

The effect of COVID-19 lockdown on the incidence of emergency department visits due to injuries and the most typical fractures in 4 Finnish hospitals

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Acta Orthopaedica

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Submitted 2021-10-14. Accepted 2022-02-17.

Background and purpose — COVID-19 lockdowns have affected personal mobility and behavior worldwide. This study compared the number of emergency department (ED) visits due to injuries and typical low-energy fractures in Finland during the COVID-19 lockdown period in spring 2020 to the reference period in 2019.

Patients and methods — The data was collected retrospectively from the electronic patient records of 4 hospitals covering 1/5 of the Finnish population. We included the patients who were admitted to a hospital ED due to any injury during the lockdown period (March 18–May 31, 2020) and the reference period (March 18–May 31, 2019). We compared the differences between the average daily ED admissions in the 2 years using the zero-inflated Poisson regression model.

Results — The overall number of ED visits due to injuries decreased by 16% (mean 134/day vs. 113/day, 95% CI –18 to –13). The number of ED visits due to wrist fractures decreased among women aged over 50 years by 40% (CI –59 to –9). Among women, the number of ED visits due to ankle fractures decreased by 32% (CI –52 to –5). The number of ED visits due to fractures of the upper end of the humerus decreased by 52% (CI –71 to –22) among women. The number of ED visits due to hip fractures increased by 2% (CI –16 to 24).

Interpretation — Restrictions in personal mobility decreased the number of ED visits due to injuries during the pandemic. The effect can mainly be seen as a decreased number of the most typical low-energy fractures among women. In contrast, lockdown restrictions had no effect on the number of hip fractures.

Coronavirus disease 2019 (COVID-19) spread throughout the world in the spring of 2020 (1). The World Health Organization declared a COVID-19 pandemic on March 11, 2020. As of March 18, 2020, the Finnish government introduced an emergency law. People over 70 years old were recommended to stay at home in quarantine-like conditions. In addition, remote working was recommended, schools and universities were closed, online education was initiated, and it was recommended that social contacts be avoided (2). On April 4, 2020, restaurants were closed. Restrictions were lifted on May 31, 2020. Such restrictions and lockdown have never before been implemented in Finland. They had major effects on citizens' mobility and daily life as, e.g., all possible employees were shifted to work from home, together with their children. In Finland, 82% of working-age citizens are working full time (88% of men and 74% of women), i.e., 37.5 hours per week (3). Approximately 90% of fathers and 76% of mothers are employed (4). The restrictions are described in more detail in the Supplementary material.

During the lockdown, the incidence of injuries decreased in many countries (5-16). Initial investigations found that fewer traffic accidents, falls, and sports injuries occurred during quarantine (5,13,14). In Sweden, the monthly rate of ankle fractures decreased by 14% between March 15 and June 15 in 2020 compared with 2017–2019 (17). Reduction was 16% in women and 24% in all patients over 70 years old. The overall number of hip fractures did not decrease during quarantine (6,10,12). In Finland, in 3 hospital examinations, ED visits for all reasons decreased by 16% between 2019 and 2020 (18). Studied from the same data, ED visits due to injuries decreased in the age groups 70–79 and 80–89, but not in the age group > 90 (19).

We hypothesized that the incidence of ED visits due to injuries may have changed during this lockdown period. The objective of this study was to determine how the lower mobility and other restrictions imposed due to the COVID-19 pandemic affected the incidence of injuries in varying weather conditions in Finland. We specifically investigated the change in the incidence of ED visits due to the most common fractures, including hip fractures, ankle fractures, wrist fractures, and fractures of the upper end of the humerus. By selecting these fractures, we aimed to explore how the restrictions effect the incidence of typical low-energy fractures.

