

Letter: The Impact of the Coronavirus (COVID-19) Pandemic on Neurosurgeons Worldwide

To the Editor:

According to the Global Healthcare Security (GHS) Index, the United States was the most prepared nation in the world to deal with pandemics (October, 2019).¹ Now in the midst of the COVID-19 crisis, it is ironic that the United States has had more cases and deaths than any other nation.² The same report found that other countries were even less prepared and there were major gaps in global healthcare security.^{1,2}

Governments have had to make difficult decisions during this pandemic, balancing health against economic collapse. The decision to proceed with social distancing, banning nonessential travel, and closing large portions of the economy has been widely adopted around the world recognizing this will likely have long-standing economic consequences.³⁻⁵

The aim of our study was to explore the impact of this pandemic on neurosurgeons with the hope of improving preparedness for future crisis.

We created a 20-question survey designed to explore demographics (nation, duration and scope of practice, and case-burden), knowledge (source of information), clinical impact (elective clinic/surgery cancellations), hospital preparedness (availability of personal protective equipment [PPE] and cost of the supplies), and personal factors (financial burden, workload, scientific and research activities). The survey was first piloted with 10 neurosurgeons and then revised.

Surveys were distributed electronically in 7 languages (Chinese, English, French, German, Italian, Portuguese, and Spanish) between March 20 and April 3, 2020 using Google Forms, WeChat used to obtain responses, and Excel (Microsoft) and SPSS (IBM) used to analyze results. All responses were cross-verified by 2 members of our team. After obtaining results, we analyzed our data with histograms and standard statistical methods (Chi-square and Fisher's exact tests and logistic regression).

Participants were first informed about the objectives of our survey and assured confidentiality after they agreed to participate (Helsinki declaration).⁶

We received 187 responses from 308 invitations (60.7%), and 474 additional responses were obtained from social media-based neurosurgery groups (total responses = 661). The respondents were from 96 countries representing 6 continents (Figure 1A-1C).

Ethical Committee

Ethics board approval was waived by the ethical committee of the neurosurgery department at Cairo University.

PERCEPTION AND KNOWLEDGE

The respondents from higher income nations (odds ratio [OR] = 2.25, CI = 0.12-42.20) and those with a greater burden of illness (OR = 5.25, CI = 0.36-75.94) were more likely to appreciate the seriousness of the pandemic. Some of this perception is likely related to a nation's overall investment in healthcare. Clearly, nations with robust epidemic surveillance systems will be forewarned of upcoming threats and be able to inform their healthcare workforce.

It was concerning to recognize that in some regions, particularly Africa, the knowledge regarding this pandemic was largely acquired from less credible sources (social media/television) ($P < .001$, OR = 4.85, CI = 2.09-11.24). Neurosurgeons from lower income nations reported lesser use of rigorous sources than wealthier nations ($P < .05$, OR = 0.60, CI = 0.42-0.86), suggesting that investment is needed to better disseminate high-quality information.

