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Early Report on the Impact of COVID-19 Outbreak in Neurosurgical Practice Among Members of the Latin American Federation of Neurosurgical Societies

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■ BACKGROUND: **The COVID-19 pandemic has caused severe economic consequences by local governmental measures to contain the outbreak. We provide insight on the impact that health care restriction has made on neurosurgical activity in Latin Iberoamerica.**

■ METHODS: **We performed an internet-based survey among presidents and members of the societies of the Latin American Federation of Neurosurgical Societies (FLANC). We blindly analyzed information regarding local conditions and their impact on neurosurgical praxis using SPSS software.**

■ RESULTS: **Information came from 21 countries. Sixteen society presidents reported having suspended regular activities and deferring local scheduled congresses, 14 reported mandatory isolation by government, and 4 instituted a telemedicine project. Four-hundred eighty-six colleagues, mean age 49 years, reported a mean 79% reduction in their neurosurgical praxis. Seventy-six percent of neurosurgeons have savings to self-support for 3–6 months if restrictions are long lasting.**

■ CONCLUSIONS: **Stopping activities among societies of the FLANC, together with a drop of 79% of neurosurgical praxis, adds to deficits in provider's protection equipment and increasing demand for attention in the health care systems, representing a huge financial risk to their sustainability. Neurosurgeons should be involved in local policies to protect health and economy. Telemedicine represents an excellent solution, avoiding another pandemic of severe diseases across all-specialties as nonessential care can turn essential if left untreated. Financial support and ethics code review is needed to battle this new disease, designated the occupational disease of the decade, that continues to scrag the health care system. Times of crisis are times of great opportunities for humanity to evolve.**

INTRODUCTION

The pandemic of coronavirus (formerly SARS-CoV-2), COVID-19, was first reported on December 31, 2019, and since many countries have suffered the severe economic consequences of governmental measures to contain the outbreak.[1,2] We are currently facing the challenge of sustaining the economy while entire cities remain on "lockdown," struggling with financial burden in a multilateral fashion.[1,3] This scenario has created a growing risk for economic crises in different professions across countries, in which the health providers are no exception.[4] Many medical specialty organizations have restricted practice to essential care services as recommended by the World Health Organization (WHO) to provide appropriate local responses to the outbreak-phase countries are dealing with while preventing non-COVID patients and their physicians from infection.[5] Neurosurgery has always been considered an essential-care specialty, meaning that we will keep attending patients.

Key words
- COVID-19 outbreak
- Financial risk
- FLANC
- Neurosurgeons
- Survey
- Telemedicine

Abbreviations and Acronyms
CI: Confidence interval
COVID-19: Coronavirus (formerly SARS-CoV-2)
FLANC: Latin American Federation of Neurosurgical Societies
SD: Standard deviation
WHO: World Health Organization

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Nevertheless, it is our perception that we have suffered enormous consequences derived from these extreme but necessary measures to contain the COVID-19 epidemic. The Latin American Federation of Neurosurgical Societies (FLANC)—1 of the 5 continental associations of the World Federation of Neurosurgical Societies—is composed of 21 American societies, the USA—Canada Latin American Neurosurgical Society, and 4 extracontinental European societies, whose primary languages (Spanish, Portuguese, Italian, and French) derive from Latin.[6] In other words, the FLANC jointly represents the neurosurgical workforce of Latin Iberoamerica. By using the FLANC as a platform, we aimed to provide an insight on the socioeconomic impact that health care restriction has made on Latin Iberoamerican neurosurgical practice as a baseline to understand the potential financial burden it will imply (especially to other physicians involved in nonessential treatment) in terms of sustainability if these measures are to be long-lasting, but no strategies are taken by local authorities to prevent (or as a fact, overcome) this crisis.