Patients and methods

In this retrospective study we analyzed the electronic patient health records of 4 Finnish hospitals: Tampere University Hospital (TAUH), Kuopio University Hospital (KUH), Central Finland Hospital (CFH), and Mikkeli Central Hospital (MCH), catering for an overall population of approximately 1.15 million people, which is 1/5 of the Finnish population (20). All 4 hospitals provide primary trauma care and have continuous emergency surgery services. TAUH and KUH have tertiary trauma care units including neurosurgery and thoracic surgery. In TAUH, KUH, CHF, and MCH, most of the patients, including primary healthcare patients, are referred to these hospitals in the evenings and on weekends. Hospitals have emergency services in the fields of general medicine, surgery, internal medicine, neurology, radiology, pediatrics, gynecology, and anesthesiology. In Finland, public healthcare is funded by taxes, and is accessible by all Finnish citizens (21).

All patients who were admitted to a hospital emergency department due to any injury during the lockdown period were included (March 18–May 31, 2020). The patient data was gathered from the electronic hospital records Uranus (CGI Oyj Finland) in TAUH and KUH, and Effica (Tieto Oyj Finland) in CHF and MCH. Injuries were classified based on the ICD-10 classification, from which injury, poisoning, and certain other consequences of external causes (S00–T98) were included. Injuries were categorized according to ICD-10 categorization of the injuries (Table 1). We combined the T20–T32 and T33–35 categories because there was only 1 case of frostbite

Table 1. ED visits due to injuries from March 18 to May 31, 2019 and 2020 in 4 Finnish hospitals. Zero-inflated Poisson regression model was used to compare the differences in the average daily ED visits due to injury between the lockdown period and the same period in 2019 for each stratum

	2019 n	2020 n	2019 n/day	2020 n/day	Difference % (CI 95 %)
All	10,067	8,462	134	113	-16 (-17 to -11)
Sex					
Male	4,759	4,050	64	54	-15 (-18 to -9.1)
Female	5,277	4,402	70	59	-17 (-19 to -11)
Age					
< 18 years	1,989	1,520	27	20	-24 (-28 to -17)
Male	861	662	12	8.8	-23 (-30 to -13)
Female	1,128	858	15	11	-24 (-30 to -14)
18–50 years	3,408	2,875	45	38	-16 (-20 to -9.4)
Male	1,390	1,216	19	16	-13 (-20 to -3.7)
Female	2,018	1,659	27	22	-18 (-23 to -9.4)
> 50 years	4,639	4,057	62	54	-13 (-15 to -6.5)
Male	2,508	2,172	33	29	-13 (-17 to -5.3)
Female	2,131	1,885	28	25	-12 (-17 to -3.8)
Hospital					
TAUH	3,970	3,287	53	44	-16 (-20 to -5.8)
KUH	1,987	1,660	27	22	-17 (-20 to -11)
CFH	2,621	2,367	35	32	-10 (-15 to -3.0)
MCH	1,489	1,340	20	18	-22 (-29 to -15)
ICD-10					
S00–S09: Head	2,290	1,975	31	26	-14 (-18 to -6.0)
S10–S19: Neck	165	123	2.2	1.6	-26 (-42 to -4.6)
S20–S29: Thorax	316	243	4.2	3.2	-23 (-35 to -5.7)
S30–S39: Abdomen, Back, Pelvis	266	234	3.5	3.1	-12 (-28 to 5.5)
S40–S49: Shoulder, Upper arm	658	548	8.8	7.3	-17 (-26 to -5.9)
S50–S59: Forearm, Elbow	824	786	11	11	-4.6 (-13 to 7.6)
S60–S69: Wrist, Hand	1,420	1,271	19	17	-11 (-17 to -2.0)
S70–S79: Hip, Thigh	542	513	7.2	6.8	-5.4 (-17 to 9.5)
S80–S89: Knee, Lower leg	1,014	772	14	10	-24 (-31 to -15)
S90–S99: Ankle, Foot	874	652	12	8.7	-25 (-33 to -16)
T00–T07: Multiple body regions	26	25	0.3	0.3	-3.8 (-45 to 68)
T08–T14: Unspecified body region	80	56	1.1	0.7	-30 (-51 to -0.4)
T15–T19: Effects of foreign body	207	191	2.8	2.5	-7.7 (-25 to 13)
T20–T35: Burns&Frostbite	135	138	1.8	1.8	2.2 (-21 to 31)
T36–T50: Drug Poisoning	303	273	4.0	3.6	-9.9 (-25 to 8.8)
T51–T65: Nonmedical toxic	58	51	0.8	0.7	-12 (-41 to 33)
T66–T78: Effects of external causes	257	173	3.4	2.3	-33 (-44 to -17)
T79–T79: Early trauma complications	17	12	0.2	0.2	-29 (-67 to 51)
T80–T88: Surgical complications	582	406	7.8	5.4	-30 (-40 to -20)
T90–T98: Sequelae of injuries	6	12	0.1	0.2	100 (-25 to 433)

