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COVID-19 in Finland: Vaccination strategy as part of the wider governing of the pandemic

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ABSTRACT

Objectives: To analyze the vaccination strategy as part of wider public governing of the COVID-19 pandemic in Finland.
Methods: The study provides a synthesis of vaccination strategy and health policy measures, as well as economic challenges, in the COVID-19 pandemic in Finland. The analysis is based on the systematic collection and reviewing of documents and reports. The review was complemented with relevant pandemic and vaccination monitoring data from Finland.
Results: The vaccination strategy approved by the Finnish Government in December 2020 prioritised various risk groups and health and social care professionals attending to COVID-19 patients. The Government has purchased COVID-19 vaccines through the EU joint procurement programme. Vaccinations were organised by municipalities and offered free of charge. The Government recommends universal vaccinations, including foreign residents and undocumented migrants. In 2021, the Government adopted a revised COVID-19 hybrid strategy, which aimed to dismantle wide restrictions as a means to control the epidemic. Despite high vaccination coverage, the Omicron variant became widespread in the population. The economic consequences of the pandemic have been less severe than expected.
Conclusions: In the approach to manage the pandemic, the vaccination strategy has a central role. Finland has probably benefitted from the EU joint vaccine procurement programme. The rapid launch of the vaccinations was supported by the existing vaccination capacity in municipalities. High vaccine coverage was seen as a key in opening society. Although a relatively high vaccination rate was not able to stop the spread of Omicron in late 2021, it has efficiently curbed serious cases and kept the death rate low.

Introduction

The official COVID-19 strategy of the Finnish Government has been based on three pillars: "to prevent the spread of the virus in Finland, to safeguard the capacity of the healthcare system and to shield and protect people, especially those who are most at risk." [1,2]. While the aims have remained unchanged, the tools that have been available and eventually used have varied over the different phases of the pandemic. Since the vaccines became available in January 2021, the role of vaccinations has become more prominent, while the acceptance of large-scale physical distancing measures has declined. The wide vaccination coverage was expected to have a significant impact on society's ability to recover, both socially and economically, and to return to normal.

In the paper, we describe the role of the vaccines as part of the "hybrid strategy", which was implemented by the Finnish government in April 2020 to control the COVID-19 pandemic. We first describe the vaccination strategy and its implementation, and the vaccination coverage and its potential impact on the incidence of and mortality from the COVID-19 infection. Next, we assess how the other measures, such as physical distancing, border control measures and health technology have been used alongside the vaccinations. Finally, we analyze the

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economic consequences of the first year of the COVID-19 pandemic and discuss how the policy measures adopted by the Finnish authorities might have affected the outcome. Data were collated from various sources, including governmental reports, scientific and professional articles, and general media to understand the proceeding of the pandemic and vaccination strategy-related policy interventions, and their outcomes in Finland [3,4].

Access to vaccines

Finnish public health system and national vaccination programme

In Finland, the Ministry of Social Affairs and Health (MSAH) is responsible for the planning, guidance and implementation of national health and social policy. The organisation of primary healthcare and social welfare services is decentralized and is the responsibility of the municipalities (until 2023). Specialized health care is run by 20 hospital districts, which are administratively regional municipal federations (also until 2023). Currently, eight out of the 20 federations, and the autonomous region of the Åland Islands, have established joint authorities organising all health and social services, including primary healthcare and specialized hospitals. In summer 2021, the Finnish Parliament passed a legislative reform, which was to adopt joint regional authorities and centralized financing for health and social services in 2023. However, the major features of public ownership and provision and tax-based financing will remain. Operating as part of the central government, six Regional State Administrative Agencies (AVI) steer and supervise public health, healthcare and social welfare services in their regions [2,4,5].

Municipalities are responsible for organising and providing vaccinations in their areas, in which they can collaborate with other municipalities, hospital districts and other local actors, such as occupational healthcare and private sector providers. In Finland, the main responsibility of COVID-19 vaccination has been in public primary care centers. The hospital districts coordinate the vaccinations of healthcare and social welfare personnel. The Finnish Institute for Health and Welfare (THL) is a national public health agency which prepares, delivers and releases common guidance to the hospital districts regarding the vaccination logistics. THL monitors the implementation, effectiveness and safety of the vaccinations as well as maintains the National Vaccination Registry [6,7].

In addition to regular childhood vaccinations provided by municipal maternity, child and school health services, the vaccination programme in Finland includes annual vaccinations against seasonal influenza, administered by municipal health services to protect various risk groups, such as children under the age of three years and adults over 65. Risk groups for hepatitis A and B and tuberculosis are also vaccinated. Due to the engagement in the vaccination programme, municipalities are well prepared to carry out large vaccination campaigns. In addition to municipal health care, vaccination programmes (e.g., influenza vaccines) are carried out by occupational health care providers, which deliver ambulatory health care services for most working-age people [7–9].

The national vaccination strategy in Finland

The Finnish national COVID-19 vaccination strategy was prepared in a process led by MSAH. The strategy has been implemented alongside the national hybrid strategy to contain the COVID-19 epidemic [1]. The aim of both strategies was to decrease the burden of the disease, to prevent deaths and loss of life and to avoid straining the healthcare system capacity. In the strategies, no numerical vaccine coverage targets were defined [6].

MSAH is responsible for the overall vaccination strategy and procurement of COVID-19 vaccines. Several expert groups assist MSAH in the procurement and prioritisation of vaccinations. Of these groups, the Advisory Board on Communicable Diseases and the Vaccine Procurement Working Group act under MSAH. The first one is appointed by the Government and monitors overall developments in infectious disease outbreaks and supports MSAH in the prevention of infectious diseases. The second one focuses on advising the vaccine procurement process. The National Advisory Committee on Vaccines (KRAR), nominated by the Director General of THL, delivers statements on the development of the national vaccination programme and for the vaccine procurements [6].