METHODS

We performed an electronic internet-based survey among the members of the FLANC on a single day to obtain information in a historically early stage of the COVID-19 outbreak in Latin Iberoamerica. As information changes abruptly from day-to-day in the pandemic, we consider that transverse studies are mandatory to pose a baseline to compare the impact of health policies on economy. We collected information on an 18-item electronic questionnaire directed to the presidents of the societies of the FLANC (**Table 1**) to obtain precise information on outbreak condition and governmental dispositions in each country, as well as information related to societal activities and COVID-19 infection incidence among local neurosurgeons. We used another 14-item questionnaire for (neurosurgeons) members of the FLANC (**Table 2**); it was aleatory distributed among conventional social network software, including demographic data, nationality, medical practice restriction, provision and use of personal protective equipment during essential care, and personal economic factors. Members were encouraged to complete the survey on a daily basis by the president of the local neurosurgical society using the contact information provided by members; survey filling was also promoted by the vice president of the FLANC and by local colleagues on a voluntary fashion. The resulting information was coded and analyzed blindly using the Statistical Package for Social Sciences (SPSS) version 25 (IBM Corporation, Armonk, New York, USA) proceeding with dispersion measures, statistics, and comparative Student *t*-tests accordingly where needed.

RESULTS

Presidents of the Societies of the FLANC 14-Item Questionnaire

We obtained answers from 16 different societies of the FLANC, reporting a total of 168,256 cases. Society names, locally reported cases, elapsed days since initial infection to the filling of the questionnaire, phase of the epidemic, and the number of tests performed weekly is listed in **Table 3** (nonresponding societies of the FLANC were not included). Eight countries are on phase 2 of pandemic, 3 on phase 3, and 5 on phase 4 (as according to the scenarios of infection described by the WHO).[7] Ten countries had specific recommendations for the practice of neurosurgery, ranging from elective surgery suspension (7); individual protection measures (4); manual of recommendations derived from their respective society (2); presurgical test for coronavirus for patients (1), and surgeons (1); stratify cases by severity and emergency (1); reducing surgical time as much as possible (1); and changes in surgical room protocols (1) following the Centers for Disease Control and Prevention guidelines. Fourteen presidents stated that their country was concentrating patients in specific hospitals, and 14 had established mandatory isolation by government. Thirteen presidents reported no neurosurgeons colleagues were infected; 4 presidents reported neurosurgeons who were COVID-19 positive 2 from Ecuador (age 50), 1 in Paraguay (age 69), and 1 in Costa Rica (age 54); and 1 president reported not knowing this data (from Spain society). All of the societies have suspended regular activities, 8 of them undertaking online meetings for societal issues, and 4 have instituted a telemedicine program/project as a result of the COVID-19 outbreak. Fifteen societies have decided to defer or reschedule local congresses, 2 will continue on date, and 1 has no local congress currently appointed.

Members of the FLANC 18-Item Questionnaire

We obtained 486 completed questioners in a single day. Responses came from 21 countries considered part of the FLANC territory, led by Mexico with 46% (223 responses) and followed by Argentina 7% (35); Bolivia 7% (35); Ecuador 5% (24); Peru 4% (21); Brazil 4% (18); Colombia 4% (17); Guatemala 3% (15); Paraguay and Portugal 3% (14) each; Chile 3% (13); Uruguay and El Salvador 2% (11) each; Spain 2% (9); Panama and Dominican Republic 2% (8) each; United States, Haiti, Honduras, Nicaragua, and Venezuela <1% each (3, 2, 2, 2, and 1 responses, respectively). The mean age of colleagues was 49.29 years (range, 29—83; standard deviation [SD], 10.76; 95% confidence interval [CI], 48.33—50.25; **Figure 1**). One-hundred sixty (33%) members practice general neurosurgery, whereas subspecialty surgery reached 99 members (20%) in spine, 48 (10%) in vascular, 43 (9%) in pediatrics, 34 (7%) in skull base, 23 (5%) in functional, 21 (4%) in endovascular therapy, 18 (4%) in trauma, 14 (3%) in oncology, 9 (2%) in endoscopy, 7 (1%) in radiosurgery, 5 (1%) in epilepsy, and 2 (<1%) in peripheral nerve. One-hundred eight (22%) members work in the private health care system exclusively, and 348 (78%) members also work in the public health system.

