

PULSE EXPERIENTIAL TEAM ASSIGNMENT

1. Title of your PULSE experiential assignment. <i>Provide a creative and informative title.</i>
Insights into Ischemic Stroke
2. Please summarize your PULSE experiential assignment (max 300 words). <i>Provide a non-technical (lay) summary of your PULSE assignment. Prompts to think about: What is the topic? What is the format? Why did you choose this topic and format? The summary for lay audience is a brief and accessible summary of the assignment that is used to explain complex ideas, technical writing and scientific terms to people who do not have prior knowledge of the subject (e.g., high school science level). This summary should include the importance, impact, and content of your assignment to a broader audience.</i> <i>[Team 23 is an example of an informative lay summary.]</i>
Ischemic stroke is a medical emergency where the brain does not receive enough blood flow, resulting in necrosis of the brain tissue. This condition can occur due to a clot blocking the blood or stenosis/narrowing of the vessel, causing ischemia. Stroke symptoms come in various ways depending on the artery that is occluded. This website aims to inform pathology students (or learners just interested in ischemic stroke in general) about this disease. This relatively common disease has plagued the lives of many, and it is crucial to both spread awareness and knowledge about its risks, symptoms, prognosis, and many other things. We chose to use a website as our medium, as it offers an interactive experience for learners, and it allows students to pursue their interested topic at their own pace. Our website features an intuitive layout and provides proper introductions to each learning module, where we discuss a specific aspect of ischemic stroke. We also have review questions under each learning module to help learners test their understanding, further improving the effectiveness of our chosen approach. We hope that our chosen format can stay engaging for their audience throughout their time there.
3. Provide up to 6 keywords relevant to your PULSE experiential assignment. <i>3-6 keywords are ideal.</i>
Ischemic stroke, cerebrovascular occlusion, blood clot, thromboembolism, sensory deficits, cholesterol management
4. Identify the course topic with which your PULSE assignment most aligns. <i>Refer to the various topics outlined under 'Course content and Schedule' in the syllabus (e.g. Inflammation).</i>
Diseases of the Central Nervous System
5. What are the learning outcomes? <i>There should be a minimum of 2 learning outcomes for your assignments. For further information on learning outcomes, the Centre for Teaching and Learning offers information: https://teaching.uwo.ca/curriculum/coursedesign/learning-outcomes.html</i>
1. Understand the difference between ischemic and hemorrhagic stroke. 2. Understand the common causes and risk factors of ischemic stroke. 3. Understand the molecular mechanisms of development. 4. Recognize the common symptoms, prevention, and treatment methods. 5. Understand how ischemic stroke results in common complications.

6. Why did the team select the chosen topic and the medium? How will the topic and medium of choice help learners?
We selected this topic because stroke is a common cause of death in the world, with it accounting for "1 in 6 deaths from cardiovascular disease," and also because we as a group were interested in this topic due to past experiences. We chose a website because we believed that it would be the easiest way for students to interact with the complex topic of stroke. This topic and medium will help learners by teaching the causes of stroke, while also demonstrating how to live a healthy lifestyle to reduce the risk of stroke in an easy-to-digest format.
7. Did the team use an artificial intelligence (AI) technology tool? If so, which AI technology tool(s) did the team use? What other technology tools did the team use? Is the technology tool novel? Is the team using this technology tool in a novel fashion? If the team did not use technology tool, why did the team decide against using the technology tool(s)? <i>Please include details (e.g., for what purpose was the tool used for? Why was the tool the best tool to use for your assignment? Are there alternative tools that were considered?)</i>
Our team opted against the use of AI tools to ensure the validity and accuracy of the information presented. This decision was made as AI-assisted writing and source-finding tend to oversimplify information, which can decrease the overall consistency. Our team mainly used Google Sites and Google Docs as our technology tools, allowing the team to collaborate both synchronously and asynchronously while also enabling us to present structured information.
8. How is your PULSE experiential assignment innovative and/or novel? <i>Describe what about the PULSE assignment is innovative/novel. Is there a particular component or content that is innovative/novel? How is it different from other content that already exists?</i>
Our approach is innovative and novel compared to traditional approaches, as an interactive website completed with learning modules is an engaging and fun way to learn content compared to lecture slides and textbooks. Although we did take some aspects of traditional learning experiences (such as review questions after each module, just like the review questions in textbooks). Our use of interactive activities, self-paced learning, and a brand-new format and interface makes this a novel learning experience for those used to more traditional methods.
9. If you used an AI tool, please copy and paste the prompt(s)/question(s) used along with the output(s)/answer(s) from the AI tool. <i>The response here is to allow others to replicate the team's work. If the prompts/outputs are lengthy (over 1 page), please attach it as a separate document and note below [Please see attached document].</i>
N/A
10. If you did not use an AI tool, please attach a copy of the team's notes to the assignment. <i>The response here is to allow others to observe the 'behind the scenes' team's work.</i>
Our notes are in the following link: https://docs.google.com/document/d/14n9O4_mSY7CqNh_cbjvdM9f8EokLI1dbAjz2wJhKvuU/edit?usp=sharing