injury for each year. In order to investigate more closely the incidence of fractures, the following sub-groups were specifically determined: hip fractures (S72.0, S72.1, and S72.2), wrist fractures (S52.5 and S52.6), ankle fractures (S82.5 and S82.6) and fractures of the upper end of the humerus (S42.2). We included every ED visit of the patients, whether single or multiple. For each case, we recorded the patient's age and sex, the exact ICD-10 code, the admission date, and the admission hospital. Furthermore, in order to make comparisons with reference data from before the pandemic, we collected the same type of data from patient records during the corresponding period for the previous year (March 18–May 31, 2019). The reference data aimed to take similar climate conditions (e.g., snow, ice, temperatures) into account.

Statistics

All data was pseudonymized for the analysis. Statistical analyses were conducted using IBM SPSS statistics 27 (IBM Corp, Armonk, NY, USA) and R statistical software version 4.0.5 (R Core Team, Vienna, Austria). The data consisted of counts of ED visits due to injuries for each calendar date, as well as ICD10-code, patient age, and gender. The patient age was classified into 3 groups: under 18 years, 18 to 50 years, and over 50 years. We compared the number of overall ED visits due to injuries, numbers of ED visits due to injuries by injury type, and number of ED visits due to injuries by injury type between sexes. The zero-inflated Poisson regression model was used to compare the average daily ED visit counts between the lockdown period with those during the reference period in 2019 for each stratum. Each of the zero-inflated Poisson regression models was constructed independently for descriptive analysis.

Ethics, data sharing, funding, and potential conflicts of interest

The study protocol was approved by the Ethics Committee, Hospital District of Northern Savo (No. 984/2020). The data is openly available on reasonable request from the author. This study was supported by Päivikki and Sakari Sohlberg Foundation. All authors declare no conflicts of interest.

Results

Total number of injuries

Overall, 8,462 ED visits due to injuries occurred in the 4 hospitals districts during the 75-day lockdown period (March 18–May 31, 2020) (Table 1 and Figure 1). The mean age of patients was 47 years (range 0–104, SD 27, median 47) and 52% of them were women. Correspondingly, 10,067 ED visits due to injuries occurred within the reference period, of which 53% were women with a mean age of 46 years (range 0–102, SD 27, median 46). The overall number of ED visits due to injuries decreased by 16% during the lockdown compared with the reference period. The decrease was 15% for men and 17% for women. The number of ED visits due to injuries among children and adolescents (< 18 years) decreased by 24%. In the age group 18–50 years, the total number of visits due to injuries decreased by 18% for women and 13% for men. Among patients over 50 years, the corresponding number of visits due to injuries decreased by 13%. In all hospitals, the incidence of ED visits due to injury decreased during the lockdown period compared with the reference period (Figure 2).

Fracture incidence

The incidence of ED visits due to hip fractures (S72–S72.2) increased by 2% during the lockdown period compared with the reference period (Table 2). The overall number of visits due to

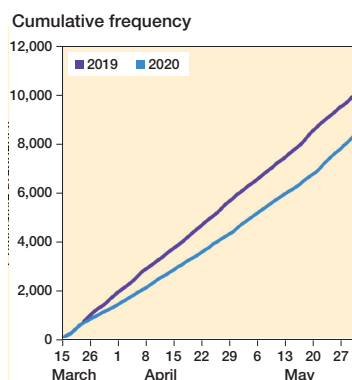


Figure 1. Total number of ED visits due to injuries treated in 4 Finnish hospitals between March 18 and May 31 in 2019 and 2020.

