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Prevalence of Persisting and New Symptoms Following Recovery from COVID-19 in the Jordanian Population

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Abstract

Background: Many patients do not have a clear idea about the recovery from COVID-19 infection. This study focuses on the prevalence of persistent symptoms of COVID-19 infection as well as new symptoms that appear after recovery, and it aids in determining the relationships between these symptoms and a variety of variables.

Methods: An online observational study was conducted between April and June 2022. It consisted of a self-administered web-based questionnaire conducted using social media platforms. Inclusion criteria were residency in Jordan, being 18 years of age or older, having recovered from COVID-19 for at least 90 days, and giving consent to participate. Participants whose infection was not confirmed by a positive PCR were excluded.

Results: The most common persistent symptoms were loss of smell (34.7%), fatigue (34.6%), loss of taste (29.5%), myalgia (26.3%), and headache (25.9%), while the most common newly appearing symptoms after recovery were smell hallucinations (15.8%), fatigue (15.5%), taste hallucinations (14.9%), and focus impairment (12.9%) and smell impairment (12.8%). The symptoms persisted more in females, non-smokers, and those who needed medical care sor oxygesnation and with increased infection duration.

Conclusion: The study about persistent and new symptoms after COVID-19 among Jordanians found a greater prevalence of symptoms related to the sense of smell. There is no association between persistent and new symptoms after COVID-19 recovery with comorbidities or oxygen therapy during illness. We recommend studying the effect of COVID-19 mutants and vaccination on the persistence of symptoms after recovery.

Keywords: COVID-19, Post-recovery, Persistent symptoms, New symptoms, Jordan

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Introduction

At the beginning of December 2019, the (SARS-CoV-2) virus was first detected in Wuhan, Hubei Province, China. The World Health Organization (WHO) has updated the name of the virus to COVID-19 (1). The disease is transmitted through respiratory droplets and direct contact with symptomatic or asymptomatic individuals. According to the WHO, the incubation period ranges from 2 to 10 days. Some infected individuals were asymptomatic, whereas symptomatic patients displayed a variety of symptoms, including high fever, a dry cough, shortness of breath, lethargy, and myalgia. Many additional symptoms, such as dizziness and diarrhea, were reported but to a lesser degree (2, 3).

It was observed that patients did not recover to their original baseline health function, and many other symptoms persisted or emerged after recovery (4). According to the National Institute for Health and Care Excellence (NICE) guidelines, the Scottish Intercollegiate Guidelines

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↑What is "already known" in this topic:
The common symptoms of post-COVID-19 conditions include fatigue, shortness of breath, chest pain, cough, headache, joint pain, depression and anxiety.

→What this article adds:
There is no association between persistent and new symptoms after COVID-19 recovery with comorbidities or oxygen therapy during illness.

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Network, and the Royal College of General Practitioners, long COVID was defined as signs and symptoms developed during or following a disease consistent with COVID-19 that continued for more than four weeks and were not explained by alternative diagnoses (5), the time for recovery, according to the WHO is approximately 2 weeks in mild cases and 3 to 6 weeks in more severe infections (6). Long COVID-19 syndrome can be interchangeably referred to as "post-COVID-19 syndrome" or "post-acute COVID-19 syndrome" (7).

Persisted symptoms were quite similar in the short or long run. These symptoms include fatigue, shortness of breath (SOB), cough, anosmia, dysgeusia, deterioration of the cognitive symptoms, lack of concentration, delirium, pneumonia, cough, joint pain, myalgia, diarrhea, retinal vascular impairment, and psychological symptoms like depression, anxiety, and post-traumatic stress disorder (PTSD) (6, 8).

The severity of the persistent symptoms could be measured subjectively; for example, the Likert scale which allows participants to give their symptom severity a score from one to ten or a category of mild, moderate, severe, and critical (9, 10), or objectively like using a one-symptom specific scale for example, the Cooperative Oncology Group (ECOG) performance scale for fatigue and the modified Medical Research Council (mMRC) scale for dyspnea (10). Furthermore, WHO has set criteria for severity assessment; the mild category includes Symptomatic patients with no evidence of viral pneumonia or hypoxia,—called moderate if SpO_2 > 90%; with fever, cough, dyspnea, fast breathing without signs of severe pneumonia. Severe cases include patients with clinically evident pneumonia (fever, cough, dyspnea) and one of the following: SpO2 < 90% on room air, respiratory rate > 30 breaths/min, or severe respiratory distress. However, this scale was not frequently used, and many studies relied on hospitalization for assessment of severity (11). All age groups were at risk of developing a severe acute respiratory syndrome (SARS-CoV-2) infection. However, the disease burden was higher among elderlies (65 years and above) (6).