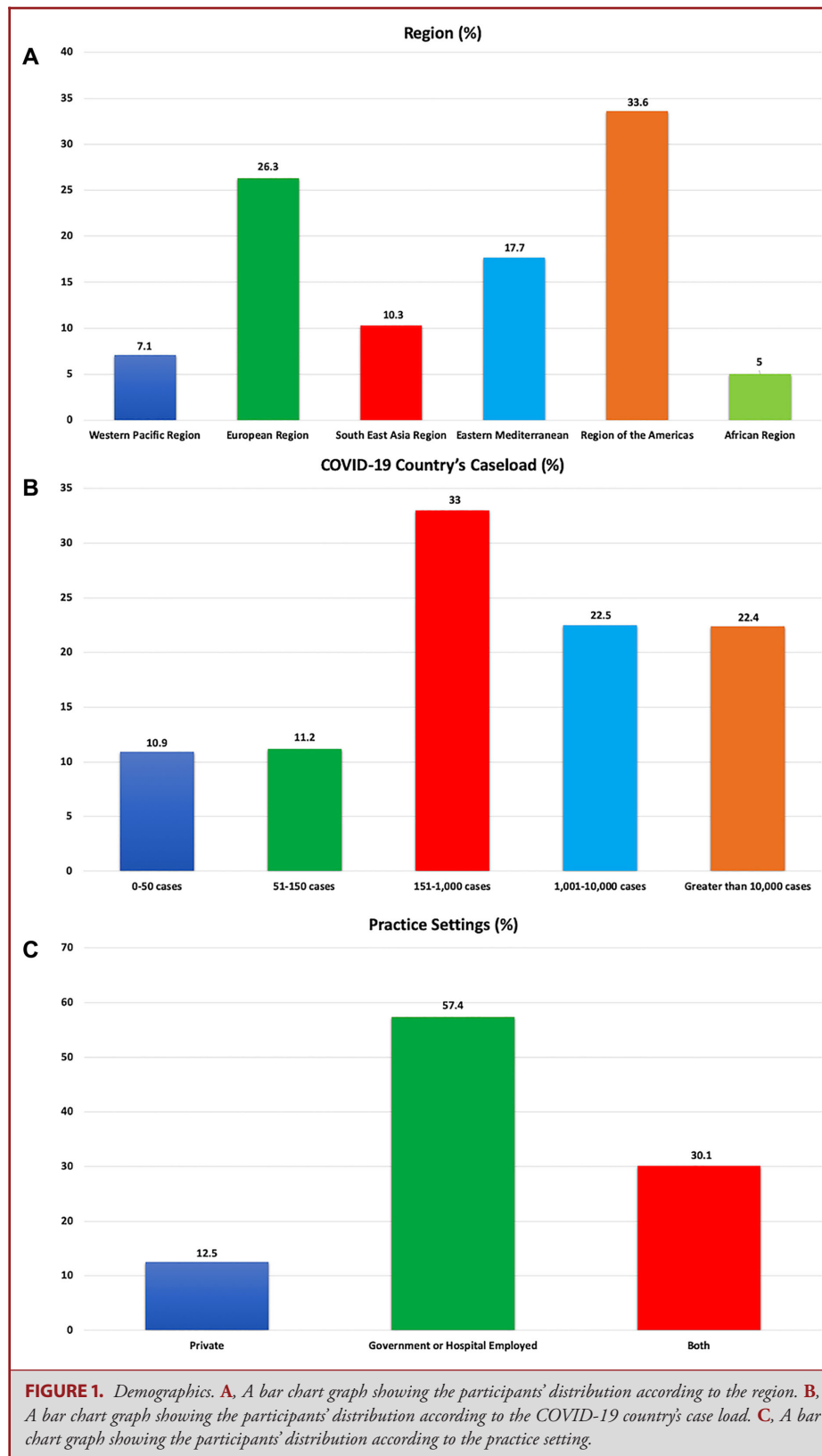
HOSPITAL PREPAREDNESS

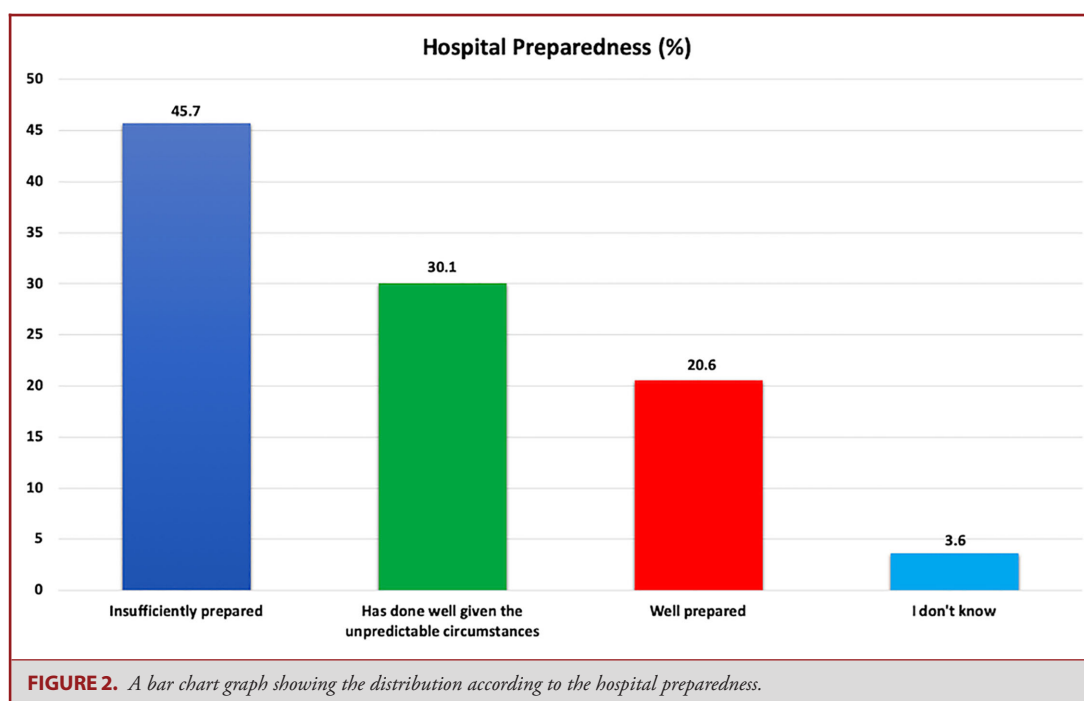
Forty-six percent of respondents felt their hospitals were "insufficiently prepared" (Figure 2). Increased hospital preparedness was significantly seen more frequently among neurosurgeons from higher income nations ($P < .05$, OR = 4.92, CI = 1.25-19.29). The perception of better preparedness was most evident in the Eastern Mediterranean ($P < .05$, OR = 2.84, CI = 1.11-7.27) when compared to Africa. When we compared responses from individuals in exclusively private practice ($P < .05$, OR = 2.21, CI = 1.23-4.00) or governmental practice settings ($P < .05$, OR = 1.63, CI = 1.07-2.48), the perception of well preparedness was more likely than those who practiced in both settings.

ELECTIVE SURGERIES AND CLINICS

Healthcare delivery has transformed as well, with nonessential contact being prohibited. In private practices, elective surgery/clinic cancellations of >50% seemed to occur more frequently in non-African countries. In government-run facilities, such cancellations paradoxically occurred more frequently in lower prevalence regions (Figure 3A).

In private practice, it was patients and physicians who significantly motivated the surgery/clinic cancellations as opposed to government directives ($P < .05$, OR = 0.52, CI = 0.28-0.98). In governmental settings, it was government directives that led to these cancellations ($P < .05$, OR = 1.89, CI = 1.14-3.13). Cancellations also increased as nations acquired more COVID-19 cases in government settings (OR = 2.94, CI = 1.35-6.42) (Figure 3B).





