



Cross-sectional Study

Effects of COVID-19 pandemic on medical students in Jordanian universities: A multi-center cross-sectional study

Naser AL-Husban^{a,*}, Aysha Alkhatat^b, Mariam Aljweesri^b, Reem Alharbi^b, Zahraa Aljazzaf^b, Nehad Al-Husban^c, Mohammed S. Elmuhtaseb^b, Khaled Al Oweidat^b, Nail Obeidat^d

^a Obstetrics and Gynecology Department, School of Medicine, The University of Jordan, Amman, Jordan

^b School of Medicine, The University of Jordan, Amman, Jordan

^c Ministry of Justice, Amman, Jordan and external council member, School of Law, Al-Balqa' Applied University, Al-Salt, Jordan

^d School of Medicine, Jordan University of Science and Technology, Irbid, Jordan

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ABSTRACT

Background: There are serious concerns regarding the effectiveness of medical education in its current format during serious crises like the COVID-19 pandemic.

Objective: To explore academic, financial, psychological, & hygienic impact on medical students.

Methods: A cross-sectional, questionnaire-based study of students at different medical schools in Jordan. It included both basic and clinical years.

Results: There were 415 responses. Females constituted 51.8%. Around 50% of the participants were from the 6th year (n = 194, 46.7%). University of Jordan students represented around 40% of the responders. 60% of the students have GPA (Grade Point Average) of less than 3 points. Nearly half of the students indicated that their academic grades were affected during the pandemic. Clinical years' students (51.0%) were more likely to be negatively affected than students in basic years (36.1%), P value 0.026. Sixty three percent reported that they sanitize their hands before touching eyes, nose, or mouth. More than two thirds (70.4%) of students indicated that their mental health was affected in the pandemic. Financial influence was a major aspect in around 53% of students and 34% of students were not able to pay the university fees due to the pandemic. The pandemic affected the elective training course location of 70.9% of respondents. Mental health was affected in 70.9% of students and 65.1% became more anxious or depressed with no significant difference among gender and academic years (P values 0.256 and 0.516, respectively). Students in the clinical years were more afraid of getting the infection than students in the basic years, however this difference was not statistically significant (p = 0.084). **Conclusions:** Covid-19 Pandemic negatively affected the academic course of the medical students especially at the clinical training years' level across Jordanian universities. COVID-19 pandemic left a negative impact on psychological & mental health of the students, too, rendering them more anxious, depressed, and afraid of coming to the hospital and handling patients.

1. Introduction

The combination of reduced exposure to clinical sessions and the suspension or cancellation of attachments and electives had noticeable impacts on medical education, particularly on final year medical students who were expected to gain certain structured competencies and skills before starting their careers (Ahmed et al., 2020) [1].

Wolanskyj-Spinner (2020) [2] had expressed serious concerns about

the effectiveness of medical education in its current format during serious crises like the COVID-19 pandemic.

The impact on medical student education has been significant, particularly affecting the transition from student to doctor. This study showed that the disruptions to student assistantships had the biggest effect on students' confidence and preparedness. For those willing to assist in hospitals to join the front-line workforce, it is crucial to maintain their wellbeing with safeguards such as proper inductions, support,

* Corresponding author. The University of Jordan, P O Box 2194, Amman, 11941, Jordan.

E-mail addresses: Husban48@yahoo.com (N. AL-Husban), Aysha96bahrain@gmail.com (A. Alkhatat), Dr.mariamrj@hotmail.com (M. Aljweesri), reeema116@gmail.com (R. Alharbi), Zaljazaf@hotmail.com (Z. Aljazzaf), Nehadalhusban@yahoo.co.uk (N. Al-Husban), muhtaseb11@hotmail.com (M.S. Elmuhtaseb), [K. Al Oweidat](mailto:K.oweidat@ju.edu.jo), naobeidat@just.edu.jo (N. Obeidat).

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and supervision. (Saraswathi I, 2020) [3].

1.1. Rationale of our study

Jordan adopted very drastic measures in combatting this pandemic. These measures affected all life aspects of the population. The education sector was hit very hard with frequent lockdowns and switching over to electronic learning with substantial consequences. These consequences on medical students in the Jordanian universities were not yet explored.

1.2. Objectives

Our aims were to study the relationship between the covid-19 pandemic with other variables as psychological stress and academic results. This will increase the awareness of educators and medical students about the effect of the covid-19 pandemic on the life aspects of students which will improve how universities handle such pandemics to help students maintain and create their own ways of training even in such conditions.

