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Neurosurgery Residents' Perspective on COVID-19: Knowledge, Readiness, and Impact of this Pandemic

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■ **BACKGROUND:** The novel coronavirus disease (COVID-19) is a life-threatening illness, which represents a challenge to all health care workers. Neurosurgeons worldwide are affected in different ways.

■ **OBJECTIVE:** This is the first study regarding the readiness of neurosurgery residents for the COVID-19 pandemic and its impact. The aim is to identify the level of knowledge and readiness and the impact of this virus among neurosurgery residents in different programs.

■ **METHODS:** A cross-sectional analysis was performed in which 52 neurosurgery residents from different centers were selected to complete a questionnaire-based survey. The questionnaire comprised 3 sections and 27 questions that ranged from knowledge to impact of the pandemic on various features.

■ **RESULTS:** The median knowledge score was 4 out of 5. The proportion of participants with a satisfactory level of knowledge was 60%. There was a statistically significant difference between the knowledge score and location of the program. Around 48% of the neurosurgery residents dealt directly with patients with COVID-19. Receiving a session about personal protective equipment was reported by 57.7%. Neurosurgery training at the hospital was affected. About 90% believed that this pandemic had influenced their mental health.

■ **CONCLUSIONS:** Neurosurgery residents have a relatively good knowledge about COVID-19. The location of the program was associated with knowledge level. Most

participants did not receive sufficient training about personal protective equipment. Almost all responders agreed that their training at the hospital had been affected. Further studies are needed to study the impact of this pandemic on neurosurgery residents.

INTRODUCTION

The novel coronavirus disease (COVID-19) is a respiratory tract viral infection, caused by the newly emergent severe acute respiratory syndrome coronavirus (SARS-COV-2).^{1,2} It is a life-threatening viral illness, which represents a challenge to all health care workers worldwide. The World Health Organization reports that this viral infection confers a 3%–4% crude mortality.³ This pandemic has affected everyone in all aspects of daily life, especially in health care.

The quality of residency training has been negatively influenced as a result of the recent pandemic. As the number of individuals infected with this virus rapidly increases, neurosurgeons from different nations are significantly affected in multiple ways.⁴⁻⁷ Neurosurgery residents face a major challenge, especially those who work in hospitals with a high number of patients with COVID-19. In addition, some residents are fully responsible for patients with this infection. The strategies to increase the regional intensive care unit (ICU) allowance included the reduction of all surgical activities, starting with elective and also including some urgent cases.⁶ Most neurosurgical centers have postponed their elective surgeries because of the burden of this infection.^{4,5,8,9} Furthermore, several programs have reduced the number of residents by 50% of normal, thus keeping the remainder of the

Key words

- Coronavirus (COVID-19)
- Impact
- Knowledge
- Neurosurgery residents
- Practice

Abbreviations and Acronyms

- COVID-19:** Coronavirus disease 2019
GCC: Gulf Cooperation Council
ICU: Intensive care unit
PPE: Personal protective equipment

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residents at home.⁷ Almost all neurosurgery programs worldwide have changed their academic meetings to online communication in an attempt to reduce physical contact.

To our best knowledge, this is the first study regarding the readiness of neurosurgery residents for the COVID-19 pandemic and the impact it has on their training. The aim of this study is to identify the level of knowledge, readiness, and practices, as well as the impact of this virus among neurosurgery residents in various neurosurgical programs.

METHODS

This cross-sectional study involves the assessment of neurosurgery residents through a questionnaire-based survey. The study was conducted during the pandemic, from April 14 until April 28, 2020.

The sample size “n” is represented by a total of 52 respondents from different neurosurgical programs. The respondents completed the survey (**Appendix A**) on awareness, knowledge, practices, and safety measures about COVID-19. The questionnaire was mainly adapted from the interim guidance and information for health care workers, published by the U.S. Centers for Disease Control and Prevention.¹⁰ Several editorial studies published recently about the impact of the virus on neurosurgery residents was also used to create the questionnaire.^{5,7,8} The target population consists of approximately 300 residents, comprising neurosurgery residents from various neurosurgical centers that we chose. A representative sample from Canada, the United States, Kuwait, Saudi Arabia, Serbia, and Italy were selected. We divided the regions into North America, which includes Canada and the United States, and Saudi Arabia and Kuwait represent the programs in the Arabian Gulf Cooperation Council (GCC) countries. Regarding the European programs, we contacted residents from Serbia and Italy. Residents from different centers were selected from 3 different regions, with a similar number of participants from each region. Moreover, we communicated with senior neurosurgeons from these regions, and they provided us with lists of residents with their contact details, from which we selected randomly. Therefore, our sampling procedure comprised random selection of participants. In addition, each resident was reached in person via a direct telephone call or a text message to restrict the data to our inclusion criteria, which involved only neurosurgical residents. Moreover, this method of direct contact facilitated a high response rate. All neurosurgeons who had finished their training or were above the sixth year of the program were excluded from our data.