Referring to the public health care system, 174 (46%) neurosurgeons continue working in full, 155 (41%) partially, and 49 (13%) suspended activities (either by local authorities' requirement, or voluntarily) as compared with their previous working schedule; whereas 315 (83%) receive full payment, 29 (8%) partial payment, and 34 (9%) have not received its due income. Referring to their neurosurgical praxis (whether public or private), the mean reduction in consultation was 78.77% (SD, 23.18; 95% CI, 76.71—80.84), and 77.64 (SD, 24.65; 95% CI, 75.44—79.84) in surgical procedures performed. When questioned about financial reserves to sustain without working in full, 5 (1%) members had savings that would serve (on personal calculus) for up to 1 month, 230 (47%) for 1—3 months, 137 (28%) for 4—months, 13 (3%) for 7—9 months, 43 (9%) for 10—12 months, and 58 (12%) for more than 1

Table 1. Presidents of the Societies of the FLANC 14-Item Questionnaire

Presidents of the Societies of the FLANC 14-Item Questionnaire	
1	Name of the society (open answer)
2	Updated number of COVID-19 cases in your country, according to your health authorities (number)
3	Date of the first case reported in your country (date)
4	Phase of the epidemic your country is in (updated)
	a) Phase 1
	b) Phase 2
	c) Phase 3
	d) Phase 4
	e) Recovery
5	How many weekly diagnostic tests for COVID-19 are being carried out in your country? (number)
6	Are there specific recommendations for neurosurgical practice in your country? (open answer)
7	What are these recommendations? (open answer)
8	Were referral centers for the care of patients with COVID-19 implemented? (yes/no)
9	Type of contingency plan for the prevention of contagion risks in your country (updated, you can select more than 1):
	a) None
	b) Social distancing
	c) Voluntary isolation
	d) Mandatory isolation (imposed by your government)
10	Number and ages of neurosurgeon colleagues infected in your country (open answer)
11	Regarding the regular activities of your society, were the onsite activities suspended? (open answer)
12	Regarding the activities of your society, was an online activity program implemented? (yes/no)
13	Regarding the activities of your society, was any telemedicine program/project implemented? (yes/no)
14	Decision made regarding the cancellation or rescheduling of its national congresses (open answer)

year (Figure 2). We performed a subanalysis separating members from the Mexican Society of Neurological Surgery from the other FLANC society members to search for statistical differences, as one third of the respondents were from this single country. The Student t-test comparison revealed a more severe reduction in consultation (mean 83.02 vs. 73.77, 23.45, and 21.89 SD, respectively) and surgical procedures performed (mean 80.62 vs. 74.13, 24.03, and 24.95 SD, respectively) in the other FLANC society members category with statistical significance ($P = 0.01$) (Figure 3). We found no statistically significant difference ($P = 0.48$) in financial reserves (savings) to sustain without working (mean 11.90 vs. 14.43, 37.61, and 41.88 SD, respectively).

Table 2. Members of the FLANC 18-Item Questionnaire

Members of the FLANC 18-Item Questionnaire	
1	Country (open answer)
2	Age (number)
3	Subspecialty (open answer)
4	Percentage of professional practice in the public sector (number)
5	Percentage of professional practice in the private sector (number)
6	Current percentage decrease in your medical consult (number)
7	Current percentage decrease in your surgical practice (number)
8	Approximate economic reserves. How many months will you endure the crisis without working a day?
9	If you work in the public sector, have you stopped working?
	a) I do not work in the public sector
	b) Partially
	c) Completely
	d) Have not stopped working
10	If you work in the public sector, how do you receive your salary?
	a) I have not received my salary
	b) Partially
	c) Completely
11	For the occasions when you still have to consult, what type of specific protection do you use? (open answer)
12	For the occasions when you still have to operate, what type of specific protection do you use? (open answer)
13	Regarding the protection measures you use; in what percentage do you acquire them by yourself? (number)
14	Regarding the protection measures you use, in what percentage is it provided by the institution? (number)
15	What are the most common emergencies that you are operating? (yes/no)
16	Have you had any suspicious symptoms or signs of COVID-19? (yes/no)
17	Has the COVID-19 test been done for any reason? (yes/no)
18	Was the result positive? (yes/no)