Final decisions on the procurement of the COVID-19 vaccines were taken by the Government. In the process, the Government decree on COVID-19 vaccinations was prepared by MSAH, in cooperation with THL, while the Parliament decided on the funding for the vaccine procurement. Finland decided to participate in the EU joint procurement programme and has not started its own programme, nor approved the use of any vaccine outside the EU programme.

The COVID-19 vaccines have been offered free-of-charge to everyone who does not have contraindications on health grounds. Vaccinations are voluntary. While people are supposed to make appointments for vaccinations themselves, municipal health services do not run any call/recall systems on vaccinations. However, separate vaccinations have been organised in elderly care and other institutions as well as at schools and for conscripts in the army.

Most of the COVID-19 vaccines that are in use in Finland at present require three doses. On February 4, 2021, KRAR recommended a 12-week interval between the corona vaccine doses. The longer interval was considered to enable a more rapid increase in the vaccine coverage in a serious epidemic situation, and coincided with a limited number of available vaccines, which that might result in better protection among the vaccinated. In May 2021, the recommendation for the interval between doses was shortened to 8-12 weeks for mRNA vaccines. In September 2021, THL again changed its recommendation on the intervals to the minimum of six weeks for both mRNA and adenovirus vaccines. In addition, on September 2021, THL proposed a third COVID-19 vaccination for certain risk groups after at least two months after the second dose. Those groups include persons with a weakened immune system due to a disease or its treatments. THL also considered that a third vaccine dose be administered as a booster for those who have received a vaccination first at an interval of 3–4 weeks. This group includes health care personnel treating COVID-19 patients and residents of nursing homes and their caregivers. KRAR has underlined that the third dose is needed as a booster for other population groups as well [10].

The COVID-19 EU passport has been available since October 2021 in Finland. It has not been mandatory for the public, but restaurants or cultural events are allowed to ask for the COVID-19 passport from their visitors. However, requesting the passport has not allowed owners or event organisers to remove the restrictions imposed by the officials.

Priority groups for vaccinations

In Finland, like everywhere [11], the insufficient supply of the COVID-19 vaccinations focused the early debate of the vaccination strategy on the questions on population groups to be prioritised in the vaccination programme. Based on expert opinions, the Government decided to prioritise first health and social care professionals and workers attending to COVID-19 patients and then various groups at high risk of severe COVID-19 disease [12]. However, ordering the next population groups for vaccinations turned out to be a complex decision.

The Government approved the national vaccine strategy for Finland on December 2, 2020 and issued a Government Resolution on the strategy on December 12, 2020 [13,14]. In addition, the Government issued a decree on COVID-19 vaccinations under Section 45 of the Communicable Diseases Act on December 22, 2020 [14]. According to the decree, vaccines were to be distributed to different groups of the population as follows:

1 Healthcare and social welfare workers, who examine or directly treat and care for patients with confirmed or suspected COVID-19 disease or who provide other kinds of urgent care, and workers and residents in care homes for older adults.
2 All those 70 years of age and older.
3 Persons at high risk for severe COVID-19 disease due to underlying health conditions.
4 Other persons than those in priority groups 1–3. Vaccines will be administered in descending order as follows: 60–69-year-olds, 50–59-year-olds, 40–49-year-olds, 30–39-year-olds and 16–29-year-olds.

THL prepared the priority list of the risk groups for severe COVID-19 to be used in determining the vaccination order. The list is based on medical risk evaluations and supports the aims of the Finnish national coronavirus strategy. Persons belonging to group 1 were to be vaccinated first and there was no priority sequence among people belonging to the same risk group [15].

The Government amended the decree on vaccinations three times during the spring and summer 2021. The first amendment specified the priority order concerning priority group 4 and included a temporary amendment that became effective until May 11, 2021. The temporary amendment enabled the vaccines to be targeted regionally according to the epidemiologic situation of the region. More vaccines were targeted to those hospital districts where at least 100 new confirmed COVID-19 cases per 100,000 inhabitants were reported in the 14 days preceding the distribution of the vaccine batches [16]. The second amendment enabled the vaccination of the electoral service officials, who were assisting home voting or voting in care institutions in the municipal election in June 2021 [15]. The third amendment on August 9, 2021, extended the voluntary vaccination to everyone aged 12 years and over [17].

There is an official recommendation for vaccination of children under 12 years old in Finland. However, the vaccination is optionally offered for all children over five years old. However, it is recommended that children in risk groups and children who are close to severely immunodeficient people should be vaccinated [18].

Vaccination policy for people without a residence permit in Finland

According to Finnish legislation, municipalities are obliged to organise the COVID-19 vaccinations only for their residents. However, MSAH (2021) has recommended that municipalities should also offer COVID-19 vaccines to people without a residence permit but staying in Finland [19]. The recommendation excludes tourists and those visiting Finland only for a short time, but includes people having health insurance in the EU, EEA countries and Switzerland as well as posted workers and students coming from outside the EU and EEA countries, and undocumented migrants. MSAH also stated that these people can be vaccinated free of charge.

On July 1, 2021 the amended Act on Client Charges in Health Care and Social Welfare (2020/1201) became effective. According to the revised Act, vaccinations for generally hazardous communicable diseases, e.g., as COVID-19, are provided free of charge for all, including foreign nationals [16,20]

The organisation and coverage of COVID-19 vaccinations are the responsibility of the municipalities. While no systematic data exist on these local arrangements, it is difficult to make a comprehensive assessment; but, according to media reports, it has been decided to offer vaccinations to migrant workers in many municipalities where large companies employing them are located. In addition, some large cities had already, before the COVID-19 pandemic, decided to offer basic healthcare for undocumented migrants. Some cities have also attempted to increase vaccine roll-out by arranging targeted vaccination opportunities for undocumented migrants.

