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### RESEARCH ARTICLE

#### IMPACTS OF CORONAVIRUS (COVID-19) PANDEMIC ON MEDICAL EDUCATION AT THE NORTHERN BORDER UNIVERSITY

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#### Abstract

**Introduction:** The COVID-19 pandemic has affected all aspects of our lives, including education, social relations, and psychological and financial status.

**Objectives:** The study aims to assess the effects of the COVID-19 pandemic on academic performance, hygiene, stress, lifestyle, and financial status among medical students at Northern Border University (NBU), Saudi Arabia.

**Methods:** This cross-sectional study was conducted on medical students at NBU, Arar City. The study collected data on socio-demographic characteristics, academic, hygiene, psychological, lifestyle, and financial impacts of the COVID-19 pandemic among medical students.

**Results:** The study surveyed 332 medical students at the NBU (response rate=86.46%). One-third of students reported deteriorating academic performance during the pandemic. Negative effects of COVID-19 on academic performance were more likely among males, older students, in clinical years, with poor IT skills, and those who had not previously participated in online learning. Over 56% of students reported negative effects on their academic grades and GPA due to the pandemic and over 50% agreed that teachers were not technology-friendly, recorded lectures were better than live lectures, and technical issues interfered with online teaching. Most students reported increased awareness of hygiene and sanitization with the MOH and WHO being the most frequent sources of information (34.94% and 28.92%, respectively).

**Conclusion:** The COVID-19 pandemic has had impacts on medical education at the NBU as regards the academic and clinical skills and physical and psychological health of medical students. This study drew attention to the needs and resources to address challenges faced by medical students during the pandemic.

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### Introduction:-

Since the declaration of the novel coronavirus (COVID-19) pandemic by the World Health Organization in March 2020<sup>1</sup> and in compliance with the curfew and social distancing regulation to prevent the transmission of infection, educational institutes around the world have closed their doors. The way to continue education has been to move from traditional classroom teaching to online teaching and blended teaching that involves face-to-face and online instructions.<sup>2</sup>

Medical education is based on lectures and patient-based education. The social distancing implemented due to the COVID-19 pandemic has prompted a shift to remote e-teaching to continue the educational process. However, the focus on COVID-19 patients makes it difficult to enable bedside teaching opportunities for medical students. In addition, students were unable to complete their clerkships and medical training due to suspended clinical rotations.<sup>3</sup>

The COVID-19 pandemic has not only affected the academic and clinical performance of medical students but also has psychological and financial impacts. Prolonged lockdown and social isolation have increased the problems of stress and anxiety among medical students due to diminished social interaction and increased concerns about academic performance as well as fear and worry about one's health and the health of loved ones.<sup>4</sup> Rational of this study was to address these effects of COVID-19 crisis among medical students at the Northern Border University, Arar, KSA. The study would help to better understand how medical students were impacted and identify challenges during the curfew.

### Aims and Objectives:-

This study aimed to assess the impacts of the COVID-19 pandemic on medical education at Northern Border University. The specific objectives of the study were:

1. To assess the academic impacts of the COVID-19 pandemic among medical students at NBU.
2. To outline the effects of hygiene, stress, and lifestyle of the COVID-19 crisis among medical students.
3. To describe the financial impacts of the COVID-19 quarantine.

### Subjects and Methods:-

#### Subjects and methods

#### Study design:

This is a cross-sectional questionnaire-based study.

#### Study setting:

This study was conducted on medical students at the Northern Border University, Arar, KSA.

#### Study sample:

The target population of this study included all medical students at the Northern Border University during the first semester of the academic year 2022/2023. The minimal sample size (n.=384) was calculated using the following formula:

$$\text{Sample size} = \frac{Z_{1-\alpha/2}^2 P(1-P)}{d^2}$$

Where

$Z_{1-\alpha/2}$  is the standard normal variate at 5% type 1 error ( $P < 0.05$ ); it is 1.96.

P= the expected proportion based on previous studies.

d= the absolute error (0.05)

The expected proportion was considered 50% since there is no previous studies in the Northern Border region, and to maximize the sample size.

### Sampling Method:-

The systematic random sampling technique was used to select study participants from students lists:

### Ethical consideration:

The study was approved by the Local Committee of Bioethics [HAP-09-A-043] at the Northern Border University, decision no. [1/44/H]. Informed consent was obtained from all study participants prior to their enrollment in the study.

**Data collection procedure:**

A self-administered online questionnaire using Google forms was used to collect data during the period from September to October 2022. The questionnaire contains an introductory paragraph that informed participants of the study's aims, the confidentiality of their responses, and the freedom to decline to answer any question or to withdraw from the study altogether.

**Tools for data collection:**

A self-administered structured online questionnaire based on previous studies<sup>3,4</sup> was used to collect data. It consists of four parts.

Part 1: Socio-demographic characteristics of the study participants including gender, age, academic year, place of residence, IT skills, previous online learning, infection with COVID-19, and COVID-19 vaccination.

Part 2: Academic effects of COVID-19 pandemic: This comprises 14 questions about medical education during COVID-19 pandemic as regards its effects on academic grades, lectures and teachers, and clinics and rounds. Students respond to these questions using a score from zero to ten, where <5 was considered as disagree, 5 was considered as neutral, and >5 was considered as agree.<sup>4</sup>

Part 3: Hygiene, psychological stress, lifestyle, and financial effects: Hygienic behaviors are evaluated using five items on sanitization and hygiene behaviors during COVID-19 crisis to which students answer by a score from zero to ten corresponding to disagree to agree.<sup>4</sup> In addition, questions about changes in physical activity, body weight, smoking, hobbies, and relationships during COVID-19 quarantine to which students respond as increased, decreased or neutral. Items on relationships, mental health impacts during COVID-19 quarantine are included.<sup>4</sup>

Part 4: Financial status during COVID-19 quarantine was assessed using four questions to which students respond by a score ranging from zero to ten, corresponding to disagree to agree.<sup>4</sup>

**Statistical analysis**

Descriptive statistics were used to summarize qualitative data as frequency (numbers; n), and percentage, and quantitative data as mean  $\pm$  Standard Deviation (SD) and range. Two-sided P values <0.05 was considered as statistically significant. Suitable univariate tests were used to evaluate the relationships between COVID-19 effects and participants' characteristics. The Chi-square test ( $\chi^2$ ) and the Fisher Exact Test (FET) were used to compare categorical data, as appropriate. The Mann-Whitney test (z) and the Kruskal Wallis test were used to compare quantitative data, as appropriate. The computerized statistical package STATA/SE version 11.2 for Windows (STATA Corporation, College Station, Texas), and MS Excel was used for data entry and analysis.

