COMMENTARY

Shortcomings of Rapid Clinical Information Dissemination

Lessons From a Pandemic

K.H. Vincent Lau, MD, and Pria Anand, MD

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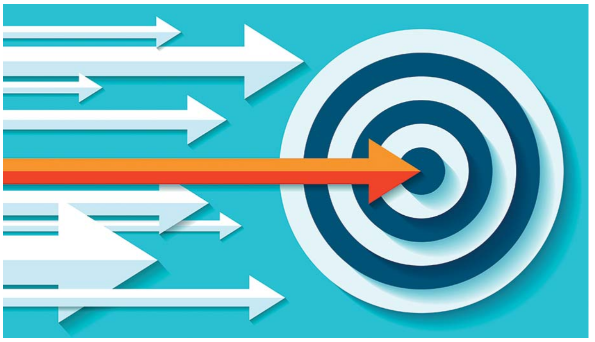
Correspondence
Dr. Lau
vincent.lau@bmc.org



Abstract

The coronavirus disease 2019 (COVID-19) pandemic has led to an acceleration of clinical information dissemination to unprecedented speeds, a phenomenon only partially explained by formal efforts of the scientific community. These have ranged from the establishment of open-source platforms for review of article preprints to the elimination of journal paywalls for COVID-19–related publications. In addition, informal efforts that rely on various modern media platforms that promote, repackage, and synthesize information have played substantial adjunctive roles, many of which did not exist during the severe acute respiratory syndrome pandemic of 2003. Although these latter efforts have greatly bolstered the speed of knowledge dissemination, their unregulated nature subjects them to risk for facilitating the spread of misinformation. In our opinion, the role of modern media in influencing clinical knowledge dissemination was not adequately examined even before the pandemic and therefore remains largely unchecked. In this article, we examine the spread of information in the field of COVID-19 and neurologic disorders, develop a simple model that maps various modern media tools on to the dissemination pipeline, and critically examine its components. Through this exercise, we identify opportunities for the scientific community to regulate and safeguard the clinical knowledge dissemination process, with implications both for the pandemic and beyond.

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The coronavirus disease 2019 (COVID-19) pandemic has led to an acceleration of clinical knowledge dissemination at all levels of the scientific community to equip frontline clinicians with decision-making support. Many journal editorial teams have established pathways for expedited peer review,[1] built open-source platforms for quick review of preprints,[2] and removed paywalls for COVID-19–related publications.[3] Clinical leaders have rapidly released consensus statements in conjunction with academic societies specific to their field of influence.[4,5] Others have contributed rapid reviews that summarize available literature and detail their frontline experiences.[6]

In addition to these journal-based efforts, information flow has also been bolstered by various web-based media and social media–based resources. Examples include online article repositories,[7] infographics that repackage information into simplified formats,[8] social media platforms that promote web-based clinical resources,[9] and many others. It is notable that the infrastructures supporting many of these resources did not exist during the severe acute respiratory syndrome pandemic of 2003, such as Facebook (created in 2004), Twitter (created in 2006), and podcasts (popularized in the 2000s),[10] whereas others have matured

Department of Neurology, Boston University School of Medicine, MA.

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greatly in the interim, including smartphones and the World Wide Web itself. Online media oftentimes propel information in interconnected ways. For instance, a scientific article may be referenced in a web-based consolidation resource, which is promoted on a podcast, which is in turn advertised on an online clinician forum.

The complexity of inter-referencing has precluded efforts to characterize clinical knowledge dissemination in the digital age. Prior works have attempted to model information flow as complex networks using journal articles and citations as nodes,[11] but some studies have found poor correlation between model strength and topography, suggesting that this method may be impractical.[12] Others have attempted to use principles of dissemination and implementation science, but these tend to focus on health systems as targets of knowledge transfer rather than individuals, which may limit its ability to characterize social influence by new media.[13] However, we believe that we can use these 2 methods complementarily to generate a simple model describing how clinicians access scientific literature, empirically derived from a snapshot of the intersection between COVID-19 and neurologic disorders. Such a model would allow us to critically evaluate the components of the knowledge dissemination pipeline in the digital age.

