Epidemiology of the First Wave of COVID-19 Among the Young Adult Population in the Israel Defense Forces

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ABSTRACT

Introduction: This work aims to describe the features of COVID-19 in young adult military personnel. Though many confirmed COVID-19 cases are young adults, little was initially published regarding their clinical manifestations. Our study depicts all confirmed cases in the Israel Defense Forces (IDF) population during the first wave of the pandemic, aiming to define the disease characteristics in this age group and the outbreak development.

Methods: This is a retrospective, observational cohort study of the first 208 confirmed COVID-19 cases in the IDF. Clinical and epidemiologic data about all confirmed cases in the IDF between February 29th, 2020 and April 26th, 2020 was collected and analyzed. Specific risk factors for longer disease duration were analyzed by t-test.

Results: Among IDF cases, median age was 21 years and 71% were male. All patients had a relatively benign course. 17.3% had a comorbidity. 74.9% had respiratory symptoms and only 41.5% had a fever. Incubation time was 5.3 days on average and time until recovery was 15.6 days. Myalgia and having a known source of infection were significantly associated with longer illness. Gradually, the proportions of personnel infected abroad decreased compared to those infected in the army.

Conclusions: Healthy young adult COVID-19 cases had a different clinical presentation and a better clinical course, but no shorter duration of disease, compared to data regarding older adults with COVID-19. This information and comprehension of the outbreak evolution later served as important factors in decision-making and policy revisions made in subsequent COVID-19 waves. This data may also aid in better IDF preparedness for future pandemics.

Background

In December 2019, a cluster of viral pneumonia in China led to the discovery of a novel pathogen later identified as the cause of the rapid-spreading pandemic of COVID-19. The first cases in Israel were discovered by late February 2020, and afterwards, the number of confirmed cases continued growing for some time. The period from February 2020 to the end of April 2020 is called, retrospectively, the

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first wave of COVID-19 in Israel. Since then, we have had three more waves of infections and the fifth wave, which is related to the Omicron variant of SARS-CoV-2, was budding by the end of 2021.

According to the Israeli Ministry of Health (MOH), by April 2020, the most prevalent age group among confirmed cases in Israel was 20-29 years, consisting of 275.53 confirmed cases per every 100,000 people. [1] Many publications at the time depicted the clinical features of COVID-19 mainly in hospitalized adults, middle-aged and older adults, or children. However, knowledge about the disease in healthy young adults and in military settings was still relatively sparse. [2-4]

The IDF (Israel Defense Forces), being a mandatory service military, recruits Israeli adolescents at the age of 18 for a three-year period of service; as such, the majority of the military population are young adults aged 18-22. In this article, we use this fact in order to describe the clinical and epidemiologic features of all confirmed cases of COVID-19 in the IDF personnel during the first wave of COVID-19, aiming to better define the clinical course in young adults. Also, our study population may be suitable for a demonstration of outbreak development. We believe this information may aid in containment of current outbreaks and better preparedness for future ones.

Methods

This is a retrospective, observational cohort study of all confirmed COVID-19 cases discovered among IDF personnel between February 29th and April 26th, 2020. The study was approved by the Institutional Ethics Committee of the IDF Medical Corps.

Case definition and discovery

A confirmed case of infection, according to the definition of the Israeli MOH when the study was conducted, is a positive RT-PCR (reverse-transcription polymerase chain reaction) test for the SARS-CoV-2 virus. All samples were processed in an authorized laboratory, the majority of them in the military COVID-19 laboratory.

Soldiers who met the definition of a suspected case underwent an RT-PCR test. This definition has broadened as knowledge about disease accumulated; at first, a suspected case was defined as one with an epidemiologic link (recent return from abroad or known recent exposure to a confirmed case) and at least one clinical criterion (fever or respiratory symptoms). At later stages, a more liberal policy for testing was adopted. Suspected cases were mostly discovered "passively", via referral from general practitioners or self-referral to a military designated call center. A minority of the cases were from active contact tracing in specific outbreaks.

After testing positive, all personnel received medical treatment and follow-up in military medical centers. Following confirmation of infection, an epidemiological investigation was initiated, and contacts were informed and instructed on isolation according to the MOH guidelines.