Finally, regarding clinic appointments, there was a significantly higher rate of cancellation or rescheduling in upper middle income countries ($P < .05$, OR = 0.20, CI = 0.05-0.82) and insufficiently prepared hospitals ($P < .05$, OR = 0.61, CI = 0.40-0.93).

When our survey explored the adaptation of neurosurgeons to social distancing, we found varying responses (Figure 3C). There was a significantly increased utilization of telephone and teleconferencing over cancellations in private practice settings ($P < .05$, OR = 2.02, CI = 1.06-3.88), high-income countries ($P < .05$, OR = 2.64, CI = 1.02-6.19), and regions where the perception of the pandemic was more seriously appreciated ($P < .05$, OR = 3.20, CI = 1.37-7.50).

HOSPITAL SUPPLIES AND PERSONAL PROTECTIVE EQUIPMENT

We were also disturbed to find that price gouging during this international crisis was not only occurring in the public domain (eg, toilet paper) but also with hospital supplies. Of all respondents, 12.1% raised this concern regarding surgical implants.

When healthcare must be delivered, it is incumbent on our institutions to provide such care in the safest possible manner. This has been another challenge across the planet with a scarcity of essential medical equipment and personal protective equipment (PPE). We were alarmed to find that many of our respondents were not utilizing PPE (12%), and this was more common in lower income nations ($P < .05$, OR = 0.441, CI = 0.216-0.90).