A Simple Model of Clinical Knowledge Dissemination

Design

On May 1, 2020, we searched PubMed for primary literature on COVID-19 and neurologic disorders using the search entry "(COVID-19 or SARS-CoV-2 or coronavirus or severe acute respiratory syndrome) AND (neurology or neurologic or neurological or neuro or brain or nerve or muscle or Guillain-Barre or stroke or seizure or meningitis or encephalitis or meningoencephalitis)." We augmented our list by reviewing the reference lists of these articles, relevant online article collections, and the reference lists of the online neurology inpatient protocols maintained at our institution (covidneurology.org).[14]

We found 18 articles considered primary literature consisting of case reports, case series, and retrospective observation studies on neurologic disorders and COVID-19 published between February 25 and May 1, 2020, as shown in the table. The lag time between patient presentation and article publication ranged from 16 to 69 days; it was not possible to establish a median due to ambiguity regarding dates of presentation, especially for case series and retrospective studies. For each article, an exact Google search of its title found a median of 398 references from online resources and a median of 1.5 references from academic journal articles. We mapped the online resources for each article as a network, with an example shown in figure 1 that depicts select media-based resources referencing the *New England Journal of Medicine* editorial on large-vessel strokes in young patients with COVID-19, published on April 28, 2020.[15] Unilateral arrows indicate the direction of referencing, such as the NEJM Journal Watch referencing the article on April 28, the day it was published. Some referencing connections between resources were established before article publication.

Description

We found that all online resources may be classified into the categories of article collections (e.g., American Academy of Neurology [AAN] COVID-19 Neurology Resource Center[7]), medical knowledge repositories (e.g., Medscape[16]), new media (e.g., *Neurology*® podcast[17]), point-of-care knowledge consolidation resources (e.g., UpToDate[18]), rapidly developed clinical protocols (e.g., Brigham and Women's COVID-19 protocols[19]), journal-based social media platforms, institutional social media platforms, clinician-specific online forums, informal online forums, personal social media accounts, and news articles for lay audiences. By examining the relationships between these resources as a network with unidirectional relationships, we collapsed them into 4 domains based on their primary purpose: repository, synthesis, formal promotion, and informal promotion, as shown in figure 2.

Repository Resources

Respository resources are article repositories that provide minimal or no commentary on publications. During the pandemic, they have been critical for directing clinicians to specialty-specific literature, such as the COVID-19 Neurology Resource Center: Articles and Publications maintained by the AAN.[7] In general, article collections are managed by academic societies, such as the American College of Physicians Journal Club,[20] or scientific journals that house specialty collections, such as the Neurology Specialty Collection of The Lancet.[21] Uncommonly, journal-based article repositories may feature publications of competing journals in the case of small academic fields.[22]

Synthesis Resources

Synthesis resources are online tools that aggregate scientific literature, often with the goal of generating clinical recommendations. During the pandemic, the need for rapid knowledge synthesis has seen the emergence of online clinical protocols, which summarize available literature and make recommendations using a combination of limited evidence, evolving frontline experience, and expert opinion. These protocols are typically written by groups of experts at an academic society or institution and are disseminated quickly and updated continuously, bypassing journal peer review. Examples include protocols on the outpatient management of neurologic disorders in patients with COVID-19 by the Association of British Neurologists[23] and those on inpatient management by neurologists at Boston Medical Center.[14] Before the pandemic, online synthesis tools were generally reserved for point-of-care knowledge acquisition, such as the popular consolidation resource UpToDate.[24] They are

Table Primary Literature on Neurologic Disorders and COVID-19 Published From February 25 to May 1, 2020, Inclusive