The national vaccination register and types of COVID-19 vaccines

For monitoring the national vaccination programme, THL maintains the National Vaccination Register, which has also started to collect data on COVID-19 vaccinations and enables nearly real-time monitoring of the vaccination coverage in Finland. The Register can be used to monitor the coverage regionally and in different population groups. Vaccination data are collected directly from the electronic patient record systems of service providers and cover vaccinations administered in public primary and specialized care, as well as the private sector.

According to the Government decree on COVID-19 vaccines, SARS-COV-2 vaccines that have been authorised under the European Union Marketing Authorisation Scheme can be used in Finland [14]. The European Commission authorised the Pfizer-BioNtech vaccine Comirnaty on December 21, 2020 [21], Moderna Spikevax on January 6, 2021 [22], AstraZeneca Vaxzevria on January 29, 2021 [23] and Janssen on March 13, 2021 [24]. At the time of writing, the Novavaxin Nuvaxovid has not been used in Finland.

The first batches of COVID-19 vaccines, produced by Pfizer-BioNTech, arrived in Finland at the end of 2020, and the first vaccinations were administered on December 27, 2020. Vaccinations continued with mRNA vaccines Comirnaty and Spikevax, administering them to priority groups 1 and 2 and adenovector vaccine Vaxzevria (previously Astra Zeneca) to priority groups 1 and 3, due to the KRAR recommendation to administer the Vaxzevria only to persons under 70 years of age. KRAR decided this since there was insufficient information on the effectiveness of the Vaxzevria vaccine among persons aged 70 years or over [25]. In Finland, vaccination coverage increased slowly compared to several other countries, and at least part of the reason was the organisation of vaccination through primary health care, where there was an initial shortage of vaccination personnel.

On March 10, KRAR stated that persons over 70 years of age could also be vaccinated with Vaxzevria [26]; yet on March 19, 2021, THL temporarily suspended the use of the AstraZeneca vaccine following reports of two cases of cerebral venous sinus thrombosis, within 4–10 days of receiving the vaccine in question, in Finland [27]. The suspension of AstraZeneca vaccines for persons under the age of 65 years of age was extended on April 14, 2021. Due to the precautionary principle, the AstraZeneca vaccine was halted in persons aged 65 or over who have previously had cerebral venous sinus thrombosis or heparin-induced thrombocytopenia (HIT) [28]. In May 2021, THL gave a recommendation to administer only mRNA vaccines to persons under the age of 65, also in cases where the person had received Vaxzevria as their first dose of COVID-19 vaccine. First, the COVID-19 vaccine Janssen was not added to the Finnish vaccination programme, since the majority of the population to whom it could be administered were already vaccinated [29]. Later the use of the Vaxzevria vaccine was terminated in November 2021, and instead the Janssen vaccine became available.

The two vaccines are similar in terms of effectiveness and target groups, yet the basic series of the Janssen vaccine request only one dose [30]. Furthermore, in January 2022, KRAR supported the use of Novavax vaccines, especially for the adults who are hesitant of taking other corona vaccines. This might increase the vaccine coverage, particularly regarding the first dose, and it could also be used as a second or third dose for persons who have received a different vaccine earlier [31].

Complaints regarding elderly people's vaccinations and vaccinations for health and social care employees

As of March 30, 2021, the Deputy Parliamentary Ombudsman received, either directly or by the Finnish Chancellor of Justice, complaints about the obligation to use the AstraZeneca COVID-19 vaccine in the age group 65–69. The complainants mainly criticised THL, MSAH and, in several cases, also the municipalities about the denied access to a booster vaccine other than AstraZeneca Vaxzevria [32].

In March 2021, THL had recommended that municipalities should

vaccinate 65–69-year-olds with Vaxzevria, despite the vaccine being considered to have a lower efficacy than other vaccines and having been linked to serious, but very rare, cases of unusual blood clots. Administering the vaccine to other age groups was no longer recommended [33]. In most municipalities, the THL recommendation was followed.

On July 26, 2021, the Deputy Parliamentary Ombudsman reprimanded MSAH and THL over instructions to vaccinate 65–69-year-olds with Vaxzevria. A reprimand is one of the strongest measures at the disposal of the Parliamentary Ombudsman. According to the reprimand, THL infringed on the Constitution, Non-discrimination Act and Act on the Status and Rights of Patients by neglecting to examine the legal issues in terms of the patient's right of self-determination and prohibition of discrimination. Since the complaints came retrospectively, it did not cause any special measures in the already modified vaccination of the elderly.

Since February 1st, 2022, the COVID-19 vaccination series has been mandatory for health and social care workers who are in close contact with patients or customers at high risk of severe COVID-19 disease. Employers in the social and healthcare sectors are obliged to ensure that their staff do not pose a risk to their customers, and thus they have the right to process health information of their employees that is related to the personnel's vaccination status and past COVID-19 infections. Employees are considered to have sufficient protection against COVID-19 through either a full vaccination series or by a PCR-confirmed infection from no longer than six months ago. If the employee does not obtain the required protection, they need to be offered other work tasks. Nevertheless, the employer does not have an obligation to continue paying salary to an employee that is prevented from working. If the employee cannot take the vaccines due to medical contraindication, they may continue working by representing a negative COVID-19 test (free of charge) result taken no longer than 72 h earlier. Only in special circumstances may an employee, without the required protection, work with customers at high risk [34]. These regulations on forced vaccination have sparked debate on social media and raised objections among some health and social care workers. The obligation has been criticised for aggravating the existing shortage of the health and social sector workforce and endangering patient safety [35].

COVID-19 trends and vaccination coverage

THL reports vaccination progress in Finland daily on its open website [36]. Data on vaccine doses administered are based on the THL National Vaccination Registry. The Vaccination Registry data and information on the website are updated daily. The entries of vaccination data may show a delay of a few days, but the information is updated also retrospectively.