This survey examined the prevalence of symptoms that persisted or emerged during the post-recovery phase, as well as their associations with various factors. We relied on the WHO criteria for the release of patients from isolation as a definition for the beginning of the recovery period, which is more than 10 days from the onset of symptoms plus three extra days with no symptoms besides anosmia and dysgeusia (12). Accordingly, persistent symptoms were defined as symptoms that appeared during the disease period and continued to persist after recovery, while new symptoms were those symptoms that did not exist during the disease period and appeared for the first time after recovery.

Methods

An online, anonymous, cross-sectional, observational study was conducted between April and June 2022. It consisted of a self-administered web-based questionnaire conducted using social media platforms. Inclusion criteria were residency in Jordan, being 18 years of age or older, having recovered from COVID-19 for at least 90 days, and giving consent to participate. Participants whose infection was not confirmed by a positive PCR were excluded .Consequently, questions on age and the desire to participate were included in the questionnaire at the beginning.

Ethical Considerations

This study adhered to the principles of the Declaration of Helsinki 1975 and was approved by the Institutional Review Board at Al-Balqa Applied University. The first page contained a brief explanation of the aim of this research and the type of required question. It also asked for their consent and clarified the optionality of participation in the study. Data were collected and then saved in a locked file. The legality of access was limited only to the research team. Neither personal information nor contact methods were collected.

In the first part of the online survey, all participants were required to sign an electronic informed consent form that included extensive information on the study goals, objectives, methods, supervisor contact information, and IRB approval. Additionally, participants were instructed that participation was voluntary and that they might stop the survey at any stage. The data was kept confidential because all identifiable information was stripped, and no identifier-related questions such as participant name or city of residence were asked. Additionally, a study-specific unique identifier was generated for each participant, and this file was locked and password-protected with controlled access and authorization for viewing, sharing, and using it reserved for the research team. All further analyses were conducted on this anonymized file. Participants did not receive any compensation or rewards for their participation in the study.

Jordan Population and Online Sampling Process

The total population of Jordan was estimated to be 11 million in 2021, with about 1.7 million COVID-19 total cases. The authors computed a sample size using the Raosoft calculator with a margin of error set to up to 5% and a confidence value of 99% (13); 664 respondents or more were considered acceptable. To increase the response rate and to reach the target population, the online survey was sent to a list of emails and social media platforms (e.g., Facebook and WhatsApp) for convenience and a non-probability sampling method.

The Survey Instruments

The survey was constructed based on research questions and a literature review of similar research. The survey was made on Google Forms, and it takes 5 minutes to be filled out. In general, the first page meant with the consent and other ethical considerations, participants who voluntarily agreed and consented to proceed by pressing "OK" at the bottom automatically were allowed to move forward to answer subsequent questions. While the second page focused on the baseline characteristics of participants such as age, gender, marital status, smoking status, weight,

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height, and chronic diseases (diabetes mellitus, hypertension, thyroid disease, chronic respiratory diseases, chronic heart disease), it also asked about the way that participants realized being COVID-19 infected. The third section covered the experienced symptoms during the infection period with multiple yes or no questions, in addition to the assessment of severity by asking about the duration of infection, the need for oxygenation, or hospitalization. The fourth section asked about persistent symptoms after recovery in an analogous manner to the third one, but participants had to report the duration of each persistent symptom. In the fourth section, multiple yes/no questions were presented to determine whether the subject experienced any new symptoms that were not experienced during the infection period itself and appeared after recovery, for which they could not be explained by other medical conditions. The questionnaire was written in English and translated into Arabic, the national language of Jordan, and then re-translated to English to ensure the validity of the language. Thirty people were asked to fill out a preview version of the survey before we commenced officially collecting data.