The incubation period was defined as the number of days from the most recent exposure to the onset of symptoms, if known. Recovery was defined according to the MOH guidelines at the time and consisted of: a specific length of time having passed since diagnosis, cessation of symptoms, and two negative RT-PCR tests. [1] Time to recovery was defined as the number of days from the first positive RT-PCR for SARS-CoV-2 to a second negative RT-PCR test (according to Israeli MOH criteria for recovery when this study was conducted). In later waves, the recovery definition was changed and relied merely on clinical presentation.

Data collection

For each confirmed case, the pertinent demographic, medical and epidemiologic data were extracted from the IDF's computerized medical records registry: age, gender, type of military service, medical status and prior illnesses, smoking status, symptoms during COVID-19 illness, assumed source of exposure and clinical course.

Data regarding possible exposure and clinical symptoms were actively collected, twice, by medical personnel; first, when applying for a PCR test, and second, immediately after testing positive for the virus, at which point a thorough epidemiological investigation was initiated. RT-PCR test results were collected from the Israeli MOH and the IDF's laboratory records. All data were gathered into a computerized database.

Due to the non-specific symptoms of COVID-19, and the difficulty establishing the exposure in some of the cases, cases where reported symptoms began prior to exposure and cases with an unknown source of exposure were removed from the incubation period calculations.

Statistical analysis

Statistics were made by Analysis Tool-Pak for Microsoft

Excel 2010, and with SPSS statistics version 25 (IBM, Armonk, NY, USA) software. Significance is defined as *(P<0.05).* Risk factors for prolonged duration of the disease were searched for in cases that met the recovery definition and had available data. By using a t-test, differences in time until recovery in accordance with the presence or absence of several clinical or epidemiologic risk factors were calculated, checking their influence on recovery time.

Results

The first case of COVID-19 within the IDF was discovered on February 29th, 2020, following exposure to a civilian returning from Italy. By April 26th, 2020, 208 IDF personnel had tested positive for the virus; Figure 1 depicts the epidemic curve of infection in the IDF. This period of time was later defined as the first wave of COVID-19.

Exposure: The assumed source of exposure for first wave cases changed over time. "Imported" cases, from outside of Israel, were prevalent in the first 3 weeks of the outbreak. The first case of local, in-military transmission was discovered on March 24th, 2020. At the time, 21.4% of cases had been imported, 57.1% had resulted from exposure to confirmed civil cases and 21.4% had an unknown source of exposure. None of the cases had any travel history past April 8th, 2020. By the conclusion of the study, in-military transmission became 36.5% of all cases (95% CI; 30.0%-43.4%), the proportion of civil-contracted cases decreased to 40% (95% CI; 33.2%-46.9%), and cases associated with travel abroad made up 6.7% (95% CI; 3.7%-11.0%) of the total cohort. The relative share of cases with an unknown source of exposure was 16.8% and did not change over time.

During the study period, we identified ten clusters of COVID-19 inside military bases, involving 4-18 soldiers per cluster.

Population characteristics are listed in Table 1. Population age ranged from 18 to 64 years. The average age was 24.1 years (95% CI; 23.1-25.2) with a median of 21 years. The median age decreased over time (from 23 years by March to 21 years by April). 148 out of 208 cases were male. The proportionate share of career personnel (as opposed to mandatory service soldiers) decreased over time. 17% had a prior chronic medical condition, posing a risk factor for severe disease. 79% were smokers. 5% of cases were healthcare workers.

The clinical manifestation of 207 patients with available data was as follows: the most prevalent symptoms were respiratory ones, with 155 soldiers

Figure 1. New confirmed cases, cumulative confirmed cases and active cases (excluding recovered cases), per day, during the first wave in the IDF.