**Results:-**

The study included 332 participants (response rate=86.46%). Table 1 shows the sociodemographic characteristics of the studied medical students at the Northern Border University. Female students constituted 69.88%, and 60.24% of participants aged 23- 30 years old and 39.76% aged less than 23 years old. Most students (84.34%) were in clinical years (4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup>, and internship years) and 15.66% were in academic years (2<sup>nd</sup> and 3<sup>rd</sup> years). 84.3% of participants were living with their family during the quarantine. 54.2% of participants rated their technical skills as average while 20.5% rated it excellent and 6% poor. 51.8% participated in online learning before COVID-19 pandemic. 34.9% of participants got infected by COVID-19, 92.8% got the COVID-19 vaccine, and 36.1% of participants reported having relatives or friends died from COVID-19 infection.

Figure 1 shows that 15.7% of students reported improvement in their academic performance during the pandemic while 45.8% reported it was neutral, 33.7% getting worse and 4.8% reported they were not studying during the pandemic. The components of online learning during COVID-19 pandemic are shown in Figure 2. Live lectures were the most frequent (54.2%), followed by pre-recorded videos (16.9%), online group discussion (14.5%), online assessments (8.4%), and live Q&A (6%).

**Table 1:-** Sociodemographic characteristics of the studied medical students (n=332).

Parameter		No.	%
Gender	Female	232	69.88

	Male	100	30.12
<b>Age (years)</b>	Less than 23	132	39.76
	23-27	200	60.24
	Mean $\pm$ SD	22.70 $\pm$ 1.93	
	Range	19-27	
<b>Academic year:</b>	2nd year	40	12.05
	3rd year	12	3.61
	4th year	52	15.7
	5th year	44	13.3
	6th year	80	24.1
	Internship	104	31.3
<b>Residence region</b>	Eastern region	4	1.2
	Northern region	300	90.4
	Southern region	16	4.8
	Western region	12	3.6
<b>Live during the quarantine</b>	alone	40	12.0
	with family	280	84.3
	with friends	12	3.6
<b>Rate of IT skills:</b>	Poor	20	6.0
	fair	64	19.3
	average	180	54.2
	Excellent	68	20.5
<b>Participated in online learning before covid-19 pandemic</b>	yes	172	51.8
	no	160	48.2
<b>Infected by COVID-19</b>	yes	116	34.9
	no	216	65.1
<b>Got the COVID-19 vaccine</b>	yes	308	92.8
	no	24	7.2
<b>Relatives or friends died from COVID-19</b>	yes	120	36.1
	no	212	63.9

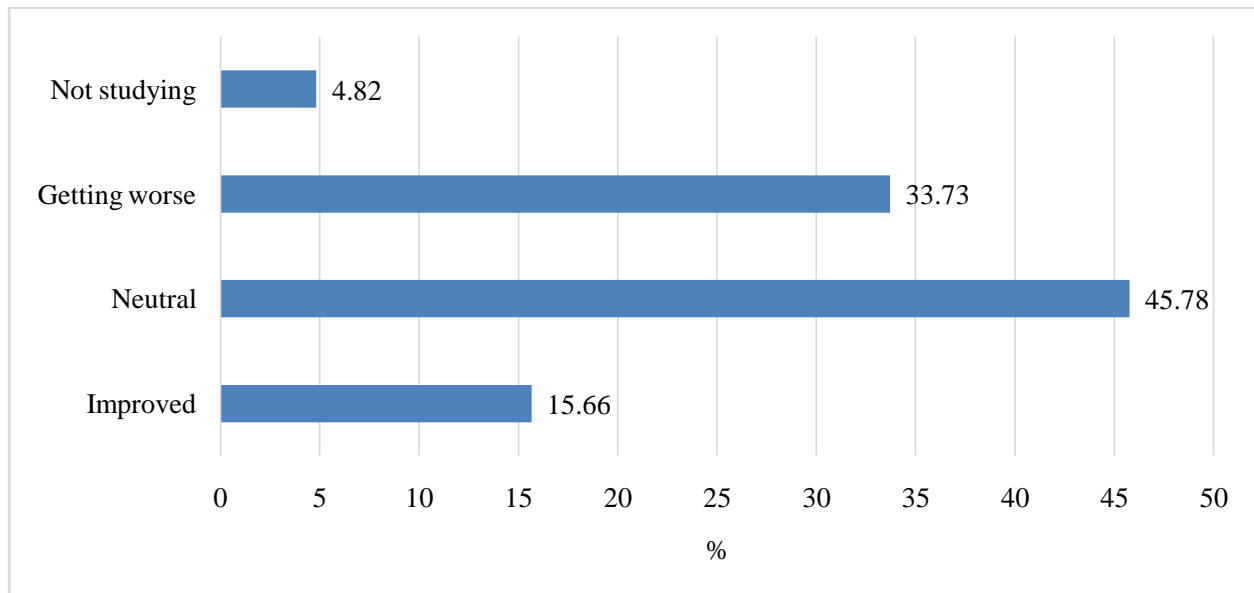


Figure (1):- Academic performance during covid-19 pandemic (n= 332).