Data Management and Analysis

The data was collected using Microsoft Forms and downloaded into Excel for coding and de-identification before being imported into the Statistical Package for Social Science (IBM SPSS Statistics for Windows, version 25, IBM Corp., Armonk, N.Y., USA) for analysis.

Descriptive Statistics

A descriptive analysis was conducted to identify the statistical validity of all variables, frequencies, and percentages for the sample demographic characteristics and COVID-19 symptoms. The dependent variables in this study were the persistence and emergence of new symptoms. A bivariate analysis was performed to evaluate the link between categorical variables (age groups, gender, comorbidity, BMI, hospitalization, smoking, and need for oxygen therapy). The logistic regression method was used to identify the relationship between sociodemographic health parameters and the occurrence of the two dependent variables; odds ratios (OR), in logistic regression output, and 95% confidence intervals (CI) were reported where appropriate to indicate the risk of developing new and persistent symptoms. A Chi-square test was used to investigate the existence of statistical correlations between demographic characteristics and the persistence and emergence of new symptoms. For categorical variables, the chi-square test was used. Statistical significance was defined as a P-value of < 0.05.

Results

These results represent 1004 participants of the Jordanian population who recovered from COVID-19 infection for at least 90 days. Tables figure out the demographic characteristics of the participants, their most experienced symptoms during infection, their persistent symptoms after recovery, and the new symptoms they developed after recovery, with the relation of these symptoms to many factors.

Baseline characteristics

Table 1 outlines the characteristics of the participants. The total number of participants was 1004. Sixty-two percent were cis-gender females, and 31.5% were smokers. Seventy-six percent of the sample population were under the age of forty, and forty-seven percent were obese.

Comorbidity and severity parameters

Table 2 shows the distribution of comorbidities. In addition to the severity parameters, the majority of the participants had no comorbidity (84.3%). However, the most frequent chronic diseases were hypertension (9.6%) and diabetes mellitus (5.9%). The severity was assessed by the need for medical care, oxygenation, and infection duration. Most of the participants did not seek medical care (81%) or oxygenation (93.5%), and the infection duration was less than 15 days (78.7%).

Frequencies of symptoms

Table 3 demonstrates the most common symptoms

Table 1. Characteristics at baseline of post-COVID-19 individuals. N =1004

Baseline Characteristics		Frequency n (%)	Persisting after the recovery n (%)	Not persisting after the recovery n (%)
Gender	Male	382 (38.0)	146 (38.2)	236 (61.8)
	Female	622 (62.0)	344 (55.3)	278 (44.7)
Social status	Single	502 (50.0)	238 (47.4)	264 (52.6)
	Married	502 (50.0)	252 (50.2)	250 (49.8)
Age group	18 to 24 years	338 (33.7)	149 (44.1)	189 (55.9)
	25 to 40 years	426 (42.4)	234 (54.9)	192 (45.1)
	41 to 50 years	104 (10.4)	53 (51)	51 (49)
	51 years and above	136 (13.5)	54 (39.7)	82 (60.3)
BMI	Underweight	37 (3.6)	17 (45.9)	20 (54.1)
	Normal	494 (49.2)	263 (53.2)	231 (46.8)
	Overweight	228 (22.7)	101 (44.3)	127 (55.7)
	Obese	245 (24.4)	109 (44.5)	136 (55.5)
	Smoker	316 (31.5)	130 (41.1)	186 (58.9)
Smoking status	Non-smoker	688 (68.5)	360 (52.3)	328 (47.7)
Comorbidity	Presence	158 (15.7)	80 (50.6)	78 (49.4)
	Absence	846 (84.3)	410 (48.5)	436 (51.5)

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Table 2. Distribution of disease severity and comorbidity factors among respondents. N = 1004