COVID-19 statistics in Finland

The first COVID-19 death in Finland was reported on March 21, 2020. By February 16, 2022, the number of laboratory-confirmed COVID-19 cases reported was 586,809, and the number of deaths was 2215. On the same day, 684 patients had been admitted in specialist hospitals due to COVID-19, and 40 of them in ICU care. Infection rates describe COVID-19 waves of cases in the population (Fig. 1). Table 1 shows the change that has taken place as the pandemic has progressed, with the incidence and numbers of laboratory causes of COVID-19 cases, hospital inpatient care episodes, hospital intensive care unit episodes and deaths by vaccine uptake status.

According to a research report by THL [37], double-vaccinated persons have very rarely been affected by severe COVID-19 disease. Approximately two out of every 100,000 fully vaccinated people suffered from a severe COVID-19 infection requiring hospital treatment, and they were mainly elderly persons. Symptoms presented by vaccinated persons are in most cases mild. The whole population-level vaccination coverage on February 16 2022 was 78,9% for the first dose, 74.4% for the second dose and 44.7% for the third dose. Vaccination coverage of the three doses has been achieved more among the elderly compared to younger age groups (Fig. 2).

The cumulative uptake of at least one dose of Covid-19 vaccine in the total population in Nordic countries in February 2022 was highest in Iceland, being 83.9%. The corresponding rates were 83.2% in Denmark, 80.7% in Finland, 80.5% in Norway and 72.5% in Sweden (Fig. 3).

Adverse reactions reported on COVID-19 vaccines in Finland

The Finnish Medicines Agency Fimea compiles information on the adverse non-serious and serious reaction reports of COVID-19 vaccines

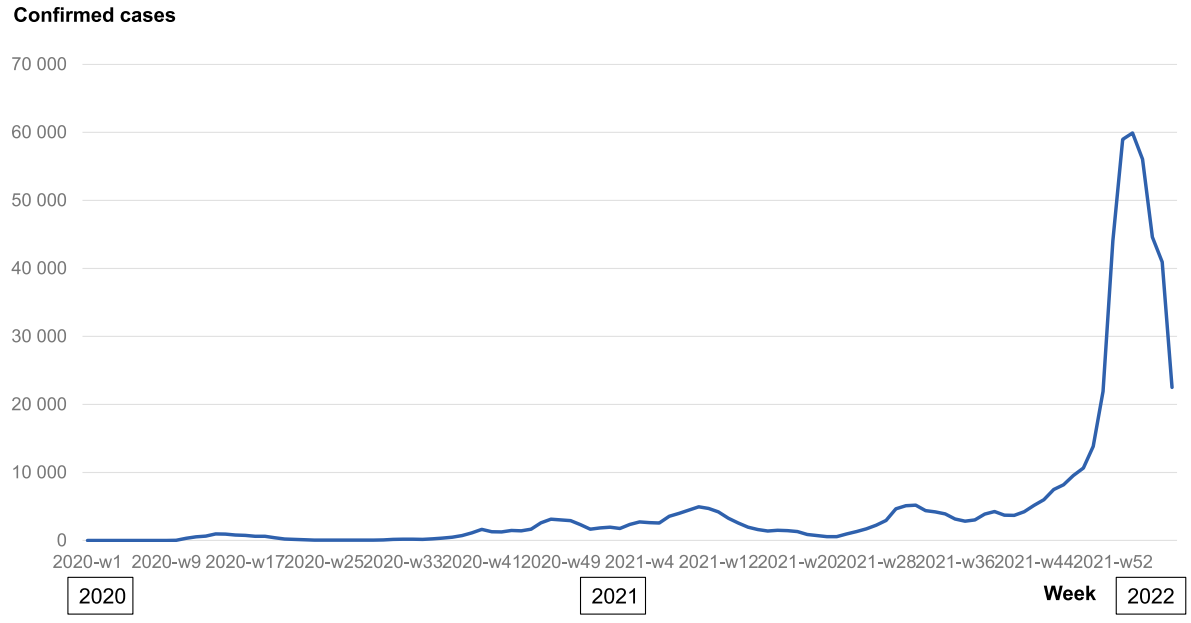

Fig. 1. Number of laboratory-confirmed COVID-19 cases by calendar week in 2020–2022 in Finland. Source: Finnish Institute for Health and Welfare (THL), National Infectious Disease Register.

Table 1
Incidence (per 100,000 person months) and number of laboratory confirmed cases of Covid-19, hospital inpatient care episodes, hospital intensive care unit episodes and Covid-19 related deaths by vaccine uptake status from March 2020 to December 2021 in Finland. Source: National Covid-19 statistics (Finnish Institute for Health and Welfare).

Confirmed Covid-19 cases	50.69	5047	12.17	2439	124.24	24,614	208.37	40,009	167.69	32,718	593.64	113,160
No vaccination	50.69	5047	12.17	2439	124.24	24,614	212.23	39,189	231.95	20,784	1115.80	37,754
Partly vaccinated	0	0	0	0	0	0	115.65	703	154.01	9900	681.43	9230
Full vaccination	0	0	0	0	0	0	59.30	117	63.13	2034	438.92	66,176
Hospital care episodes	7.31	725	0.79	158	5.59	1106	8.99	1740	4.39	863	11.27	2117
No vaccination	7.31	725	0.79	158	5.59	1106	9.49	1679	12.60	674	59.60	1273
Partly vaccinated	0	0	0	0	0	0	3.13	59	2.51	167	13.73	107
Full vaccination	0	0	0	0	0	0	0.58	2	0.93	62	4.47	737
Intensive care unit episodes	1.91	189	0.14	27	0.94	187	1.90	369	0.82	162	2.39	463
No vaccination	1.91	189	0.14	27	0.94	187	2.01	362	2.72	124	16.06	336
Partly vaccinated	0	0	0	0	0	0	0.36	7	0.45	28	2.33	17
Full vaccination	0	0	0	0	0	0	0	0	0.06	10	0.62	110
Number of deaths	2.62	260	0.27	55	1.42	281	1.73	334	0.63	124	3.26	632
No vaccination	2.62	260	0.27	55	1.42	281	1.62	293	0.57	51	7.20	220
Partly vaccinated	0	0	0	0	0	0	3.73	39	0.65	41	2.66	47
Full vaccination	0	0	0	0	0	0	0.83	2	0.71	32	2.51	365