11. How did the team ensure the veracity of the information presented in the PULSE assignment?

The response should highlight how the team has ensured that the information presented in the assignment is evidence-based and not spreading misinformation. You should specifically mention which databases (if any) or textbook materials you used, and how you kept track of the sources/references for each claim. If AI provided you with false information, please describe how the team has fact-checked the AI response and the legitimate (scientific) sources you used. A reference document should be provided in the reference section (15. References) below. Please ensure to include in-text citations in your assignment where applicable.

To ensure the veracity, validity, and reliability of our information, most of our sources are academic and peer-reviewed. These sources are published from well-known, credible journals such as The National Library of Medicine, The American Heart Association, ScienceDirect, Frontiers, Sage, International Journal of Molecular Sciences, and the Journal of Neurosurgery. For sources that were non-academic, they were carefully selected from various credible clinical websites including Mayo Clinic, Cleveland Clinic, MDCalc, Canadian Stroke Best Practices, UBC Functional Neuroanatomy, and the Heart and Stroke Foundation. In addition, we've also used information from the Atherosclerosis and Hemodynamic Disorders, Thromboembolism and Shock lectures to complement our sources. We kept track of our sources and claims by writing notes under the sources we found and communicating with other members to verify information and prevent overlap. AI tools were not used for sources and information.

12. Write a meaningful team reflection about the PULSE session (max 250 words).

Prompts to help your team write the reflection: Were there any team/individual biases that surfaced when creating content for the assignment? Did the team implement any practices to ensure the content was equitable, diverse, and/or inclusive? How has the PULSE assignment helped with the team's learning? If the team had to estimate, how long did the assignment take? What worked well for your team? What would the team do differently next time? What were the opportunities and challenges with creating the PULSE assignment to help others' learning? Were there any barriers or limitations?

We were able to complete this project on time, and the process went relatively smoothly. We ensured that during discussions, all group members had an equal chance to convey their opinions and concerns, and all contributions were treated with respect. Our project is designed to be accessible because it is a website, allowing users to access it from any location and complete the learning modules at their convenience. The tools we used (Google Sites and Google Docs) were all easy and intuitive to use. Through the creation of our website, we all become familiar with our chosen aspect of ischemic stroke, as each of us has done extensive research for their own work. The project took around 1.5 months to complete, and the delegated tasks we had really helped with our efficiency. If we were to do this project again, we would like to include new learning elements to make the learning experience more interactive and engaging.

13. Write the contributions of individual team members using unique initials.

Example: All team members contributed to the design of the prompts used in the technology tool, ChatGPT (GPT-3.5). T.K and T.K2 fact checked the information presented by ChatGPT using published literature on PubMed (PMID 29211319, 32477271). Y.Z finalized and formatted the final infographic and compiled the prompts and outputs. P.E was involved in...

All group members contributed to the research process, website-designing process, and formulation of the content in the assignment template, as well as the creation of the website. KLL was in charge of etiology; AL was in charge of pathogenesis and part of symptoms; LW was in charge of prevention, treatment, and part of symptoms; and YZ was in charge of complications and prognosis. Each member was in charge of the website section they were involved in, and as a group we completed the home page on the website. We did our own citations, which were then collectively organized.