Item		Frequency n(%)	Persistence after the recovery n(%)	No persistence after the recovery n(%)
Comorbidities	Hypertension	104 (9.6)	53 (51)	51 (49)
	Diabetes mellitus 2	64 (5.9)	33 (51.6)	31 (48.4)
	Chronic respiratory diseases	37 (3.4)	19 (51.4)	18 (48.6)
	Cardiovascular diseases	21 (1.9)	10 (47.6)	11 (52.4)
	Hypothyroidism	50 (4.6)	22 (44)	28 (56)
	Others	19 (2.53)	11 (57.9)	8 (42.1)
	None	846 (84.3)	410 (48.5)	436 (51.5)
Severity parameter				
The need for medical care	Did not seek medical care	813(81.0)	366 (45)	447 (55)
	Hospital visit	157(15.6)	101 (64.3)	56 (35.7)
	Hospital admission	34(3.4)	23 (67.6)	11 (32.4)
Oxygenation	Yes	65(6.5)	34 (52.3)	31 (47.7)
	No	939(93.5)	456 (48.6)	483 (51.4)
Infection duration	Less than 15 days	790(78.7)	332 (42)	458 (58)
	15 days to 1 month	125(12.5)	81 (64.8)	44 (35.2)
	More than 1 month	89 (8.9)	77 (86.5)	12 (13.5)

Table 3. Self-reporting of symptoms that appeared during infection, symptoms that lasted after infection, and symptoms that have recently appeared.

	Appearing during illness No. Patients/ 1004 (%)	Persisting after the recovery No. Patients/ 1004 (%)	Chance for persisting*	New symptoms No. Patients/ 1004 (%)
Gastrointestinal system				
Reduced appetite	363 (36.2)	212 (21.1)	58%	96 (9.6)
Nausea	320 (31.9)	122 (12.2)	38%	60 (6.0)
Vomiting	163 (16.2)	64 (6.4)	39%	32 (3.2)
Abdominal pain	158 (15.7)	111 (11.1)	70%	38 (3.8)
Diarrhea	293 (29.2)	123 (12.3)	42%	63 (6.3)
Cardiopulmonary system				
Dyspnea	354 (35.3)	210 (20.9)	59%	93 (9.3)
Cough	417 (41.5)	182 (18.1)	44%	56 (5.6)
Chest pain	270 (26.9)	193 (19.2)	71%	88 (8.8)
Rhinorrhea	248 (24.7)	120 (12.0)	48%	48 (4.8)
Central and peripheral nervous system				
Headache	662 (65.9)	260 (25.9)	39%	101 (10.1)
Dizziness	342 (34.1)	194 (19.3)	57%	92 (9.2)
Loss of smell	681 (67.8)	348 (34.7)	51%	129 (12.8)
Loss of taste	589 (58.7)	296 (29.5)	50%	120 (12.0)
Hearing impairment	210 (20.9)	91 (9.1)	43%	54 (5.4)
Smell hallucination	259 (25.8)	208 (20.7)	80%	159 (15.8)
Taste hallucination	216 (21.5)	185 (18.4)	86%	147 (14.6)
Cognitive assessment				
Focus impairment	459 (45,7)	237 (23.6)	52%	130 (12.9)
Memory impairment	320 (31.8)	195 (19.4)	61%	110 (11.0)
Insomnia	290 (28.9)	195 (19.4)	67%	111 (11.1)
Others				
Fatigue	817 (81.4)	347 (34.6)	42%	156 (15.5)
Fever	565 (56.3)	144 (14.3)	25%	45 (4.5)
Arthralgia	578 (57.6)	260 (25.9)	45%	121 (12.1)
Myalgia	496 (49.4)	264 (26.3)	53%	118 (11.8)
Eye pain/redness	177 (17.6)	108 (10.8)	61%	64 (6.4)
Impairment of physical activity	502 (50)	203 (20.2)	40%	123 (12.3)

* Calculated by obtaining the percentage of people whose symptom persisted among the percentage of whom were suffering from the symptom during their active infection.

found during the active phase of the disease, the persistent and new symptoms. It also shows the chance for each symptom to persist. Fatigue (81.4%), loss of smell (67.8%), headache (65.9%), and loss of taste (58.7%) were the most commonly reported symptoms during the infection period. Concerning persistent symptoms, smell impairment, fatigue, taste impairment, and myalgia were the most common persistent symptoms present in 34.7%, 34.6%, 29.5%, and 26.3%, respectively. The most common new symptoms were smell hallucinations, fatigue, and taste hallucinations (15.8%, 15.5%, and 14.6%, respectively). Other symptoms are listed in the table.