2. Materials & methods

2.1. Study design

It was a cross-sectional study.

2.2. Participants and eligibility

Samples were collected randomly from a target population which was all ongoing medical students at the time of conduction of this study, classified by their academic years (from the 1st to the 6th academic year).

2.3. Settings, sources and method of selection

An e-questionnaire (appendix 1) was completed by students. The questionnaire was built through google forms (without relying on pre-existing ones) and was made available in Arabic.

The link of the questionnaire; <https://docs.google.com/forms/d/e/1FAIpQLSdrZ0gHYJsQg6oelKo-S2ePCWpMdpOm9bdypIvXtXJFFy-aFw/viewform>.

Data collection was conducted between November 17th 2020 and December 23rd 2020 Demographic variables that were assessed included age, gender, academic year, Place of residence, university, and GPA (Table 1).

Outcomes; we studied the effect of the pandemic on the academic aspects (we asked questions regarding GPA, lectures, effect on teachers and effect on clinics and rounds), hygiene behaviors, psychological stress, financial adverse effects and influence on elective training. We chose those aspects depending on our recent observations on the public both nationally and abroad and after we reviewed the literature.

2.4. Ethical consideration

The study obtained approval of the institutional review board (IRB) at the Jordan university hospital; 298/2020, dated 29/12/2020. Consent was obtained at the start of filling of the questionnaire and was mandatory to complete the questionnaire.

This study was also registered at [ClinicalTrials.gov](https://clinicaltrials.gov) with a unique identification number; NCT04726865 [4].

2.5. Statistical analysis

SPSS version 25.0 was used for the statistical analysis. After the data had been entered into a Microsoft Excel 2010 worksheet and appropriately configured, they were subsequently imported into SPSS. Mean

Table 1
General characteristics of the study participants.

Variable	Level	N	%
Gender	Male	200	48.2%
	Female	215	51.8%
Age	18–20	82	19.8%
	21–23	185	44.6%
	24–26	148	35.7%
	Academic year	1st year	24
Academic year	2nd year	40	9.6%
	3rd year	32	7.7%
	4th year	65	15.7%
	5th year	60	14.5%
	6th year	194	46.7%
	Place of residence	Amman	234
Irbid		99	23.9%
Karak		48	11.6%
Salt		25	6.0%
Zarqa		9	2.2%
University		Al-Balqa'a Applied University	25
	Al-Yarmouk Applied University	45	10.8%
	Hashemite University	50	12.0%
	The University of Jordan	167	40.2%
	Jordan University of Science & Technology	66	15.9%
	Mu'tah University	62	14.9%
GPA	3 or more	166	40.0%
	Less than 3	249	60.0%

N; number, %; percentage, GPA; grade point average.

values (\pm standard deviation) were used to describe the continuous variables (e.g., age), while counts (frequency) were used to describe the other nominal variables (e.g., gender). The information obtained were summarized and presented in tables.

The percentages in the presented tables represent the valid percentages, as missing data were excluded from the total number of participants for each variable (Tables 1–4).

A score from 10 points was constructed using the mean of the items in each group of variables. This score was formulated for the academic, hygiene behaviors, and financial effects of Covid-19. The higher this score, the larger the effect of Covid-19 on the aforementioned aspects.

Chi-Square test (Table 5) was used to study the difference in the effect of COVID-19 pandemic on academic achievement, mental health and hygiene behaviors among gender and year of study (i.e., basic vs. clinical years). All statistical tests were two-sided, with p values < 0.05 considered to be statistically significant. All underlying assumptions were met, unless otherwise indicated.

2.6. Sample size; our aim was to have around 400 participants to represent the 4 medical schools in the country

We tried to minimize any potential bias by involving participants from different medical schools across the whole country.

Moreover, the work has been reported in line with the STROCCS criteria [5].

3. Results

3.1. Descriptive data

The total number of responses was 415 responses out of 740 (response rate was 56%); 200 (48.2%) were males and 215 (51.8%) were females. The most common age group was ages between 21 and 23 years (n = 185, 44.6%) followed by age group 24–26 years and then age group 21–23 years. Nearly half of the participants were from the 6th year (n = 194, 46.7%). Most of the students who participated in this survey lived in Amman (n = 234, 56.4%) and Irbid (n = 99, 23.9%). Students who had a GPA of 3 or more points were 166 (40%) and the rest had a GPA of less than 3 points (Table 1).