15. References

Please provide a numbered reference list with Nature citation style. [Please feel free to use citation management software (i.e., free citation manager, e.g., Zotero and Mendeley)]

1. Hui C, Tadi P, Patti L. Ischemic Stroke [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2026 Apr 7]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499997>
2. Kum J. Atherosclerosis and its Sequelae [Lecture Notes]. PATHOLOGY 3500: Introduction to Pathology, University of Western Ontario; 2026 Jan 7 [cited 2025 Apr 5].
3. Leary MC, Caplan LR. Cardioembolic stroke: An update on etiology, diagnosis and management. Annals of Indian Academy of Neurology [Internet]. 2008 Jan 11 [cited 2026 Apr 7];11(Suppl 1):S52. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9204115/>
4. Arboix A, Alió J. Cardioembolic Stroke: Clinical Features, Specific Cardiac Disorders and Prognosis. Current Cardiology Reviews [Internet]. 2010 Aug 1 [cited 2026 Apr 7];6(3):150–61. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2994107/>
5. Kum J. Hemodynamic Disorders, Thromboembolism and Shock [Lecture Notes]. PATHOLOGY 3500: Introduction to Pathology, University of Western Ontario; 2025 Oct 6 [cited 2025 Apr 5].
6. Dixit I, Logan C, Prakitpong F. Circle of Willis – 3D model [internet]. Functional Neuroanatomy; [cited 2026 Apr 3]. Available from: <https://www.neuroanatomy.ca/3D/circlewillisLS.html>
7. Maida CD, Norrito RL, Rizzica S, Mazzola M, Scarantino ER, Tuttolomondo A. Molecular Pathogenesis of Ischemic and Hemorrhagic Strokes: Background and Therapeutic Approaches. International Journal of Molecular Sciences [Internet]. 2024 Jun 6 [cited 2026 Apr 7];25(12):6297. Available from: <https://www.mdpi.com/1422-0067/25/12/6297>
8. Majumder D. Ischemic stroke: Pathophysiology and evolving treatment approaches. Neuroscience Insights [Internet]. 2024 Oct 22 [cited 2026 Apr 7];19(19). Available from: <https://journals.sagepub.com/doi/10.1177/26331055241292600>
9. American Stroke Association. Stroke Symptoms [Internet]. www.stroke.org. American Stroke Association; 2024 [cited 2026 Apr 7]. Available from: <https://www.stroke.org/en/about-stroke/stroke-symptoms>
10. Definitions [Internet]. Canadian Stroke Best Practices. [cited 2026 Apr 7]. Available from: <https://www.strokebestpractices.ca/recommendations/secondary-prevention-of-stroke/definitions>
11. Gorelick PB, Whelton PK, Sorond F, Carey RM. Blood Pressure Management in Stroke. Hypertension [Internet]. 2020 Oct 12 [cited 2026 Apr 7];76(6). Available from: <https://www.ahajournals.org/doi/10.1161/HYPERTENSIONAHA.120.14653>
12. Saver JL. Time Is Brain—Quantified. Stroke [Internet]. 2006 Jan [cited 2026 Apr 7];37(1):263–6. Available from: <https://www.ahajournals.org/doi/10.1161/01.str.0000196957.55928.ab>

