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Short Report

SARS-CoV-2 universal screening upon adult hospital admission in Southern Israel

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SUMMARY

As the prevalence of coronavirus disease 2019 (COVID-19) increased in the local community, severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) universal screening was initiated for all adult patients admitted through the emergency departments (EDs) at Soroka University Medical Centre. Of 8518 patients screened, 288 (3.38%) tested positive. One hundred and thirty-three (46%) positive cases were asymptomatic and would have been admitted without necessary precautions. Patients with symptoms that may be attributable to COVID-19 were significantly older and were admitted through the medical ED. Patients of Bedouin Arab ethnicity accounted for half of those who tested positive, which was double their prevalence in the general population. These findings indicate that universal SARS-CoV-2 screening on adult hospital admission is crucial in areas with a high prevalence of COVID-19.

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Introduction

Severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) is highly infectious, even in the pre-symptomatic period and in asymptomatic individuals. A significant percentage of asymptomatic persons are treated by the healthcare system [1]. In these circumstances, hospitals must take precautions to prevent the dissemination of SARS-CoV-2 in their inpatient population and strive to maintain a COVID-19-free hospital.

SARS-CoV-2 nosocomial transmission to patients and healthcare workers (HCWs) has a serious impact on routine hospital activities, up to and including closing hospital departments and services due to the lack of staff, as well as having a direct impact on the health of patients and HCWs [1].

Universal screening on admission incorporates testing of all admitted patients, regardless of the indication for admission or presence of symptoms. The implementation of universal SARS-CoV-2 screening in pregnant women admitted for delivery started early during the pandemic. Pregnant women comprise a unique source of information as they are hospitalized independently of illness. This group provides an estimate of SARS-CoV-2 circulation in the general population, and most of them were asymptomatic [2,3].

The US Centers for Disease Control and Prevention recommends targeted SARS-CoV-2 testing of patients without signs or symptoms of coronavirus disease 2019 (COVID-19) to identify those with asymptomatic or pre-symptomatic SARS-CoV-2 infection, and further reduce the risk of exposures in some healthcare settings, in accordance with local guidelines and testing availability [4].

In the past few months, several hospitals throughout the world have initiated universal SARS-CoV-2 screening testing in all admitted patients [1,5–7]. In areas with low community

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transmission of SARS-CoV-2, it is debatable whether universal screening on hospital admission is justified [1,5]. In areas with high prevalence of COVID-19, asymptomatic screening would likely identify more asymptomatic cases. Previous studies have reported that additional data on universal screening on admission is needed to evaluate the clinical impact on healthcare facilities [5]. This study aimed to address this issue along with the prevalence of SARS-CoV-2 in the community.

Methods

Setting

Soroka University Medical Centre is a 1100-bed tertiary medical centre in Southern Israel that serves a population of approximately 1 million people. The hospital's virology laboratory serves as a reference laboratory for the community, and performs approximately 3500 nasopharyngeal SARS-CoV-2 polymerase chain reaction (PCR) swab tests from the hospital and community every day.

Universal screening was initiated in the study institution on 8th September 2020 and is ongoing. All adult patients admitted are screened; elective admissions must arrive with a negative test result from the community within 72 h of admission, and urgent admissions are tested upon admission and isolated using droplet precautions pending test results, usually received within 6–24 h, all according to the institutional policy.

The study cohort included all patients who were not known to have COVID-19 and who were urgently admitted between 8th September and 31st December 2020. Symptomatic patients were defined as those with fever >38.1°C, cough or shortness of breath. The percentage of positive SARS-CoV-2 test results on admission was compared with the community-positive test results handled in the virology laboratory. This study was approved and the need for informed consent was waived by Soroka Helsinki Research Ethics Committee (SOR-20-156).

Statistical analysis

Categorical data were expressed as absolute number and percentage, and continuous variables were expressed as mean and standard deviation. Differences between demographic characteristics of positive SARS-CoV-2 patients vs negative SARS-CoV-2 patients on admission screening, and between symptomatic and asymptomatic positive SARS-CoV-2 patients were assessed using Student's *t*-test for continuous variables and Chi-squared test for categorical variables. Risk factors for positive SARS-CoV-2 among the whole study population and for asymptomatic positive SARS-CoV-2 among all asymptomatic patients (positive or negative) were assessed using logistic regression and described as odds ratio and 95% confidence interval. Variables found to be associated with the outcome on univariate analysis ($P<0.2$) and clinically significant factors were included in the model. Two-sided *P*-values <0.05 were considered to indicate significance. All statistical analyses were conducted using SPSS 25.0 (IBM Corp., Armonk, NY, USA).