Most frequent causes to perform emergency surgery during the outbreak were considered trauma indications 29% (216 mentions by members); followed by dural hematomas 12% (100); tumors 12% (90); spine, hydrocephalus, and vascular (aneurysms and arteriovenous malformations) 10% each (74, 72, and 71 respectively); stroke (hemorrhagic and ischemic) 9% (63); nonspecified cranial hypertension 3% (21); and intractable pain, infections, plexus injuries, intractable epilepsy, and radiosurgery <1% each (1 case each) (Figure 4).

Table 3. Summary of Selected Data According to the Presidents of the Societies of the FLANC 14-Item Questionnaire Responses

Number	Society Name Affiliated to the FLANC	National COVID-19 Cases Reported by Local Authorities	Elapsed Days Since First Case in their Country	Country's COVID-19 Phase of the Epidemic	Weekly National Tests Performed as Reported by Local Authorities
1	Argentine Neurosurgery Association	1554	34	Phase 2	1500
2	Colombian Neurosurgery Association	1470	34	Phase 2	400
3	Costa Rican Association for Research in Neurosurgery	454	30	Phase 2	1200
4	Cuban Society of Neurology and Neurosurgery	323	27	Phase 2	4000
5	Dominican Society of Neurology and Neurosurgery	1956	38	Phase 3	2100
6	Ecuadorian Neurosurgery Society	3747	37	Phase 3	100
7	Guatemalan Association of Neurological Surgery	70	25	Phase 2	50
8	Mexican Society of Neurological Surgery	2143	39	Phase 2	777
9	Neurosurgery Association of El Salvador	62	17	Phase 2	700
10	Panamanian Society of Neurosurgery	2100	30	Phase 4	200
11	Paraguayan Society of Neurological Surgery	113	29	Phase 3	700
12	Peruvian Society of Neurosurgery	2281	31	Phase 4	1000
13	Portuguese Society of Neurosurgery	11,730	63	Phase 4	110,000
14	Society of Neurosurgery of Chile	4815	34	Phase 4	50,000
15	Spanish Society of Neurosurgery	135,032	65	Phase 4	10,000
16	Uruguayan Society of Neurosurgery	406	24	Phase 2	1400
	Total	168,256			184,127

Members referred to acquire the personal protection equipment by self-investment in a mean proportion of 55.45% (SD, 38.59; 95% CI, 52.01–58.89), and 45.55% (SD, 38.59; CI, 41.11–47.99) were provided by the institution.

From a total of 486 respondents, 31 (6.38%) had reported symptoms related to COVID-19 infection, 29 (5.97%) had taken the test for COVID-19, and from those only 4 (13.79% of tested) were positive (2 from Spain and 2 from Ecuador) representing 1% of members answering the survey.

DISCUSSION

To date, 1,599,909 cases of infection have been reported, and 98,812 deaths have been lost by the COVID-19 pandemic,[8] with Latin America surpassing 70,000 reported cases,[9] as compared with our results in which 168,256 cases are distributed among countries pertaining to the FLANC (including Portugal, Spain, France, United States, and Canada). Apart from being a global health concern, COVID-19 is having major consequences on the world economy, and experts have predicted that COVID-19 will lower global gross domestic product growth by one half a percentage point for 2020 (from 2.9%–2.4%).[1] The International Labour Organization has estimated that closing cities in response to the outbreak will produce the loss of 195 million jobs in the next 3 months, with up to 4 of every 5 workers having already been affected by these governmental disposals.[10]