We also assessed the likelihood that the symptom would continue if the patient had manifested it during the acute phase of his infection. This was done by obtaining the percentage of people whose symptoms persisted among the percentage of those who were suffering from the symptom during their active infection. The likelihood of taste hallucinations was 86%, followed by olfactory hallucinations (80%) and chest discomfort (71%); other symptoms are shown in Table 3.

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The associations between symptoms and other factors

Table 4 shows the association between persistent as well as new symptoms and other factors. Persistent symptoms appeared more often in females (55.3%) and those ages between 25 and 40 years (54.9%); however, odds ratios were twice as high in males and insignificantly higher in ages above 50, as shown in Table 5. Non-smokers (52.3%), those who required medical care (64.3%), and participants with an infection duration of more than a month (86.5%). New symptoms were more prevalent in females (33.9%), non-smokers (30.5%), hospitalized patients (38.2%), and those who required healthcare (37.6%) and in participants with a duration of infection greater than 30 days (57.3%).

Table 5 shows the new and persisting symptoms' association with many factors by logistic regression. This table shows that hospitalized patients were around two times more likely to have persisted and new symptoms when compared to non-hospitalized patients. Moreover, smokers and participants who required medical care had more persistent and new symptoms significantly. Overweight and obese participants developed more new symptoms.

The most common persistent symptoms

We took the most persistent symptoms in our study and studied the relationship between these symptoms and many other variables. The studied symptoms include fatigue, myalgia, arthralgia, and loss of smell. Although percentages are different, a similar pattern of association can be seen. Generally speaking, all of these symptoms were significantly more prevalent in females, hospitalized, and non-smokers. Moreover, varying but comparable percentages were shown in participants with different durations of infection. The effect of comorbidity and the need for oxygenation were insignificant; however, the symptoms were more prevalent in participants with no chronic disease and in those who didn't require oxygen therapy. All the numbers and percentages are clarified in Table 6.

Discussion

This study assessed the persistent and new symptom development of COVID-19 after recovery in an online cross-sectional survey of 1004 Jordanians at least 90 days after recovery, as well as their connection with demographic characteristics and the infection severity. Females constituted sixty-two percent of the sample. Seventy-five per-

Table 4. Sample characteristic factors associated with the emergence of new and persisting symptoms

Variable	Association of emergence of new symptom				Association of persisting symptoms			
	Yes	No	χ^2	*P*	Yes	No	χ^2	*P*
	n (%)	n (%)			n (%)	n (%)		
Gender								
Male	64(16.8)	318(83.2)	35.076	<0.001	146 (38.2)	236 (61.8)	27.649	<0.001
Female	211(33.9)	411(66.1)			344 (55.3)	278 (44.7)		
Age (in years)								
18- 24	90(26.6%)	248(73.4%)	6.632	0.085	149 (44.1)	189 (55.9)	14.112	0.003
25– 40	127(29.8%)	299(70.2%)			234 (54.9)	192(45.1%)		
41– 50	32(30.8%)	72(69.2%)			53(51.0%)	51(49.0%)		
>50	26(19.1%)	110(80.9%)			54(39.7%)	82(60.3%)		
BMI								
Underweight	15(40.5%)	22(59.5%)			17(45.9%)	20(54.1)		
Normal	149(30.2%)	345(69.8%)	9.650	0.022	263(53.2%)	231(46.8)	7.687	0.053
Overweight	49(21.5%)	179(78.5%)			101(44.3%)	127(55.7%)		
Obese	62(25.3%)	183(74.7%)			109(44.5%)	136(55.5%)		
Comorbidity								
Yes	44(27.8%)	114(72.2%)	0.020	0.888	80(50.6%)	78(49.4%)	0.251	0.617
No	231(27.3%)	615(72.7%)			410(48.5%)	436(51.5%)		
Smoking								
Yes	65(20.6%)	251(79.4%)	10.787	0.001	130(41.1%)	186(58.9%)	10.845	0.001
No	210(30.5%)	478(69.5%)			360(52.3%)	328(47.7%)		
Infection severity								
No medical care	203 (25%)	610(75.0%)	12.603	0.002	366(45.0%)	447(55.0%)	24.644	<0.001
Medical Care	59 (37.6%	98 (62.4%)			101(64.3%)	56(35.7%)		
Hospitalization	13 (38.2%)	21 (61.8%)			23(67.6%)	11(32.4%)		
Oxygenation								
Yes	11(16.9%)	54(83.1%)	3.829	0.050	34(52.3%)	31(47.7%)	0.341	0.559
No	264(28.1%)	675(71.9%)			456(48.6%)	483(51.4%)		
Infection duration								
<15 days	176(22.3%)	614(77.7%)			332(42.0%)	458(58.0%)		
15-30	48(38.4%)	77(61.6%)	58.0041	<0.001	81(64.8%)	44(35.2%)	77.991	<0.001
>30	51(57.3%)	38(42.7%)			77(86.5%)	12(13.5%)		