3.2. Outcome data and main results

3.2.1. Academic effects of Covid-19

The mean score of the effects on academic aspects caused by Covid-19 pandemic was 7.4 (±1.6). Nearly half of the students indicated that their academic grades and GPA were affected during the pandemic due to the pass/fail system that was implemented (Table 2). There was no difference between males and females in this regard. However, Students in clinical years (i.e., 4th, 5th, and 6th years) were more affected than students in basic years (i.e., 1st, 2nd, and 3rd). Academic grades of students in the clinical years (51.0%) were more likely to be negatively affected (p = 0.026) than students in basic years (36.1%). Moreover, students in the clinical years were more likely to be negatively affected by the pass/fail system (p < 0.001). The most common academic factors that were affected during the teaching process in the pandemic according to students were the unsatisfactory clinics/rounds teaching (73.2%), followed by fluctuations in lectures' timing (71.0%). A large percent of students indicated that the clinics/rounds became shorter (66.4%), less informative (45.8%) with fewer patients to examine (69.0%). Regarding the teachers' side of the academic interaction, the students indicated that limited feedback and motivation (57.7%) from teachers in addition to the difficulties that some teacher might find when giving online lectures (58.5%) were some of the downside of the online lectures and seminars (Table 2).

Financial effects of Covid-19: The mean score of the effect on financial aspects caused by Covid-19 pandemic was 5.7 (±2.5). Around 220 (53%) students indicated that they were affected financially by the COVID-19 pandemic. Students who considered budgeting more carefully in the current situation were 241 (62.9%) and those who were not able to pay the university fees due to the pandemic were 81 (34.0%) (Table 3).

Table 2
The effect of Covid-19 pandemic on the academic aspects.

Variable	Disagree (%)	Neutral (%)	Agree (%)
Academic grades			
Covid-19 pandemic affected my academic grades negatively	47 (14.3%)	126 (38.4%)	155 (47.3%)
The pass/fail system affected GPA negatively	48 (15.8%)	104 (34.2%)	152 (50.0%)
Lectures and teachers			
Fluctuations in lectures' timing is one of the downsides of online teaching	10 (2.5%)	107 (26.6%)	286 (71.0%)
Limited feedback and motivation of the students in online teaching	27 (6.7%)	143 (35.6%)	232 (57.7%)
Teachers not being technology friendly is one of main issues facing online teaching	29 (7.0%)	142 (34.5%)	241 (58.5%)
Recorded lectures are better than live lectures as it enables the student to set their own learning time	24 (6.1%)	121 (30.8%)	248 (63.1%)
Technical issues facing online teaching makes it difficult as, poor Wi-Fi connection, lack of computer or mobile device	15 (3.7%)	129 (31.8%)	262 (64.5%)
Clinics and rounds			
I feel the clinics/rounds had been affected during Covid-19 negatively	11 (2.7%)	98 (24.1%)	297 (73.2%)
The hands-on experience has suffered greatly	6 (1.5%)	120 (29.3%)	283 (69.2%)
The clinics/rounds have become shorter	8 (2.0%)	128 (31.6%)	269 (66.4%)
There are fewer patients to examine	9 (2.2%)	117 (28.8%)	280 (69.0%)
Patients in the hospital became reluctant to be cooperative to students	24 (6.0%)	168 (42.2%)	206 (51.8%)
The rounds/clinic limited number of students	11 (2.7%)	128 (31.9%)	262 (65.3%)
The rounds/clinics became less informative	29 (7.8%)	173 (46.4%)	171 (45.8%)

Table 3

The effect of COVID-19 pandemic on elective training, financial and mental aspects of students.