Informed consent was obtained from each participant. The study objectives were explained to the residents. They were also assured regarding confidentiality of the collected information and that they were free to decline participation in the study. One participant who refused to complete the survey was excluded. The questionnaire consisted of 3 sections and 27 questions. The first section (8 items) involves the baseline information: gender, age, location of the program, year of training, and current health condition. The next section (13 items) contains inquiries about basic biological and microbiological knowledge of the virus¹¹⁻¹³ and hand hygiene, as well as personal protective equipment

(PPE).¹⁰ In addition, we evaluated whether the residents received any formal training in hand hygiene, PPE, and N-95 mask handling. The final section (6 items) focuses on the impact of this pandemic on the resident in terms of neurosurgical training, studying, and mental health, as well as whether their social life was affected or not.^{5,7,8}

A convenient sampling method was used for data collection, and the distribution of qualitative responses was presented as

Table 1. Descriptive Analysis of the Neurosurgery Residents in our Sample (n = 52)

Characteristic	n	%
Gender		
Male	38	73.1
Female	14	26.9
Age		
<30 years	36	69.2
≥30 years	16	30.8
Location of the residency program		
Canada	19	36.5
United States	5	9.6
Kuwait	5	9.6
Saudi Arabia	12	23.1
European country	11	21.1
Year of residency training		
1	14	26.9
2	6	11.5
3	12	23.1
4	9	17.3
5	8	15.4
6	3	5.8
Neurosurgery residents under stay home order		
Yes	9	17.3
No	43	82.7
Neurosurgery residents under quarantine or isolation		
Yes	11	21.2
No	41	78.8
Test for coronavirus		
Positive	1	1.9
Negative	19	36.5
Not tested	32	61.5
Have you dealt with COVID-19 patients?		
Yes	25	48.1
No	27	51.9
Frequencies may not add to the total because of missing values.		

Table 2. (A) Frequencies of Correct Responses to the 5 Items in the Knowledge Section about COVID-19 Pandemic and About Hand Hygiene in Relation to the Location of the Program. (B) Infection Control Training According to the Location of the Program

Item	Location of Program, n (%)						P Value†
	All (n=52), n (%)	Canada (n = 19)	United States (n = 5)	Kuwait (n = 5)	Kingdom of Saudi Arabia (n = 12)	Europe* (n = 11)	
A) Correct response to the knowledge items							
The type of the virus	40 (76.9)	14 (73.7)	3 (60)	3 (60)	9 (75)	11 (100)	0.053
The main mode of transmission	47 (90.4)	16 (84.2)	4 (80)	5 (100)	12 (100)	1 (9.1)	0.514
The most common 2 symptoms	45 (86.5)	17 (89.5)	4 (80)	3 (60)	12 (100)	9 (81.8)	0.046
The most accurate estimated incubation period	21 (40.4)	6 (31.6)	4 (80)	2 (40)	4 (41.7)	5 (45.5)	0.002
The preferred hand hygiene method in the health care settings	27 (51.9)	16 (84.2)	3 (60)	0 (0)	7 (58.3)	1 (9.1)	0.003
B) Infection control training							
Received any formal training for hand hygiene in the last 2 years (yes)	41 (78.8)	18 (94.7)	4 (80)	2 (40)	9 (75)	8 (72.7)	0.101
Received formal training on donning and doffing of personal protective equipment before this pandemic (yes)	30 (57.7)	17 (89.5)	3 (60)	2 (40)	4 (33.3)	4 (36.4)	0.009
Aware of the correct size of N-95 mask that fits you before this pandemic (yes)	26 (50)	17 (89.5)	2 (40)	1 (20)	5 (41.7)	1 (9.1)	<0.001
Aware of how to correctly obtain the nasopharyngeal swab sample (yes)	26 (50)	14 (73.7)	4 (80)	1 (20)	3 (25)	4 (36.4)	0.020
*European countries in our sample.							
†P values were generated using Pearson's χ^2 test (bold values with ≤ 0.05 are statistically significant).							

frequency and percentages. Subgroups were classified on the basis of gender, age, location of the program, and year of residency training. SPSS version 23 (IBM Corp., Armonk, New York, USA) was used for data entry and analysis. First, univariate analysis was conducted, and qualitative variables were described by frequency and percentage. The quantitative variable (total knowledge score) was calculated by adding the points for the 5 knowledge items (each item equals 1 point). This variable, with a nonnormal frequency distribution, was summarized by a median and interquartile range. We determined that the cutoff of the satisfactory knowledge level is a total knowledge score \geq median. Also, a logistic regression model was used to identify the determinants of low knowledge level. At that point, a P value ≤ 0.05 was used as the cutoff level for statistical significance. Pearson's χ^2 test was used to assess the association between the qualitative variables. A Mann-Whitney U test was used to compare 2 groups with a non-normal frequency distribution, and a Kruskal-Wallis 1-way analysis of variance test was used to compare more than 2 groups. We tested the association of our questions in relation to age, gender, location of the program, and year of residency training.