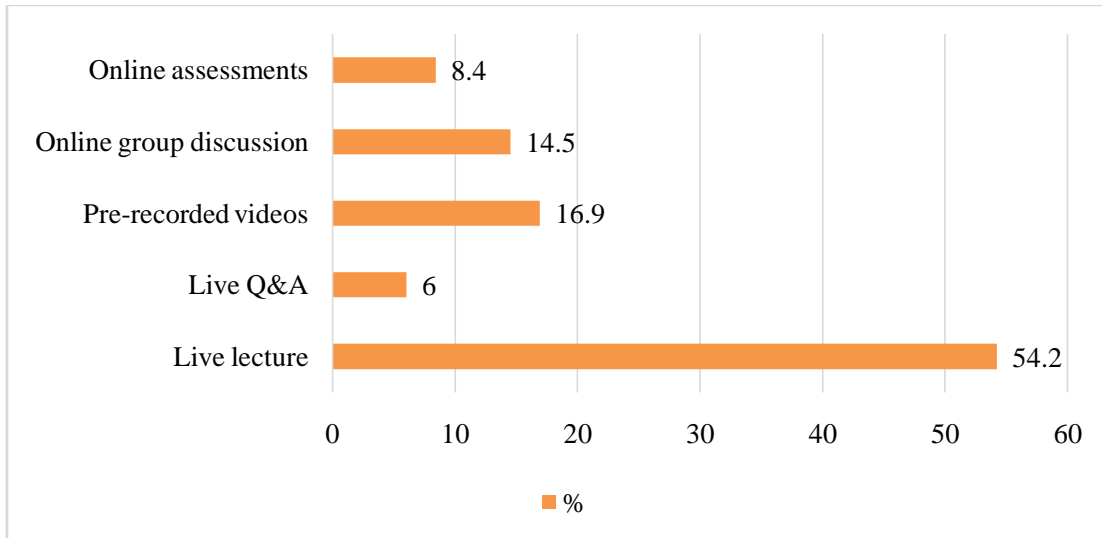


Figure (2):- Components of online learning during covid-19 pandemic (n= 332).

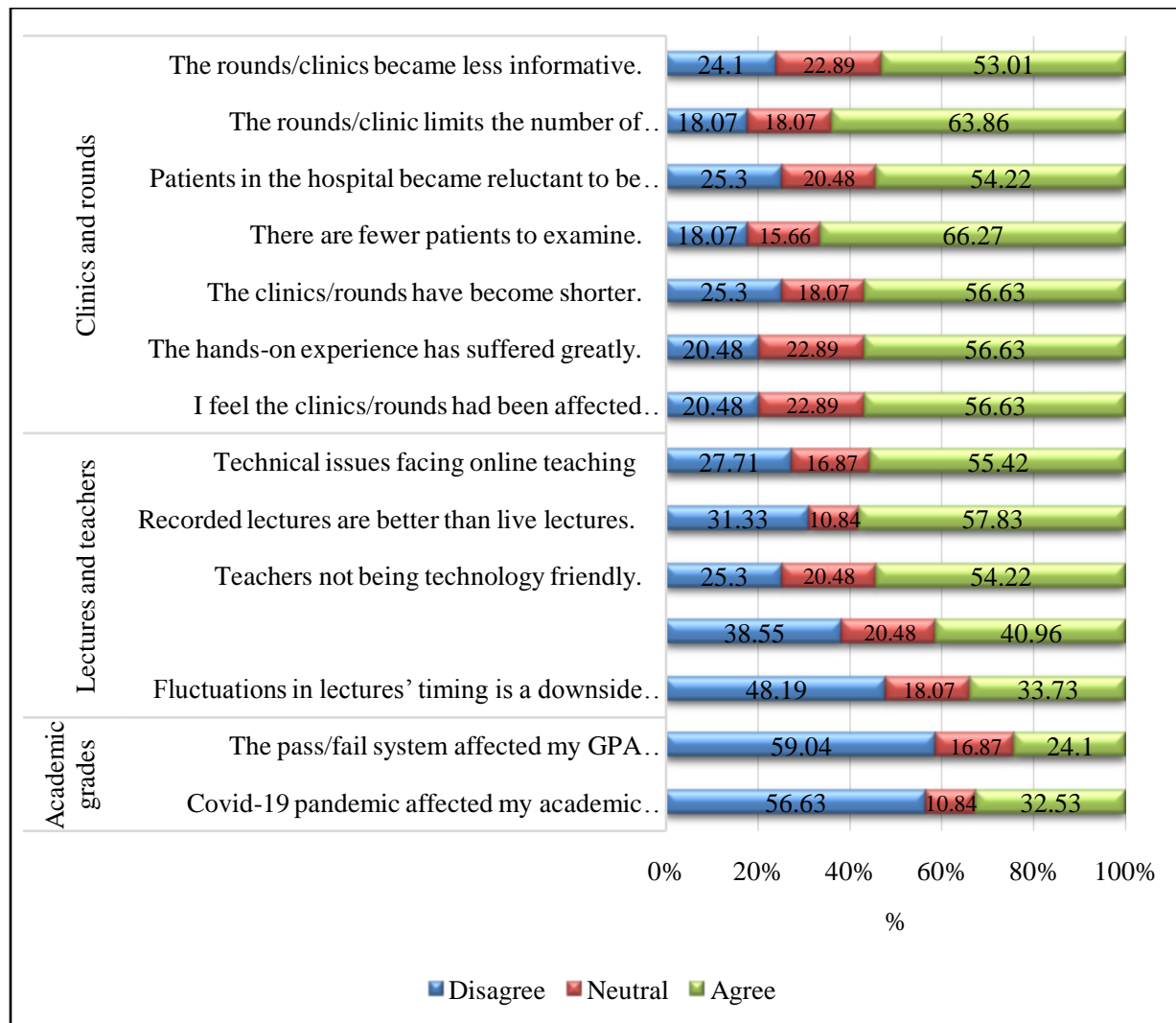


Figure (3):- Academic effects of COVID-19 pandemic among medical students in the NBU (n= 332).

The reported academic effects of COVID-19 pandemic are demonstrated in Figure 3. The academic effects score was  $5.93 \pm 2.11$ . More than 56% of students reported that the pandemic had negative effects on their academic grades and GPA. 48.19% and 38.55% of students disagreed that fluctuations in lectures' timing and limited feedback were drawbacks of online teaching, respectively. >50% agreed that teachers were not technology friendly, recorded lectures are better than live lectures, and technical issues interfered with online teaching. The majority of students agreed that clinics and rounds were negatively affected by the pandemic.

The hygiene and sanitation score was  $6.91 \pm 2.58$ . Figure 4 shows the effects of COVID-19 pandemic on hygiene and sanitation among medical students at NBU. The majority of students reported appropriate handwashing, hand sanitization before touching eye, nose, or mouth, increased awareness to sanitize equipment after examining each patient, helped in raising hygiene awareness of people, and increased patients' awareness of self-hygiene.