* = incidence per 100,000 person months

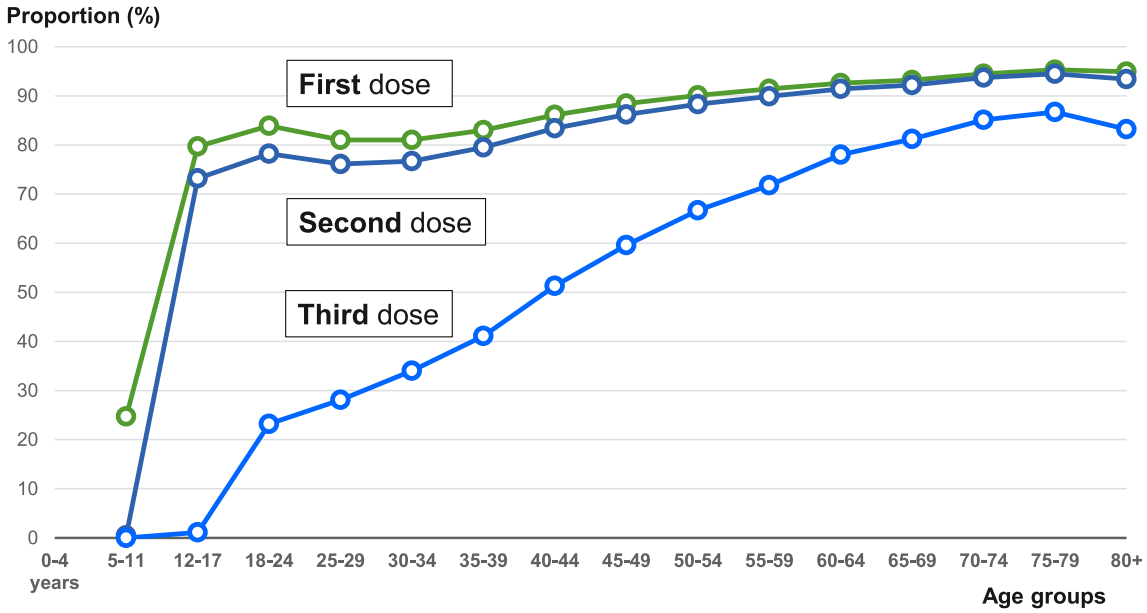

Fig. 2. COVID-19 vaccination coverage (%) by age groups and doses on February 13, 2022 in Finland. Source: Finnish Institute for Health and Welfare (THL), National Vaccination Registry.

submitted to the agency on a website accessible for all through the internet [38,39]. Data and information on the website are updated once a week and more detailed reports are published weekly in Finnish and Swedish. These adverse reports can be submitted by healthcare or other professionals as well as the general public.

The mRNA vaccine, e.g., Comirnaty, Spikevax and vaccine Vaxzevria, adverse reaction reports are entered in the Fimea Vaccine Adverse Reaction Register. At present, more than 10 million doses of COVID-19 vaccines have been administered in Finland. The number of adverse reactions reported is relatively small compared to the doses administered. The highest number of serious adverse reaction has been reported for the Vaxzevria vaccine (Table 2). These data are also shared regularly with THL. In addition, all adverse reports are transferred to the EudraVigilance database, developed and maintained by the European Medicines Agency (EMA). The vaccine marketing authorisation holders and WHO have access to the adverse reaction reports via EudraVigilance. In addition, consumers can view the reports in the database.

Impact of vaccinations with other policies

Physical distancing measures

In October 2020, the Finnish Government introduced the so-called "hybrid strategy" [1,2]. The intention was to move from the general restrictions to a situation where restrictions and protective measures are targeted at big public events, restaurant and pubs (particularly nightclubs and restaurants with large customer capacities or very confined premises), preventing the spread of the virus from higher-risk countries, and protecting the elderly and other people in risk groups [1,2]. In addition, the restrictive measures were set under the responsibility of regional and local authorities (AVI and municipalities). Later, the Government specified the strategy defining by the restrictions to children's activities, such as schools and sports training, to be the last resort measures implemented in the case where the epidemic was spreading rapidly at the community level.

The hybrid strategy was based on a situational picture on the uncertainty of how rolling out the vaccinations proceeds [1,6]. However, as the vaccination programme has evolved, the national strategy has

