Initial experiences of US neurologists in practice during the COVID-19 pandemic via survey

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Abstract

Objective

To test the hypothesis that US neurologists were experiencing significant challenges with lack of personal protective equipment (PPE), rapid changes in practice, and varying institutional protocols, we conducted this survey study. The current coronavirus disease of 2019 (COVID-19) pandemic has caused widespread disease and death. Rapid increases in patient volumes have exposed weaknesses in health care systems and challenged our ability to provide optimal patient care and adequate safety measures to health care workers (HCWs).

Methods

A 36-item survey was distributed to neurologists around the United States through various media platforms.

Results

Over a 1-week period, 567 responses were received. Of these, 56% practiced in academia. A total of 87% had access to PPE, with 45% being asked to reuse PPE due to shortages. The pandemic caused rapid changes in practice, most notably a shift toward providing care by teleneurology, although a third experienced challenges in transitioning to this model. Wide variations were noted both in testing and in the guidance provided for the exposed, sick, or vulnerable HCWs. Notably, 59% of respondents felt that their practices were doing what they could, although 56% did not feel safe taking care of patients.

Conclusions

Results from our survey demonstrate significant variability in preparedness and responsiveness to the COVID-19 pandemic in neurology, affected by region, health care setting, and practice model. Practice guidelines from professional societies and other national entities are needed to improve protection for physicians and their patients, promote recommended practice changes during a pandemic, and optimize future preparedness for public health emergencies.

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Glossary

COVID-19 = coronavirus disease of 2019; **HCWs** = health care workers; **PPE** = personal protective equipment; **PUI** = patients under investigation.

Coronavirus disease of 2019 (COVID-19) is a worldwide pandemic, with cases in the United States far exceeding those of any other country. Physicians and other health care workers (HCWs) are part of the growing death toll. In China, transmission to HCWs was noted to be 3.8% in a large recent analysis by Wu et al.¹ HCWs in the United States face numerous challenges, ranging from overwhelmed health care systems to shortages of personal protective equipment (PPE) to appropriate evidence-based guidelines for prevention, infection control, and management.²

Neurologists are an interesting specialty group to be affected by the COVID-19 pandemic. Inpatient neurologists have been part of the frontline group treating afflicted patients, with recent data from Italy showing an increased risk of delirium, strokes, seizures, and encephalitides in this patient group.³ Outpatient neurologists care for high risk patients with chronic neurological diseases ranging from neurodegenerative diseases to autoimmune conditions on immunosuppressive therapy, who would be safer with home-based care. This has prompted a call for transition of care to teleneurology as quickly as possible, but there is concern that it is being adopted at variable speeds depending on the practice capabilities.

As the pandemic gradually worsens, we noted significant discrepancy in our colleagues' experiences across the United States as shared by neurologists on social media and in the press. This survey aimed at gathering data on these experiences across the country during the early phases of the COVID-19 pandemic in the inpatient and outpatient settings.

Methods

A self-administered English-language survey of 36 questions, spanning inpatient and outpatient neurology, was developed by members of the Women Neurologists Group (WNG) using Google forms. The questions were developed based on consensus amongst the authors and focused on issues raised during the COVID-19 pandemic that warranted further exploration. The survey was sent out to US-based neurologists through a number of mechanisms including social media platforms (Facebook®, Twitter®, and Instagram®), email list services (program director mailing lists, residency lists, and local state neurology societies), and the American Academy of Neurology (AAN) Synapse platform. Participation in the survey was voluntary and anonymous, and consent was obtained by agreeing to participation. Any active neurologist in the United States was targeted for participation. The survey was open online for 1 week from March 21 to March 28, 2020. Questions included

basic demographics (age, sex, state, and years in practice), practice before the pandemic, and practice changes due to pandemic (telehealth, use of PPE, institutional guidelines, and recommendations for high risk physicians). Potential confounders included the possibility that the survey could be taken twice by the same individual—given desire to preserve anonymity, we chose not to track respondents or require sign-in but encouraged respondents to only take the survey once. Subgroups of interest, which were examined, were fully trained neurologists vs trainees and comparing areas where there were high concentrations of cases (hotspots) with the rest of the respondents' experience. Missing data points were handled by reducing the total number of respondents as applicable. However, there were very few relevant missing data points.

Demographics and most variables are reported as frequencies, percentages, or means. Comparisons of groups of states used Fisher exact tests.

Data availability

The complete survey and the raw data (all the responses to the survey) are available for review (data available from Dryad [doi.org/10.5061/dryad.z34tmpg95]).