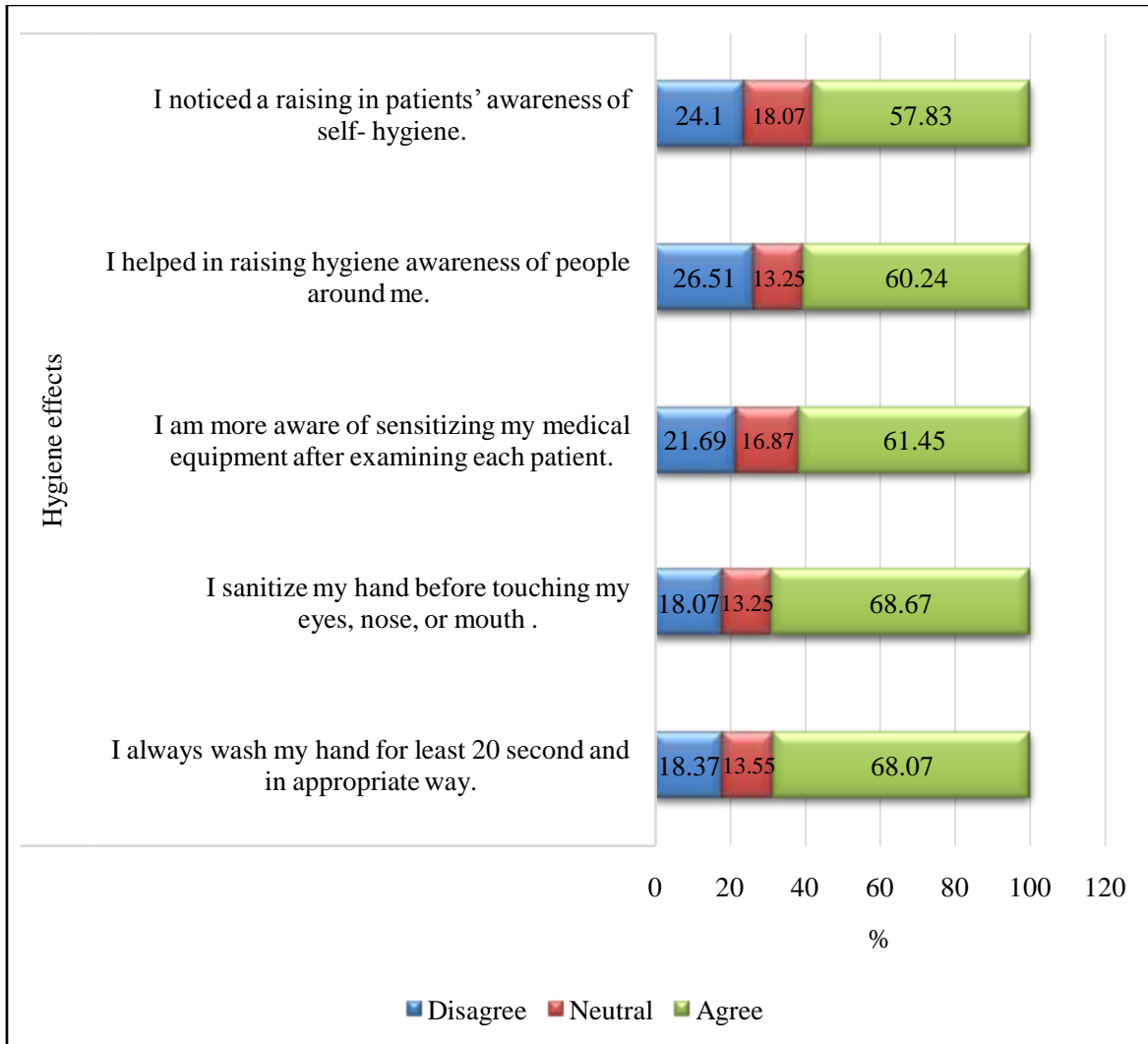


Figure (4):- Effects of COVID-19 pandemic on hygiene and sanitation among medical students in the NBU (n= 332).

The most frequent source of information about sanitization and overall hygiene was the MOH (34.94%), followed by the WHO (28.92%), and social media (19.28%) as shown in Figure 5.

Table 2 shows effects of COVID-19 pandemic on lifestyle and psychological stress among studied medical students. Physical activity was decreased in 45.8% and increased in 14.5% of participants. 33.7% of participants had increased body weight during the quarantine. 13.3% of participants were smokers and 45.45% of them reported increased

smoking during the quarantine. 45.8% of students reported that they learned a new hobby during the quarantine. 34.9% of participants were obsessed with contracting COVID-19 infection.

The financial effects score was 4.21±2.4. Figure 6 shows that more than half of participants disagreed that they used expensive transportation means, couldn't pay living costs, or their household suffered financially because of the COVID-19 pandemic. However, 38.55% reported more thinking in budgeting during the pandemic.

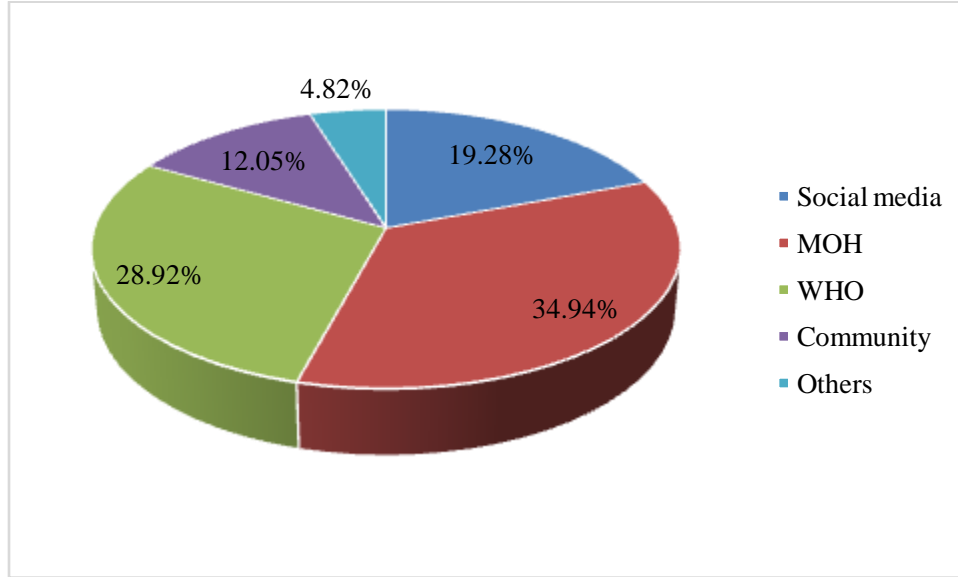


Figure (5):- Source of information about sanitization and overall hygiene among medical students in the NBU (n=332).