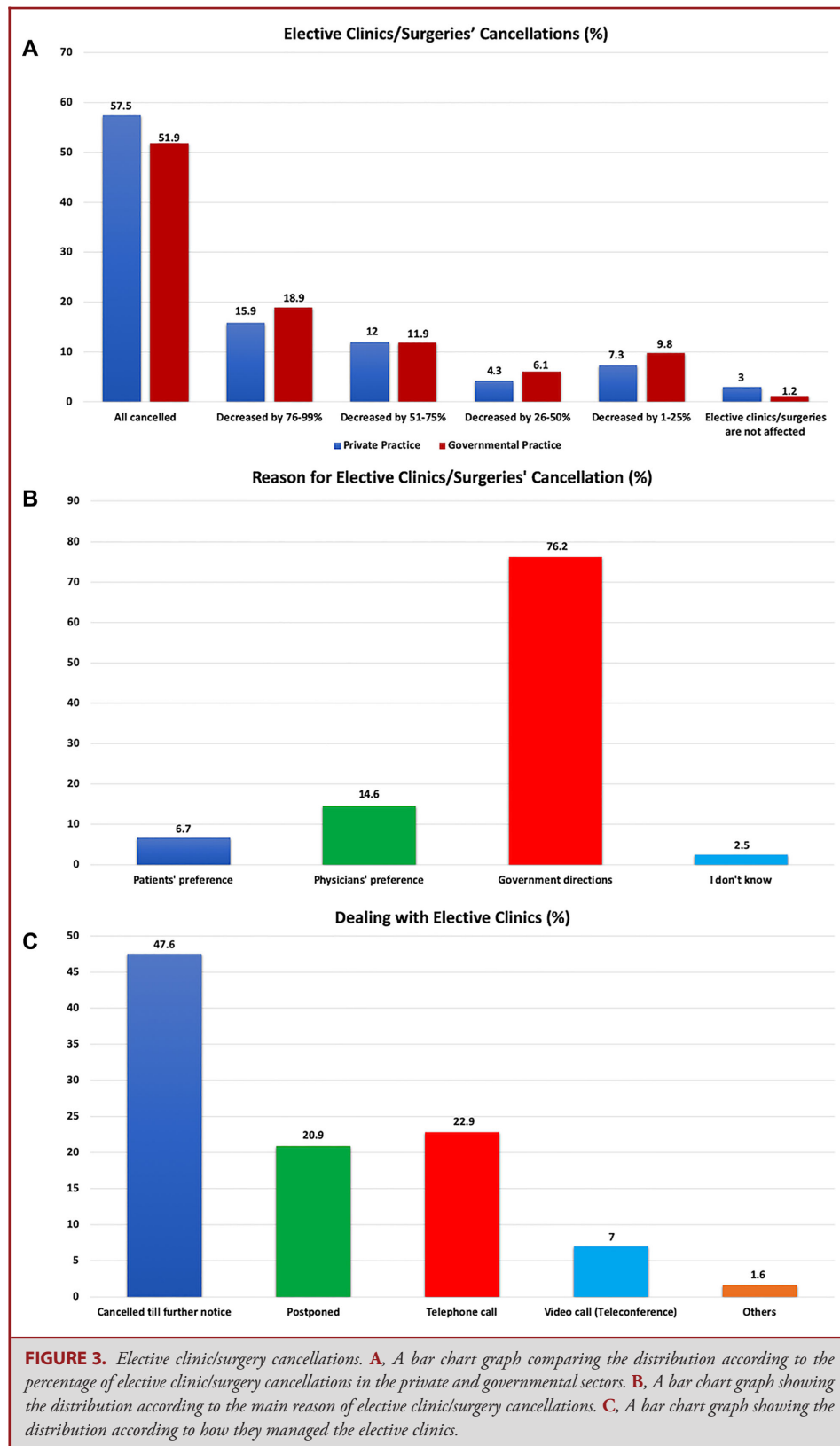
However, respondents from areas with lower burden of illness (151-1000 [$P < .05$, OR = 3.70, CI = 1.46-9.39] and 1001-10 000 [$P < .05$, OR = 2.93, CI = 1.21-7.15]) and a greater perception of threat ($P < .05$, OR = 3.47, CI = 1.32-9.12) were utilizing PPE more (Figure 4).