Standard protocol approvals

The study protocol was reviewed by the Emory Institutional Review Board and was deemed to meet criteria for exemption under 45 CFR 46.104(d)(2). The study was approved for indefinite exemption, barring significant changes in the protocol.

Results

A total of 567 neurologists participated in the survey, 99% in active practice. Demographics are highlighted in table 1. Actively practicing neurologists' responses are described below (561 completed surveys). Respondents were located in all 50 US states, with the highest number of responses from GA and CA (7%, respectively). Eighty-eight percent of respondents were board certified/eligible neurologists, and 12% were fellows and Post graduate year (PGY) 2-4 neurology residents.

PPE

When seeing patients under investigation (PUI), 87% of respondents reported that their institution provided PPE. PPE for the majority of respondents consisted of at least an N95 mask, gown, and gloves. A small percentage (13%) reported that they supplied or created their own PPE. Some noted in free text comments that they had been told about PPE supplies running low in their institution and would soon be running out. More than 45% of respondents were asked to reuse PPE more than once.

Table 1 Demographics (N = 567)

Sex ^a	Male	Female	
	179 (32%)	385 (68%)	
Training status	Post-training	Fellow	Resident
	500 (89%)	22 (4%)	45 (8%)
Age (range in years)	20–40	41–60	>61
	274 (49%)	242 (43%)	51 (9%)
Practice setting ^b	Academic	Private practice	Hospital
	316 (56%)	100 (18%)	123 (22%)

^a Three respondents preferred not to answer.

^b Nineteen respondents worked at the VA, and 9 responded described their setting as “other.”

Among our trainees’ responses, 27% were seeing confirmed positive patients and PUI in person. Among those, 72% had access to PPE consisting of powered air-purifying respirator, N95, gowns, and gloves. Of the trainees, 10% stated that their institutions did not provide PPE. Table 2 provides this information in further detail.

Guidelines for exposure

A total of 84 neurologists indicated that they had consulted on patients not under suspicion of COVID-19 (and therefore

without appropriate PPE), who were later diagnosed with the virus. Troublingly, 44% of these consultants were not notified of the positive test results personally. Neurologists who did have known positive exposure received a broad range of recommendations from their infection control departments. Forty-three percent (43%) were advised to continue seeing patients unless/until symptomatic. Similarly, 43% were recommended to self-quarantine/stay home once symptomatic. Only 12% were offered immediate testing for COVID-19. Criteria for testing varied widely between institutions, from being restricted to those with fever associated with dyspnea and cough to others that included those with isolated symptoms only. No recommendations regarding testing were received by 5% of respondents reporting COVID-19 exposure.

There was also a wide range of recommendations provided to respondents who had to take time off for quarantine or when sick with symptoms of COVID-19. Only 19% had been provided with confirmed, additional paid time off (ranging from 40 hours to 14 days). Thirteen percent responded that no accommodations were being made, whereas 6% were told that they would have to take unpaid leave. Almost 49% were not aware of what they would do in the event that they had to quarantine or actually fell sick with COVID-19. For older (>65 years), pregnant, and immunocompromised physicians, who are considered higher risk, 44% of respondents identified that their institution/practice had advised them not to see patients in person.

Inpatient practice

About half (42%) of respondents had teleneurology capabilities on the inpatient side for acute stroke assessments before the pandemic. However, when consulted on an at-risk patient with COVID-19, 47% were seeing them in person, 36% were using teleneurology/phone capabilities, and 17% reported a combination of teleneurology and in-person contact depending on specific cases. For stroke alerts, only 32% were using teleneurology. Nonurgent consults had been triaged by 63% of respondents. The main method was choosing to do a phone consultation with the primary team instead of seeing the patient in person (54% of responses).

Table 2 Responses regarding PPE availability

Survey questions	Responses n (%)
Does your institution provide PPE?	Yes 348 (62.1)
	No 53 (9.5)
	Unsure 107 (19.1)
	Other 59 (9.3)
What types of PPE are you provided with to see COVID-19/PUI patients?	PAPR, gown, and shield: 47 (8.5)
	N95, gown, and shield: 185 (33.4)
	Surgical mask and gown: 107 (19.3)
	Surgical mask only: 13 (2.3)
	Home-made PPE: 14 (2.5)
	I don't know: 145 (26.2)
Were you asked to reuse PPE?	Other: 43 (7.8)
	Yes 251 (45.1)
	No 136 (24.5)
	Unsure 169 (30.4)

Abbreviations: COVID-19 = coronavirus disease of 2019; PAPR: powered air-purified respirator; PPE = personal protective equipment, PUI = patients under investigation.