RESULTS

In the present cross-sectional sample survey, 53 neurosurgery residents attending different centers worldwide were contacted directly from the 6 countries mentioned earlier. Of these participants, 52 returned a completed self-administered questionnaire, and hence, the analysis was based on this number (response rate 98.1%).

Table 1 shows the descriptive analysis of self-reported baseline information and the health status of the residents regarding COVID-19 virus. Most participants were male (73.1%). Concerning age, 69.2% were younger than 30 years and 30.8% were aged 30 years or older. Regarding the location of the neurosurgery program, the percentage of residents representing each country in our sample was as follows: Canada, 36.5%; the United States, 9.6%; Kuwait, 9.6%; Saudi Arabia, 23.1%; and the European countries (Italy and Serbia), 21.1%. The frequency of participants from each

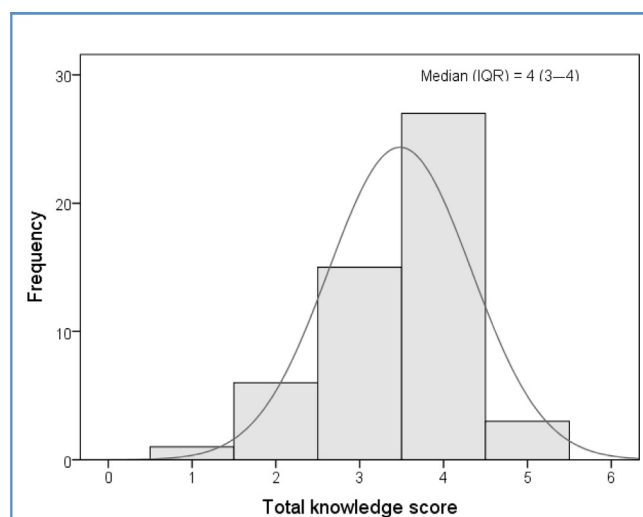


Figure 1. Frequency distribution of the total knowledge score among the neurosurgery residents in our sample. IQR, interquartile range.

year of residency (R) training were R1, 26.9; R2, 11.5; R3, 23.1; R4, 17.3; R5, 15.4%, and R6, 5.8%. Besides, Table 1 also shows the situation of residents in terms of this pandemic: 17.3% were under stay home order by their institution or the government; however, 82.7% were resuming their work at the hospital. In addition, according to our results, 21.2% of the neurosurgery residents were under quarantine or isolation. From our sample, only 1 resident from Europe tested positive for COVID-19. Furthermore, about 36.5% were negative, and the remaining 61.5%, who represent the majority, were not tested for the infection. Almost half of the responders (48.1%) dealt directly with patients with COVID-19, whereas the rest did not.

Table 2A shows the frequency of correct responses to the 5 items of the knowledge score about the virus and the safety measures in relation to the location of the program. The percentage of residents who answered the questions correctly was as follows: 76.9% knew the virus type, 90.4% knew the main mode of transmission, and 86.5% recognized the most common symptoms. The estimation of the incubation period of this virus was answered most accurately by only 40.4% of participants. Concerning the preferred hand hygiene method in the health care settings, unexpectedly, only 51.9% knew the correct answer.

Table 3. Association of Total Knowledge Score About COVID-19 Pandemic with Baseline Information of the Participants

Characteristic	Knowledge Score (out of 5 Points), Median (Range)	P Value
Gender		0.114
Male	4 (3)	
Female	3 (3)	
Age		0.303
<30 years	4 (4)	
≥ 30 years	3.5 (2)	
Year of residency training*		0.538
1 and 2	4 (4)	
3 and 4	4 (3)	
5 and 6	4 (2)	
Location of the neurosurgery program*		0.049
North America	4 (4)	
GCC countries†	4 (2)	
Europe	3 (2)	
Dealing with patients with COVID-19		0.128
Yes	4 (3)	
No	4 (4)	

P values were generated using the Mann-Whitney U test for comparing 2 groups. Median score = 4.