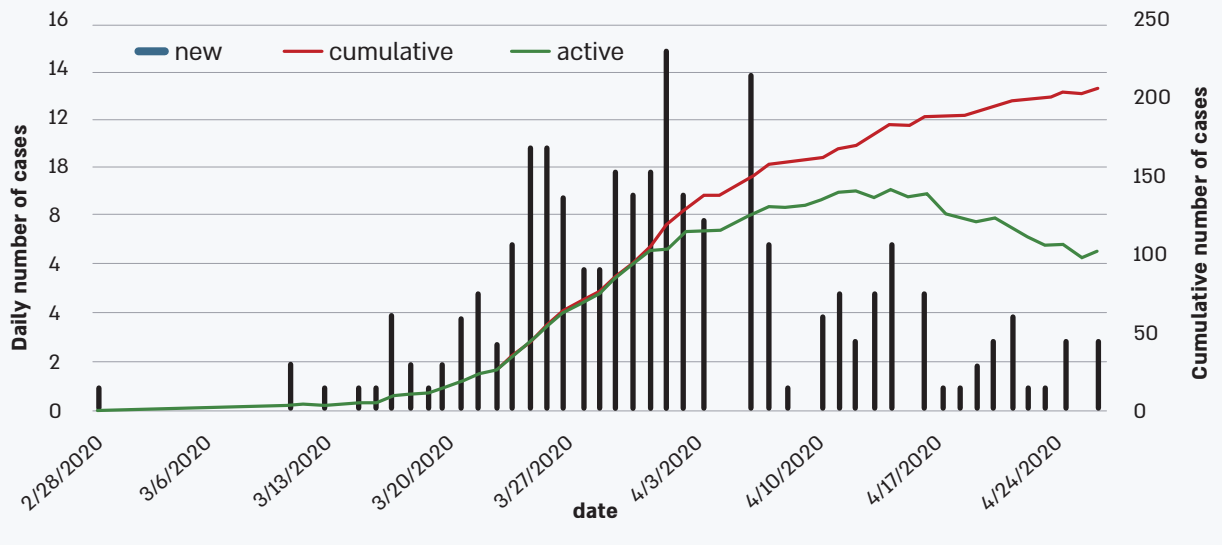


Table 1: Epidemiologic, clinical and military characteristics of 208 patients in our study. Data is presented in absolute numbers and percentages for all cases

PARAMETER	NUMBER	Percentage
Age		
18-22	133	63.9%
23-30	39	18.7%
31-40	21	10.1%
41-50	12	5.7%
50 and Above	3	1.4%
Gender		
Male	148	71.1%
Female	60	28.8%
Type of Service		
Mandatory	129	62%
Career	69	31.3%
Reserve	10	4.8%
Service Characteristics		
Health Care Workers	11	5.3%
Combat	79	38%
Administrative Role	129	62%
Comorbidity		
None	172	82.7%
Minor Risk Factor*	25	12%
Moderate Risk Factor**	11	5.3%
Severe Risk Factor	0	0%
Smoking Status		
No	164	78.8%
Yes	44	21.1%

* comorbidities considered to be a minor risk factor included moderate obesity, non-active asthma, anemia, multiple sclerosis, s/p recent labor, etc.

**comorbidities considered to be a moderate risk factor for a severe disease included active controlled asthma, controlled diabetes mellitus, metabolic syndrome, moderately impaired renal function and concurrent corticosteroid systemic treatment.

complaining about a cough or shortness of breath (74.9%). Fever was present in 87 soldiers (41.5%). 38 soldiers had neither fever nor respiratory symptoms (18.3%). 27.1% had gastrointestinal symptoms, and 30.4% had anosmia. Asymptomatic cases were a small percentage of the cases, and were mostly observed late in the study period (11 cases overall; 5.2%).

The clinical course in the study population was, overall, benign. Two of the 208 cases (1%, 95% CI; 0.1%- 3.4%) required specific treatment, with oxygen, hydroxychloroquine and azithromycin, treatments that were recommended at the time, and ultimately made a full recovery. None required ICU or mechanical ventilation. By the date of data collection, 8 recovered patients (7.6%, CI 95%; 3.3-14.4) still complained about unresolved anosmia or residual cough.

Incubation period was calculated for 123 patients, with an average of 5.3 days and a median value of 4 days (0-23, CI 95%; 4.47-6.24 days). The average lapse of time from onset of symptoms to confirmation of COVID-19 was 6.3 days, with a median of 5 days (range (-10) - 35, CI 95%; 5.40-7.25 days).