Forty-five percent of respondents stated that there was a neurointensivist at their institution. Of these, 81% noted that the role of the neurointensivist has not changed/not yet changed due to the pandemic.

Neurologic complications seen by neurologists in hospitalized patients with COVID-19 included viral myositis (0.9%), encephalitis (3.7%), altered mental status (12.7%), abnormal movements (2.6%), status epilepticus (8.3%), and brain death (1.3%).

Outpatient practice

Before this pandemic, about a third (29.4%) of respondents had access to a telehealth platform. A majority (68%) were able to implement teleneurology on a large scale. Reported obstacles toward implementation of teleneurology included internet bandwidth, licensing, and equipment problems. At the time of the survey, 21% of respondents still had to come into the office for teleneurology appointments. Survey respondents were informed about changes to teleneurology billing by their respective administrators in 37%, whereas 41% of neurologists had to inform their practice managers and each other of recent changes in guidelines. About 20% of respondents were unaware of changes in billing.

Practice changes in US states most affected by COVID-19

US states deemed to be COVID-19 US hotspots (more than 1,000 cases per capita) at the time of the survey included NY, NJ, LA, MA, CT, MI, and WA. One hundred twenty surveys were collected from physicians practicing in these states. Sixty-six percent of these respondents had teleneurology capabilities or quickly implemented teleneurology in their practice/institution. This was similar to nonhotspot states ($p > 0.05$). Sixty-four percent of respondents were asked to reuse PPE in these regions compared with 39% in other states ($p < 0.05$). Forty percent of respondents in these areas were being asked to do more inpatient work compared with 26% in nonhotspot areas ($p < 0.05$). The figure illustrates these differences.

Overall concern

Overall, 59% of all respondents felt that their practices were doing what they could to help them in this pandemic. Only 25% of respondents were aware of neurology leadership representation on hospital COVID task forces, whereas 38% knew that there was no neurology representation. Notably, 56% indicated not feeling safe in taking care of patients.

Discussion

In the prevention of occupational disease, controlling the hazard at the source is the foremost guiding principle. In previous epidemics and pandemics, health care institutions set up protocols such as appropriate screening measures,⁴ workforce reorganization, isolation, and huddling of infected patients. Among these measures, set up of appropriate PPE is of the

utmost importance; this becomes even more important in a respiratory-borne illness.²

This survey stemmed from hearing of different protocols and guidelines among different practices and institutions across the United States. We aimed at gathering data of practices and experiences of neurologists across the country during the early phases of the COVID-19 pandemic in an effort to highlight the need for more uniform guidance. Our results confirm that practice and experiences of neurologists varied significantly across the country and by institution. There was variability in PPE availability and provision, inclusion or exclusion of trainees in taking care of COVID-19, inpatient practices around consultation, and outpatient teleneurology capabilities and implementation. Neurologists employed in different practice settings also received varied guidance regarding testing, quarantining, and working when exposed, sick, or when part of a high-risk group.

Although the majority (87%) of respondents stated that their institutions provided them with PPE, this number should be closer to 100%, especially in a disease with high infectivity such as COVID-19.⁵ Most institutions had expressed shortages in PPE, with almost half (45%) of neurologists having to reuse their PPE and a small percentage (13%) having to make their own PPE. Some respondents left comments that their institutions informed them that they would be running out of PPE very soon. The difference is especially notable in the hotspot areas, where 64% of respondents were being asked to reuse their PPE compared with 39% in nonhotspot areas, which speaks itself to the concerns of PPE shortages.

Perhaps most concerning was that because of rapidly changing guidelines from the CDC, physicians were using PPE only to see PUIs and COVID-confirmed patients, even where there was widespread community spread and concern for asymptomatic transmission. In some instances, patients were seen without PPE at all, only to turn out to be positive later on. In our sample, almost half (44%) of these physicians were not even notified of these positive results. When they did get notified, almost half (43%) of these physicians were told to continue seeing patients until they developed symptoms. This is especially concerning since the concept of asymptomatic human-to-human transmission has been reported in January 2020.^{5–8}

The shortages of PPE felt by neurologists are similar to those felt by HCWs around the entire country, with a third to half of infection preventionists in the United States stating that they were out of various PPE (masks, shields, and gowns).⁹ Given widespread concerns raised by physicians in practice, several organizations including the American Association of Family Practice (AAFP) and the American College of Emergency Physicians (ACEP) have already released position statements encouraging the use of necessary PPE, even if that means providing one's own supplies.^{10,11} The ACEP has also made specific recommendations and provided guidance on what this PPE should look like for emergency providers.¹²