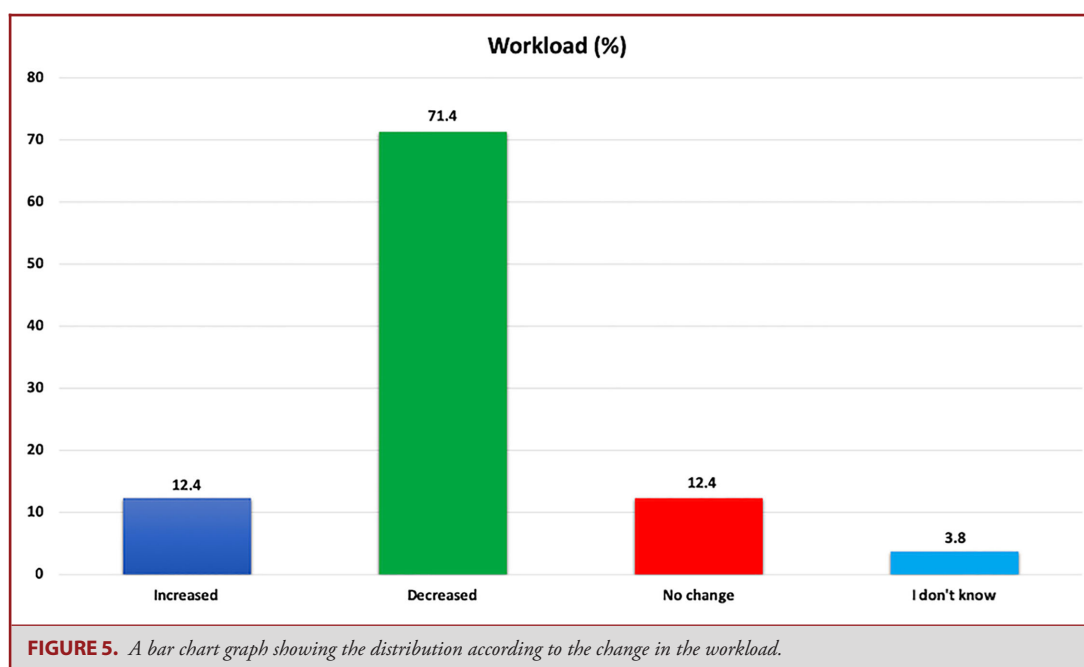
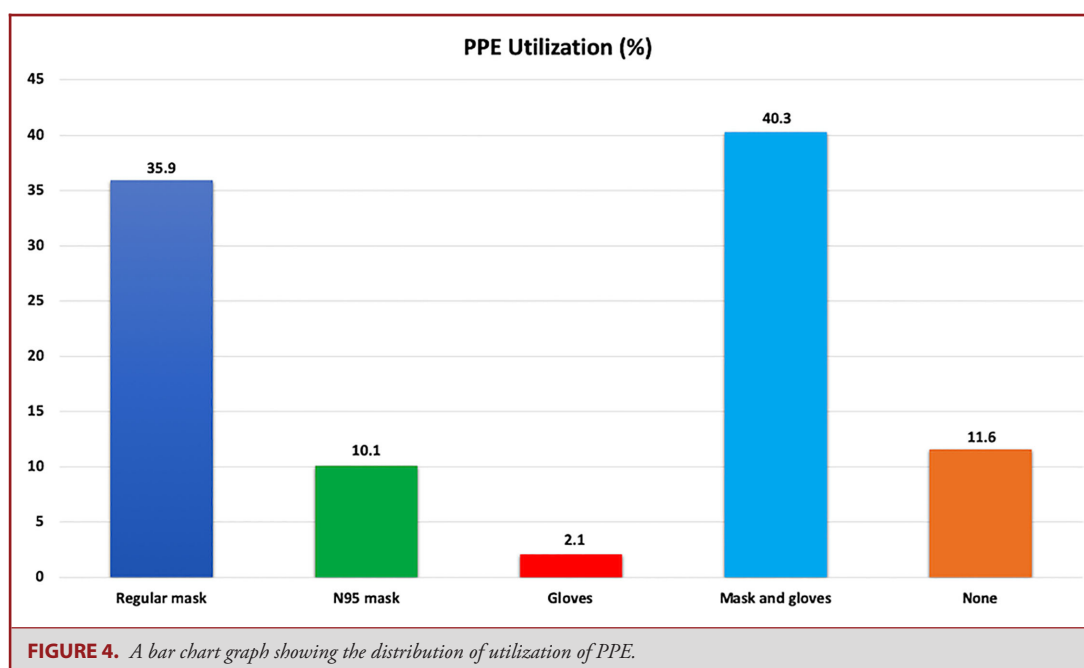
ECONOMIC, SCIENTIFIC, RESEARCH IMPACT