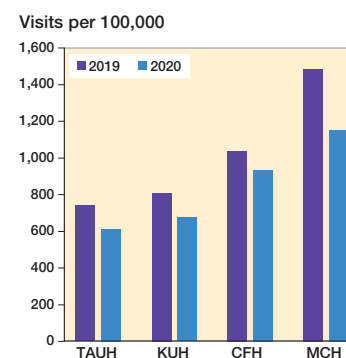


Figure 2. Incidence of ED visits due to injuries per 100,000 population.

wrist fractures (S52.5 and S52.6) decreased by 9% during the lockdown period, although in the case of women over 50 years old the decrease was as high as 40%.

The number of visits due to ankle fractures (S82.5 and S82.6) decreased by 18% during the lockdown period (Table 2). When comparing sexes, a statistically significant decrease of 32% was observed among women.

The number of visits due to fractures of the upper end of the humerus (S42.2) decreased by 20% during the lockdown period (Table 2). The fractures decreased statistically significantly, by 52%, among women. Among women aged 18–50 years, the decrease was 64% and among women over 50 years of age it was 47%.

Injuries according to ICD-10 classification

The most common injury type was head injury (S00–S09) during both study periods, resulting in 1,975 ED visits in 2020 and 2,290 in 2019 (Table 1). Statistically significant reductions were in the ICD10 groups head injuries (S00–S09) by 14%, neck injuries (S10–S19) by 26%, thorax injuries (S20–S29) by 23%, shoulder and upper arm injuries (S40–S49) by 17%, wrist and hand injuries (S60–S69) by 11%, knee and lower leg injuries (S80–S89) by 24%, ankle and foot injuries (S90–S99) by 25%, unspecified part of trunk, limb, or body region injuries (T08–T14) by 30%, other and unspecified effects of external causes injuries (T66–T78) by 33%, and complications of surgical and medical care (T80–T88) by 30%.

For some injury types, variation between sexes was observed. Head injuries were reduced for women by 18%, neck injuries among men by 53%, thorax injuries among women by 25%, shoulder and upper arm injuries among women by 22%, wrist and hand injuries among men by 18%, knee and lower leg injuries among women and men by 31% and 15%, ankle and foot injuries among women by 26% and men by 25%, other and unspecified effects of external causes injuries among women by 32% and men by 34% and complications of surgical and medical care among women by 25% and men by 35%.

Table 2. ED visits by the most typical low-energy fractures from March 18 to May 31, 2019 and 2020 in 4 Finnish hospitals. Zero-inflated Poisson regression model was used to compare the differences in the average daily ED visits due to injury between the lockdown period and the same period in 2019 for each stratum