The medical praxis has also been affected, as the WHO has recommended reducing activity with the advance of epidemy in local countries to provide essential care to give the best use of resources to contain the outbreak and reduce infection rates.[5] Neurosurgery as a specialty has adopted these measures and has emitted recommendations to properly classify and select patients requiring emergent treatment during triage (whether COVID is nonsuspected, suspected, denied, or confirmed).[11-15] Our results demonstrate the dramatic consequences that these measures have provoked in neurosurgical practice, whether in the public or private, reaching rates as high as 80% in most of the countries. This fact proves right the estimates of the International Labour Organization,[10] given that 17% of neurosurgeons in public health care system are suffering a degree of unrefunded work (8% partial reduction in salary, and 9% not receiving payment) as early as 2 elapsed months since the start of the COVID-19 epidemic in Latin Iberoamerica on February 9, 2020.[16]

We are most concerned about the sustainability of medical practice in neurosurgery as for that of many other specialties, having lesser percentages of essential care. We agree with both, government decisions and WHO recommendations, in that containing measure must remain, however, we also agree with the International Labour Organization as many jobs are to be lost if this situation is to be sustained.[5,10] As Hilsenrath[17] stated, we are at the point where political and public health leaders will clash regarding economic versus health interests. For example, the United Kingdom government decided not to adhere to screening

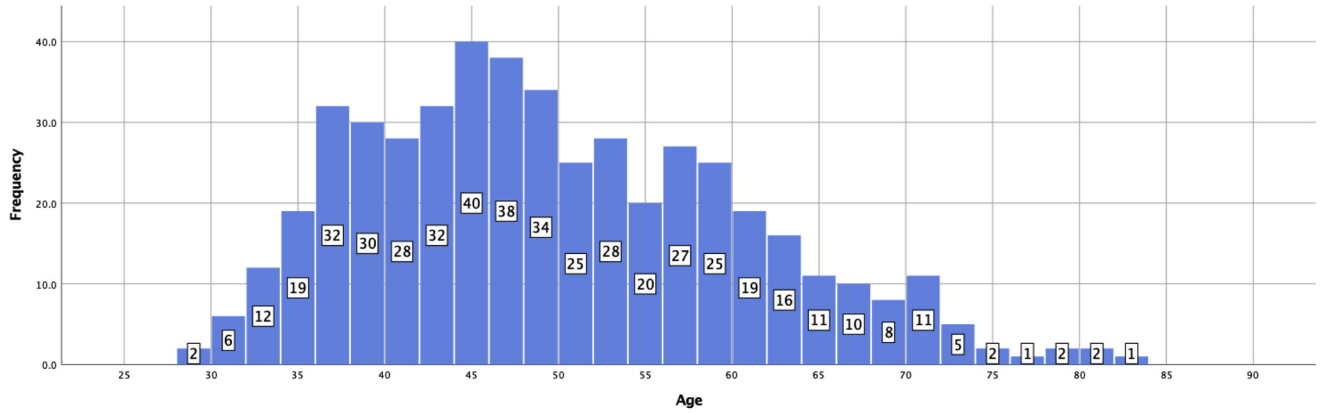

Figure 1. Age histogram of neurosurgeons that answered the Members of the FLANC 18-item Questionnaire.

recommendations by the WHO at a certain point of the pandemic derived from a locally depleted health care system.[18] Some other countries that were affected earlier in the pandemic keep encouraging to take advantage of the experience they had.[19] An ethical balance must exist to mitigate health and economic damage best,[17] changing the mind is a wise decision, as demonstrated by the United Kingdom government, offering economic support to be able to deal with the challenge COVID-19 imposes.[20]