The reduction in clinical services has also had an impact on surgeons. The majority of our respondents (71.4%) reported a decreased workload (Figure 5) and financial burden (62.5%) (Figure 6). These surgeons were more likely to be spine or peripheral nerve surgeons ($P < .05$, OR = 0.30, CI = 0.10-0.88) or from low-income nations ($P < .001$, OR = 0.28, CI = 0.15-0.54).

Although emergency procedures are likely to be continuing in most countries, it is unusual for neurosurgeons to receive their reimbursement primarily from such care. Increased hospital preparedness ($P < .05$, OR = 0.50, CI = 0.30-0.82) and being government-employed ($P < .001$, OR = 3.41, CI = 1.79-6.48) seemed to protect against financial difficulties.

The implications of closures on wait-times and healthcare outcomes remain unknown, but delayed treatment will likely have long-term consequences. Responsibility for such consequences remains to be determined. Physicians, hospitals, governments, or nations may become targets for future liability. This too contributes to physician stress.

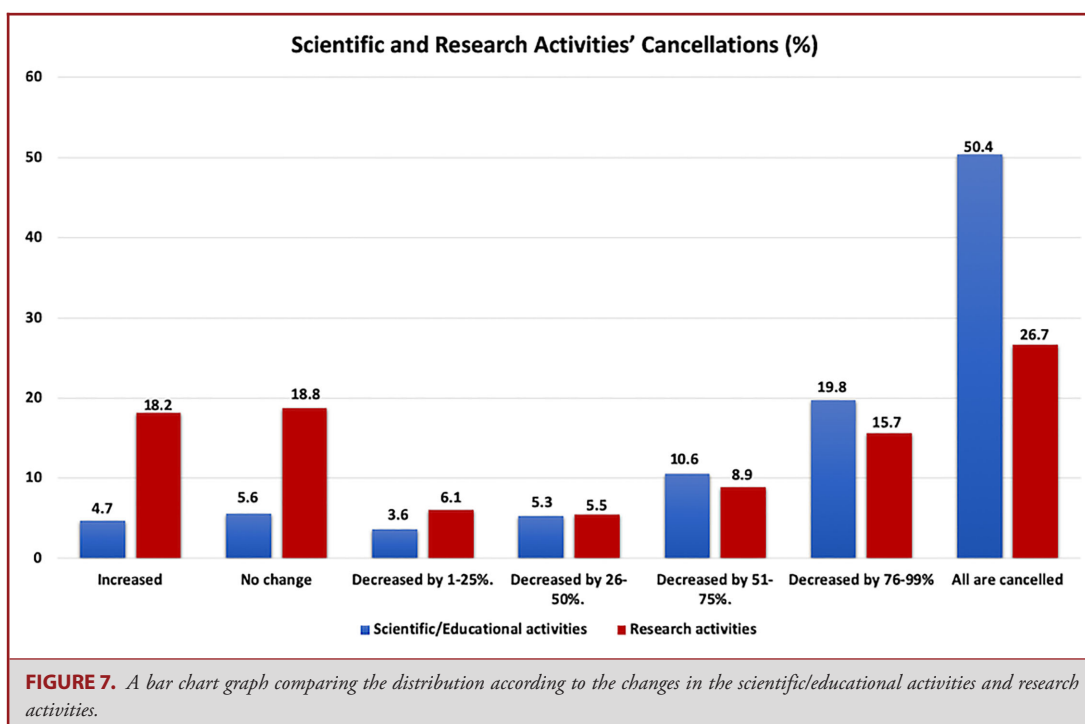
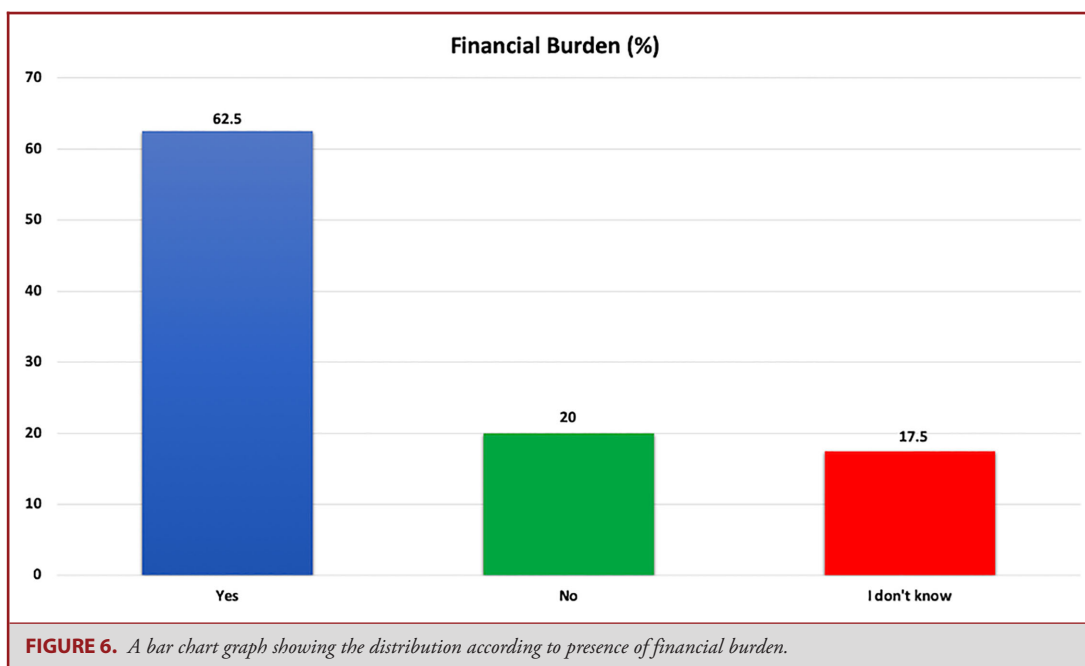