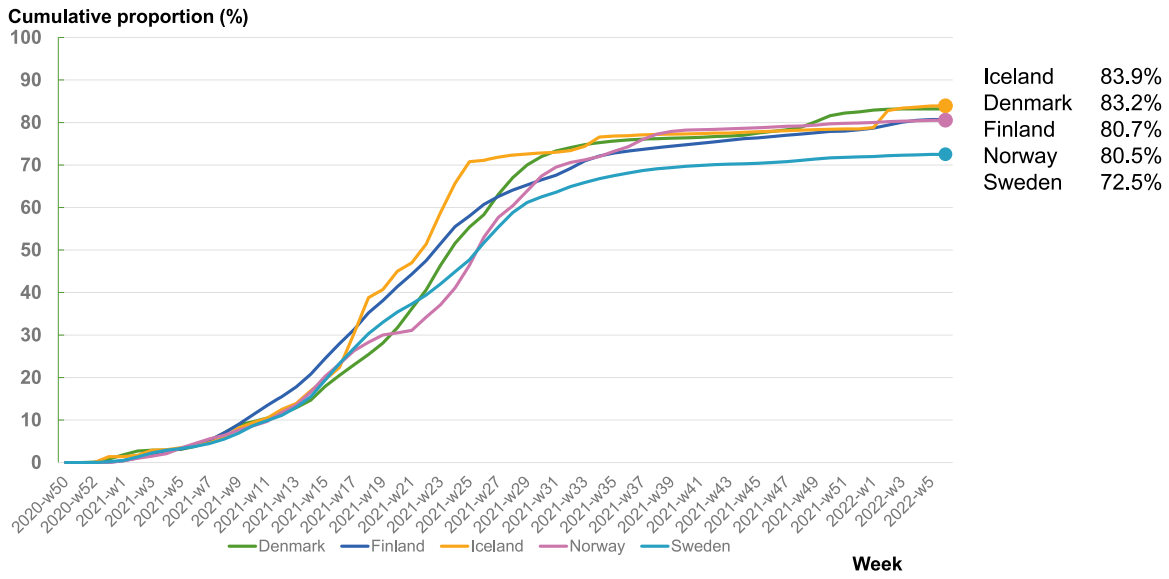

Fig. 3. Cumulative uptake (%) of at least one dose of Covid-19 vaccine in the total population in the Nordic countries by calendar week in 2020–2022. Source: European Center for Disease Prevention and Control, COVID-19 Vaccine Tracker.

Table 2
Adverse reactions reported on corona vaccines by January 13, 2022 [33].

Type of vaccine	Total number of reports		Non-serious		Serious *		Administered doses (THL)
	N	(%)	*N*	(%)	*N*	(%)	*N*
mRNA vaccine Comirnaty	4740	(0.06)	1379	(0.02)	3361	(0.04)	8,172,797
mRNA vaccine Spikevax (previously COVID-19 vaccine Moderna)	1063	(0.08)	380	(0.03)	683	(0.05)	1,412,252
Adenovirus vector vaccine Vaxzevria (previously AstraZeneca)	1435	(0.25)	598	(0.11)	837	(0.15)	554,095
Total	7176	(0.07)	2349	(0.02)	4827	(0.05)	10,139,144
	**	**	**	**	**	**	

* The seriousness of the reactions is based on the reporter's assessment, or if not available, on expert assessment at Fimea. An adverse reaction is considered serious if it is fatal or life-threatening, requires hospitalisation or prolongs hospital stays, causes persistent or significant disability or incapacity or congenital anomaly.
** The total number may be less than the sum of the different vaccines, as one report may contain more than one COVID-19 vaccine as a suspected vaccine.

remained the same. Especially the hospitality and culture sectors have requested that the restrictions be lifted and for the implementation of the COVID-19 passport to ensure safe events. In August 2021, the Prime Minister stated that as soon as the vaccination coverage increases, society should been kept open [34].

This was regarded as a change in the strategical position on the epidemic control [1] and indicated an increased role of the vaccinations in the COVID-19 strategy of the Finnish Government. On September 6, 2021, the Government adopted a revised COVID-19 hybrid strategy, aiming to dismantle wide restrictions as a means to control the epidemic. The goal, which would prompt the lifting of other control measures, was to reach the vaccination coverage of two doses for at least 80% of the population, aged 12 years and over, or that the opportunity for vaccination would have been offered for all. The new strategy was focused on the gradual opening of society, and it aimed to provide cross-sectoral support of the recovery from the epidemic, and the conditions for economic growth and reconstruction [40]. In the beginning of February 2022, a protest was held in Helsinki demanding that cultural facilities and events be opened immediately and that the closure will be the last. The protest also wanted to draw attention to the unfairness of the restrictions. Also in Finland, like several other countries, the so-called Convoy protest was also held at the beginning of February 2022 in Helsinki, which called for the lifting of restrictions [41].

Border control with COVID-19

According to Finnish legislation, a Finnish citizen cannot be prevented from entering the country, and without legal reasons, leaving the country cannot be restricted. While the international border controls have been discontinued as of July 26, 2021, all persons arriving in Finland are still bound by obligations stated in the communicable disease act. A person from another country is granted entry to Finland if he or she can present a certificate for having received a full vaccine series at least 14 days before, a certificate of past COVID-19 infection during the last six months, or a negative laboratory test on COVID-19 within the last three days. These conditions apply to those born in or before 2006 [42]. These instructions, based on the Government decision and according to current information, will be valid until March 13, 2022. Border control regulations have changed several times during the pandemic, and provisions still differ between those arriving from the Schengen Area and EU countries and those arriving from elsewhere.

On May 26, 2021, Finland launched a national certificate of COVID-19 vaccination that contains information about the COVID-19 vaccines that the certificate holder has received. The data for an electronic certificate can be accessed from the national patient-accessible electronic health records (PAEHR; My Kanta Pages) through the internet.

Health technology and digital tools

The EU Digital COVID Certificate is available at the Finnish PAEHR (patient-accessible national electronic health records in Finland) and includes a test certificate and a certificate of recovery as of July 14, 2021. The EU COVID-19 vaccination certificate has been available in the PAEHR since June 22, 2021 [43]. The EU COVID-19 certificate consists of three different certificates: a COVID-19 vaccination certificate, a certificate of a negative COVID-19 test result and a certificate of

recovery from COVID-19 infection. Persons who are not using the PAEHR can obtain a certificate of COVID-19 vaccination from healthcare providers. In July 2021, the healthcare providers deployed a service that enables printing out the EU vaccination certificates for persons who are not able to use the PAEHR on the internet.

In the future, the Finnish PAEHR is planned to provide certificates of COVID-19 vaccinations and other COVID-19 certificates as well as certificates of other vaccinations. The aim is that these functionalities, creating certificates drawn from the My Kanta Pages, would be available also after the COVID-19 pandemic.