**P* values were generated using Kruskal-Wallis 1-way analysis of variance test for comparing >2 groups (bold values with ≤ 0.05 are statistically significant).

†Arabian Gulf Cooperation Council countries (Kuwait and Saudi Arabia).

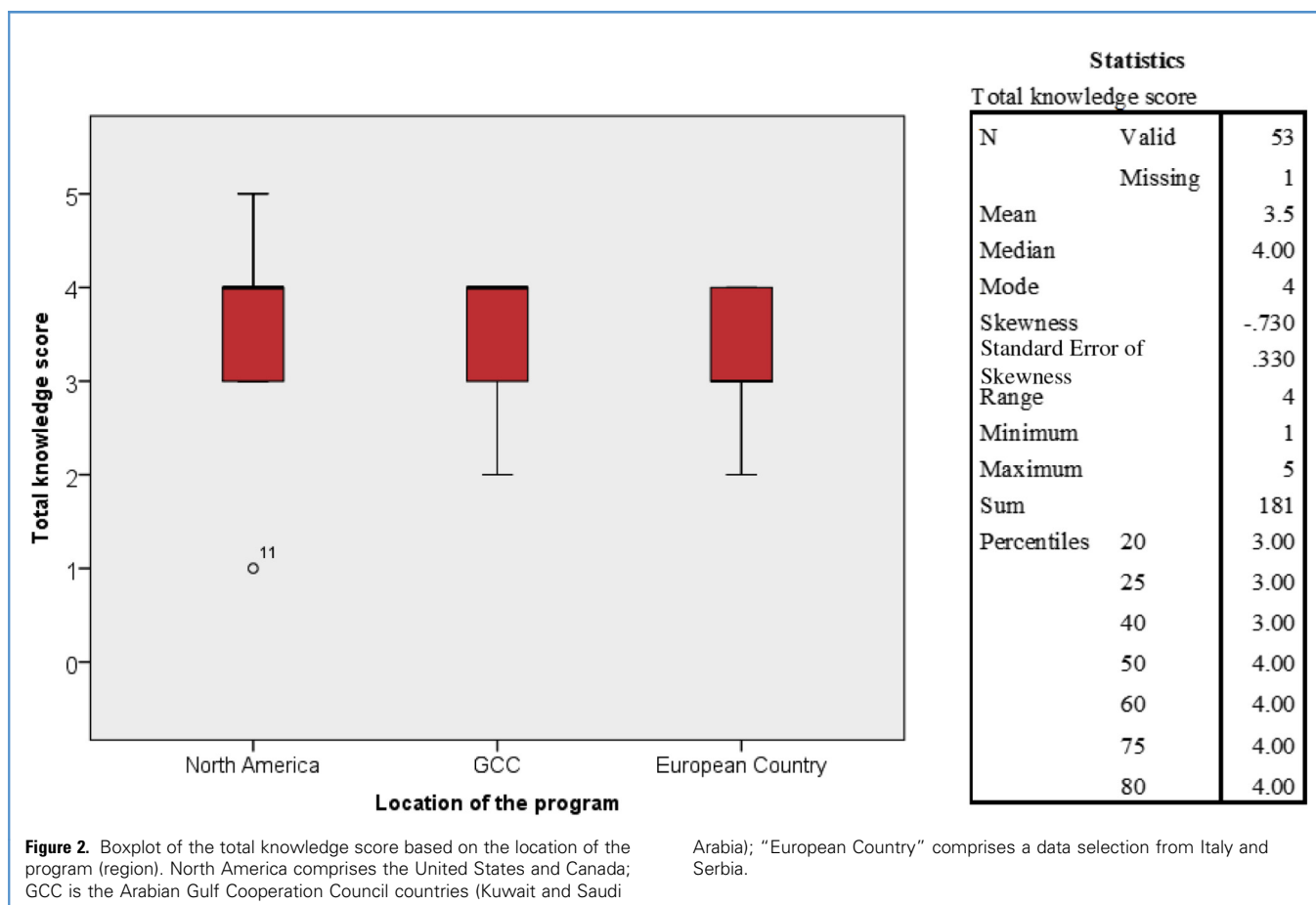


Table 2A also shows the responses according to each location of the program in detail, and some of the items showed statistically significant results. **Table 2B** shows the responses about training in safety measures, safe practices, and strategies of infection control. As expected, receiving formal hand hygiene training was reported by 78.8%. In addition, receiving a formal session about

the correct sequence of donning and doffing PPE was reported by 57.7%. Only 50% of our sample knew their correct size of N-95 mask before this pandemic. Likewise, only 50% knew how to correctly obtain a nasopharyngeal swab sample. Most of the results in the previously mentioned items were significantly associated with the location of the program.