Table (2):- Lifestyle and psychological stress during COVID-19 pandemic among medical students at NBU (n=332)

Parameter		No.	Percent
Physical activity during covid-19 quarantine	Increase	48	14.5
	Neutral	132	39.8
	Decreased	152	45.8
Body weight during covid-19 quarantine	Increase	112	33.7
	Neutral	148	44.6
	Decreased	72	21.7
Smoking status	Yes	44	13.3
	No	288	86.7
Cigarette or shisha consumed during quarantine *	Increased	20	45.45
	Neutral	8	18.18
	Decreased	16	36.36
Learn or acquire a new hobby during the COVID-19 quarantine	Yes	152	45.8
	No	256	54.2
Obsessed with contracting the disease	Yes	464	34.9
	No	384	65.1

\*For smoker participants only (n.=44)

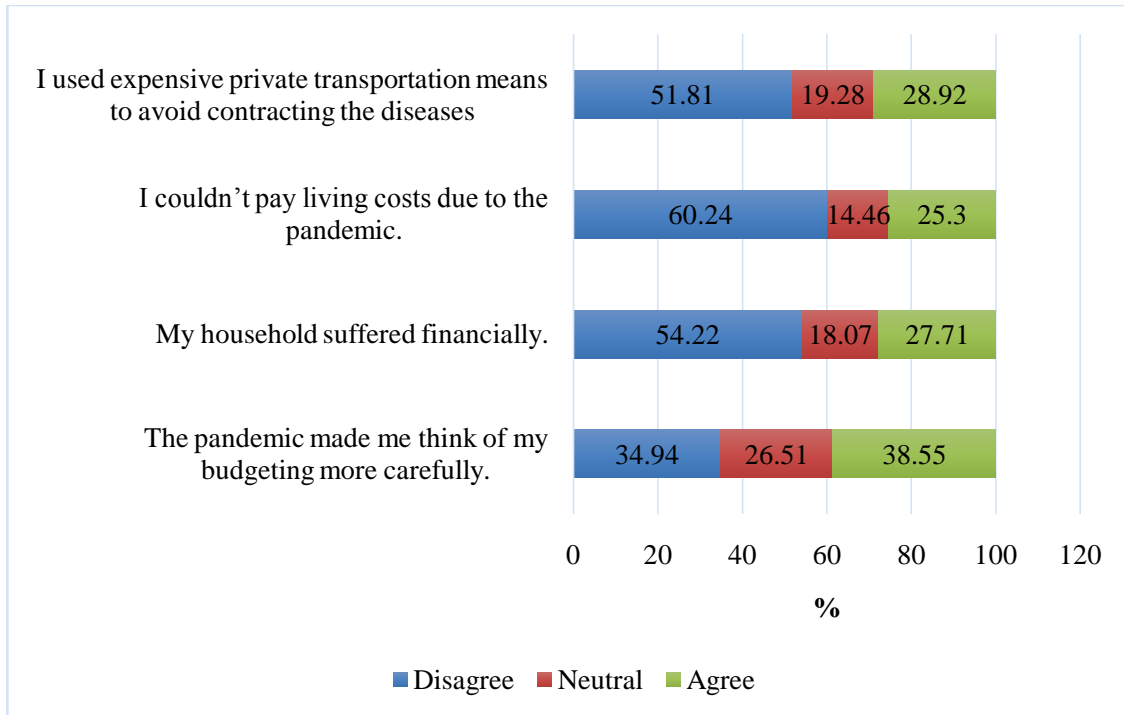


Figure (6):- Financial effects of COVID-19 pandemic among medical students in the NBU (n=332).

The relationships between academic performance and sociodemographic characteristics of medical students in the Northern Border University are shown in Table 3. There were significant differences in academic performance by gender and age distribution of studied students ( $P < 0.001$  and  $P = 0.002$ , respectively). Students who were living with their families reported improved academic performance more frequently (92.3%) while those who were living alone during the quarantine reported getting worse more frequently (17.9%),  $P = 0.003$ . Poor IT skills associated with higher frequency of getting worse academic performance (7.1%) and excellent IT skills associated with higher frequency of improved academic performance during the quarantine (30.8%),  $P < 0.001$ . Students who reported that they participated in online learning before were more likely to report improved academic performance during the pandemic ( $P = 0.007$ ).

Table 4 shows the relationships between scores for academic, hygiene, and financial effects of COVID-19 pandemic and sociodemographic characteristics of participants. Scores of academic and hygiene effects were significantly higher in males, elder students, and those in the clinical years ( $P < 0.001$ ). Academic effects were less frequent in students who participated in online learning before the pandemic ( $P < 0.001$ ). Scores for academic effects were more likely lower in participants who got COVID-19 infection and those who had relatives or friends died from COVID-19 ( $P < 0.001$ ,  $P < 0.01$ , respectively). Hygiene scores were higher among students who got the COVID-19 vaccine compared to those who did not ( $P < 0.001$ ). There were no significant differences in financial scores by sociodemographic characteristics of participants.

**Discussion:-**

The transition to virtual learning imposed by the curfew during the COVID-19 pandemic has been a challenge for medical education in both the preclinical and clinical years. This study provided insight into the specific effects on Northern Border University medical students during the COVID-19 crisis.

Table (3):- Relationships between academic performance during the COVID-19 pandemic and sociodemographic characteristics of medical students in the NBU (n=332).