	2019 n	2020 n	2019 n/day	2020 n/day	Difference % (CI 95 %)
S72.0–S72.2 Hip fractures	287	294	3.83	3.92	2 (–16 to 24)
Sex					
Male	182	193	2.43	2.57	6 (–18 to 32)
Female	105	101	1.40	1.35	–34 (–29 to 33)
Age					
< 18 years	1	2	0.01	0.03	100 (–82 to 2,106)
Male	0	0	0.00	0.00	0
Female	1	2	0.01	0.03	100 (–82 to 2,106)
18–50 years	6	5	0.08	0.07	–17 (–75 to 173)
Male	2	4	0.03	0.05	100 (–63 to 919)
Female	4	1	0.05	0.01	–75 (–97 to 124)
> 50 years	280	287	3.73	3.83	3 (–14 to 22)
Male	180	189	2.40	2.52	5 (–16 to 30)
Female	100	98	1.33	1.31	–2 (–27 to 32)
S52.5–S52.6 Wrist fractures	491	446	6.55	6.95	–9 (–19 to 10)
Sex					
Male	338	326	4.51	4.35	–4 (–17 to 19)
Female	153	120	2.04	1.60	–22 (–38 to 2)
Age					
< 18 years	91	79	1.21	1.05	–13 (–36 to 19)
Male	40	29	0.53	0.39	–28 (–55 to 17)
Female	51	50	0.68	0.67	–2 (–34 to 50)
18–50 years	89	85	1.19	1.13	–5 (–29 to 36)
Male	59	58	0.79	0.77	–2 (–31 to 57)
Female	30	27	0.40	0.36	–10 (–47 to 52)
> 50 years	311	282	4.15	3.76	–9 (–22 to 13)
Male	239	239	3.19	3.19	0 (–18 to 21)
Female	72	43	0.96	0.57	–40 (–59 to –9)
S82.5–S82.6 Ankle fractures (medial and lateral)	203	166	2.71	2.21	–18 (–34 to 3)
Sex					
Male	107	101	1.43	1.35	–6 (–29 to 29)
Female	96	65	1.28	0.87	–32 (–52 to –5)
Age					
< 18 years	18	9	0.24	0.12	–50 (–78 to 13)
Male	8	5	0.11	0.07	–38 (–80 to 91)
Female	10	4	0.13	0.05	–60 (–88 to 33)
18–50 years	60	53	0.80	0.71	–12 (–42 to 31)
Male	23	26	0.31	0.35	13 (–37 to 103)
Female	37	27	0.49	0.36	–27 (–57 to 25)
> 50 years	125	104	1.67	1.39	–17 (–37 to 11)
Male	76	70	1.01	0.93	–8 (–34 to 33)
Female	49	34	0.65	0.45	–31 (–54 to 10)
S42.2 Fractures of the upper end of humerus	132	106	1.76	1.41	–20 (–38 to 4)
Sex					
Male	82	82	1.09	1.09	0 (–27 to 37)
Female	50	24	0.67	0.32	–52 (–71 to –22)
Age					
< 18 years	14	14	0.19	0.19	0 (–52 to 110)
Male	7	10	0.09	0.23	43 (–46 to 275)
Female	7	4	0.09	0.05	–43 (–83 to 95)
18–50 years	13	11	0.17	0.15	–15 (–62 to 89)
Male	2	8	0.03	0.11	300 (–15 to 1,784)
Female	11	3	0.17	0.04	–64 (–92 to –2)
> 50 years	105	81	1.40	1.08	–23 (–42 to 3)
Male	73	64	0.97	0.85	–12 (–37 to 23)
Female	32	17	0.43	0.23	–46 (–71 to –4)

Discussion

We found that the total number of ED visits due to injuries decreased by 16% during the lockdown period (March 18–May 31, 2020). Women had a statistically significant reduction in the number of ED visits due to ankle fractures and fractures of the upper end of the humerus. In addition, elderly women had a statistically significant reduction in wrist fractures. The number of hip fractures was not reduced in either sex. In general, a reduction in fractures was observed in all age groups except in the case of hip fractures.

The heavy social restrictions were associated with reduced numbers of injuries during the lockdown period in Finland, as we expected. People drove only the most necessary journeys by car, which reduced injuries caused by traffic accidents (22). Restaurants were closed, presumably reducing accidents due to the influence of alcohol. In our data, the total number of injuries decreased especially among children. Because of the lockdown, schools were closed, and children stayed at home for remote learning, which reduced injuries in school sports and school trips. In addition, hobby groups and other regular group activities were cancelled, which probably reduced sports injuries. As it was generally recommended to stay at home, citizens were probably more likely to treat minor injuries at home. The reduction in surgical complications is explained by the reduction in elective surgery due to the transfer of medical staff to intensive care units or pandemic wards (2).

The total number of ED visits decreased by 16% after the lockdown in Finland, which is in line with the reduction in ED visits due to injuries (18). In comparison with other countries, the reduction in the number of injuries was moderate in Finland during the lockdown (5–16). The difference may be explained partly by the level of restrictions; for example, the Finnish government set no total curfew during the lockdown and many restrictions were recommendations rather than binding measures. The incidence of coronavirus in Finland in spring 2020 was not as high as in many other European countries. Therefore, if the pandemic was perceived only as a minor threat, there may have been lower compliance with restrictions, resulting in a less noticeable reduction in the total number of injuries in 2020 compared with 2019 than observed in some other countries.