The distribution of the total knowledge score was shifted to the right with left skewness (**Figure 1**). The maximum total knowledge score was 5, and the median knowledge score of our participants was 4 out of 5, representing a good knowledge level. **Table 3** shows the association of this score about the virus with gender, age, year of residency training, and location of the neurosurgery program. **Table 3** also shows the association between the knowledge score and whether the participant was caring for patients with COVID-19. The median for male residents was 4, compared with 3 in females. There was neither a difference in medians nor statistical significant association of the knowledge score regarding age and year of residency training. The median in each location was 4, 4, and 3 in North America, GCC countries, and Europe, respectively. The difference in medians was statistically significant between Europe and North America, as well as between Europe and GCC countries ($P = 0.049$). **Figure 2** shows the boxplot of the knowledge score based on the region of the program. The cutoff

Table 4. The Impact of COVID-19 Pandemic Among the Neurosurgery Residents (n = 52)

	n	%
Training at the hospital was affected (yes)	51	98.1
Studying hours were affected (yes)	42	80.8
Opinion: elective procedures must be resumed (yes)	22	42.3
Opinion: brain tumor/compressive spinal cord tumor surgeries must be postponed (yes)	12	23.1
Mental health was affected (yes)	47	90.4
Social life was affected (yes)	52	100

Frequencies may not add to the total because of missing values.

Table 5. Association of the Mental Health Impact of COVID-19 Pandemic and Year of Residency Training (n = 52)

Item	Influence on Mental Health, n (%)		P Value
	Yes	No	
Residency year of neurosurgery program training			0.006
1 (n = 14)	14 (100)	0 (0)	
2 (n = 6)	5 (83.3)	1 (16.7)	
3 (n = 12)	12 (100)	0 (0)	
4 (n = 9)	8 (88.9)	1 (11.1)	
5 (n = 8)	5 (62.5)	3 (37.5)	
6 (n = 3)	3 (100)	0 (0)	
Total sample = 52 (100)	47 (90.4)	5 (9.6)	

P values were generated using Pearson's χ^2 test (bold values with ≤ 0.05 are statistically significant).

of the satisfactory knowledge level was 4, which is the median. In our results, 59.6% of respondents had a satisfactory level of knowledge about the virus, whereas 40.4% had a nonsatisfactory level.

The impact of this pandemic among neurosurgery residents is shown in Table 4. Almost all residents found that their training at the hospital was affected. When asked about their opinion regarding the neurosurgical procedures during this pandemic, approximately 42% desired to resume their elective surgical procedures. In addition, the number of daily studying hours was affected for approximately 80% of respondents, whereas the remainder did not face a change in their studying hours per day. The social life of all residents in our sample was influenced by the situation. This pandemic affected the mental health of 90% of the participants. In Table 5, the association of the impact on mental health of COVID-19 and year of training showed that the mental health of all residents in the first, third, and sixth year of training was affected. Although the percentage of fifth-year residents was also high (62.5%), they were the lowest group in this aspect. This association was significant ($P = 0.006$), but the effect of other confounders could not be eliminated.