13. Swieten, John. Modified Rankin Scale for Neurologic Disability [Internet]. MDCalc. [cited 2026, Apr 7] Available from: <https://www.mdcalc.com/calc/1890/modified-rankin-scale-neurologic-disability>
14. Cleveland Clinic. Fibrinolytic (Thrombolytic) Therapy: Uses, Drugs & Side Effects [Internet]. Cleveland Clinic. 2022 [cited 2026 Apr 7]. Available from: <https://my.clevelandclinic.org/health/treatments/22772-thrombolytic-fibrinolytic-therapy>
15. Spronk E, Sykes G, Falcione S, Munsterman D, Joy T, Kamtchum-Tatuene J, et al. Hemorrhagic Transformation in Ischemic Stroke and the Role of Inflammation. *Frontiers in Neurology* [Internet]. 2021 May 14 [cited 2026 Apr 7];12. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC8160112/>
16. Mathews S, De Jesus O. Thrombectomy [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2026 Apr 7]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK562154/>
17. Mayo Clinic. Stroke rehabilitation: What to Expect as You Recover [Internet]. Mayo Clinic. 2024 [cited 2026 Apr 7]. Available from: <https://www.mayoclinic.org/diseases-conditions/stroke/in-depth/stroke-rehabilitation/art-20045172>
18. Stroke rehabilitation [Internet]. Heart and Stroke Foundation of Canada. [cited 2026 Apr 7]. Available from: <https://www.heartandstroke.ca/stroke/recovery-and-support/stroke-care/stroke-rehabilitation>
19. Camilo O, Goldstein LB. Seizures and Epilepsy After Ischemic Stroke. [Internet] *Stroke*. 2004 Jul;35(7):1769–75. [cited 2026, Apr 7] <https://doi.org/10.1161/01.STR.0000130989.17100.96>
20. Chohan S, Venkatesh P, How C. Long-term complications of stroke and secondary prevention: an overview for primary care physicians. *Singapore Medical Journal* [Internet]. 2019 Dec;60(12):616–20. [cited 2026, Apr 7] Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7911065/>
21. Kuo CL, Hu GC. Post-stroke Spasticity: A Review of Epidemiology, Pathophysiology, and Treatments. *International Journal of Gerontology* [Internet]. 2018 Dec;12(4):280–4. [cited 2026, Apr 7] Available from: <https://www.sciencedirect.com/science/article/pii/S1873959818300073>
22. Liang D, Bhatta S, Gerzanich V, Simard JM. Cytotoxic edema: mechanisms of pathological cell swelling. [Internet] *Neurosurgical Focus*. 2007 May; 22(5):1–9. [cited 2026, Apr 7] <https://doi.org/10.3171/foc.2007.22.5.3>
23. González-Fernández M, Ottenstein L, Atanelov L, Christian AB. Dysphagia after stroke: an overview. *Current Physical Medicine and Rehabilitation Reports* [Internet]. 2013 May 3; 1(3):187–96. [cited 2026, Apr 7] Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4066736/>
24. Molla Dessalegn Nigus, Sendek EM, Mulugeta Biyadgie Ewunetu, Cherkos AB, Awol Arega Yimer. Post stroke aspiration pneumonia, associated factors, and treatment outcome among stroke patients admitted to Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia. [Internet] *Frontiers in Stroke*. 2024 Nov 8. [cited 2026, Apr 7] <https://doi.org/10.3389/fstro.2024.1410657>
25. Medeiros GC, Roy D, Kontos N, Beach SR. Post-stroke depression: A 2020 updated review. *General Hospital Psychiatry* [Internet]. 2020 Sep 1;66(1):70–80.

[cited 2026, Apr 7] Available from:

<https://www.sciencedirect.com/science/article/pii/S0163834320300955>

16. Annotated Bibliography

An annotated bibliography is a list of sources (books, articles, websites, etc.) that you used for your project. Each entry has two parts:

1. *Citation – written in the required citation style (same formatting and order as the Nature citation style in your list of references).*
2. *Annotation – a short paragraph that summarizes, evaluates, and explains how the source is useful for your assignment.*

Why do this?

- *Helps you keep track of your research.*
- *Shows your instructor you read and understood your sources.*
- *Develops critical thinking by requiring you to evaluate the quality and relevance of each source.*

Write the annotation (about 150–200 words each)

- *Summary: Briefly describe the main argument or purpose of the source.*
- *Evaluation: Comment on the credibility, strengths, or weaknesses of the source.*
- *Relevance: Explain how you will use this source in your assignment.*

1. Hui C, Tadi P, Patti L. Ischemic Stroke [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2025 [cited 2026 Apr 7]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK499997>

This article is an excellent source for general information, etiology, pathogenesis, symptoms, prognosis, complications, and treatment for ischemic stroke. It explores the causes and etiology of ischemic stroke, such as cardioembolism and large artery atherosclerosis, and their underlying causes. It further delves into the pathogenesis and pathophysiology of this condition and the specific symptoms for ischemia and infarction that occur at different locations. Prognosis and complications are also discussed in detail in this paper, as well as current treatment methods for ischemic stroke. Although this article lacks the sufficient details that make for a comprehensive report on ischemic stroke, it remains an excellent source for all information related to ischemic stroke on all topics and aspects. But there remains a downside to this source, as the molecular mechanisms behind the medical condition in concern are not explored well enough. This issue can be easily overcome by exploring other sources that contain this information, which we have done.