*Indicates statistically significant values.

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Table 5. Factors associated with the emergence of new symptoms and persisting symptoms by logistic regression

Factor analyzed severity	Model 1: New symptom development		Model 2: Persisted symptoms	
	OR (95% CI)	*P*–value	OR (95% CI)	*P*–value
Gender				
Female	1		1	
Male	2.19 (1.54–3.10)	<0.001	1.69 (1.27–2.25)	<0.001
Age (in years)				
18- 24	1		1	
25-40	0.65 (0.35–1.21)	0.176	0.69 (0.41–1.18)	0.176
41-50	0.87 (0.47–1.61)	0.648	0.67 (0.38–1.18)	0.163
>50	0.97 (0.59–1.60)	0.896	1.64 (0.74–1.84)	0.517
BMI				
Underweight	1		1	
Normal	0.54 (0.27–10)	0.091	1.14 (0.57–2.26)	0.718
Overweight	0.43 (0.20–0.93)	0.032	0.81 (0.39–1.67)	0.565
Obese	0.37 (0.17–0.79)	0.011	0.84 (0.41–1.74)	0.640
Comorbidity				
Yes	0.884 (0.59–1.34)	0.557	0.86 (0.57–1.20)	0.308
No	1		1	
Smoking				
Yes	1.28 (0.89–1.82)	0.173	1.38 (1.02–1.87)	0.037
No	1		1	
Infection severity				
No medical care	1		1	
Medical care	1.86 (1.11–3.22)	0.006	2.55 (1.23–5.31)	0.012
Hospitalization	1.81 (1.58–4.01)	0.001	2.20 (1.55–3.14)	<0.001
Oxygenation				
Yes	1.77(0.89–3.50)	0.102	0.76 (0.49–1.29)	0.301
No	1		1	

Table 6. The distribution of the variables among the most common persistent symptoms

Variable		Fatigue n (%) – *P*-value		Loss of smell n (%) – *P*-value		Myalgia n (%) – *P*-value		Arthralgia n (%) – *P*-value	
Gender	Male	95(24.8)	<0.001	92(24)	<0.001	68(17.8)	<0.001	53(13.8)	<0.001
	Female	253(40.6)		255(40)		196(31.5)		207(33.2)	
Comorbidity	Presence	52(14.9)	0.415	63(18.2)	0.278	51(19.3)	۰,۱۳۹	47(18.1)	0.493
	Absence	296(85.1)		284(81.8)		213(80.7)		213(81.9)	
Duration of infection	<15 days	225(64.7)		223(64.3)		164(62.1)		164(63.1)	
	15-30 d	60(17.2)	<0.001	70(20.2)	<0.001	22(9.7)	<0.001	55(21.2)	<0.001
	>30 d	63(18.1)		54(15.6)		36(15.9)		41(15.8)	
The need for oxygenation	Required O2	29(8.3)	0.153	25(7.2)	۰,۸14	20(7.6)	0.751	13(5.0)	0.162
	No O2	319(91.7)		322(92.8)		244(92.4)		247(95.0)	
The need for medical care	No medical care	267(76.7)	<0.001	243(70.0)	<0.001	180(68.2)	<0.001	182(70.0)	<0.001
	hospital visit	65(18.7)		85(24.5)		65(24.5)		63(24.2)	
	Hospital admission	16(4.6)		19(5.5)		19(7.2)		15(5.8)	
Smoking	Smoker	89(25.6)	0.034	86(24.8)	0.024	69(26.1)	0.048	61(23.2)	0.018
	Non-smoker	259(74.4)		261 (75.2)		195(73.9)		199(76.5)	

cent of them were younger than forty years of age, and only sixteen percent of the patients had comorbidities, the most common of which were hypertension and diabetes, as shown in Tables 1 and 2. Other characteristics collected included BMI, smoking status, and social status, which will be discussed in further detail later.