Ref.	Location	Neurologic manifestation	Journal	Publication date	Date of case presentation	No. of cases	Search results: Total hits; total citations
43	Wuhan, China	Dizziness; headache; impaired consciousness; acute cerebrovascular disease; ataxia; seizure; skeletal muscle injury; nerve pain; impaired taste, smell, or vision	*JAMA Neurology*	February 25, 2020 (preprint); April 10, 2020 (journal publication)	January 16, 2020, to February 19, 2020	78	1,970; 119
44	Wuhan, China	Acute ischemic stroke; cerebral venous sinus thrombosis; cerebral hemorrhage	*Lancet Neurology*	March 13, 2020 (preprint)	January 16 to February 29, 2020	13	351; 27
45	United States (Detroit)	Acute hemorrhagic necrotizing encephalopathy	*Radiology*	March 31, 2020 (preprint)	Unspecified	1	1,120; 32
46	Wuhan, China	Guillain-Barré syndrome	*Lancet Neurology*	April 1, 2020	January 23, 2020	1	11,500; 17
47	Yamanashi, Japan	Meningitis; encephalitis	*International Journal of Infectious Diseases*	April 3, 2020 (preprint)	March 2020 (date unspecified)	1	2,060; 21
48	Wuhan, China	Encephalitis	*Brain, Behavior, and Immunity*	April 10, 2020	February 10, 2020	1	125; 2
49	Strasbourg, France	Agitation; corticospinal tract findings; dysexecutive syndrome; confusion	*New England Journal of Medicine*	April 15, 2020	March 3, 2020, to April 3, 2020	49	2,050; 7
50	Sari, Iran	Guillain-Barré syndrome	*Journal of Clinical Neuroscience*	April 15, 2020	Unspecified	1	233; 2
51	Wuhan, China	Encephalopathy	*Journal of Medical Virology*	April 15, 2020	February 10, 2020	1	91; 0
52	Madrid, Spain	Guillain-Barré syndrome (Miller-Fisher syndrome)	*Neurology*	April 17, 2020 (preprint)	Unspecified	2	1,040; 1
53	United States (Los Angeles)	Meningitis; encephalitis	*Brain, Behavior, and Immunity*	April 17, 2020	April 1, 2020	1	74; 0
54	Northern Italy	Guillain-Barré syndrome	*New England Journal of Medicine*	April 17, 2020	February 28 through March 21, 2020	5	Title is same as Virani article: 6,570; 5
55	China (Hubei, Sichuan, and Chongqing Provinces)	Seizure-like events	*Epilepsia*	April 18, 2020	January 18, 2020, to February 18, 2020	2	398; 0
56	United States (Pittsburgh, PA)	Guillain-Barré syndrome	*IDCases*	April 18, 2020	Unspecified	1	Title is same as Toscano article: 6,570; 0
57	Piacenza, Italy	Guillain-Barré syndrome	*Journal of Neurology*	April 24, 2020	Marcy 28, 2020	1	29; 0
15	United States (New York)	Stroke	*New England Journal of Medicine*	April 28, 2020	March 23, 2020, to April 7, 2020	5	2,200; 0
58	Monza, Italy	Guillain-Barré syndrome	*Neurology: Neuroimmunology & Neuroinflammation*	April 29, 2020	Unspecified	1	79; 0
59	Bilbao, Spain	Stroke	*European Journal of Neurology*	April 30, 2020	Unspecified	1	1; 0

uncommon outside of point of care, as clinicians tend to rely on their peer-reviewed journal-based counterparts.

Formal Promotion Resources

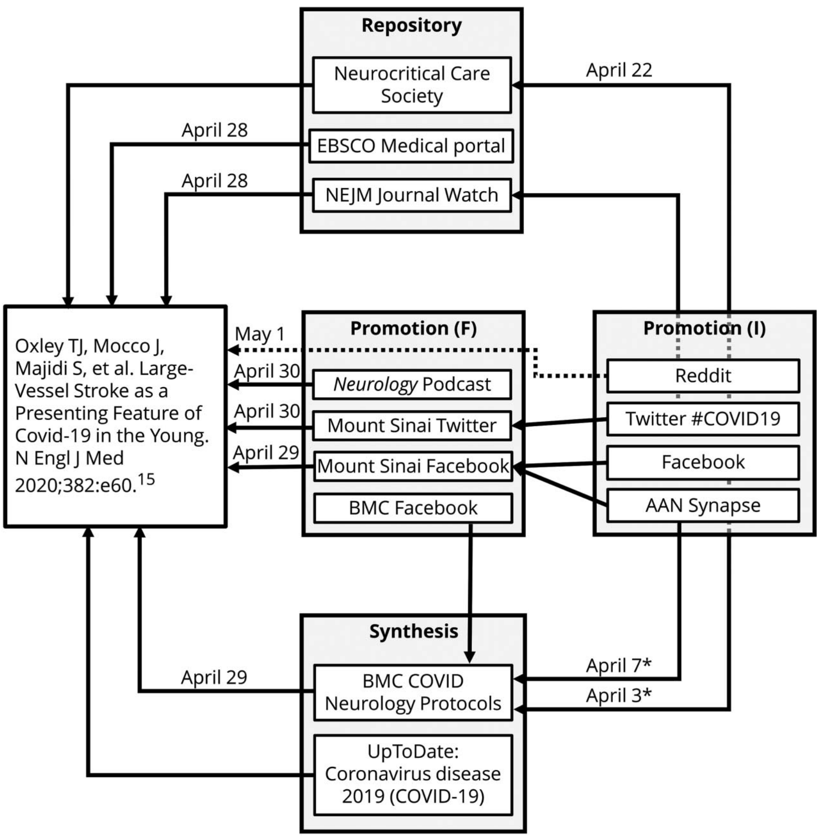
Formal promotion resources are online media that draw attention to content without modification, including the official social media platforms of scientific journals, academic societies, and medical institutions. During the pandemic, many landmark articles have been shared widely on institutional social media platforms.[9,25] Before the pandemic, 1 study correlated the social media presence of a journal with its impact as measured by its Klout score and SCImago Journal Rank,[26] and another correlated the number of tweets about an article with its eventual number of citations,[27] both demonstrating correlation without causation. Some social media promotions are bolstered by the use of infographics, which are minimalist visual representations of article content to boost popularity, previously found to increase Altmetric scores and abstract views.[28] Some researchers believe that article promotion on social media will soon become an expectation,[8,29] with advent of social media–specific impact metrics such as a Twitter impact factor[30] or twimpact factor.[27]