DISCUSSION

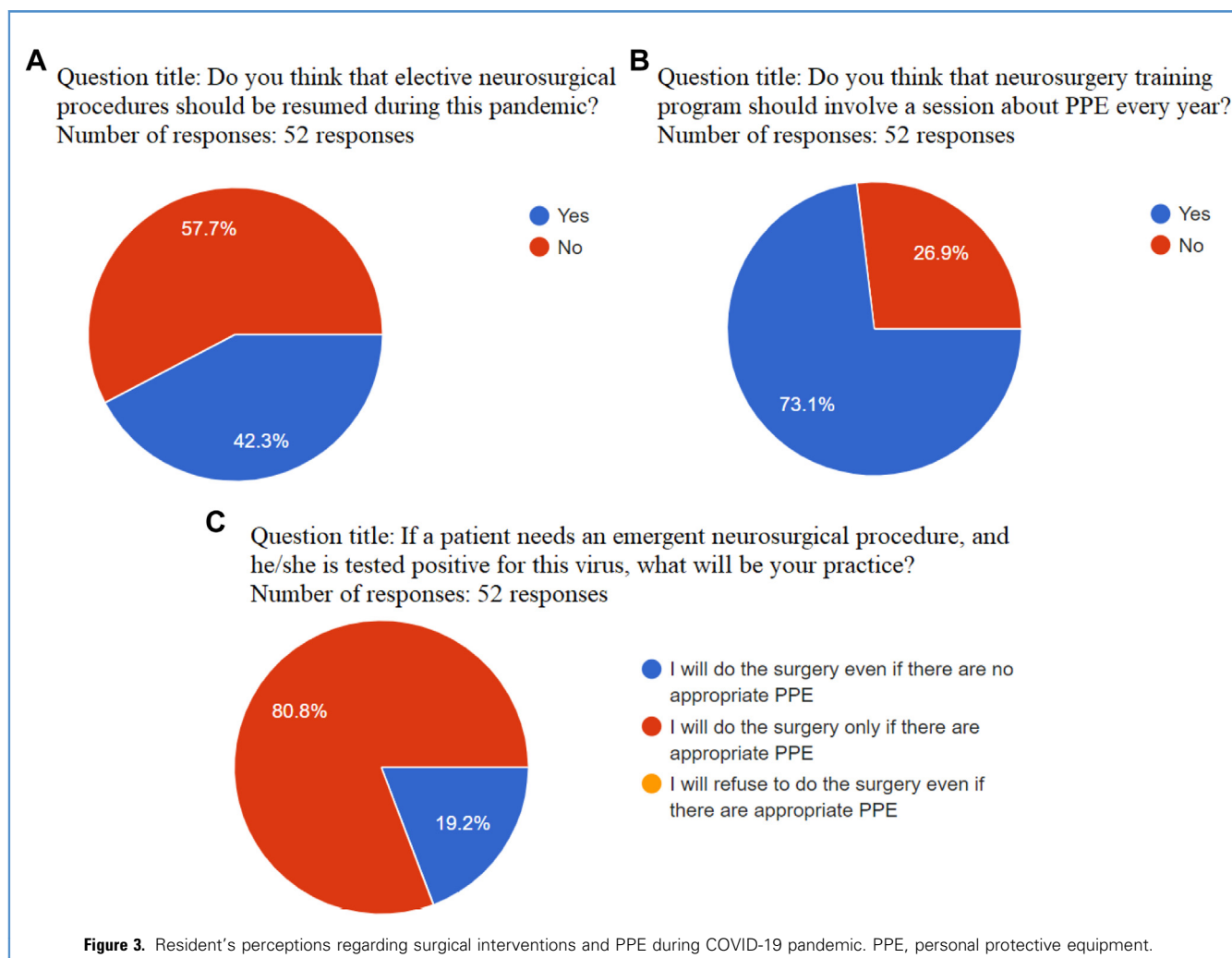
Our study is the first regarding the readiness of neurosurgery residents for the COVID-19 pandemic and the impact it has on their training. This pandemic is evolving rapidly worldwide, disrupting personal and professional life, including that of neurosurgeons and neurosurgical residents.⁴

Most programs have seen a significant decrease in elective or nonessential surgical volume, affecting functional neurosurgery cases foremost.⁷ Regarding surgery, around 57.7% of respondents in our study agreed that elective neurosurgical procedures should not be resumed during this pandemic (Figure 3A). Another editorial stated “We have halted all elective cases, but will

continue to schedule urgent and emergent cases. Emergent case such as head and spine trauma, cauda equina syndrome, embolic stroke, ruptured aneurysms, and acute hydrocephalus are relatively noncontroversial; however, urgent cases such as malignant brain tumors and progressive cervical spondylotic myelopathy may require a more nuanced discussion.”⁴ Responses from our analysis disclosed that only 23% of respondent believe that brain tumor or compressive spinal cord tumor surgeries should be postponed. In terms of skill set, a trustworthy neurosurgical team should be able to treat patients with infectious diseases who also require emergency operations.⁸ In our survey, most residents (approximately 80%) perform emergency surgery on a patient with confirmed COVID-19 only if there is appropriate PPE, whereas a few (approximately 20%) perform it regardless of the presence or absence of PPE; none of the participants refused to perform surgery (Figure 3C). Access to and training on proper PPE use are critical to the safety of workers.¹⁴ When asked about their opinion as to whether neurosurgical programs should involve a session about PPE every year, around 73% of residents agreed that this session is essential (Figure 3B).

Overall, programs reported a significant decrease in the volume of cases. Clinic visits have transitioned to telemedicine where possible, decreasing resident exposure to outpatient encounters.⁷ Similarly, all in-person conferences (e.g., grand rounds, resident education conferences, and multidisciplinary meetings) have been replaced by video teleconferences.⁴ In concordance with our expectations, almost all residents found that their training at the hospital was affected. Certainly, once this pandemic has concluded, careful retrospective analysis of its impact on resident case volume will be necessary to ensure that we are prepared for any future event.⁷ The American Board of Neurological Surgery has postponed both primary and oral examinations.^{7,15} The Royal College of Physicians and Surgeons of Canada has also decided to postpone the written examination, and the oral component will no longer be required.¹⁶ In our sample, the number of daily studying hours was affected in about 80% of respondents. Nonetheless, the number of studying hours might be affected positively or negatively.