Results

From September to December 2020, 10,052 patients were admitted; of them, 8518 were urgent admissions that were screened for SARS-CoV-2. Two hundred and eighty-eight (3.38%) patients tested positive; of them, 133 (46%) were asymptomatic and 155 (54%) patients had symptoms that could have been attributed to COVID-19. Of the 133 asymptomatic patients, 93 (70%) were from the internal medicine emergency room (ER), 28 (21%) were from the surgical ER, and 12 (9%) were from the obstetrics ER. The symptomatic patients that were identified were significantly older than the asymptomatic SARS-CoV-2-positive and SARS-CoV-2-negative patients ($P<0.001$) (Table I). There was no gender difference between the groups. Most of the positive patients admitted through surgical and obstetrics ERs were asymptomatic. Overall, 45.8% of patients who screened positive for SARS-CoV-2 on hospital admission were of Bedouin Arab ethnicity, comprising 51.9% of asymptomatic and 40.6% of symptomatic SARS-CoV-2-positive patients. Within the group that tested negative, only 24.4% were of Bedouin Arab ethnicity ($P<0.001$). Multi-variable analysis demonstrated that admission through the medical ER was the most significant factor identified (Tables II and III).

During the study period, the virology laboratory also received 163,641 nasopharyngeal swabs for SARS-CoV-2 testing from the community (all ages tested); most were from symptomatic individuals and as part of epidemiological

Table I
Demographic characteristics of patient population: severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) positive vs SARS-CoV-2 negative on admission screening

	SARS-CoV-2 positive (*N*=288)			SARS-CoV-2 negative (*N*=8230)	*P*-value SARS-CoV-2 positive vs negative	*P*-value SARS-CoV-2 positive symptomatic vs asymptomatic
	Total (*N*=288)	Asymptomatic (*N*=133)	Symptomatic (*N*=155)			
Age (mean ± SD)	62.2 ± 20.8	55.4 ± 21.6	67.9 ± 18.2	57.0 ± 21.8	<0.001	<0.001
Female gender, *N* (%)	147 (51.0)	71 (53.4)	76 (49.0)	4063 (49.4)	0.577	0.461
Ethnicity, *N* (%)						
Jewish	156 (54.2)	64 (48.1)	92 (59.4)	6225 (75.6)	<0.001	0.056
Bedouin Arab	132 (45.8)	69 (51.9)	63 (40.6)	2005 (24.4)		
Emergency room, *N* (%)						
Internal medicine	244 (84.7)	93 (69.9)	151 (97.4)	4755 (57.8)	<0.001	<0.001
Surgery	31 (10.8)	28 (21.1)	3 (1.9)	2679 (32.6)		
Obstetrics	13 (4.5)	12 (9.0)	1 (0.6)	796 (9.7)		

SD, standard deviation.

Table II
Multi-variable analysis (logistic regression) for positive severe acute respiratory syndrome coronavirus-2

Variable		OR	95% CI	*P*-value
Age, years		1.01	1.00–1.02	0.002
Female gender (reference group: male)		1.13	0.88–1.45	0.327
Bedouin ethnicity (reference group: Jewish)		3.74	2.89–4.82	<0.001
Emergency room	Internal medicine (reference group: surgery)	4.39	2.97–6.45	<0.001
	Internal medicine (reference group: obstetrics)	3.62	1.94–6.80	<0.001

OR, odds ratio; CI, confidence interval.

Table III
Multi-variable analysis (logistic regression) for asymptomatic positive severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) (vs negative SARS-CoV-2)

Variable		OR	95% CI	*P*-value
Age, years		1.00	0.99–1.01	0.972
Female gender (reference group: male)		1.27	0.88–1.83	0.202
Bedouin ethnicity (reference group: Jewish)		3.65	2.52–5.29	<0.001
Emergency room	Internal medicine (reference group: surgery)	2.13	1.37–3.32	0.001
	Internal medicine (reference group: obstetrics)	2.21	1.09–4.48	0.027

OR, odds ratio; CI, confidence interval.

investigations following exposure to a SARS-CoV-2-positive patient, and a minority were from asymptomatic population screening (mainly nursing home staff and residents). In total, 10,454 (6.39%) individuals tested positive in the community.