The certificates of COVID-19 vaccination are digital certificates, QR codes, or a combination of these, available in the PAEHR, and people can display the certificates on their mobile device or have them printed on paper. The authenticity of the certificate can be checked by scanning the QR code. The certificates in the PAEHR are available in Finnish, Swedish and English, and they are free of charge.

Considering other digital tools, the web-based Omaolo, COVID-19 symptom checker self-assessment tool, available in Finnish, Swedish and English, has been used extensively nationwide. The symptom checker self-assessment evaluates two different things: symptoms and potential exposure [44,45]. The tool is linked to the web-based appointment service for COVID-19 testing. The Finnish national contact tracing app Koronavilkku ('Corona Blinker'), produced by THL, was introduced in August 2020 [45–47]. The app can also be used to access the Omaolo COVID-19 symptom self-assessment tool. The assessment of the effectiveness of the Koronavilkku has not been reported. However, while the number of cases increased sharply, the tracing was overloaded, and the application did not provide the expected benefit for infection tracing.

THL is also analysing the presence of the coronavirus in Finnish wastewater. The presence of the virus is examined by measuring the coronavirus RNA (genome) in untreated wastewater. An RNA test indicates if the coronavirus is present in households connected to the sewer network. Wastewater monitoring can be used to detect changes in the prevalence of coronavirus in different cities. This also helps to anticipate and assess changes in the population's infection situation [48].

The economic consequences less drastic than expected

After the outbreak of COVID-19, it was suggested that the COVID-19 pandemic could be economically more drastic than the Financial Crisis of 2008–2009. In the Finnish context, the economic shock of COVID-19 was compared with the domestic banking crisis and consequent deep recession in the early 1990s [2]. However, the initial drop in the Finnish GDP in 2020 turned out to be only 2.8% [49]. Average GDP losses in EU countries was 6.1%, which is still about 2 percentage points less than what the European Commission Economic forecasted in July 2020 [50]. Economic recovery started in the third quarter of 2020, and the Finnish GDP was, at the end of 2021, already higher than before the pandemic. The EU average has recovered at a slower pace but has reached pre-pandemic levels by the end of 2021.

Earlier studies have argued that the pandemic could affect a small open economy, like Finland, via three main channels [2]. Better-than-expected developments in all these three areas explain why the overall effect was less negative too. First, economic sentiment deteriorated quickly in April 2020 but has improved since that. Already in Summer 2021, both consumer confidence and business sentiment indicators have the highest figure since 2018 [51,52]. The facts that infection rates were negligible in summer 2020, and that restriction measures curbed the epidemic relatively effectively since that, contributed positively to sentiment. Moreover, positive news regarding vaccination coming available in spring very likely started to affect sentiment already in late 2020. News regarding the Omicron variant and new restriction measures deteriorated expectations slightly in December 2021.

Second, although the Government restrictions have curbed economic activities strongly in some service sectors, the overall effect has been relatively moderate, as the relative importance of those sectors in Finland is smaller than in other EU countries. Although total private consumption and spending contracted and saving increased in 2020, spending related to traveling, as well as culture and hospitality services, has partly turned into other forms of spending. Large Government programmes for economic stimulus and abnormally low interest rates positively contributed to domestic demand.

The third effect, stemming via international trade and financial markets, was assumed to be negative, but Finnish exports recovered quickly and exceed the now the pre-crisis level [53]. Also, risks related to international financial markets have not been realized. Stock markets recovered quickly from the initial hit, and increased volatility has developed positively, mirroring the extremely supportive monetary policy, which has continued in Europe for already over a decade.

As the overall economic consequences turned out to be less dramatic than foreseen in spring 2020, effects on public finances also became smaller than expected, but still substantial. General government net lending increased from 1% of the GDP in 2019 to 5.45% in 2020, while the Ministry of Finance forecast was 8.2% in June 2020 [54]. Deficit contracted in 2021 but was still substantial.

Extra spending was connected to COVID-19 testing, purchases of vaccines and large business and household support packages. A Finnish peculiarity was that Local Government finances improved by more than 1% in relation to the GDP, as the Central Government overcompensated for COVID-19-related expenditure for municipalities responsible for financing public health services. Hospital districts, run by municipal federations, also received sufficient direct emergency funding, despite the decreased number of patients treated.

It is also expected that the pandemic will have a sizeable effect on the composition of production and employment as well as distributional effects. Broadly, these expectations haven't been realized in Finland. Although contraction in services production was much larger than in other main sectors of the economy, services have also recovered quickly back to the pre-pandemic level. Finnish industrial production was already in decline when the pandemic started, but since the end of 2020, it has been growing very fast, such as exports. The employment rate (15–64 years old, trend) dropped 2.7 percentage points in March 2020, but has recovered to about one percentage point higher than it was before the pandemic. Similarly, the unemployment rate (15–74 years old, trend) was, in May 2021, 1.7 % higher than in February 2020, but it has restored more than fully by the end of 2021. Noting the relatively quick recovery of economic conditions, and large public support packages, it is not very surprising that the Gini Coefficient, measuring overall income inequality, dropped somewhat in 2020 [51]. Information regarding the situation in 2021 is not yet available.

Conclusions and policy implications

Like elsewhere, vaccinations have been an important element in the Finnish Government's strategy to manage with the COVID-19 pandemic [6]. In the beginning of the pandemic, the vaccinations were considered as a tool to prevent the spread of the virus. While along with new variants and evidence on insufficient protection of vaccination against the virus, the Government vaccination strategy moved to emphasise the high vaccination coverage as a means to prevent severe cases [40]. While, in broad terms, the Government policies have followed expert recommendations, there are issues which have raised questions about not sufficiently following the expert opinions. For instance, some experts have questioned the rationale of the vaccine mandate of health and social care workers, given that vaccinated people can still spread the virus [55].