2. Kum J. Atherosclerosis and its Sequelae [Lecture Notes]. PATHOLOGY 3500: Introduction to Pathology, University of Western Ontario; 2026 Jan 7 [cited 2025 Apr 5].

This lecture provides a general introduction of the overall mechanism of atherosclerosis. It explains how a thrombus can arise from vascular plaque that formed due to fat accumulation and how a thrombus can further trigger the following complications; it is significant to explain the connection between atherosclerosis and ischemic stroke. The

strength of this source is that the graphics and figures on the slideshow acquired from previous research show what the formation of thrombus looks like histologically during atherosclerosis, effectively helping us to strengthen our concept of this vascular disease. It also gives a list of examples of the risk factors of ischemic stroke induced by large artery atherosclerosis, such as sex, obesity, and stress, that can be utilized on the webpage to give the reader an understanding of this etiology in terms of daily life. These pieces of knowledge can be incorporated with the information acquired from the other webpage on ischemic stroke in general, allowing us to briefly showcase the entire process from the development of plaque to the blockage of cerebral vessels on our website.

3. Leary MC, Caplan LR. Cardioembolic stroke: An update on etiology, diagnosis and management. *Annals of Indian Academy of Neurology* [Internet]. 2008 Jan 11 [cited 2026 Apr 7];11(Suppl 1):S52. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9204115/>

This clinical article provides a detailed review of specific risk factors, clinical features, prevention, diagnostic approaches, and treatments of cardioembolic stroke, a common subtype of ischemic stroke. This article offers a brief yet comprehensive overview of cardioembolic stroke, serving as a crucial introduction for our webpage. The article further categorizes cardioembolic stroke into 3 subgroups: cardiac chamber abnormalities, arrhythmias, and valvular heart diseases. It explains each subgroup briefly and reviews several specific diseases and disorders within each category to identify the risk group of patients with these diseases that has a bigger potential to develop a cardioembolic stroke. The classification of different causes of cardioembolic stroke gives us a rough idea of how an embolus can form in each disease. This source presents a good starting point for thinking about what types of diseases trigger cardioembolism as well as the onset of stroke. Even though our webpage only aims to provide a general introduction to ischemic stroke, it is still necessary to look for other articles for further explanations of the three subgroups of stroke causes. However, the examples of risk factors mentioned and the general information about cardioembolism still make it a useful reference.

4. Arboix A, Alió J. Cardioembolic Stroke: Clinical Features, Specific Cardiac Disorders and Prognosis. *Current Cardiology Reviews* [Internet]. 2010 Aug 1 [cited 2026 Apr 7];6(3):150–61. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2994107/>

This clinical article provides similar information on cardioembolism to the one right above. It focuses more on the etiology and its relationship with some other complications, including atherosclerosis and atrial fibrillation. Moreover, some epidemiological information is also provided, such as the proportion of cardioembolic stroke among all cases of ischemic stroke and the mortality. Some of the knowledge of the diagnosis, such as the usage of CT and MRI, is also derived from these sources to

construct a part of explaining the identification of this type of stroke. Even though it has a different categorization of the etiology subgroups in which arrhythmias are replaced by paradoxical embolism, it still points out both of them as significant risk factors. Therefore, the risk factors are only listed out with little description of their influence on the blood vessel but not categorized as they were in the two referenced articles. Compared to the article right above, it has a few more details about the characterization of the common risk factors, which is enough for this webpage's purpose, which aims to briefly introduce the etiology. Overall, this is a valuable source where useful information was obtained to form the core of introducing cardioembolism and its connection to stroke.

5. Kum J. Hemodynamic Disorders, Thromboembolism and Shock [Lecture Notes]. PATHOLOGY 3500: Introduction to Pathology, University of Western Ontario; 2025 Oct 6 [cited 2025 Apr 5].