Half of respondents (50.4%) stated that their scientific activities had been suspended, while 26.7% reported cessation of research (Figure 7). Cancellation of educational activities was more likely in the Americas ($P < .05$, OR = 3.30, CI = 1.04-10.48) and Europe ($P < .05$, OR = 3.72, CI = 1.03-13.47). Cessation of research was more common in low-income nations

(OR = 2.28, CI = 0.59-8.85) and countries with a COVID-19 caseload of 1001-10 000 (OR = 1.05, CI = 0.46-1.11).

In conclusion, our survey provides insight into the COVID-19 pandemic. We found that many neurosurgeons lacked credible knowledge and that their institutions were inadequately prepared. This has resulted in a paralysis of healthcare delivery, which has



harmed patients. As we move forward, we must learn from our mistakes so we may be better prepared.

Global healthcare initiatives have already proven successful with human immunodeficiency virus (HIV) and malaria.⁷⁻¹⁰ Empowering lower income nations to proactively contain these

epidemics has wider implications for global healthcare security. In the 1980s, such initiatives in Africa to combat acquired immunodeficiency syndrome (AIDS) were quickly translated into combating Ebola in 2014 and 2016.^{11,12} We all have benefited from such programs.

We encourage increased resource allocation for better pandemic preparedness. Neurosurgeons must develop disaster strategies to curtail future crises through collaboration and communication, which has never been seen before.

Disclosures

The authors have no personal, financial, or institutional interest in any of the drugs, materials, or devices described in this article.

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Acknowledgments

Dedication: “To our brothers and sisters that have fallen to this invisible enemy. As we write this article hundreds of physicians throughout the world died at the frontline fighting the COVID-19 infection. In these unprecedented times our thoughts, actions and prayers are with them and their families.” *Major contributors (arranged according to their contribution):* Abdulkadir A Hussein, Mayreli Llerena Bernal, Mostafa Elhalaby, Mohamed Akl, Soraia Sousa, Maria Cahua, Dante J. Morassutti, Shijie Zhou, HebatAllah Qassim,

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