Variable	Disagree (%)	Neutral (%)	Agree (%)
The pandemic effected your selection of elective location	4 (2.2%)	49 (26.9%)	129 (70.9%)
The pandemic effected your future residency/specialty	17 (10.0%)	62 (36.5%)	91 (53.5%)
How would you rate your elective experience?	7 (6.1%)	62 (54.4%)	45 (39.5%)
The pandemic made me think of my budgeting more carefully	19 (5.0%)	123 (32.1%)	241 (62.9%)
My household suffered financially	55 (17.1%)	140 (43.5%)	127 (39.4%)
I could not pay the university fees due to the pandemic	60 (25.2%)	97 (40.8%)	81 (34.0%)
I used expensive private transportation means to avoid contracting the diseases rather than cheap public transportation	36 (11.0%)	100 (30.7%)	190 (58.3%)
Covid-19 impact on mental health	123 (29.6%)	292 (70.4%)	
Became more anxious and depressed	145 (34.9%)	270 (65.1%)	
Obsession with contracting the disease	210 (50.6%)	205 (49.4%)	

Effect of Covid-19 pandemic on abroad students and on elective training: About 216 (52%) medical students lived originally outside Jordan and those who returned to their original country during the pandemic were 171 (79%) students. Students who did their elective training were only 135 (32.5%). Those who did their elective in Jordan were 52 (12.5%), in Kuwait were 10 (2.4%), in KSA were two (0.5) and in the USA was one (0.2%). The rest did their elective in other various places. Most of the elective training was conducted in training centers (i. e., Hospitals and health centers; n = 110, 81%), and only 25 (19%) students did their elective using online services. More than two thirds (70.9%) of students indicated that the pandemic affected their selection of the elective location. Nearly 40% of students who did their elective, rated their elective experience positively and more than the half (54.4%) gave it a neutral rating (Table 3).

Effects of Covid-19 on hygiene behaviors: The mean score of the effect on hygienic behaviors caused by Covid-19 pandemic was 7.6 (±1.9). The most common source of information for the students regarding sanitization and overall hygiene is the World Health Organization (WHO; n = 174, 41.9%) followed by social media (n = 172, 41.4%). Only 67 students (16.1%) indicated that their source of information was from the surrounding community. Two students indicated that they acquired their information from all previous sources.

Only 267 (65.0%) students indicated that they always washed their hands for least 20 s and in an appropriate way, with no significant difference among gender. However, those of the clinical years (67.1%) were more likely (p = 0.004) to wash their hands appropriately than students in basic years (57.9%) (Tables 4 and 5).

Table 4
The effect of COVID-19 pandemic on sanitization and hygiene behaviors.

Variable	Disagree (%)	Neutral (%)	Agree (%)
Always wash hands for least 20 s and in an appropriate way	21 (5.1%)	123 (29.9%)	267 (65.0%)
Sanitize hands before touching eyes, nose, or mouth	16 (3.9%)	135 (33.1%)	257 (63.0%)
Became more aware of sensitizing medical equipment after examining each patient	11 (2.7%)	118 (28.6%)	283 (68.7%)
Helped in raising hygiene awareness of people around me	24 (5.9%)	146 (36.0%)	236 (58.1%)
Noticed a raising in patients' awareness of self-hygiene	23 (5.7%)	179 (44.6%)	199 (49.6%)

Table 5
Differences in the effect of COVID-19 pandemic on academic, mental health and hygiene behaviors among gender and year of study.

Variable	Level	N (%) of participants who agree	P – value
Always wash hands for least 20 s and in an appropriate way	Male	120 (61.2%)	0.210
	Female	147 (68.4%)	
	Basic Years	55 (57.9%)	
	Clinical Years	212 (67.1%)	
Sanitize hands before touching eyes, nose, or mouth	Male	110 (55.8%)	0.015
	Female	147 (69.7%)	
	Basic Years	44 (47.3%)	
	Clinical Years	213 (67.6%)	
Became more aware of sensitizing medical equipment after examining each patient	Male	122 (61.9%)	0.018
	Female	161 (74.9%)	
	Basic Years	48 (51.6%)	
	Clinical Years	235 (73.7%)	
Covid-19 impact on mental health	Male	146 (73.0%)	0.256
	Female	146 (67.9%)	
	Basic Years	65 (67.7%)	
	Clinical Years	227 (71.2%)	
Became more anxious and depressed	Male	135 (67.5%)	0.315
	Female	135 (62.8%)	
	Basic Years	60 (62.5%)	
	Clinical Years	210 (65.8%)	
Obsession with contracting the disease	Male	101 (50.5%)	0.665
	Female	104 (48.4%)	
	Basic Years	40 (41.7%)	
	Clinical Years	165 (51.7%)	
Covid-19 pandemic affected my academic grades negatively	Male	81 (53.3%)	0.106
	Female	74 (42.0%)	
	Basic Years	30 (36.1%)	
	Clinical Years	125 (51.0%)	
The pass/fail system affected GPA negatively	Male	76 (53.5%)	0.495
	Female	76 (46.9%)	
	Basic Years	18 (26.9%)	
	Clinical Years	134 (56.5%)	

N; number, %; percentage, GPA; grade point average.