This lecture content provides general information on ischemia, thrombosis, and embolism and how each of these influences and affects each other. It explores the causes of each process and how one affects the other. This source offers an excellent opportunity to gain general information about these processes and discover additional details. It also offers information on different types of emboli, different processes that thrombi undergo (especially how they can transform into an emboli), and different types of infarction, all of which are relevant to ischemic stroke. Its delivery is appropriate for university-level understanding and contains excellent explanations on the different processes and has sufficient details to supplement the information presented. But this source does not go into more details compared to other papers and studies that focus on ischemic stroke. Despite the potential for additional details, it serves as an excellent resource for university-level students and those interested in this topic. We are using this source as a source of information for ischemia, thrombosis, and embolization and their related mechanisms.

6. Dixit I, Logan C, Prakitpong F. Circle of Willis – 3D model [internet]. Functional Neuroanatomy; [cited 2026 Apr 3]. Available from: <https://www.neuroanatomy.ca/3D/circlewillisLS.html>

This website offers a 3D diagram to explore the neuroanatomy of all the different arteries in the Circle of Willis, where ischemic stroke has a tremendous effect if any of the arteries are occluded. It offers interactive and innovative methods of exploration by having an interactive 3D model with labels. Although it contains no information on ischemic stroke, it is a great tool to explore the anatomical relations between these arteries and ischemic stroke. Developed by expert researchers at the University of British Columbia, this tool presents as an accurate, precise, and up-to-date anatomical representation of the Circle of Willis. This is embedded as an activity on our online learning modules for ischemic stroke, where the students are able to explore the neuroanatomy themselves, familiarizing them with the arteries of concern to ischemic stroke. Hands-on interaction in these cases is an excellent learning experience, and the

utilization of this website in our learning program would improve the efficacy of our program.

7. Maida CD, Norrito RL, Rizzica S, Mazzola M, Scarantino ER, Tuttolomondo A. Molecular Pathogenesis of Ischemic and Hemorrhagic Strokes: Background and Therapeutic Approaches. *International Journal of Molecular Sciences* [Internet]. 2024 Jun 6 [cited 2026 Apr 7];25(12):6297. Available from: <https://www.mdpi.com/1422-0067/25/12/6297>

This paper delves into the molecular mechanisms of ischemic stroke, with its three main aspects: excitotoxicity, oxidative stress, and neuroinflammation. It goes in depth describing the processes in each aspect, from the direct effect of ischemia to the further development of the condition. This paper also explores hemorrhagic stroke as well as potential treatment methods, both current developments and future potential developments. The underlying epigenetic factors of ischemic stroke are also explored in a section in this paper. Although our primary research extracted from this paper is mainly the molecular mechanisms of ischemic stroke, this remains an excellent and detailed source for all topics mentioned above. Criticism regarding the content of this paper includes the relative lack of information on mitochondrial dysfunction caused by excitotoxicity and calcium overload. This downside is easily overcome through the use of other sources on the same topic to strengthen the research on mitochondrial dysfunction. Regardless, this source is excellent as a source of information for the molecular mechanisms of ischemic stroke.

8. Majumder D. Ischemic stroke: Pathophysiology and evolving treatment approaches. *Neuroscience Insights* [Internet]. 2024 Oct 22 [cited 2026 Apr 7];19(19). Available from: <https://journals.sagepub.com/doi/10.1177/26331055241292600>

This paper explores the pathophysiology of ischemic stroke and both current and future treatment strategies. It delves into the molecular pathophysiology of ischemic stroke, covering the three main aspects of excitotoxicity, oxidative stress, and inflammatory response. It is similar to another study referenced in our work, but this study has a greater focus on the molecular mechanisms underlying the pathogenesis of stroke. This article has an excellent and detailed description of the effect of ischemia on ion channels and further complications as well as the development of mitochondrial dysfunction. Further information on important molecules such as nitrogen monoxide and specific inflammatory cytokines and agents is explored. Their role in the pathophysiology of ischemic stroke is presented, along with specific immune-related processes that occur (such as blood-brain barrier breakdown and immune cell activation). Both current and possible future developments in ischemic stroke treatment are explored, but only the pathophysiology sections of this paper are used.