The most prevalent symptoms of acute infection were fatigue (81.4%), loss of smell (67.8%), headache (65.9%), loss of taste (58.7%), and arthralgia (57.6%), as shown in Table 3. Similarly, fatigue and taste disorders were among the most frequent acute infection symptoms in a Turkish study (14). A study conducted in the United Kingdom indicated that 59 percent of COVID-19-positive individuals experienced a loss of smell and taste (15). In several other studies, including two from the USA, fever was the most commonly reported symptom, followed by cough and shortness of breath (16, 17).

The average percentage of individuals with persistent symptoms was 48.8%, compared to 55% and 45%, respectively, in two trials conducted in the Faroe Islands and China (18, 19). The most prevalent persistent symptoms were loss of smell (34.7%), fatigue (34.6%), loss of taste

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(29.5%), myalgia (26.3%), and headache (25.9%), as shown in Table 3. Results of similar studies conducted in China, Denmark, and the Faroe Islands were comparable to the current survey with little differences in the order of symptoms and percentages (18, 20, 21). However, according to a study conducted in Nevada, USA, the most common persisting symptoms were anosmia and ageusia (22). Although these two symptoms usually occur concurrently, it is interesting to mention that a meta-analysis of eight observational studies showed that there is no association between them (23). These symptoms are also common after Severe Acute Respiratory Syndrome (SARS) infection, where fatigue, myalgia, weakness, depression, and sleep difficulties were previously reported (24). In addition, the most prevalent symptoms after Acute Respiratory Distress Syndrome (ARDS) (25) and Middle Eastern Respiratory Syndrome Coronavirus (MERS-CoV) were fatigue and muscle weakness (26).

Persistent symptoms were significantly more prevalent among females, as demonstrated in Table 4. A one-year follow-up study in China supported this finding (19), and similar results were observed in a cohort study in Oman as well (27). However, odds ratios were significantly higher among men, as shown in Table 5. Moreover, no gender differences were found in studies conducted in the Faroe Islands or France (18, 19). Nonsmokers exhibited more persistent symptoms and a significantly higher odd ratio. This contradicts previous research conducted in the Faroe Islands, China, and France (18, 19, 28). One explanation of why non-smokers reported more persistent symptoms is that both COVID-19 symptoms and smokers have respiratory symptoms, and smokers may not relate the worsening of symptoms to the infection.

In our study, the severity of symptoms was determined by the length of the illness and the need for medical treatment and oxygenation. Oxygenation had no significant association with symptom persistence; other severity parameters had a significant effect on the persistence of symptoms, as shown in Table 4. However, according to two different investigations conducted in England and a cohort study conducted in France, around 75% of those who required oxygenation experienced persisting symptoms (29, 30). When compared to our finding, most of the participants who required oxygen were young; 57% of them were younger than 40 years old, and 72.3% of them had an infection duration of fewer than 15 days, which may explain the low prevalence of persistent symptoms among them.

Hospitalization history is a well-established factor associated with symptom persistence and severity; hospitalization or intensive care unit admission and repeated healthcare visits can raise the risk, according to research conducted in Oman and Italy (27, 31). Another factor observed by a French study is the duration of infection; the longer the period of infection, the greater the prevalence of persistent symptoms (28). Approximately 78% of patients with persistent symptoms were under the age of 40, with the majority falling between the ages of 25 and 40, as shown in Table 4. This may be explained by the assumption that the older age group did not relate their persistent symptoms to COVID-19 infection but to their co-morbid diseases. This assumption is supported by the sharp increase in chronic disease distribution in the Jordanian population over the age of 50, particularly diabetes and hypertension (30). Moreover, previous research found that the elderly are at a higher risk of hospitalization, but the prevalence of persistent symptoms is not significantly different when categorizing patients by age group, and a similar conclusion was reached in an Italian cohort study (31).