Parameter	Academic performance during COVID-19 pandemic				X <sup>2</sup>	P
	Improved (n.=52)	Neutral (n.=152)	Getting worse (n.=112)	Not studying (n.=16)		

		No	%	No.	%	No.	%	No	%		
<b>Gender</b>	Female	40	76.9	112	73.7	64	57.1	16	100.0	FET	<0.001
	Male	12	23.1	40	26.3	48	42.9	0	0.0		
<b>Age (years)</b>	<23	16	30.8	68	44.7	36	32.1	12	75.0	14.33	0.002
	23-27	36	69.2	84	55.3	76	67.9	4	25.0		
<b>Academic Year</b>	Pre-clinical	8	15.4	28	18.4	12	10.7	4	25.0	FET	0.22
	Clinical	44	84.6	124	81.6	100	89.3	12	75.0		
<b>Residence region</b>	Eastern region	0	0.0	4	2.6	0	0.0	0	0.0	FET	<0.001
	Northern region	44	84.6	144	94.7	104	92.9	8	50.0		
	Southern region	0	0.0	4	2.6	4	3.6	8	50.0		
	Western region	8	15.4	0	0.0	4	3.6	0	0.0		
<b>Live during the quarantine</b>	alone	4	7.7	16	10.5	20	17.9	0	0.0	FET	0.003
	with family	48	92.3	132	86.8	88	78.6	12	75.0		
	with friends	0	0.0	4	2.6	4	3.6	4	25.0		
<b>Rate of IT skills</b>	Poor	0	0.0	8	5.3	8	7.1	4	25.0	FET	<0.001
	fair	12	23.1	40	26.3	12	10.7	0	0.0		
	average	24	46.1	84	55.3	64	57.1	8	50.0		
	Excellent	16	30.8	20	13.2	28	25.0	4	25.0		
<b>Participated in online learning before COVID-19 pandemic</b>	yes	36	69.2	72	47.4	60	53.6	4	25.0	12.27	0.007
	no	16	30.8	80	52.6	52	46.4	12	75.0		
<b>Infected by COVID-19</b>	yes	20	38.5	48	31.6	40	35.7	8	50.0	2.66	0.45
	no	32	61.5	104	68.4	72	64.3	8	50.0		
<b>Got the COVID-19 vaccine</b>	yes	48	92.3	140	92.1	108	96.4	12	75.0	FET	0.03
	no	4	7.7	12	7.9	4	3.6	4	25.0		
<b>Relatives/ friends died from COVID-19</b>	yes	20	38.5	60	39.5	36	32.1	4	25.0	2.49	0.48
	no	32	61.5	92	60.5	76	67.9	12	75.0		

$\chi^2$ : the Chi-square test; FET: the Fisher Exact Test; statistical significance at  $P < 0.05$

**Table (4):-** Relationships between scores for the academic, hygiene, and financial effects of the COVID-19 pandemic and sociodemographic characteristics of medical students in the NBU (n=332).

Parameter		No.	Scores mean $\pm$ SD		
			Academic effects	Hygiene effects	Financial effects
<b>Gender</b>	Female	232	*** 5.57 $\pm$ 2.08	*** 6.44 $\pm$ 2.70	4.21 $\pm$ 2.29
	Male	100	6.78 $\pm$ 1.93	8.01 $\pm$ 1.89	4.22 $\pm$ 2.64
<b>Age (years)</b>	<23	132	*** 5.31 $\pm$ 1.91	*** 6.04 $\pm$ 2.63	3.98 $\pm$ 2.07
	23-27	200	6.35 $\pm$ 2.14	7.49 $\pm$ 2.39	4.36 $\pm$ 2.58
<b>Academic year:</b>	Pre-clinical	52	*** 4.59 $\pm$ 1.44	*** 5.01 $\pm$ 2.34	3.88 $\pm$ 2.22
	Clinical	280	6.18 $\pm$ 2.12	7.27 $\pm$ 2.47	4.27 $\pm$ 2.43
<b>Residence region</b>	Eastern region	4	6.93 $\pm$ 0	10 $\pm$ 0	3.25 $\pm$ 0

	Northern region	300	6.10±2.06	7.08±2.50	4.3±2.44
	Southern region	16	4.46±0.55	4.5±0.54	3.37±1.33
	Western region	12	3.36±2.48	4.93±3.66	3.5±2.58
<b>Live during the quarantine</b>	Alone	40	6.1±1.39	6.24±2.79	4.55±1.77
	with family	280	5.94±2.20	7.08±2.54	4.12±2.47
	with friends	12	5.28±2.08	5.27±2.02	5.33±2.15
<b>Rate of IT skills:</b>	Poor	20	5.57±1.24	5.4±1.80	4.4±3.37
	fair	64	6.05±1.59	7.39±2.10	3.95±2.02
	average	180	5.97±2.28	6.75±2.57	4.42±2.37
	Excellent	68	5.84±2.29	7.35±3.01	3.87±2.43
<b>Participated in online learning before covid-19 pandemic</b>	yes	172	*** 5.55±2.41	6.74±2.89	4.18±2.37
	no	160	6.35±1.64	7.10±2.19	4.25±2.42
<b>Infected by COVID-19</b>	yes	116	*** 5.41±2.03	6.63±2.77	4.08±2.27
	no	216	6.22±2.10	7.07±2.47	4.29±2.46
<b>Got the COVID-19 vaccine</b>	yes	308	5.97±2.13	*** 7.11±2.53	4.21±2.42
	no	24	5.39±1.81	4.47±1.99	4.29±2.13
<b>Relatives or friends died from COVID-19</b>	yes	120	** 5.52±1.72	6.65±2.47	4.26±2.12
	no	212	6.17±2.27	7.07±2.64	4.19±2.54

The Mann-Whitney test and the Kruskal Wallis test were used for comparisons as appropriate; \*: P<0.05, \*\*: P<0.01; \*\*\*: P<0.001

During the curfew, the Blackboard, and the Zoom applications were the most frequent tools used in teaching at the Northern Border University. In addition, social media such as WhatsApp has been used in the educational process and communication between tutors and students. Such technological tools allowed the continuation of medical education under strict regulation to control the pandemic.<sup>5</sup>

About three-fourths of studied students reported average to excellent IT skills and >50% participated in online learning before the pandemic. Similar results were recorded at Elm University, Riyadh.<sup>7</sup> Along with this, about two-thirds of Saudi medical students reported intermediate to advanced online learning experiences before the COVID-19 pandemic.<sup>6</sup> This helped enable the virtual transition during the COVID-19 crisis.