Another form of formal promotion is podcasts that feature interviews with authors of recent publications.[31] Examples include the weekly *Neurology* podcast managed by the AAN[17] and the *AANEM presents Nerve & Muscle Junction* podcast managed by the American Association of Neuromuscular & Electrodiagnostic Medicine,[32] the former featuring several special reports on COVID-19 and neurology during the pandemic. Formal promotion resources may reference scientific literature directly but may also reference repository and synthesis resources, as shown in figure 2.

Informal Promotion Resources

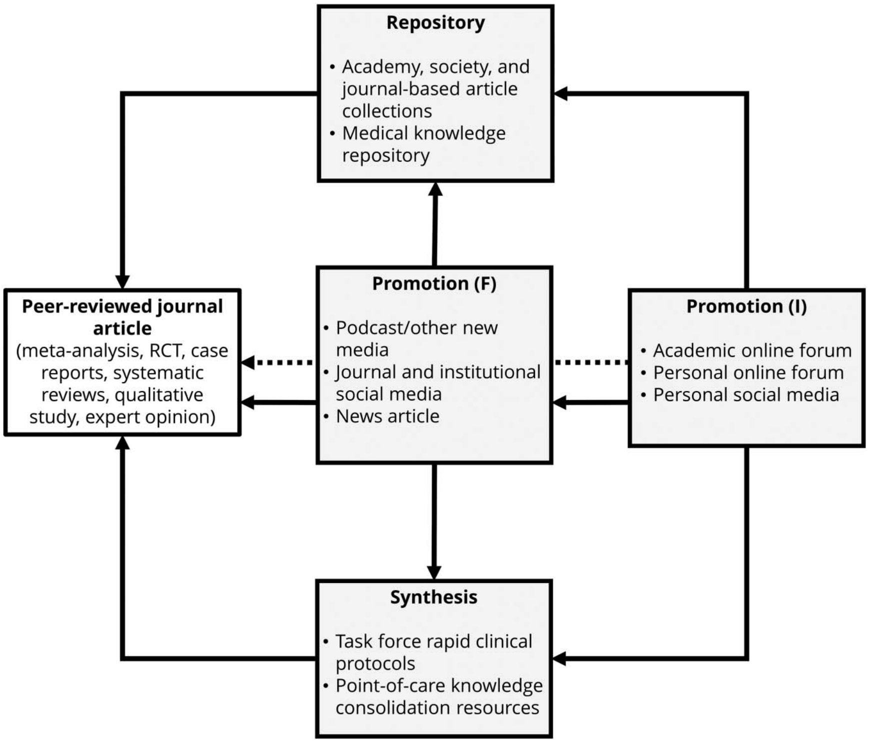
Informal promotion resources are online tools analogous to traditional word of mouth, including official academy-based forums, unofficial interest-based forums, and personal social media. During the pandemic, there has been a surge of online discussions on COVID-19–related information and resources via clinician-specific forums, such as the Synapse AAN Online Communities platform.[33] This type of promotion may reach clinicians in a unique way during their leisure time through personal or social networks or engage clinicians who are less proactive in seeking information by formal means. Informal promotion resources may reference scientific literature directly or the media-based resources of any of the other 3 domains, as shown in figure 2.