In this economic versus health carrier, as a response to cope with the pandemic, the World Bank stated specific projects for Latin America and the Caribbean on April 2; a 14 billion investment is to be given in this first round to Argentina, Ecuador, Paraguay, Haiti, Dominican Republic, Panama, and Bolivia.[21] This investment will help to strengthen the public health system and policies aiming to identify new cases and to prepare for increased levels of demand.[21] We hope this help continues to be provided to the rest of Latin America, and increasing projects be directed toward patients at risk, as well as to physicians. This

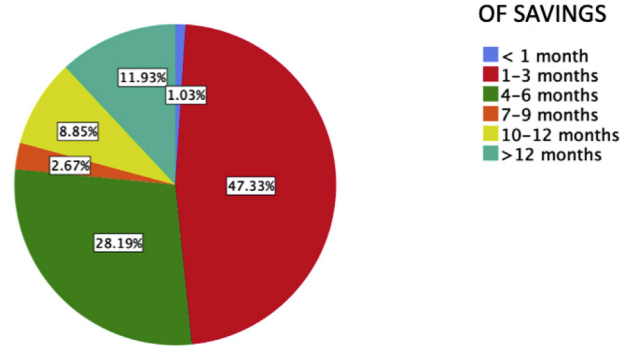

Figure 2. Self-assessment prediction of durability of savings (without working a single day) by neurosurgeons, members of the FLANC, if COVID-19 outbreak remains long lasting.

population has demonstrated to be at increased risk of morbidity and mortality but also to psychological distress by burnout and dealing with the disease[22] in a scare security health system too, as COVID-19 is considered the new occupational illness of the decade.[23]

However, we must remain ethical for everyone needing medical care, whether COVID-19 related or non-COVID-19-related, as Kim and Grady[24] recognized, we are living through truly novel times; however, ethical principles must remain the same. It is our belief and our best wisdom that current technology permits us to develop information as fast as ever before, we must take this advantage that our predecessors did not have in previous pandemics. We have the opportunity to change the medical practice for the good of humanity, providing care even if physically apart, but joint in mind, as we all juried the hypocritic judgment.[25] Relying on providing essential care will ultimately affect the health of the whole humanity, driving to another pandemic of increasing essential care needs by suboptimal treatment (if any) of the nonessential care morbidities. As the natural course of illnesses describes, nontreatment provides increasing complications that ultimately impact health.[26-29] Suboptimal treatment can theoretically turn nonessential care pathologies into essential care pathologies at an exponential growth rate, as massive or even more than the COVID-19 pandemic. Besides, keeping the usual health care of patients would prove against physicians self-right to preserve health, especially when protection equipment recommendations by WHO are not satisfied.[30] Our results show that neurosurgeons must acquire this equipment in a relation of 55% of self-investment, not to imagine if we were to attend the full spectrum of pathologies in the COVID-19 outbreak. Hopefully, telemedicine brings the opportunity to deliver health care to some extent, at least as for nonessential care,[2,14,31] avoiding the complications and counter effects of no treatment. It will also aid in reactivating medical praxis and contribute to the economy for sustaining a long-lasting pandemic. Telemedicine can help people preserve jobs (or create new ones),[17] economy, and health to counterattack the struggling financial crisis that has been held in the present and will affect the future for the many years to come.