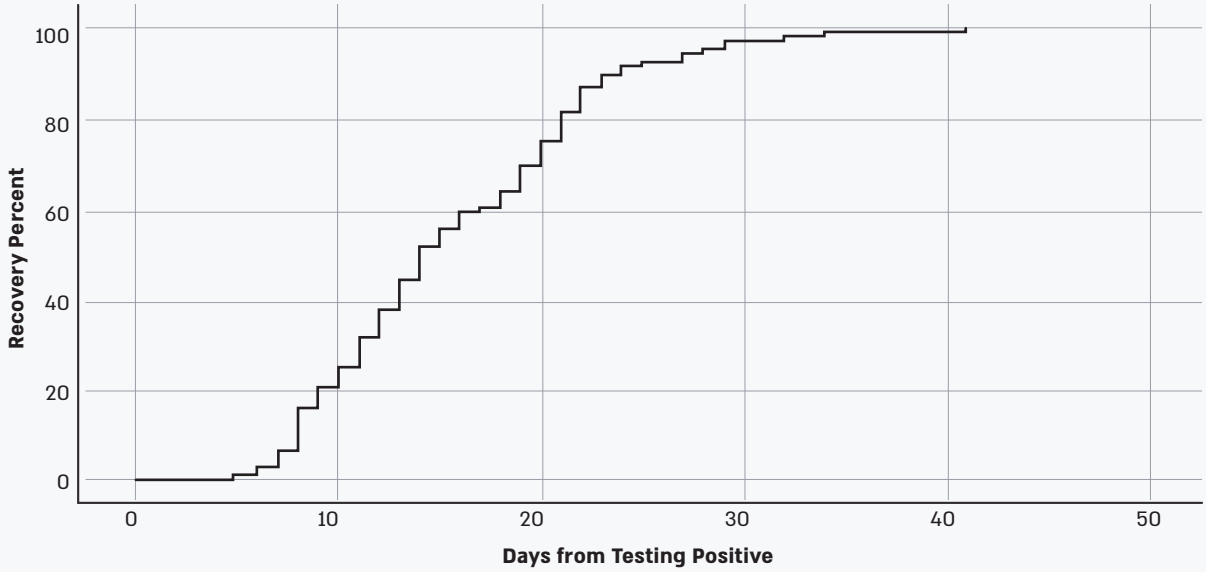
Recovery period: the average lapse of time from a positive PCR test to the first negative one was 11.2 days (range 2-39, CI 95%; 10.2-12.1 days). 105 cases were defined as "recovered" according to Israeli MOH criteria by the date of data collection; the average lapse of time from their positive PCR test to recovery was 15.6 days, with a median of 14 days (range 5-41, 95% CI; 14.4-16.8 days). Time to recovery is presented in Figure 2.

Table 2 demonstrates the influence of several risk factors on recovery time in 104 patients who recovered and had available clinical data by the conclusion of the study. Patients who complained of myalgia or weakness had a longer course than patients who had not (17.5 ± 2.5 vs. 14.6 ± 1.4 days, P= 0.038). Patients with an unknown source of exposure had a shorter course of the disease (11.5 ± 2 vs. 16.5 ± 1.4 days, P =0.001). Gender, age, presence of comorbidities, smoking, type of military service and clinical presentation did not influence illness duration.

Discussion

This report describes COVID-19 patterns in a young adult population during the first wave of the pandemic in the IDF. Since most data about the disease at that time pertained to older adults and the elderly, sufficient knowledge about the young adult population was, and is still, relatively sparse. This report also describes the

Figure 2. Kaplan – Meier estimator depicting the percentage of recovery over time among 105 cases who had recovered by the conclusion of the study.



evolution of the pandemic inside the IDF, knowledge that was crucial for control and prevention later on.