Figure 1 Select Media-Based Resources Referencing the *New England Journal of Medicine* Editorial on Large-Vessel Strokes in Young Patients With COVID-19, Published on April 28, 2020[15]



Unilateral arrows indicate direction of referencing material, for example, the Neurocritical Care Society referencing the article directly. All arrows are equivalent; dotted arrows are used when crossing other elements of the figure for clarity. Dates when a reference is created are shown if known. Note that the dates marked with an asterisk indicate that connections are made predating journal publication on April 28. For example, the BMC protocols were promoted on AAN Synapse weeks before adding a reference to the journal article. AAN = American Academy of Neurology; BMC = Boston Medical Center; NEJM = *New England Journal of Medicine*; Promotion (F) = formal promotion; Promotion (I) = informal promotion.

Figure 2 Proposed Model of Modern Clinical Knowledge Dissemination as Influenced by Modern Media Tools



Unilateral arrows indicate direction of referencing material, for example, an article collection referring a scientific article. All arrows are equivalent; dotted arrows are used when crossing other elements of the figure for clarity. Note that informal promotion resources may reference any of the other 3, formal promotion resources may reference the remaining 2, and the others may only reference a journal article directly. Promotion (F) = formal promotion; Promotion (I) = informal promotion; RCT = randomized control trial.

We acknowledge several limitations to our simple model, such as its focus on only non–point-of-care knowledge acquisition, given that point-of-care knowledge acquisition is a complex study of its own beyond the scope of this model or article. We also excluded print resources as there is increasing evidence that textbooks and other print media may be falling out of favor.[34,35] Our model was also derived from a snapshot of a narrow field using PubMed with limited search terms and web engine searches that are known to be imperfect with redundancies and inaccuracies. However, we believe that its overall framework is valid and sufficiently detailed for the purpose of scrutinizing its components.

Implications

Our bird's-eye view model draws attention to 3 major shortcomings of the current state of modern clinical information dissemination. First, examining the category of synthesis resources reveals that it uniquely features only 2 subtypes: point-of-care knowledge consolidation resources and rapid clinical protocols developed by task forces, the former usually of high quality as there are only few that are commercially successful.[18] Meanwhile, the latter differs greatly from the resources in the other 3 domains, as they do not simply promote or redirect information but add to it in a scientific, theoretically rigorous way. Although they afford a speed of dissemination that may be necessary during the pandemic, their nature of bypassing journal peer review has potential negative consequences—oversimplifying complicated topics at best and spreading misinformation at worst. During the pandemic, rapidly developed and disseminated online clinical protocols emerged out of necessity. Although this format has not been scrutinized in the literature, the synthesis component likely has the same drawbacks as the rapid reviews, traditionally criticized for poor quality when evaluated against standards of evidence synthesis for meta-analyses and systematic reviews.[36,37] The recent unfortunate retraction of a scientific journal article on hydroxychloroquine or chloroquine as treatment of COVID-19 highlights the risks of incomplete peer review at the level of primary data in a database.[38] The scientific community would do well to standardize the development of online protocols and to establish uniform evaluative criteria. One group in Brazil proposed a regimented process involving multiple parallel systematic reviews in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocols[39] for use during the pandemic. Such standardization would be especially important if this format of information synthesis is needed in future crises.

The second shortcoming is that there is a high level of redundancy in web-based resources, especially evident when examining the types of resources under repository and formal promotion resources. We identified only 18 scientific articles considered primary literature at the intersection of neurology and COVID-19, yet each was referenced by a median of 398 web-based sources, the majority of which shared identical purposes and promoted information without adding any meaningful value. Although this is not detrimental in terms of inaccuracy of knowledge propagation, it does suggest a very high level of accumulated wasted effort among many stakeholders in the dissemination pipeline, from individual academics to hospital centers to academic societies. We argue that academic institutions at the highest levels have the responsibility to consolidate media-based efforts that propagate knowledge such that its members do not need to rely on niche online resources. A recent example is the journal article–based assessment option for recertification piloted by the American Board of Psychiatry and Neurology, which has seen warm reception thus far[40] as expected, given that critics have long called for modernization and digitalization of continuing medical education.[41] The communication technologies that spawned complex networks of unregulated influences on knowledge acquisition can also be used to facilitate collaboration between reputable academic societies to consolidate efforts at the highest levels.