9. American Stroke Association. Stroke Symptoms [Internet]. www.stroke.org. American Stroke Association; 2024 [cited 2026 Apr 7]. Available from: <https://www.stroke.org/en/about-stroke/stroke-symptoms>

This website from the official American Stroke Association (ASA) explores the general stroke-related symptoms in a simple-to-read manner. The purpose of this source is to educate the general population on strokes and also the signs to notice a stroke. The source is very credible, as it is from the ASA, which comes from an offshoot of the American Heart Association, which is a large nonprofit organization coming from the United States. The strength of this source is that it has up-to-date reliable information, with BEFAST being the new version of FAST by adding two new symptoms. Some weakness of the source is that the information is very general due to the target audience being regular citizens, thus the language being simpler and lacking the specificity of research papers. This source is used in this assignment by referencing it in the symptoms section of the website. The intro to that webpage is about BEFAST, the acronym in order to quickly detect a stroke and call 911. This is one of the most important lessons in the module, which is why it is front and center.

10. Definitions [Internet]. Canadian Stroke Best Practices. [cited 2026 Apr 7]. Available from: <https://www.strokebestpractices.ca/recommendations/secondary-prevention-of-stroke/definitions>

This website from the Heart and Stroke Foundation defines various parts of stroke in detail such as the triage process, evaluation, treatment, risk factor management, and prevention of stroke. The purpose of this source is to go in depth on all things stroke related for both the general public and people looking for more information on stroke. The trustworthiness of this website is very good as it is from the Heart and Stroke Foundation which is well established. The strengths of this website are that it describes the various aspects of stroke in very good detail and also provides the specific treatment strategies and preventative measures for it. The weakness of it may be that it lacks some of the details papers may provide on the specific strategies and when they are used. This source is used in the assignment by seeing prevention, both primary and secondary. It also was used in the treatment section of the website when describing the treatments such as antiplatelet therapy and anticoagulation drugs.

11. Gorelick PB, Whelton PK, Sorond F, Carey RM. Blood Pressure Management in Stroke. Hypertension [Internet]. 2020 Oct 12 [cited 2026 Apr 7];76(6). Available from: <https://www.ahajournals.org/doi/10.1161/HYPERTENSIONAHA.120.14653>

This peer reviewed article in the journal Hypertension explores the relationship between blood pressure and stroke risk through meta-analyses of other studies. It states that stroke and blood pressure are cornerstones of treatment as hypertension has a high attributable risk for stroke. The reliability of this paper is very good as it utilizes a meta-analysis method meaning it collects data from various sources and finds agreements

between them, therefore reducing confounding. Strengths of this paper are that it covers the variety of effects hypertension can have by splitting it into sections such as dementia and cognitive impairment, and in this case, the types of drugs used to treat hypertension. This is great because it is easy to access and read without confusing statistics. A weakness is that this article uses a lot of technical jargon which slows down information processing as specific knowledge related to the field is required. This article was used in the website in order to provide insight on the types of medications used to treat hypertension to prevent the first stroke, also known as primary prevention.

12. Saver JL. Time Is Brain—Quantified. *Stroke* [Internet]. 2006 Jan [cited 2026 Apr 7];37(1):263–6. Available from:

<https://www.ahajournals.org/doi/10.1161/01.str.0000196957.55928.ab>

This paper defines the long lived term in the stroke field of “Time is brain” and attempts to discover the association between the amount of tissue lost in an untreated acute ischemic stroke and the amount of neural tissue lost. This is a systematic literature review which integrates data from various studies to calculate the loss of neural tissue over time. The credibility of this study is very good as it is published in *Stroke*, a peer-reviewed journal from the American Stroke Association. The strength of this source is that it uses multiple data points from various journals in order to back up its data which reduces confounding. A weakness of this source is that it assumes a linear rate of neuronal loss when it could be very different due to ischemia potentially having a 3D, rounder structure with also various shapes depending on which vessel is occluded. This source is used in the assignment by drawing the statistics of neuronal loss.