The current study shows no significant correlation between comorbidities and symptom persistence. Similar results were reported in a Nigerian study (32). In contrast, an Italian study found a linkage between the existence of comorbidities and long-term COVID syndrome. Meanwhile, a Mexican survey connected the duration of symptoms to the number of underlying medical conditions (31, 33).

According to our knowledge, this is the first study to evaluate the development of new post-COVID-19 symptoms. As shown in Table 3, the most prevalent new complaint was olfactory hallucinations, reported by 15.8%. Females reported a higher incidence of new symptoms, as seen in Table 4, which may be related in part to the fact that a higher proportion of women (20%) than men (18%) required health treatment. In addition, 11% of women reported a period of illness lasting longer than a month, compared to 5% of men. This could be attributed to the effect smoking has on an individual's health, as smokers were more likely to report the occurrence of new symptoms. On the other hand, differences in weight, age, or even the presence of comorbidities did not show any significant associations. This is likely because it is hard to tell the difference between problems related to age, weight, chronic diseases, and COVID-19 symptoms.

The pattern of distribution of the most common persistent symptoms among variables, including fatigue, myalgia, loss of smell, and loss of taste, did not differ from the pattern of distribution of all symptoms when each symptom was analyzed separately in Table 6, For example, fatigue was the most common new symptom, and it was most common in females. However, the female gender is a well-known risk factor for developing post-COVID-19 chronic fatigue syndrome, as shown in a ten-month cohort study conducted on Irish health workers that has been independent of the impact of age (26), since age causes fatigue as well. (24). ICU admission was also associated with chronic fatigue syndrome and myopathy, as found in a Canadian study (25). A large meta-analysis examining the loss of smell and loss of taste in 1,483 participants concluded that there is no correlation between the number of days after the diagnosis of COVID-19 and the emergence of these symptoms, whereas in our study, the loss of smell and taste is significantly higher among those with an infection duration of fewer than 15 days (23). In contrast to our findings, a study conducted by Padova University in Italy among the elderly reveals that hospitalized patients are more likely to have taste loss; anyhow, taste loss can be explained by old age, multiple pharmacological therapies, comorbidities, or starvation (34). Non-smokers

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reported a more frequent loss of smell and taste compared to smokers, which may be partially explained by a Brazilian study of the effects of smoking on the olfactory nerve, which found that smoking causes inflammation and nerve bundle degradation, resulting in a less notable reporting of the loss of smell and taste post-COVID-19 (35).

There are several limitations to consider in this study. Firstly, we did not investigate the impact of COVID-19 variants and the vaccination status of the participants, which could have influenced the outcomes. Secondly, as this study employed a cross-sectional design, there is a possibility of selection bias occurring. Moreover, the use of an online survey may have excluded individuals without internet access or those less inclined to participate in online surveys, resulting in a sample that may not be representative of the general population.

Furthermore, the reliance on self-administered questionnaires introduces the potential for response bias, where participants may not provide accurate or truthful responses. Additionally, participants might have been more inclined to answer questions in a socially desirable manner, potentially impacting the validity of the results. Moreover, the accuracy of the data collected could have been compromised by participants' difficulties in accurately recalling past events or experiences.

These limitations highlight the need for caution when interpreting the findings and emphasize the importance of addressing these factors in future studies to enhance the robustness and generalizability of the results.

Conclusion

The research conducted on persistent and new symptoms experienced by Jordanians after recovering from COVID-19 revealed a higher incidence of symptoms associated with the sense of smell. Interestingly, we did not observe any correlation between these persistent and new symptoms and the presence of comorbidities or the use of oxygen therapy during the illness. These findings emphasize the importance of directing future studies toward investigating the consequences of COVID-19 among individuals who have recovered, as well as the necessity of long-term follow-up to gain a deeper understanding of the duration and impact of these symptoms on their quality of life. Moreover, we strongly recommend exploring the influence of COVID-19 variants and vaccination on the persistence of symptoms following recovery.

Conflict of Interests

The authors declare that they have no competing interests.

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