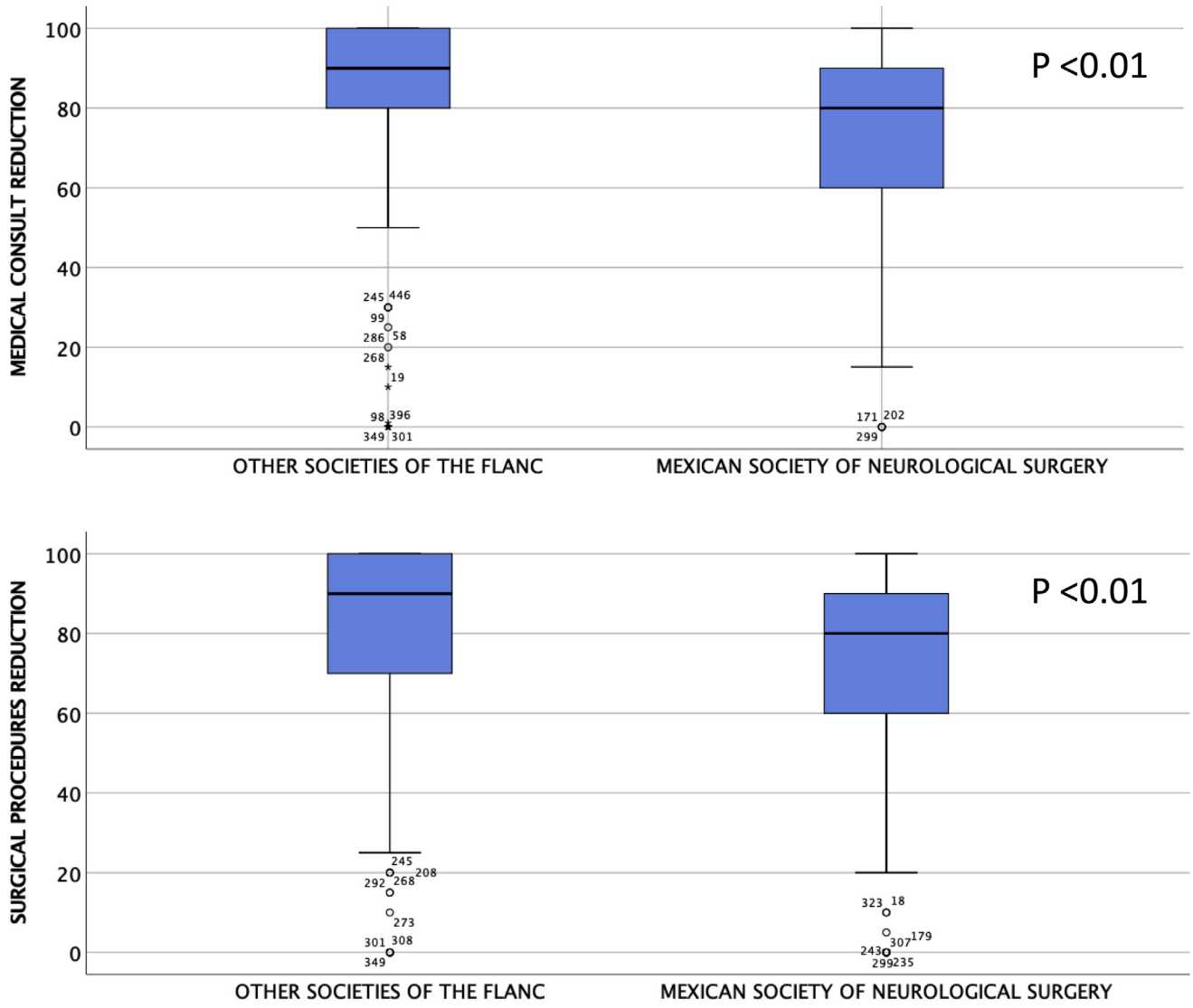

Figure 3. The Student *t*-test demonstrating a more severe reduction in neurosurgical praxis among members from other FLANC societies as compared with the Mexican Society of Neurological Group.

We also appeal to respect physicians' jobs and rights, as this pandemic has also turned into a witch hunters pandemic. Frustration and long-waiting times are known causes that lead to increased aggression from patients to health care providers.[32] The fear of COVID-19 has pushed people to take irrational measures to prevent infection from health care providers.[33] In Mexico, we have witnessed direct aggression to nurses on public transport, with people covering them with chloride.[34] Rationality and respect must prevail to health care providers; we must also search for local government policies that protect health care workers from aggressions.

Finally, further research is needed to follow the economic impact of the pandemic in the neurosurgical praxis, and to develop new methods to keep with this economic crisis while maintaining health care. We must encourage governments to improve new strategies to keep medical care (essential and nonessential) without overexposing patients and doctors to prevent an all-cause pandemic of severe disease burden across specialties. Health investment is required more than ever, and physician-oriented, as well as patient-oriented, politics must be designed to provide an ethical and fair environment to protect everyone's health and maintain the sustainability of health care systems.