It is challenging to assess the relative impact of the vaccinations in relation to other measures in containing the pandemic. Although Finland has good monitoring data on the epidemic, health care strain, vaccinations and economic performance, it is difficult to link public

health measures, such as various restrictions and vaccinations, to any tangible outcomes. An important element in terms of containing the COVID-19 epidemic in Finland has obviously been the fact that the epidemic reached the country later than many other European countries, leaving time for imposing public health measures, which, together with contextual factors, such as low population density, resulted in the number of COVID-19 cases remaining low for a relatively long time. The Omicron variant changed the situation at the end of 2021, and the pandemic surged in the population, including Finland. The high numbers of infections have also led to an increase in the number of deaths. However, the case fatality is much lower than earlier, which obviously partly reflects the impact of vaccine in preventing serious cases of the disease.

The COVID-19 vaccination strategy has raised intensive public debate, which has, along the progress of the pandemic, focused on different issues, such as the availability of vaccines, the priority order of vaccinations and the possible prioritisation of different regions within the country, based on their situation in terms of COVID-19 infection rates in their populations [11,12]. Until 2021, the highest rates of laboratory-confirmed cases of COVID-19 infections in Finland were reported in the metropolitan area of the capital city of Helsinki. However, the order of vaccinations has mainly been based on age and medical risk groups in accordance with the national vaccination strategy, which led to, in the early days of the epidemic, proportionally more vaccines being allocated to rural municipalities with older populations but low infection rates. Another issue, which has strongly divided opinions, is the requirement of vaccinations among health and social care employees.

Although there was initial concern about the sufficient availability of vaccines, it seems that participating in the EU joint vaccine procurement was a good solution, which secured a relatively smooth, although slow, inflow of vaccines to Finland. However, delivery of vaccines in small batches and delays in deliveries due to limited manufacturing capacity and production problems has hampered the planning and organisation of the COVID-19 vaccination programme. Although, for some COVID-19 vaccines, distribution required an unbroken cold chain, and specialized cold storage complicated the planning of vaccine logistics within a very tight schedule, the main challenge, in terms of the implementation of vaccinations, has remained the low quantities of imported vaccines.

In Finland, the COVID-19 vaccinations are organised by municipal primary healthcare authorities, which are also responsible for implementing the general national vaccination programme, including annual seasonal influenza vaccinations [6,9]. As a result, COVID-19 vaccinations in Finland have been carried out by organisations and personnel experienced in arranging large scale vaccination campaigns and having material infrastructure to secure safe logistics for vaccines. For instance, only in some rural areas of the sparsely populated Northern part of the country was it necessary to use vaccines that do not require a particularly low temperature for storage. In order to increase the capacity to vaccinate, the participation of private providers and occupational healthcare services in the vaccination was also initially considered but not generally adopted in the end. However, each municipality has been able to agree separately on the participation of private health care and occupational health care in the vaccination of residents. In some municipalities, the shortage of skilled vaccinators was addressed by inviting retired nurses to vaccinate.

In the COVID-19 vaccination programme, municipal health services have not sent any invitations for the vaccinations to municipal residents. Instead, each person has been requested to make an appointment for vaccination. This may have had a significant effect on the fact that part of the population has not taken the vaccine. For instance, it needs to be assessed whether people representing different language groups were reached effectively enough. The vaccination strategy procedure emphasises the voluntary nature of vaccinations but raises the question on the universal right to free vaccination. A specific group has been the residents of nursing homes and military service attenders, who have been systematically offered vaccinations. Also, in some municipalities, young people over the age of 12 have been offered vaccinations at schools. In addition, in summer 2021, several municipalities adopted, e.g., pop-up and walk-in vaccination sites to facilitate the vaccination enrolment of younger adults with a low vaccination coverage [56,57]. Vaccinations have been received without an appointment in several cities since the beginning of 2022.

However, there are several other vulnerable groups, such as non-institutionalized frail elderly persons and persons with mental health conditions, whose access to vaccinations was not addressed in the vaccination strategy. There are also no attempts at monitoring the vaccination coverage among undocumented migrants and other non-Finnish persons. For future vaccination campaigns, a thorough survey of the current system is needed to assess how effectively the vaccination roll-out, based on personal responsibility, manages to reach different vulnerable groups and to secure optimal vaccination coverage.

In many countries, the opposition against vaccination and restrictions to contain the COVID-19 pandemic has been relatively marked. In Finland, by contrast, COVID-19 vaccinations have been widely accepted. The strongest predictor of high intentions to take a COVID-19 vaccine is trusting the vaccine to be safe [58]. Vaccinations and restrictive measures have also provoked opposition, and protests have also been seen in Finland.

Evidently, an important factor contributing to Finland's high vaccination coverage is the high confidence in the authorities; but in the end, it is probable that clear and open communication, using multiple channels by the authorities regarding the safety of the vaccines and vaccination benefits, has also contributed. However, government COVID-19 communication has also suffered from shortcomings, particularly in relation to the AstraZeneca vaccinations in the elderly population [32]. The confusion with restrictions has also caused dissatisfaction, and it has been seen as inappropriately targeted, especially to the cultural sector and restaurant business.

To support learning for future vaccination campaigns, government-funded research projects are underway on how to assist healthcare professionals in intervening misconceptions about the COVID-19 vaccines and in strengthening public confidence in them [59].

As mentioned earlier, the fact that the economic consequences of the pandemic turned out to be less severe in Finland than in other EU Member States is consistent with fewer confirmed COVID-19 cases and less strict restrictions [2]. As the infection prevalence and strictness of restrictions are (positively) correlated, it is rather challenging to carry out a study on how restrictions might have affected the economy and how much was due to the anxiety of consumers and management of private enterprises. In public discussion, it has widely been assumed that there was a trade-off between health policy and economic policy targets. There already exists, however, some evidence that effectively implemented restrictions may strengthen economic confidence, and thus, consumption and investments [60].

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Patient consent

Not required.

Declaration of Competing Interest

None declared.

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