The final shortcoming is that our model showcases the very central role social media plays on how clinicians access scientific literature, pointing them toward any of the types of resources in the other 3 domains. Social media is largely unregulated by definition, its contents random and components oftentimes distracting. Its effects are far-reaching, and erroneous information is easily propagated. Examples in which incorrect information spreads through social media is admirably acknowledged are rare[42]; we assume that in the vast majority of cases, inaccurate information is propagated unnoticed. In addition, the pervasiveness of social media in society has called into question its effects on the attention span of the present generation. Its increasing encroachment on clinicians' academic lives may also blur the line between one's social and professional identities. As the influence of social media is expected to only grow stronger with advent of new technologies, further examination may be necessary from a sociotechnological standpoint, requiring the expertise of researchers outside our field to study how the clinician community acquires knowledge in the digital age.

Although we may use our new understanding of modern clinical knowledge dissemination to accelerate parts of the process (e.g., journal editorial teams may create podcasts, and researchers may design infographics to accompany their published works), the more important application is to address key problematic areas relevant to the pandemic and beyond. Urgent next steps include standardizing methods of rapid knowledge synthesis, consolidating redundant efforts to avoid collective waste, and regulating the influence of social media on knowledge dissemination. Certainly, these efforts are likely to be met with some opposition, as various stakeholders in the knowledge dissemination pipeline may be resistant to change, including those engaged in rapid dissemination of information wishing to bypass the laborious process of peer review or creators of web-based niche resources who wish to remain relevant. Nonetheless, modern media is changing the landscape of clinical information flow faster than we are able to understand. We must continually examine the process to mitigate the risks of misinformation and optimize the ways clinicians interact with scientific literature such that they are best supported in the practice of evidence-based medicine.

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Appendix Authors

Name	Location	Contribution
K.H. Vincent Lau, MD	Boston University School of Medicine, MA	Designed and conceptualized commentary and drafted the manuscript
Pria Anand, MD	Boston University School of Medicine, MA	Designed and conceptualized commentary and drafted the manuscript

References

1. Song P, Karako T. COVID-19: real-time dissemination of scientific information to fight a public health emergency of international concern. Biosci Trends 2020;14:1–2.
2. Johansson MA, Saderi D. Open peer-review platform for COVID-19 preprints. Nature 2020;579:29.
3. Vervoort D, Ma X, Luc JGY, Zieroth S. Rapid scholarly dissemination and cardiovascular community engagement to combat the infodemic of the COVID-19 pandemic. Can J Cardiol 2020;36:969.e1–969.e2.
4. Nguyen TN, Abdalkader M, Jovin TG, et al. Mechanical thrombectomy in the era of the COVID-19 pandemic: emergency preparedness for neuroscience teams: a guidance statement from the Society of Vascular and Interventional Neurology. Stroke 2020;51:1896–1901.
5. Sharma D, Rasmussen M, Han R, et al. Anesthetic management of endovascular treatment of acute ischemic stroke during COVID-19 pandemic: consensus statement from Society for Neuroscience in Anesthesiology & Critical Care (SNACC): endorsed by Society of Vascular & Interventional Neurology (SVIN), Society of NeuroInterventional Surgery (SNIS), Neurocritical Care Society (NCS), and European Society of Minimally Invasive Neurological Therapy (ESMINT). J Neurosurg Anesthesiol 2020;32:193–201.
6. Guidon AC, Amato AA. COVID-19 and neuromuscular disorders. Neurology 2020; 94:959–969.
7. American Academy of Neurology. COVID-19 Neurology Resource Center: Articles and Publications. 2020. Available at: aan.com/tools-and-resources/covid-19-neurology-resource-center/covid-19-articles-and-publications/. Accessed April 21, 2020, 2020.
8. Chan AKM, Nickson CP, Rudolph JW, Lee A, Joynt GM. Social media for rapid knowledge dissemination: early experience from the COVID-19 pandemic. Anaesthesia Epub 2020 Mar 30.
9. Mount Sinai Neurology. Mount Sinai Neurology @MSHSNeurology. Available at: twitter.com/mshsneurology?lang=en. Accessed May 7, 2020.
10. Cho D, Cosimini M, Espinoza J. Podcasting in medical education: a review of the literature. Korean J Med Educ 2017;29:229–239.
11. Costa LdF. Learning about knowledge: a complex network approach. Phys Rev E Stat Nonlin Soft Matter Phys 2006;74(2 pt 2):026103.
12. Lima TS, de Arruda HF, Silva FN. The dynamics of knowledge acquisition via self-learning in complex networks. Chaos 2018;28:083106.