It is worth noting that live lectures were the most used component of online learning, suggesting that they may be more effective at promoting student learning than other methods such as pre-recorded videos or online group discussions. Live lectures and quizzes were the most commonly reported by students of the health faculties of Elm University.<sup>7</sup>

One key finding of the present study was that the majority of participants reported neutral academic performance during the pandemic, with 15.66% reporting improved academic performance particularly among those with at least fair IT skills and previously participated in online learning before the COVID-19 pandemic. While 33.73% reported worsening their academic performance during the pandemic. Online classes were widely used in medical colleges in Pakistan; however, the majority of students were dissatisfied with this method of teaching finding it ineffective and losing interest in studying.<sup>8</sup> This suggests that the transition to online learning was not universally successful, with some students able to adapt well while others struggled. This may be due to a variety of factors, including access to technology, personal circumstances, and the effectiveness of online teaching methods.

Based on the data reported in this study, it appears that the COVID-19 pandemic had a significant impact on medical education at the Northern Border University in Saudi Arabia. In terms of academic quality, the mean academic score was 5.93±2.11 with most students reporting that the pandemic had negative effects on their academic grades and GPA. The impacts of the COVID-19 crisis on academic aspects were more recorded among elder male students in the clinical years who did not participate in online learning before the pandemic. More academic impacts were

recorded by Husban et al ( $7.4 \pm 1.6$ ).<sup>4</sup> The lower academic scores at the Northern Border University can be due to the pre-existing platform (Blackboard), which made the online transition easier.<sup>9</sup>

More than half of the students in our study preferred recorded lectures to live lectures, agreed that teachers were not technology friendly and that technical issues interfered with online teaching. In addition, the fluctuations in lecture timing and limited personalized feedback in online teaching were also identified as downsides by a significant number of participants. These findings were in line with results reported in Jordan.<sup>4</sup> Another study in Jordan found that poor quality of teaching and poor interaction were the most frequent disadvantages of online teaching. Moreover, about one-fourth of the students were satisfied with the distance learning experience, especially those who had previous experience with online learning. The teacher's active role and the inclusion of multimedia increased student satisfaction.<sup>10</sup> In a study in Pakistani medical colleges, most students reported that the COVID-19 pandemic had impacted their study duration and increased time wastage, and they were anxious about their graduation exam because of the pandemic.<sup>8</sup>

The pandemic also had an impact on the clinical training of the participants. Most students in the present study agreed that clinics and rounds were negatively affected by the pandemic with shorter sessions and fewer patients to examine being identified as issues. A significant number of participants also reported that patients were less cooperative and that the rounds and clinics became less informative. Similarly, clinical rounds were the most frequently affected by the pandemic among Jordanian medical students where >70% reported unsatisfactory clinical rounds with fluctuation in lectures' timing, and about two-thirds reported shorter rounds with fewer patients to examine.<sup>4</sup> Over 50% of medical students in Libya disagreed that e-learning could be used for clinical teaching.<sup>3</sup> Clinical rotations were also severely affected as indicated by two-thirds of medical students.<sup>8</sup> Objective Structured Clinical Examinations (OSCEs) for 38.4% of final-year medical students in the UK were canceled, and 18.7% had simulated patients instead.<sup>11</sup> German medical students also reported worrying about minimal social relationships, interaction with teachers, clinical training, and exams during the COVID-19 pandemic.<sup>9</sup>

However, a study in Spain reported that the COVID-19 quarantine made students' learning strategies more efficient with better academic performance and better grades.<sup>12</sup> Moreover, online teaching has been proposed as a promising solution for the continuation of medical education in a problematic situation such as the COVID-19 crisis.<sup>10</sup> In addition, the positive attitude of medical students was recorded following COVID-19 virtual bedside rounds using a videoconferencing application.<sup>13</sup>

The mean hygiene and sanitation score was  $6.91 \pm 2.58$ . The majority of students reported increased awareness of hygiene and sanitization during the pandemic, particularly among males in clinical years and those who got the COVID-19 vaccine. The most frequent source of information about sanitization and overall hygiene was the MOH (34.94%), followed by the WHO (28.92%), and social media (19.28%). A comparable score was reported among Jordanian medical students, however, the WHO, social media, and the surrounding community were the most frequent sources of information regarding hygiene and sanitization (41.9%, 41.4%, and 16.1%, respectively).<sup>4</sup>

Physical activity was decreased in 45.8% of the study participants and about one-third reported increased body weight during the quarantine. 13.3% of participants were smokers and 45.45% of them reported increased smoking during the quarantine. 45.8% of students reported that they learned a new hobby during the quarantine. 34.9% of participants were obsessed with contracting COVID-19 infection. Psychological impacts of the COVID-19 pandemic have also been reported by a significant number of medical students due to negative news of the pandemic, fear of getting sick, fear of transmitting the disease to relatives, and losing loved ones.<sup>8</sup> Similarly, 58% and 29.5% of German medical students rated their feeling of getting infected with COVID-19, and fear of being infected as average, respectively.<sup>9</sup> In agreement, the majority of medical students reported that their mental health was impacted by the pandemic and become more anxious, depressed, and afraid of contracting infection.<sup>4</sup> Correspondingly, prolonged stay-at-home measures and social isolation during the pandemic have been associated with increased stress and anxiety, disturbed social relations, fear and worry about one's health and loved ones, and disturbed sleeping habits.<sup>14</sup> This highlights the importance of addressing mental health concerns for medical students during conditions of disruption and isolation such as the pandemic.

The negative effects of the COVID-19 pandemic on the economy are evident around the world in terms of reduced production, consumption, demand, and use of goods and services.<sup>15</sup> In our study, the mean financial effects score was  $4.21 \pm 2.4$ , which was lower than that recorded in Jordan ( $5.7 \pm 2.5$ ) with 53% of medical students facing financial

problems due to the pandemic and 34% being unable to pay the university fees.<sup>4</sup> In the present study, most students did not experience financial problems and about one-third reported considering budgeting during the pandemic. This may be due to the higher living standard in Saudi Arabia. In addition, studying in governmental universities such as Northern Border University is free of charge. Besides, the massive efforts for the prevention and control of COVID-19 infection have been offered free of charge to all residents of the Kingdom.