Also, 257 (63.0%) participants indicated that they sanitized their hands before touching eyes, nose, or mouth. Females (69.7%) and clinical years students (67.6%) were more ($p = 0.015$ and $p = 0.002$, respectively) aware of sanitizing hands before touching the face than males (55.8%) and basic years students (47.3%). Moreover, females ($p = 0.018$) and clinical years students ($p < 0.001$) were more aware of sanitizing medical equipment after examining each patient (Tables 4 and 5).

Psychological stress and Covid-19 pandemic with subgroup analysis of gender and academic years: More than two thirds (70.4%) of students indicated that their mental health was affected in the pandemic, and 270 (65.1%) students implied that they became more anxious or depressed. Nearly half of the students were afraid of contracting the disease during their interaction with patients and other colleagues in the hospital. There was no significant difference among gender and academic year regarding the effect of Covid-19 pandemic on mental health. Students in the clinical years were more afraid of getting the infection than students in the basic years, however this difference

was not statistically significant ($p = 0.084$) (Table 5).

4. Discussion

Since the beginning of the Pandemic, authorities in Jordan imposed drastic measures across the country including lockdowns and curfews. These measures hardly hit various sectors in the kingdom. Schools and universities were significantly affected and the teaching process was conducted almost online.

4.1. Findings and interpretation

Our data suggests that COVID-19 pandemic left a negative impact on academic course, psychological and financial aspects of the medical students' life, especially at the clinical training years' level. Unsatisfactory, shorter, and less informative teaching rounds with no or fewer patients to examine, in addition to diminished motivation and less effective feedback were considered the main underlying factors.

Most of the teaching in Jordanian universities, including clinical medical students, was online. Clinicians used various electronic techniques to deliver their teaching duties. Zoom application and Microsoft teams were the main tools used in teaching. Moreover, social media particularly WhatsApp were used for teaching purposes. Video recordings of real clinical rounds, surgical operations in theatres and emergency and outpatient clinic cases were used and videos were sent to medical students' groups to watch and discuss. The University of Jordan had already blended learning programs in place and they were partially activated. Our students had a fair experience with the online learning well before the pandemic. This helped maintained the teaching process in a reasonably appropriate manner. A multicenter study found that online teaching had enabled the continuation of medical education during these unprecedented times [6].

In a study involving respondents in a medical school in Saudi Arabia [7], 41.8% reported having little or no online teaching/learning experience before the pandemic, and 62.5% preferred blending online and face-to-face instruction. The main challenges were related to communication, student assessment, use of technology tools, online experience, pandemic-related anxiety or stress, time management technophobia. Most of the participants believed that the pandemic boosted their confidence in the online medical education efficiency. In a study involving medical students in Jordan during the pandemic, Zoom was the most used platform. The most important disadvantages were poor technical setup, absence of direct contact and inability to have real clinical access. Most students were not pleased with their experience [8].

4.2. Similarities to other studies

Looking at what literature contains about this issue, one can find that for instance Zaza et al. [9], via their cross-sectional study on Australian medical students, they concluded that the impact of COVID-19 pandemic on mental well-being has led to legitimate concerns by students regarding their studies and progress through the medical course.

In United States, around 71% of public university students indicated increased stress and anxiety due to the COVID-19 outbreak. It was concluded that the long-lasting pandemic situation and onerous measures such as lockdown and stay-at-home orders, the COVID-19 pandemic brings negative impacts on higher education [9]. It was shown that fear and worry about own health and of the loved ones, difficulty in focusing, disruptions to sleeping patterns, diminished social interactions due to physical distancing, and increased concerns on academic performance, all were major players [10].

In their holistic review about socioeconomic implications of COVID-19 pandemic, Nicola et al. [11] reported that the most significant impact is on the postgraduate research community with research into many non-COVID related topics being placed on hold, to allow clinically trained staff who are normally on academic secondments to return to the

frontline and free up staff and resources for 'mission-critical' research.

Additionally, concerns have been raised regarding the number of scientific conferences that have been cancelled or postponed [11].

In one study, around 40% of youth suffered psychological problems. Relation to being less educated, being the enterprise employee, suffering from the Post Traumatic Stress Disorder symptom and using negative coping styles [12].