Discussion

Hospitalized patients with existing medical conditions are at high risk of severe illness and death following infection with SARS-CoV-2. Asymptomatic and pre-symptomatic individuals contribute to widespread transmission of SARS-CoV-2. Prevention of the spread of SARS-CoV-2 requires rapid identification and isolation of infectious people.

This study detected 288 patients that tested positive for SARS-CoV-2, the highest number reported to date in the literature of universal SARS-CoV-2 screening on hospital admission. This is though to be due to the high prevalence of COVID-19 in the community during the study period. As in the study by Arnold *et al.*, a high percentage were asymptomatic; these patients were younger than symptomatic patients, and admitted through the surgical and obstetrics ERs [7].

Studies have shown that universal screening of all pregnant women admitted for delivery will control further spread of the virus; and protect the women, their newborns and HCWs against infection [2,3]. The present study supports this concept; 12 of 13 pregnant women hospitalized for delivery who screened positive for SARS-CoV-2 on admission were asymptomatic.

Universal screening using SARS-CoV-2 PCR is now advised for every patient admitted to hospital in the UK [6]. Potential benefits include using COVID-19 status to determine hospital isolation practices, guiding the use of personal protective equipment [1,3]. For HCWs, this strategy might improve workforce depletion by reducing unnecessary quarantine, diminishing transmission/infection from asymptomatic patients, and helping to contain the spread of SARS-CoV-2 in healthcare settings [1].

Limiting screening of asymptomatic patients to defined high-risk groups will underestimate the true number of asymptomatic patients in the hospital setting. Departments such as general medicine and surgical wards are not defined as high risk, although they treat elderly patients with several comorbidities and a significant risk of a devastating outcome if infected with SARS-CoV-2. This study demonstrated that patients admitted to the hospital during an epidemic, especially through the medical ER, are at risk of being misidentified, thus reducing the ability to maintain a COVID-19-free hospital.

The COVID-19 pandemic has been investigated in ethnic minority groups worldwide, showing higher attack rates and worse prognosis in these populations [8,9]. Although Bedouin Arabs account for approximately 25% of the population of Southern Israel, this study found that 45.8% of patients who screened positive for SARS-CoV-2 on hospital admission were of Bedouin Arab ethnicity. During the 4-month study period, patients of Bedouin Arab ethnicity comprised 28.7% of patients who presented at the ERs (internal medicine, surgical and obstetrics) and 31.8% of patients admitted. Additionally, 11 of 13 pregnant women hospitalized for delivery who screened positive for SARS-CoV-2 on admission were of Bedouin Arab ethnicity. This conforms to the high attack rate described previously within minority groups, probably due to more crowded living conditions.

Several issues have arisen concerning universal screening on hospital admission; testing capacity might be limited due to staff shortage, and a limited number of testing kits and reagents. Some advocate that a positive test result in asymptomatic individuals could be a false-positive result and should be repeated. Interpreting the result of a RT-PCT test for COVID-19 depends on the accuracy of the test and pre-test probability. A positive RT-PCR test result has more weight than a negative RT-PCR test result due to the test's high specificity but moderate sensitivity. The positive likelihood ratio of the

nasopharyngeal swab RNA test for COVID-19 is approximately 14; therefore, a positive COVID-19 test result should be very compelling [10].

This study has some limitations. First, the study was conducted in a single medical centre although this centre serves a large diverse population. Second, at the time of the study, the prevalence of SARS-CoV-2 in Israel fluctuated, being high between September and mid-October 2020, lower during the second half of October and November 2020, and high again in December 2020. Third, a repeat SARS-CoV-2 test was not performed 72 h after admission in those who tested negative on admission, which may have led to missing patients who presented in the incubation period. However, all patients who were negative upon admission but developed possible SARS-CoV-2-related symptoms during hospitalization were retested.

In conclusion, this study provides data on universal screening for all adult ER admissions during periods of high community transmission of SARS-CoV-2 in the community in Southern Israel, identifying the highest number reported to date in the literature of universal SARS-CoV-2 screening on acute care hospital admissions, half of whom belonged to a minority ethnic group (Bedouin-Arab), with a substantial number of asymptomatic patients on hospital admission. When feasible, universal screening on hospital admission should be applied to allow adequate protection of staff, apply effective infection control measures, and prevent nosocomial transmission.

Conflict of interest statement
None declared.

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