13. Chambers DA. Dissemination and implementation research: from a reporting framework to precision medicine. Am J Public Health 2017;107:839.
14. Boston Medical Center. COVID-19 Neurology Protocols. 2020. Available at: covidneurology.org. Accessed April 17, 2020.
15. Oxley TJ, Mocco J, Majidi S, et al. Large-vessel stroke as a presenting feature of Covid-19 in the young. N Engl J Med 2020;382:e60.
16. Medscape. Today on Medscape. Available at: medscape.com. Accessed May 1, 2020.
17. American Academy of Neurology. Neurology Podcast. 2020. Available at: aan.com/education-and-research/online-learning-programs/neurology-podcast/. Accessed April 20, 2020.
18. McIntosh K. Coronavirus disease 2019 (COVID-19): Epidemiology, virology, clinical features, diagnosis, and prevention. 2020. Available at: uptodate.com/contents/coronavirus-disease-2019-covid-19-epidemiology-virology-clinical-features-diagnosis-and-prevention. Accessed May 1, 2020.
19. Brigham and Women's Hospital. Brigham and Women's Hospital COVID-19 clinical guidelines. 2020. Available at: covidprotocols.org. Accessed April 30, 2020.
20. American College of Physicians. ACP Journal Club. 2020. Available at: acponline.org/clinical-information/journals-publications/acp-journal-club. Accessed April 30, 2020.
21. The Lancet. The Lancet Specialty Collectoins: Neurology. 2020. Available at: thelancet.com/collections/Neurology. Accessed May 3, 2020.
22. Morrison M, Dickenson D, Lee SS. Introduction to the article collection 'Translation in healthcare: ethical, legal, and social implications'. BMC Med Ethics 2016;17:74.
23. Association of British Neurologists. Association of British Neurologists Guidance on COVID-19 for people with neurological conditions, their doctors and carers. 2020. Available at: cdn.ymaws.com/www.theabn.org/resource/collection/6750BAE6-4CBC-4DDB-A684-116E03BFE634/ABN_Neurology_COVID-19_Guidance_22.3.20.pdf. Accessed April 20, 2020.
24. Wolters Kluwer. UpToDate. Available at: uptodate.com. Accessed May 1, 2020.
25. Frontiers Neurology. Frontiers Neurology @FrontNeurol. 2020. Available at: twitter.com/frontneurol. Accessed May 1, 2020.
26. Wong K, Piraquive J, Levi JR. Social media presence of otolaryngology journals: the past, present, and future. Laryngoscope 2018;128:363–368.
27. Eysenbach G. Can tweets predict citations? Metrics of social impact based on Twitter and correlation with traditional metrics of scientific impact. J Med Internet Res 2011;13:e123.
28. Huang S, Martin LJ, Yeh CH, et al. The effect of an infographic promotion on research dissemination and readership: a randomized controlled trial. CJEM 2018;20:826–833.
29. Johannsson H, Selak T. Dissemination of medical publications on social media—is it the new standard? Anaesthesia 2020;75:155–157.
30. Cardona-Grau D, Sorokin I, Leinwand G, Welliver C. Introducing the twitter impact factor: an objective measure of urology's academic impact on twitter. Eur Urol Focus 2016;2:412–417.
31. Thoma B, Murray H, Huang SYM, et al. The impact of social media promotion with infographics and podcasts on research dissemination and readership. CJEM 2018;20:300–306.
32. American Association of Neuromuscular & Electrodiagnostic Medicine. Physician Podcasts. 2020. Available at: aanem.org/Education/All-Education-Products/Physician-Podcasts. Accessed April 25, 2020.
33. American Academy of Neurology. Synapse AAN Online Communities. 2020. Available at: synapse.aan.com. Accessed April 21, 2020.
34. Ju C, Bove J, Hochman S. Does the removal of textbook reading from emergency medicine resident education negatively affect in-service scores? West J Emerg Med 2020;21:434–440.
35. Fialkowski MK, Calabrese A, Tilinghast B, et al. Open educational resource textbook impact on students in an introductory nutrition course. J Nutr Educ Behav 2020;52:359–368.
36. Tricco AC, Antony J, Zarin W, et al. A scoping review of rapid review methods. BMC Med 2015;13:224.