The number of hip fractures remained stable during the lockdown period (6,10,12). In Norway,

hip fractures were halved in men aged 35–69 during lockdown, but not at all in women aged over 70 (23). Thus, it seems that the incidence of hip fractures is affected by the patient's age. This is most likely explained by the fact that most hip fractures in the elderly occur in simple falls indoors, whereas high-energy trauma mechanisms are more common in the younger population (24). We categorized age groups differently than in Norway, but in Finland there was not a reduction in the number of hip fractures corresponding to that reported in Norway among men aged 35–69 (23).

Women appeared to be protected from injuries during the lockdown. Ankle fractures, fractures of the upper end of the humerus, and wrist fractures decreased only among women. We chose the age group over 50 because we wanted to observe the effects of restrictions on the typical low-energy fractures occurring after the age of 50. Elderly women have a higher prevalence of osteoporosis and frailty, and therefore limited outdoor exposure may have had a greater decreasing effect on the number of fractures in women. From a Finnish cultural perspective, women may be more likely to comply with restrictions than men. Similar results were found in our neighboring country, Sweden, where ankle fractures were reduced more in women than in men during lockdown (17). One explanation for the difference may be that women live longer than men and are therefore more prone to fractures.

Differences in the hospitalization reduction are multifactorial. The hospitals are located in different regions, with different age structures. For example, the region where the MCH is located (South Savo) has a clearly higher proportion of older inhabitants than the region (Pirkanmaa) where the TAUH hospital is located (18). On the other hand, in South Savo, the population almost doubles during the holiday seasons, due to summer cottages (25,26), and during lockdown people went to their cottages for protection from the coronavirus. We also cannot exclude possible differences between hospitals in reducing elective operations.

In order to study the difference in the daily counts of admissions between lockdown conditions and the corresponding pre-lockdown period from the previous year, we initially assumed that the daily counts follow a Poisson distribution and considered using Poisson regression. Poisson regression may result in inaccurate results if there is a substantial amount of overdispersion or if the counts do not follow a Poisson distribution. In the current case we did not observe this and therefore decided to use the model, taking into account an excess count of zero values in the daily counts. Therefore, we ended up using a Zero-Inflated Poisson (ZIP) regression that takes into account excess zeros and provides more accurate estimates for the differences.

Our study has some limitations. The lockdown time interval was quite short. Rather than a 1-year reference period, comparative data for several previous years could have strengthened our study, but international literature supports our findings (5-16). Data from several previous years could have

better stabilized the confounding weather conditions. However, there was no remarkable difference between 2019 and 2020 mean spring temperatures based on the database of the Finnish Meteorological Institute (Figure 3, see Supplementary data) (27). Slight but opposing differences were observed in the March and April daily average temperatures. In addition, our cumulative data on emergency department visits due to injuries shows that the difference in the number of visits is steadily increasing within both study periods (Figure 1).

In our data, patients may have been admitted for follow-up visits due to the same diagnosis several times, although similar cases would probably also have occurred during the reference period. As we used electronic patient records as a source of data, the possibility of missing data entries exists. Although coverage and accuracy of the Finnish National Hospital Discharge Register (NHDR) has been shown to be excellent, validity of electronic patient records is unfortunately poorly studied. However, the data is transferred from electronic patient record to NHDR and we assume it to be just as reliable. In addition, the data coverage is assumed to be corresponding in the reference period. We have no information on the number of injuries treated in private healthcare or in all primary healthcare units and this may also cause selection bias. During the lockdown period, there were no restrictions that would have directed citizens more to public or private healthcare. We assume that the relative use of these services has remained the same during the pandemic since Finnish public healthcare is based on tax funds and is therefore accessible by every citizen.

Our study has several strengths. The extensive data included 1/5 of the Finnish population and 4 different hospitals. The study involved both large and small hospitals, and regions with more urban but also more countryside types of populations. The number of ED visits due to injuries decreased in all 4 hospitals, and hence the results may be generalized to most of the country. In Finland, accidents are mainly treated in public healthcare and diagnoses are recorded in electronic health records, resulting in a comprehensive registry suitable for research purposes, which means that the applicability of our data to the whole population was good.