A study involving physicians caring for patients during epidemics¹⁷ advised of possible alternatives to real patient–physician interaction to avoid placing trainees at risk. Less than half of the neurosurgery residents (46.2%) felt competent in caring for patients with COVID-19, and most of those who felt capable had already dealt with patients with COVID-19 (Figure 4). Because of the increasing number of patients with COVID-19 who require hospitalization, some radiology residents have been reassigned to internal medicine and ICU to care for the high influx of patients.¹⁷ Similarly, almost half of the neurosurgery residents in our sample (48.1%) dealt directly with patients with COVID-19 in the previously mentioned settings. On the other hand, some neurosurgery residents might gain intensive care skills. Working temporarily in the ICU or internal medicine department will benefit any physicians in some way. “Social distancing measures have circumvented the traditional trainee-faculty member workstation teaching, which is especially disadvantageous for residents who may be rotating on a service for the first or second time in their



training.”¹⁴ Our survey showed that 96.2% of the sample followed social distancing in a daily manner, whereas only 2 of the participants found it difficult to stick to this practice.

“Work-related stress is a potential cause of concern for health professionals. It has been associated with anxiety including multiple clinical activities, depression in the face of the coexistence of countless deaths, long work shifts with the most diverse unknowns and demands in the treatment with patients with COVID-19.”¹⁸ In our data, this pandemic negatively affected the mental health of 90% of the participants. However, this influence is not specific and might affect the residents' mental health either positively or negatively.

The median knowledge score about COVID-19 pandemic and infection control measures was 4 out of 5 (80%; range, 1–5). The correct answers to the knowledge questions were the following: 76.9% knew that the virus type is single-stranded RNA¹¹ and 90.4% knew that the main mode of transmission is via respiratory droplets.¹² Moreover, the most common 2 symptoms

of the virus are fever and cough,¹² which 86.5% answered correctly. The most accurate estimation of the incubation period of this virus is 5 days,¹² which was answered correctly by only 40.4% of participants. Concerning the preferred hand hygiene method in health care settings, which is hand rub for at least 20 seconds with 70% ethanol,¹⁰ unexpectedly, only 51.9% of respondents knew the correct answer. On the other hand, 42.3% believed that hand rub for at least 20 seconds with soap and water was the preferred method. Only 50% of the residents knew their correct N-95 mask size, which is required to safely manage any suspected or confirmed cases.

This study has some limitations. Temporal association of the knowledge score with the aspects discussed cannot be definitely established because of the nature of the cross-sectional study design. Besides, the pandemic has affected the world population in diverse degrees at different times. We reached neurosurgery residents in only 6 countries with different academic settings and resources. Therefore, the ability to generalize the

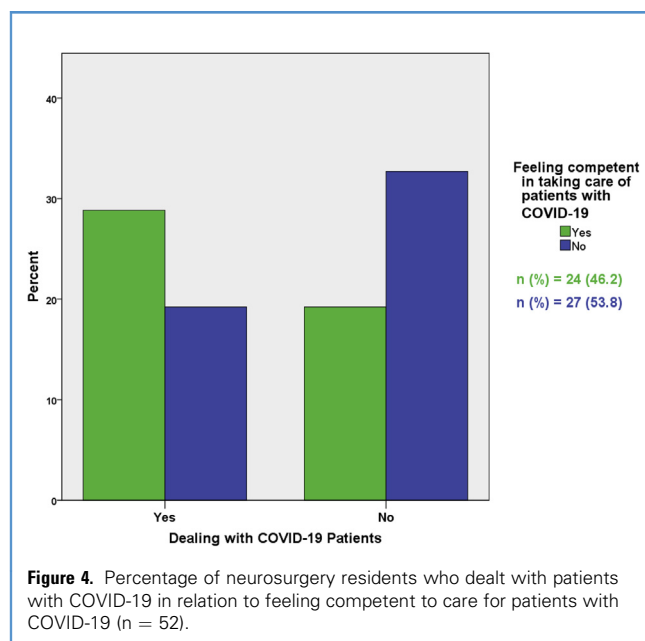


Figure 4. Percentage of neurosurgery residents who dealt with patients with COVID-19 in relation to feeling competent to care for patients with COVID-19 (n = 52).

results of this study to all neurosurgery programs may be limited.