Overall, these results suggest that the COVID-19 pandemic had significant negative impacts on medical education at the Northern Border University. It is important for universities and healthcare organizations to consider the unique challenges faced by medical students during this time and to provide support and resources to help them navigate these challenges. This may include providing access to technology, mental health resources, and financial assistance, as well as adapting teaching methods to better support online learning.

The integration of technology in medical education has been found to enhance students' self-learning, time management, capability to collaborate and become more adaptable. This would enable better interprofessional collaboration within the era of telemedicine in the future. Thus, online learning was recommended to be continued after the pandemic.<sup>7:16</sup> Moreover, online learning has been found useful to maintain medical education for both students and residents during the pandemic with fewer number of residents in hospitals thus limiting the transmission of infection, in addition to the innovation of new teaching modalities such as the flipped classroom.<sup>17</sup> However, the growing use of online curricula posed difficulties for teaching and testing clinical medicine skills like physical examination, patient interactions, and laboratory dissections.

This study is the first to throw light on the effects of COVID-19 pandemic on medical students of the Northern Border University. The main limitations of this study were the small sample size, only medical students were included, and not the educators.

### **Conclusion:-**

COVID-19 pandemic has impacted medical education at the Northern Border University as regards the academic and clinical skills, physical and psychological health of medical students. Strong recommendations on medical students' ongoing education growth during crises and potential pandemics are required. All medical schools should maximize their use of online learning and assessment tools.

Future research should focus on overcoming the obstacles and difficulties medical schools face when delivering instruction during a pandemic. Future studies should also determine the advantages of the modifications to medical education brought about by COVID-19. This will allow the future organisation of medical education to integrate the improvements brought about by these developments.

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### **Authors' contributions**

All authors contributed equally to this work.

### **Conflict of interest**

The authors declare no conflicts of interest with respect to the authorship and/or publication of this article.

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### **Availability of data and materials**

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**References:-**

1. Cucinotta D, Vanelli M. WHO declares COVID-19 a pandemic. *Acta Biomed* 2020; 91(1):157-160.DOI:10.23750/abm.v91i1.9397
2. Lemay DJ, Bazalais P, Doleck T. Transition to online learning during the COVID-19 pandemic. *Computers in Human Behavior Reports* 2021; 4:100130.
3. Alsoufi A, Alsuyihili A, Msherghi A, Elhadi A, Atiyah H, Ashini A et al. Impact of the COVID-19 pandemic on medical education: Medical students' knowledge, attitudes, and practices regarding electronic learning. *PloS one* 2020; 15(11):e0242905.
4. AL-Husban N, Alkhayat A, Aljweesri M, Alharbi R, Aljazzaf Z, Al-Husban N et al. Effects of COVID-19 pandemic on medical students in Jordanian universities: A multi-center cross-sectional study. *Annals of Medicine and Surgery* 2021; 67:102466.
5. Dost S, Hossain A, Shehab M, Abdelwahed A, Al-Nusair L. Perceptions of medical students towards online teaching during the COVID-19 pandemic: a national cross-sectional survey of 2721 UK medical students. *BMJ Open* 2020; 10(11):e042378.
6. Rajab MH, Gazal AM, Alkattan K. Challenges to online medical education during the COVID-19 pandemic. *Cureus* 2020; 12(7).
7. Khashaba A, Albreiket A, Elghazali A, Alkhouja A, Baghareeb S. Students' Perceptions towards the Experience, Quality, Challenges and Effectiveness of Online Teaching-Learning during Covid-19 Pandemic in Riyadh Elm University, Saudi Arabia. *Mymensingh medical journal : MMJ* 2022; 31:242-251.
8. Aziz N, Waseem M, Fatima A, Anwar A, Khalid F, Asghar T. IMPACT OF COVID-19 ON EDUCATION OF UNDERGRADUATE MEDICAL STUDENTS OF PAKISTAN. *Journal of University Medical & Dental College* 2020; 11(4):7-15.
9. Festl-Wietek T, Loeffler T, Erschens R, Zipfel S, Herrmann-Werner A. Medical education in times of COVID-19: German students' expectations - A cross-sectional study. *PloS one* 2020; 15.
10. Al-Balas M, Al-Balas H, Jaber H, Obeidat K, Al-Balas H, Aborajooch E et al. Distance learning in clinical medical education amid COVID-19 pandemic in Jordan: Current situation, challenges, and perspectives. *BMC Medical Education* 2020; 20.
11. Choi B, Jegatheeswaran L, Minocha A, Alhilani M, Nakhoul M, Mutengesa E. The impact of the COVID-19 pandemic on final year medical students in the United Kingdom: a national survey. *BMC Medical Education* 2020; 20(1):206.
12. Gonzalez T, De La Rubia MaA, Hincz KP, Comas-Lopez M, Subirats L, Fort S et al. Influence of COVID-19 confinement on students' performance in higher education. *PloS one* 2020; 15(10):e0239490.
13. Hofmann H, Harding C, Youm J, Wiechmann W. Virtual Bedside Teaching Rounds on Patients With COVID-19. *Med Educ* 2020; 54.
14. Son C, Hegde S, Smith A, Wang X, Sasangohar F. Effects of COVID-19 on College Students' Mental Health in the United States: Interview Survey Study. *J Med Internet Res* 2020; 22(9):e21279.
15. Nicola M, Alsafi Z, Sohrabi C, Kerwan A, Al-Jabir A, Iosifidis C et al. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery* 2020; 78:185-193.
16. Theoret C, Ming X. Our education, our concerns: The impact on medical student education of COVID-19. *Med Educ* 2020; 54(7):591-592.DOI:<https://doi.org/10.1111/medu.14181>
17. Giordano L, Cipollaro L, Migliorini F, Maffulli N. Impact of Covid-19 on undergraduate and residency training. *The Surgeon* 2021; 19(5):e199-e206.