The epidemic curves as well as the majority male cases are in correlation with previous publications from other countries and about other age groups. [1, 5-12] The clinical manifestation described in our cohort is somewhat different from previously described data, mainly in hospitalized adults. [4, 6, 7, 10, 11, 13] We describe a relatively lower prevalence of fever (42% vs. 77%-98% in other studies), which is similar to data gathered about the general Israeli population and in other studies of children and younger demographics (28.2%-59.6%). [1, 4, 7, 12] A relatively high prevalence of respiratory symptoms (75% vs. 33%-82% in other studies) and gastrointestinal complaints (27% vs. 2%-13%) was found in our study, while myalgia or weakness (38% vs. 11%-62%) and anosmia (30% vs. 9%-70.2%) prevalence resemble previous studies. This wide range of variance in clinical presentation was also observed in previous publications, especially those regarding COVID-19 cases of a younger age. [2-7 ,12]

The differences in clinical symptoms may be attributed to different presentations of the disease in young adults, but also, alternatively, to the changing and evolving case definition and testing criteria, which vary between different reports and countries.

Although our study demonstrated mostly mild illness in this specific military population, the duration of disease, defined according to the MOH guidelines at that time [1], was not shorter than that of the older population. By July 2020, due to the understanding that a positive PCR test is not equivocal to infectivity, the definition of recovery was changed to be based on clinical presentation only, a change which led to a shorter recovery time for all age groups.

An incubation period of 5.3 days is compatible with the range reported in previous publications, 4 to 6.4 days. [6, 8-10, 14, 15] An interval period of 6.3 days from onset of symptoms to testing positive is longer compared to previous studies. [2, 6, 14] The period of 15.6 days from testing positive to recovery is similar to previous studies [4, 6, 16] and not any shorter due to better clinical course. [3]

As expected, the clinical course of our cases was largely benign, which was in contrast to studies of the older population [7, 10, 11, 17] and congruent with publications about younger populations. [2, 3, 6, 10, 12, 17] This difference can be attributed to the health status of our cohort, a young, healthy group, even though some had comorbidities. Another possible

Table 2. Average duration and 95% confidence interval of recovery time in days, with or without tested risk factor (in parenthesis – the number of patients in each group), with P value of difference of duration between groups.

RISK FACTOR	YES - Mean days to recovery ± 95% confidence interval (number of cases with risk factor)	NO - Mean days to recovery ± 95% confidence interval (number of cases without risk factor)	P=
Age Above 30	16.7 ± 3.5 days (n=22)	15.3 ± 1.3 days (n=82)	0.4
Male	15.5 ± 1.6 days (n=74)	16 ± 2 days (n=30)	0.73
Comorbidity	16.4 ± 3.2 days (n=23)	15.4 ± 1.4 days (n=81)	0.53
Smoking	14.1 ± 2.3 days (n=21)	16 ± 1.5 days (n=83)	0.26
Combat Duty	14.8 ± 2.5 days (n=27)	15.9 ± 1.5 days (n=77)	0.47
Asymptomatic	16.2 ± 6.9 days (n=5)	15.6 ± 1.3 days (n=99)	0.84
Fever	16 ± 2 days (n=46)	15.3 ± 1.6 days (n=58)	0.6
Respiratory Symptoms	15.5 ± 1.5 days (n=80)	16.1 ± 2.4 days (n=24)	0.15
Myalgia or General Weakness	**17.5 ± 2.5 days (n=36)**	**14.6 ± 1.4 days (n=68)**	**0.03***
Sore Throat	15.4 ± 1.7 days (n=37)	15.8 ± 1.8 days (n=67)	0.76
Gastrointestinal complains	16.6 ± 2 days (n=29)	15.2 ± 1.6 days (n=75)	0.35
Rhinorrhea	16.5 ± 2.4 days (n=35)	15.2 ± 1.5 days (n=69)	0.34
Anosmia	15.5 ± 2.4 days (n=27)	15.6 ± 1.5 days (n=77)	0.93
Known Source of Exposure	**16.5 ± 1.4 days (n=86)**	**11.5 ± 2 days (n=18)**	**0.001***
Cases Imported From Abroad	17.2 ± 4.2 days (n=13)	15.3 ± 1.4 days (n=91)	0.35
Among Contact Exposure Cases-Contracted In Army	15 ± 2.4 days (n=26)	17.2 ± 2 days (n=47)	0.17

Asterisk (*) and bold-type-font indicate a statistically significant result. (P<0.05)

factor is the IDF's liberal testing policy which often discovers mild cases. The IDF population when the pandemic started in Israel included a very small group of soldiers with severe comorbidities, who were discharged from military service shortly after the beginning of the outbreak. Not having any confirmed cases with a severe comorbidity may have contributed to the fact that none of our cases had a severe clinical course, which in turn may demonstrate the success of this early discharge policy.