On the other hand, in October 2020, a field experiment of 458 students at Universidad Autónoma de Madrid (Spain) showed that COVID-19 confinement changed students' learning strategies to a more continuous habit, improving their efficiency, and better scores in students' assessment are expected due to COVID-19 confinement that can be explained by an improvement in their learning performance [13].

4.3. Differences in our study

The majority of our respondents had a significant awareness of hand hygiene and medical equipment sanitization. Jordanian medical students showed expected level of knowledge about the COVID-19 virus and implemented proper strategies to prevent its spread [14].

It is well-known that strategies implicated to fight COVID-19 such as lockdown, factories closure, quarantine and self-isolation policies influenced production, consumption, demand and utilization of products and services which had led to negative bad impacts on the finance & business industry worldwide [11].

In a large-scale questionnaire-based study conducted in China among college medical students with a more than 7 thousand responders, analysis indicated that economic effects, and effects on daily life, as well as delays in academic activities, were positively associated with anxiety symptoms. However, social support was negatively correlated with the level of anxiety [15].

Moreover, living in urban areas, family income stability and living with parents were found as protective factors against anxiety & other psychological impact [15]. Despite that our society in Jordan still holds strong social ties, this feature was not reflected in protection against anxiety and stress because a large proportion of our medical students were international students. Moreover, a significant proportion of the domestic students were living away from their parents in different governorates. There should be strategies to respond positively to students' worries and fears to help them solve these problems in the future [16].

4.4. Strengths and weaknesses (limitations)

This study featured medical students from all medical schools in Jordan. However, our study had several limitations that should be noted. These were small sample size, involving only medical students and not considering the educators' point of view. So, further studies are needed to include students across different colleges to elaborate more about the impact of COVID-19 pandemic and suggested solutions.

Relevance of the findings: implications for clinicians, policy-makers/health care providers and future research.

Our study suggested practical national solutions for these negative impacts and any similar disasters in the future. These include;

1. The availability of hybrid online learning programs that can be converted easily into total online system.
2. Simulation teaching programs for clinical-years students who need practical clinical and surgical sessions should be made available and accessible.
3. Immediate Fund projects to help students cope with their financial stress.
4. There should be psychological/psychiatric help, evaluation and assessment for students who have mental stress and psychological issues related to the crisis.

5. Conclusion

Covid-19 Pandemic negatively affected the academic course of the medical students especially at the clinical training years' level across Jordanian universities. Not only that, but our data also suggested that the COVID-19 pandemic left a negative impact on psychological & mental health of the students, too, rendering them more anxious, depressed, afraid of coming to the hospital and handling patients.

Sources of funding

No funding was obtained for this study.

Author contribution

Naser Al-Husban; study concept and design, writing the paper.

Aysha Alkhayat, Mariam Aljweesri, Reem Alharbi, Zahraa Aljazzaf; data collection, analysis and interpretation.

Nehad Al-Husban, Mohammed S Elmuhtaseb, Khaled Al Oweidat, Nail Obeidat; interpretation, revision and language.

Registration of research studies

1. Name of the registry: [ClinicalTrials.gov](https://www.clinicaltrials.gov).
2. Unique Identifying number or registration ID: NCT04726865.
3. Hyperlink to your specific registration (must be publicly accessible and will be checked): [ClinicalTrials.gov](https://www.clinicaltrials.gov) Protocol Registration and Results System (PRS) Receipt Release Date: January 26, 2021 [ClinicalTrials.gov](https://www.clinicaltrials.gov) ID: NCT04726865.

Guarantor

Dr Naser Al-Husban MD, FRCOG, Associate Professor and Consultant, School of Medicine, The University of Jordan.

Ethical approval

The study was approved by the Institutional Ethics Committee.

Ethical statement

The study obtained approval of the institutional review board at Jordan University hospital. It was also registered at [ClinicalTrials.gov](https://www.clinicaltrials.gov).

Consent forms

Obtained at the beginning of the questionnaire but written consent form not obtained as the data were analysed anonymously. Anonymity and confidentiality of respondents were maintained all through the process.

Data availability

All data are available without restrictions.

Provenance and peer review

Not commissioned, externally peer-reviewed.

Declaration of competing interest

The authors have declared that no competing interests exist. The author(s) received no specific funding for this work.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.amsu.2021.102466>.

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