In conclusion, movement restrictions appear to reduce the number of injuries during a state of lockdown. The effect can mainly be seen as a decreasing number of the most typical low-energy fractures among women. By contrast, mobility restrictions appear to have no effect on the number of hip fractures. In general, fractures were reduced more in young people than in the elderly.

HN participated in study design, conducted data analysis, and drafted the manuscript. JK participated in data analysis, edited data, and commented on the manuscript. HK, VM, and TR commented on the manuscript. IK and VP participated in data collection and commented on the manuscript. RS participated in data analysis and commented on the manuscript. JS participated in the design and coordination, and commented on the manuscript.

Acta thanks Karl-Åke Jansson, Rob Nelissen and Antti Malmivaara for help with peer review of this study.

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Supplementary data

Restrictions for the lockdown period in spring 2020 in Finland (2)

Date	Description of the government's decision
March 18, 2020	<p>All school, education institutions, universities, and early education were closed and contact teaching was suspended. Exceptionally, pre-primary education and contact teaching for grades 1–3 were provided for children of parents working in critical sectors.</p> <p>Gatherings of more than 10 people were prohibited and unnecessary stays in public places were avoided.</p> <p>People aged over 70 years were advised to avoid social contact.</p> <p>Municipal and state museums, libraries, theaters, swimming pools, and other sport facilities, and day care services for elderly were closed. Private and third-sector organizations were recommend to do the same.</p> <p>Visits to housing services for the elderly and at-risk groups were prohibited. Also visits to hospitals were prohibited except for family members of children and critically ill patients.</p> <p>Public sector employees worked from home if possible. Private sector workers were also recommended to work from home.</p> <p>The capacity of healthcare was increased in the public and private sectors. At the same time, non-urgent activity was reduced.</p> <p>Shutdown of borders was started, and citizens or permanent residents returning to Finland were placed under a 2-week quarantine.</p>
March 18 to April 15, 2020	Due to the higher incidence of coronavirus in the rest of the country, it was decided to isolate the province of Uusimaa (capital area) from the rest of society.
April 4, 2020	All restaurants were closed. Takeaway food was allowed to be sold.
May 14, 2020	Restrictions on primary school and early education were terminated and physical teaching gradually returned.
June 1, 2020	Most of the restrictions were terminated. Restaurants were opened, the gathering limit was increased to 50.

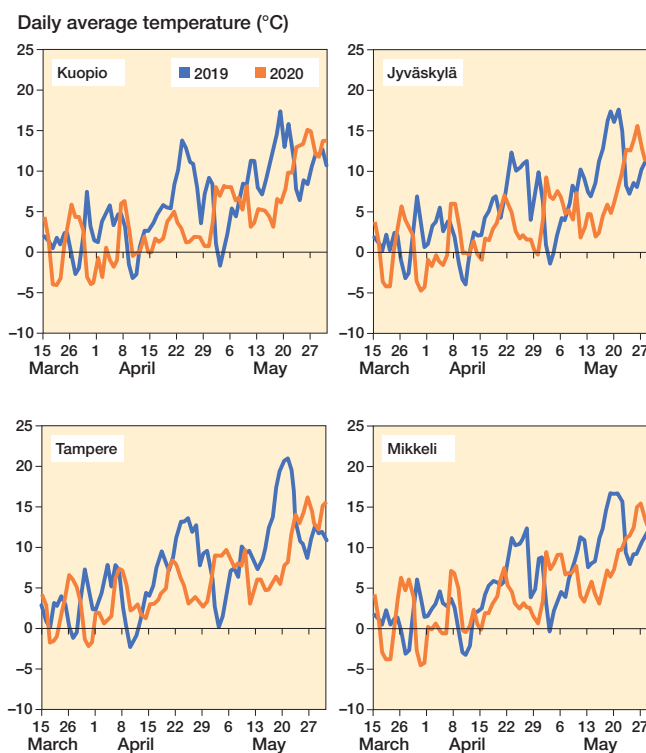


Figure 3. Daily average temperatures in spring in 2019 and 2020 in the cities where the study hospitals are located (27).