered valid. Moreover, 56 (0.49%) subjects had a positive TMA/PCR, of which 40 (0.35%) did not present positive IgM/IgG, meaning that they were in the initial stages of infection (considered acute cases). This screening was an extremely important step, as it avoided the incorporation of 56 new COVID-19 cases that could have potentially infected other students and staff.

Regularly screening to strategic sectors

By date 25th April, 13,328 test per 100.000 habitants per week were performed. All positive tests or any suspected cases and contact of positive cases are confirmed by TMA/PCR.

Home self-testing with Rapid Antigen COVID-19 Tests (Christmas Campaign)

Starting on December 18th and lasting until January 29th, the Ministry of Health launched a massive self test campaign to control the propagation of the virus. They bought 150,000 RAT from Biocredit®, which allowed a minimum of 3 self-tests per resident over 6 years old. Tests were free and accessible to each resident in their parish to limit grouping. Such tests were recommended to be used before meeting relatives. In case of a positive result, it was recommended to confirm the result by TMA/PCR.

The population greatly accepted these tests, therefore a total of 98,383 tests were given out. A total of 48,760 people collected at least one test, which represents 65.2% of the population over 6. A total of 178 positive cases confirmed by TMA/PCR were detected. We also estimated up to 1179 cases over a period of 10 days without any intervention would result in 50% more infections during the period. After that, self-tests kits are regularly provided to health and social health personnel in contact with patients or institutionalized persons to be tested before each work shift to prevent nosocomial transmission.

At the same time, in November 2020 the government approved a decree regulating the use of RATs for diagnosis in laboratories and pharmacies and during December 2020 allowed their sale in pharmacies.

Primary prevention

COVID-19 vaccination campaign

As of 25th April 2021, 23,823 people have been vaccinated with at least one dose, which correlates to 30.8% of the Andorran population.

Health digitalization

From March to June 2020, all the serological data from the massive screenings was collected from the StopLabs using softwares and technological infrastructures developed by technicians from the Actuatech Foundation.

Once put in place, this database was incorporated into a new tool, called *Pandemius*. This tool was deployed to connect the database and patients medical history information which could then be used by contact tracers. Pandemius, was activated in November 2020 and managed by the TIC department of the SAAS. Pandemius is mostly used by the Covid Office, which is responsible for tracking positive COVID-19 cases, establishing quarantines and following up close COVID-19 contacts.

Discussion

The incidence risk of the disease in Andorra is high, the highest in the world[1], but in a small country, small changes in data produce a significant change in indicators. If we compare the disease burden indicators to other small European countries, Andorra has one of the highest incidences of cases and one of the lowest mortality rates. It is likely that the low lethality is due in part to the large number of cases detected because of the high number of tests performed but also to the fact that the health system has never been at risk[10]. Despite the increased number of hospitalized patients, hospital full occupancy was never reached, and the healthcare system never collapsed. As a result, the age

limitation for admission to the ICU did not occur unlike in other neighboring countries.

This study illustrates how the COVID-19 pandemic affected about a fifth of the population living in Andorra, mainly those in the younger age group, but with variable affectation depending on the wave. During the first wave the elderly were the most infected group, associated with a high case fatality rate therefore the lethality rate was higher during this time. In the following waves case distribution was more homogeneous throughout the different age groups. The ICU occupancy was at half of its capacity, even though it was expanded, but the health system never collapsed. Multiple strategies were deployed for large testing of the population, and results were reported within 24 hours, reducing the time of potential infections. Moreover, an increased knowledge of the extent of the disease was acquired, and a better way to prevent it, Andorra is one of the countries of the world with more tests per inhabitant.

Even though the first wave affected mostly the elderly, the Andorran Healthcare System acted quickly and proactively to control the pandemic in nursing homes. Interestingly, of all the patients who were transferred to Cedre's intermediate healthcare facility 76% of cases were cured. The case fatality rate in those remaining in the nursing home was 20% lower than those reported in other settings (34%)[11,12] despite mostly patients having high functional dependence[13]. The number of COVID-19 cases in the elderly has been lower in the following waves thanks to screening measures and limiting access to visitors.