CONCLUSIONS

To our knowledge, the present article is the first to describe the specific consequences that have affected health care providers as a result of the WHO recommendations to restrict medical attention to essential care to contain the COVID-19 outbreak. Stopping

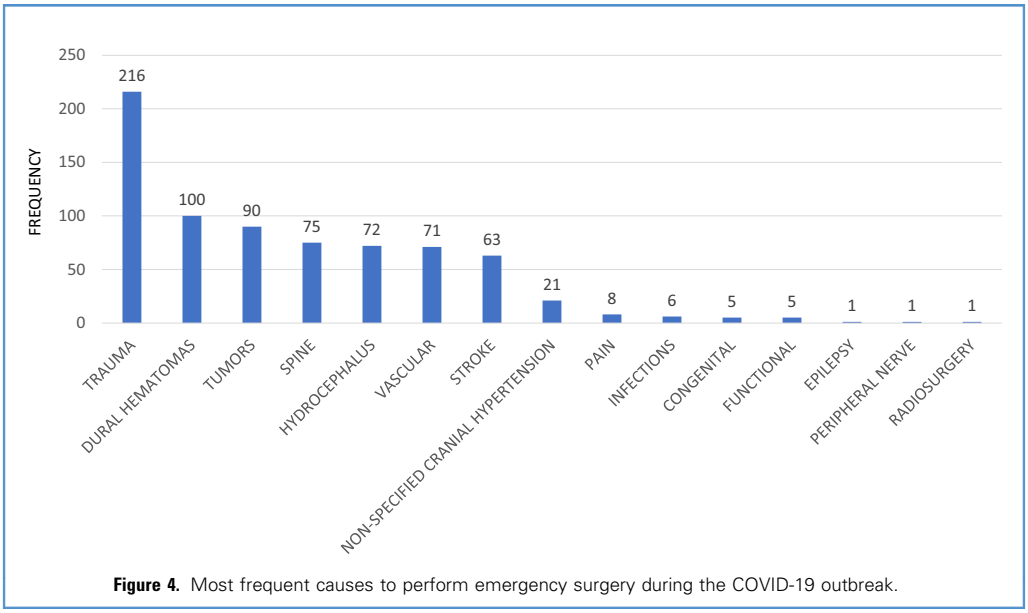

Figure 4. Most frequent causes to perform emergency surgery during the COVID-19 outbreak.

activities among societies of the FLANC, together with a drop of 79% of neurosurgical praxis, adds to deficits in provider's protection equipment and increasing demand for attention in the health care systems, representing a huge financial risk for their sustainability. Neurosurgeons should be involved in local policies to protect health and economy. Telemedicine represents an excellent solution, avoiding another pandemic of severe diseases across all-specialties as nonessential care can turn essential if left untreated. Financial support and ethics code review is needed to battle this new disease, designated the occupational disease of the decade, that continues to scrag the health care system. Times of crisis are times of great opportunities for humanity to evolve.

CRediT AUTHORSHIP CONTRIBUTION STATEMENT

José Antonio Soriano Sánchez: Conceptualization, Methodology, Validation, Software, Resources, Investigation, Writing - review & editing, Supervision, Visualization, Project administration. **Tito Arcadio Perilla Cepeda:** Supervision, Validation, Visualization. **Marcelo Zenteno:** Conceptualization, Validation. **Alvaro Campero:** Validation, Visualization. **Claudio Yampolsky:** Validation, Visualization. **Mauro Loyo Varela:** Validation, Visualization. **Manuel Eduardo Soto García:** Validation, Visualization. **José Alberto Israel Romero Rangel:** Investigation, Formal analysis, Data curation, Writing - original draft, Writing - review & editing, Visualization.

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