37. Garritty C, Stevens A, Hamel C, Golfam M, Hutton B, Wolfe D. Knowledge synthesis in evidence-based medicine. Semin Nucl Med 2019;49:136–144.
38. Mehra MR, Ruschitzka F, Patel AN. Retraction-Hydroxychloroquine or chloroquine with or without a macrolide for treatment of COVID-19: a multinational registry analysis. Lancet 2020;395:1820.
39. Rada G, Verdugo-Paiva F, Avila C, et al. Evidence synthesis relevant to COVID-19: a protocol for multiple systematic reviews and overviews of systematic reviews. Medwave 2020;20:e7868.
40. American Board of Psychiatry and Neurology. MOC Part III Pilot Project. Available at: abpn.com/maintain-certification/moc-part-iii-pilot-project/. Accessed May 3, 2020.
41. Sinclair P, Kable A, Levett-Jones T. The effectiveness of internet-based e-learning on clinician behavior and patient outcomes: a systematic review protocol. JBI Database System Rev Implement Rep 2015;13:52–64.
42. Edwards S, Roland D. Learning from mistakes on social media. Emerg Med J 2019;36:453–455.
43. Mao L, Jin H, Wang M, Hu Y, et al. Neurologic manifestations of hospitalized patients with coronavirus disease 2019 in Wuhan, China. JAMA Neurol 2020;77(6):683-690.
44. Li Y, Li M, Wang M, et al. Acute cerebrovascular disease following COVID-19: a single center, retrospective, observational study. Stroke Vasc Neurol. 2020;5(3):279-284.
45. Poyiadji N, Shahin G, Noujaim D, et al. COVID-19-associated acute hemorrhagic necrotizing encephalopathy: imaging features. Radiology. 2020;296(2):e119–E120.
46. Zhao H, Shen D, Zhou H, et al. Guillain-Barré syndrome associated with SARS-CoV-2 infection: causality or coincidence? Lancet Neurol. 2020;19(5):383-384.
47. Moriguchi T, Harii N, Goto J, et al. A first case of meningitis/encephalitis associated with SARS-Coronavirus-2. Int J Infect Dis. 2020;94:55-58.
48. Ye M, Ren Y, Lv T. Encephalitis as a clinical manifestation of COVID-19. Brain Behav Immun. 2020;88:945-946.
49. Helms J, Kremer S, Merdji H, et al. Neurologic features in severe SARS-CoV-2 infection. N Engl J Med. 2020;382(23):2268-2270.
50. Sedaghat Z, Karimi N. Guillain Barre syndrome associated with COVID-19 infection: a case report. J Clin Neurosci. 2020;76:233-235.
51. Yin R, Feng W, Wang T, et al. Concomitant neurological symptoms observed in a patient diagnosed with coronavirus disease 2019. J Med Virol. 2020;92(10):1782-1784.
52. Gutiérrez-Ortiz C, Méndez A, Rodrigo-Rey S, et al. Miller Fisher Syndrome and polyneuritis cranialis in COVID-19. Neurology. 2020;95(5):e601-e605.
53. Duong L, Xu P, Liu A. Meningoencephalitis without respiratory failure in a young female patient with COVID-19 infection in Downtown Los Angeles, early April 2020. Brain Behav Immun. 2020;87:33.
54. Toscano G, Palmerini F, Ravaglia S, et al. Guillain-Barré syndrome associated with SARS-CoV-2. N Engl J Med. 2020;382:2574-2576.
55. Lu L, Xiong W, Liu D, et al. New-onset acute symptomatic seizure and risk factors in corona virus disease 2019: a retrospective multicenter study. Epilepsia. 2020;61(6):e49-e53.
56. Virani A, Rabold E, Hanson T, et al. Guillain-Barré syndrome associated with SARS-CoV-2 infection. IDCases. 2020;20:e00771.
57. Padroni M, Mastrangelo V, Asioli GM, et al. Guillain-Barré syndrome following COVID-19: new infection, old complication? J Neurol. 2020;267(7):1877-1879.
58. Alberti P, Beretta S, Piatti M, et al. Guillain-Barré syndrome related to COVID-19 infection. Neurol Neuroimmunol Neuroinflamm. 2020;7(4):e741.
59. González-Pinto T, Luna-Rodríguez A, Moreno-Estébanez A, et al. Emergency room neurology in times of COVID-19: malignant ischemic stroke and SARS-COV2 infection. Eur J Neurol. 2020;27(9):e35-e36.

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Shortcomings of Rapid Clinical Information Dissemination: Lessons From a Pandemic

K.H. Vincent Lau and Pria Anand

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