We believe that one of the key actions of Andorra's pandemic management has been the proactive strategy in detecting cases, isolation of positive cases and establishment of quratantinnes. In the beginning of the first wave, the availability of diagnostic tests such as PCRs was limited. However, the country was able to conduct a massive serological screening that tested the entire population twice in order to understand the impact of COVID-19 within the population and as well as detect and isolate acute cases[7]. At that time, this study was the first and largest of its kind in Europe and showed a seroprevalence higher in older people, seasonal workers and some of the ski-related areas. Later, "Stoplabs" created by the massive screening were maintained throughout the pandemic in order to give a rapid test response performing TMA and PCR, and more recently RATs were in place. Following current guidelines, people with COVID-19 symptoms should be tested as soon as possible after symptom onset. This requires easy access to testing and minimizes test turnaround in order to quickly isolate positives and timely contact tracing should be carried out, ensuring that all close contacts are tested, regardless of symptoms[14]. The fact that there was no need for a medical prescription for TMA nor RATs has made it possible to perform more tests and not overload the primary healthcare. This strategy also contributes to identify a higher number of cases, contributing to a higher case detection rate. The response from the population was very good, which is shown by the high number of tests performed, placing the country in 11th place in the world and 7th in Europe in the number of tests performed per capita.

In addition to these over-the-counter tests, periodic screenings in the sectors most exposed to the virus, such as healthcare, social health and tourism, further expand on the number of tests performed and on the epidemic situation. As observed in the massive serologic screening, the population most affected were older people and seasonal workers, mostly associated with ski-related tourism. Surveillance with weekly TMA/PCR and RAT was prioritized in these sectors to generate a safer environment for the tourism sector and lower the economical impact of the country. Moreover, primary and secondary schools were included in sentinel surveillance activities, due to the expected high number of personal interactions occurring in this environment. This effect was observed during the second wave, being the most important of all in terms of the number of detected cases and mainly due to the high incidence on the student population.

Another unprecedented strategy was the Self-Test Christmas Campaign being one of the first countries to implement home-testing. Current studies show that the frequency of testing is key in containing the pandemic, especially during group gatherings[15-19]. A sustainable method to guarantee safety during an increase of possible close contacts is to systematically test the population. RAT are an economical and an easy option as they do not require professional expertise and can be done at home, thus allowing to test a larger number of people. These tests have a high sensitivity and specificity detecting contagious people although confirmatory TMA or PCR tests are required for diagnostic validation while people remain quarantined. Due to their low price they have become an extraordinarily useful tool in the Public Health field to fight Covid[20-22]. The number of positive cases detected during Christmas Campaign was lower than expected, possibly due to the fact that all positive cases may not have notified health authorities. We estimated the total number of cases to be 30 to 50% higher. The overall assessment was considered positive as the incidence in cases dropped 50% during the third wave compared to the second; which was not the case in neighboring regions, such as Catalunya, where the third wave was similar to the second[23]. As a result of the initial campaign, the Andorran government allowed the RAT to be performed in laboratories and pharmacies, and later approved their sale in pharmacies.

Other relevant actions in the country's health management may have contributed to a positive evolution of the pandemic. For example, a database consisting of COVID-19 diagnostic test results, with data provided by the country's laboratories and test centers, as well as important patient information, provided by the SAAS. In the hospital setting, a crisis Committee was established in the SAAS that coordinated the entire healthcare facilities reorganization in the country in close cooperation with the Ministry of Health. Additionally, a Scientific Committee and Technic Committee of experts from various disciplines were also set up to advise the Ministry of Health. Moreover, a carefully designed communication strategy was implemented, with daily press conferences to effectively share epidemiological data to the population.

Finally, the COVID-19 pandemic has enhanced the digitization process in Andorra and especially in the health system. It has also highlighted the need for an integrated platform containing all the health information of the Andorran population, which allows better decision making for public health measures and a better service for the providers and users. In this line, an Andorran Health App is about to be launched. This app will allow citizens to access their clinical records, perform Telemedicine and at the same time respond to Prems and Proms forms.

One of the strengths of this study is to present the global COVID-19 response from different angles, including the epidemiological burden as well as the comprehensive state-driven interventions package. Andorra has pioneered some of these interventions, such as mass SARS-CoV-2 serological screening, and Christmas home-test campaign.

The study also had some limitations, some data collected in the first phase of the pandemic may be incomplete due to the lack of data digitization tools and tracking of some lab results. However, data quality and completeness has been steadily improving as the pandemic evolved. Second, the small size of the country may overestimate incidence and case fatality rate.

In conclusion, the implementation of the different public health strategies for COVID-19 in Andorra likely contributed to mitigate its impact in vulnerable groups. Reducing viral transmission in a country with a high flow of tourism and surrounded by two countries with a high incidence of COVID-19, has been a game changer to protect its healthcare system and inhabitants. Proactive testing strategies using different tools had a significant impact on pandemic control to effectively find, trace and isolate cases. Finally, curfew and state of alarm were never required and shops, restaurants, schools were kept open with some mitigation measures lowering the economical and social impact in the country. Cost-effectiveness studies of the different interventions will contribute to better understand their usefulness.

Aknowledgments

We thank the Principality of Andorra's Government and Andorra Health Services for its support and its financial contribution to acquire medical equipment, supplies and essential tools, as well as the Health Department for its guidance.

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