Figure Comparison of hotspots with other states

Lessons from previous pandemics such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS).¹³ The SARS outbreak differed from COVID-19, in part, because it was mainly limited to Asia and the Western Pacific region, with nearly 50% of cases harbored in Beijing.¹⁴ The SARS pandemic affected HCWs disproportionately, accounting for half of all infections.¹⁵ The current pandemic represents the most serious pandemic in modern history to affect the United States and Europe, perhaps explaining the lack of coordination and preparedness, despite the availability of recently published data. The United States and South Korea had their first cases identified on the same day,¹⁶ yet because of drastic measures and the widespread of testing and uniform use of PPE, South Korea was able to contain the disease, whereas the United States, at the time of this writing, has 15 times the number of cases in South Korea. Similar trends are seen in Singapore with very strict measures of containment.¹⁷

The pandemic thrust most institutions into rapidly changing practices. Before the pandemic, about half (42%) of practices had access to teleneurology, mainly on the inpatient side for emergencies such as acute stroke and minimally on the outpatient side (17%). The pressure to shift to telehealth presented itself rapidly and with urgency in neurology, both for the safety of our providers and our patients. Neurology patients are often high risk, due to their age, multiple comorbidities, or conditions that require immunosuppressive treatments. Thus, there exists a clear need for avoiding personal contact for nonurgent medical care as much as possible without harm to the patient's assessment and management. Among practices that already had teleneurology capabilities limited to the inpatient side, 43% were able to transition their platforms to the outpatient side, but about 22% of them were unable to secondary to issues with licensing, equipment, and appropriate bandwidth. Even among practices that used outpatient teleneurology before the pandemic, about a third of them (32%) were unable to fully transition to using

teleneurology exclusively due to equipment and bandwidth issues. Governmental and national agencies implemented policies to address this shift in practice as early as February 6, 2020, and continued to update these policies on a regular basis.^{18,19}

Limitations and future directions

Our survey questions were not validated and were developed with a consensus decision amidst the authors, which can be noted to be a limitation. Although we had representation from all 50 states, the number of survey participants was still relatively small. As of 2013, there were over 16,000 practicing neurologists in the United States, and thus, our survey represents less than 3% of the active workforce. Women neurologists were overrepresented in our sample as the survey was initially posted in the Women Neurologists Group on Facebook. Responses were similar between males and females, but we do not have the statistical power to determine whether these comparisons are meaningful. We hope to further analyze differences between practice settings, sex, and geographical area when surveys are repeated.

Another drawback is that the survey was sent out at the beginning of the pandemic in the United States, and the varied responses may be reflective of lack of policies at this particular point in time and change rapidly as institutions adjust to the pandemic. A larger sample size would allow us to better compare experiences across practice settings. In regard to the neurologic complications noted in our survey, there are only a small number of findings included in the survey and there might be other complications that are not mentioned or noted here. This is another aspect that may have been affected by the timing of the survey as the identification and understanding of the neurologic impact has grown and become more known over the last month. We plan to send a repeat survey at a later time point to gather data on the changing practices and experiences of the neurology community.

Conclusions

This report highlights the practices and experiences. Our results highlight the need for uniform guidelines and policies at the federal level. Neurologists should be a part of pandemic task forces in hospitals and health care systems. Neurology chairs and leaders in professional societies should consider quick dissemination of successful protocols to limit infection risks, yet successfully continue to care for our patients. Experience gained in this pandemic should lead to formulation of actionable practice guidelines by professional societies and other national entities to ensure optimal preparedness and safe practice measures for physicians and their patients.

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Disclosure

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Appendix Authors

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Akanksha Sharma, MD	University of Washington Medical Center, Seattle, WA	Designed and conceptualized the study, survey development, contributed to manuscript writing, contributed to data analysis, and created the final draft
Christina Maxwell, PhD	Global Neurosciences Institute, Lawrenceville, NJ	Survey development, performed majority of data analysis and interpretation, and contributed to the manuscript
Jill Farmer, DO	Global Neurosciences Institute, Lawrenceville, NJ	Survey development and contributed to manuscript writing and revision
Diana Greene-Chandos, MD, FNCS	University of New Mexico, Albuquerque, NM	Survey development and contributed to manuscript writing and revision

Appendix (continued)

Name	Location	Contribution
Kathrin LaFaver, MD	Northwestern University, Chicago, IL	Survey development and contributed to manuscript writing and revision
Karima Benameur, MD	Emory University, Atlanta, GA	IRB process, survey development, and contributed to manuscript writing and revision

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