CONCLUSIONS

Our study suggested that neurosurgery residents have a relatively good level of knowledge about the COVID-19 pandemic, although many participants did not have a satisfactory level of knowledge. The location of the program was independently and significantly associated with knowledge score after adjusting for confounding between variables. Concerning infection control, most neurosurgery residents received formal hand hygiene training before the pandemic. However, receiving formal training of the correct sequence for donning and doffing PPE was not sufficient. Most

responders agreed that their training at the hospital was affected. Larger retrospective studies that include a representative sample of neurosurgical residents in a wide range of regions is essential to generalize the results to the target population.

Recommendations

It is recommended that health authorities provide infection control sessions to prepare residents for future events. Neurosurgery program directors may consider sharing experiences with other programs to enhance education and decrease the infection rate among surgeons. Regarding surgery, delay of elective procedures but proceeding with semielective, urgent, and emergency surgery is advised. However, surgeons should also be provided with sufficient quantities of PPE so that procedures can be performed safely. Because of increased stress and decreased studying hours, we urge providing residents with adequate time to prepare for any upcoming evaluation. According to the reviewed editorials about this pandemic, we also encourage that academic training should be continued with social distancing measures with a minimal number of attendees, or even online communication. Furthermore, ease of access of residents to mental health professionals to prevent any psychologically traumatic events and providing them with stress-management sessions are also suggested.

CRediT AUTHORSHIP CONTRIBUTION STATEMENT

Ahmad K. Alhaj: Methodology, Writing - review & editing. **Tariq Al-Saadi:** Conceptualization, Data curation, Supervision, Writing - review & editing. **Fadil Mohammad:** Writing - original draft, Formal analysis. **Said Alabri:** Software, Data curation.

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APPENDIX A

QUESTIONNAIRES

Section 1: Baseline information

- 1) Gender
(male/female)
- 2) What is your age?
Below 30 years old
30 years old or above
- 3) What country is your neurosurgery residency program located in?
Canada
USA
Kuwait
KSA
European country
- 4) What is your current year of the neurosurgery residency program?
R1, R2, R3, R4, R5, R6
- 5) I am currently under a “stay at home” order by the residency training program?
Yes
No
- 6) In the last 4 months until now, have you been in a “quarantine/ isolation” order by the government?
Yes
No
- 7) Did you test positive for coronavirus?
Yes
No
Not tested
- 8) Have you already dealt with COVID-19 patients?
Yes
No

Section 2: Knowledge, practices, and safety measures about COVID-19 (answers in bold)

- 9) What is the type of this virus?
RNA virus single-stranded
RNA virus double-stranded
DNA virus single-stranded
DNA virus double-stranded
- 10) The main mode of transmission of this virus from person to person is via:
Respiratory droplets
Spread from contact with contaminated surfaces of objects
Fecal-oral transmission
Parenteral transmission
- 11) What are the most common 2 symptoms of COVID-19?
Fever and sore throat
Fever and cough
Fever and fatigue
Fever and chest pain
- 12) What is the most accurate estimation of the incubation period of this virus?
3 days
5 days
7 days
9 days
- 13) The preferred method of hand hygiene in the health care settings is:
Hand rub for at least 10 seconds with 70% ethanol
Hand rub for at least 20 seconds with 70% ethanol
Hand rub for at least 10 seconds with soap and water
Hand rub for at least 20 seconds with soap and water
- 14) Did you receive any formal training for hand hygiene in the last 2 years?
Yes
No
- 15) Did you receive any formal training on how to wear as well as how to remove the personal protective equipment (PPE) before this pandemic?
Yes
No
- 16) Did you know what is the correct size of N-95 mask that fits you before this pandemic?
Yes
No
- 17) Do you know how to correctly take the nasopharyngeal swab?
Yes
No
- 18) Do you feel competent to take responsibility for the care of the COVID-19 patients?
Yes
No
- 19) Do you think that the neurosurgery training program should involve a session about PPE every year?
Yes
No
- 20) Are you practicing social distance?
Yes
No

- 21) If a patient needs an emergent neurosurgical procedure, and he/she has tested positive for this virus, what will be your practice?
I will do the surgery even if there are no appropriate PPE
I will do the surgery only if there are appropriate PPE
I will refuse to do the surgery even if there are appropriate PPE

Section 3: Impact of COVID-19

- 22) The COVID-19 pandemic has affected my neurosurgery training in the hospital.
Yes
No

- 23) The COVID-19 pandemic has affected my neurosurgery studying hours.
Yes
No

- 24) Do you think that elective neurosurgical procedures should be resumed during this pandemic?
Yes
No

- 25) Do you think that brain/spinal cord tumor operations should be postponed?
Yes
No

- 26) Do you think that your mental health can be affected during these situations?
Yes
No

- 27) Do you think that this pandemic affects your social life?
Yes
No