Although defined as recovered, some cases were still experiencing residual signs or symptoms of the disease for a prolonged period of time afterwards, which is in line with previous studies [4]. This indicates a long and sustained clinical course, contradicting previous reports which indicated that mild cases are short-lasting [18].

Assessing the source of exposure, age patterns and type of military personnel involved, put together, may help understand the outbreak evolution inside the IDF.

As long as cases were mostly imported, a larger share of older and career personnel were involved, despite their relatively small numbers in the army. At that time, the many young combat mandatory soldiers, who usually do not leave the military barracks, were relatively safe from the disease. With the increasing number of cases, more soldiers in the army were exposed and military infection clusters were created, lowering the average age and elevating the proportion of mandatory soldiers, the largest population in the army. This evolution of the outbreak resembles what has been described in previous publications about COVID-19 reaching isolated or remote populations, for example the Icelandic population. [5,6]

Having a known source of exposure was associated with shorter disease, probably due to higher index of suspicion and earlier detection. Contrasting former studies, only myalgia was associated with longer duration of the disease. [19, 20]

Our report is not without limitations. First, this report depicts only the first wave of COVID-19. Much more information has since been gathered about the disease. Nevertheless, the first wave data was most crucial in understanding the epidemiology, clinical demonstration and recovery in the young adult subgroup. Knowing that illness in the military was mostly mild helped medical military officers reassure commanding officers and develop suitable military prevention measures, while continuing most military routines.

A second limitation is recall bias – in many cases the symptom inquiry was done retrospectively on the day of testing positive, and therefore the information collected about the onset and nature of symptoms, the exact dates and the exposure source may have some inaccuracies. Incubation period calculation from the last day of exposure may mislead and depict a shorter incubation time than was actually the case. This type of assumption has been made before [7] and may later be partly corrected due to unidentified exposures in other cases. It should be mentioned that some of the cases were confirmed close to the conclusion of the study; therefore, their disease dynamics and the evolution of their clinical course are not included in this study.

Nevertheless, the fact that our cohort is of a respectable number of cases and that all IDF confirmed cases during the first wave were included in our report, avoiding selection bias, strengthens the results.

Although further waves of COVID-19 included a higher number of cases and lasted longer, the basics of the outbreak evolution were largely the same. A different clinical presentation from the one expected in our population made us stop using tools that were acceptable at that time (like looking for fever as a screening tool for infection), and was later anticipated and seen in the next waves of COVID-19. A prolonged period until (full) recovery, the effect on a certain subpopulation in the military milieu of the port of entry for variants (from abroad), and the rapid spread afterwards, have been observed repeatedly in every wave of the pandemic, which may prove an important lesson for the future.

Conclusions

Rapid discovery and documentation of cases in the then-new pandemic were important tools for policy making in the IDF, both ad hoc and in later waves. This is the outbreak report of all 208 confirmed COVID-19 cases among IDF personnel between February 29th and April 26th 2020, a period of time now known as the first wave of COVID-19 in Israel. Our study population, healthy young adults, had a better clinical course, with certain differences in clinical presentation, when compared to previous studies on older demographics. Interestingly, time intervals have been similar to the ones found in previous studies, despite the younger and healthier population observed in this one. In our group, only a few variables influenced length of time until recovery. Some important insights can be gleaned from this report about the evolution of the first wave of the pandemic in the IDF. When devising policy, these factors should be borne in mind in order for the IDF to better prepare for upcoming waves of COVID-19 as well as other possible pandemics.

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Ethical approval: the study was approved by the Institutional Ethics Committee of the IDF Medical Corps.

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