13. Swieten, John. Modified Rankin Scale for Neurologic Disability [Internet]. MDCalc. [cited 2026, Apr 7] Available from: <https://www.mdcalc.com/calc/1890/modified-rankin-scale-neurologic-disability>

This webpage explains the application of the Modified Rankin Scale, a widely used tool for measuring the degree of disability or dependence in individuals who have experienced stroke or other neurological conditions. The scale provides a structured scoring system ranging from 0 (no symptoms), 1 (no significant symptoms), 2 (slight disability), 3 (moderate disability), 4 (moderately severe disability), 5 (severe disability), 6 (death), along with brief clinical descriptors to guide interpretation. The Modified Rankin Scale is commonly used in both clinical practice and research to evaluate patient outcomes and recovery over time. The source is credible as MDCalc is a trusted platform used by healthcare professionals as medical calculators and guidelines. However, because it is designed as a quick-reference tool rather than a detailed academic discussion, it provides limited background information and lacks in-depth methodological explanation. Regardless, the source was useful for understanding how disability after stroke is quantified, and has been particularly valuable in the prognosis section of this project.

14. Cleveland Clinic. Fibrinolytic (Thrombolytic) Therapy: Uses, Drugs & Side Effects [Internet]. Cleveland Clinic. 2022 [cited 2026 Apr 7]. Available from: <https://my.clevelandclinic.org/health/treatments/22772-thrombolytic-fibrinolytic-therapy>

This webpage describes the thrombolytic therapy used in removing clots. This can be applied for both strokes and other diseases such as pulmonary embolisms or deep vein thromboses. It generally describes what the treatment is and who the candidates for it are. The credibility of this page is very good as it is from the Cleveland clinic which is a reputable source for information on any diseases and medical information. The strength of this page is that it accurately describes and gives general information on the treatment. However, it only gives general information which may not be good for the level of information we want to convey in the website. Thus, some other sources are used to fill in the gaps. This page was used to give a general definition and a launching point for the details on the therapy. It also helped in the contraindications and some specific details.

15. Spronk E, Sykes G, Falcione S, Munsterman D, Joy T, Kamtchum-Tatuene J, et al. Hemorrhagic Transformation in Ischemic Stroke and the Role of Inflammation. *Frontiers in Neurology* [Internet]. 2021 May 14 [cited 2026 Apr 7];12. Available from: <https://pmc.ncbi.nlm.nih.gov/articles/PMC8160112/>

This article describes hemorrhagic transformation, a common risk of thrombolytic drugs. This occurs when an influx of blood rushes into the ischemic area of a stroke after the clot is removed turning an ischemic stroke into a potentially hemorrhagic one. It also describes hypertension and other effects such as age on hemorrhagic transformation. The credibility of this page is good as it is a review article that summarizes other sources. This means cross-checking sources was done in order to find a general consensus, reducing confounding. The strength of this article is that it collected general information and displayed it in a concise manner with many backing sources. A weakness is that it may miss some of the details in the cited studies. This source was used for finding what hemorrhagic transformation, a common side effect of treatment with alteplase, was. It also helped in finding other factors such as high blood pressure and its effects on stroke treatment.

16. Mathews S, De Jesus O. Thrombectomy [Internet]. PubMed. Treasure Island (FL): StatPearls Publishing; 2023 [cited 2026 Apr 7]. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK562154/>

This webpage describes thrombectomy generally, a technique used to remove a clot from a blood vessel by puncturing the groin and inserting a catheter to the location of the clot. It provides specific information such as the indications for treating with thrombectomy and also complications and contraindications of the treatment. This

source is trustworthy as it comes from StatPearls which is a digital library which is peer-reviewed and therefore offers accurate medical information. A strength of this webpage is that it provides specific details pertaining to thrombectomy and gives all the detail needed. A weakness is that the terminology is dense and needs to be translated to layman terms in order to fit the target audience for the website. This page was used for the section on thrombectomy in its entirety as it had all the information needed. However, a lot of the information was simplified in order to be understood and many specific numbers are omitted to get the general idea across.

17. Mayo Clinic. Stroke rehabilitation: What to Expect as You Recover [Internet]. Mayo Clinic. 2024 [cited 2026 Apr 7]. Available from: <https://www.mayoclinic.org/diseases-conditions/stroke/in-depth/stroke-rehabilitation/art-20045172>

This source describes the various forms of stroke rehabilitation. For example, physical therapy, mental health support, and technology related therapies are listed here. It also describes the role of healthcare professionals and is a general introduction to understanding where stroke rehabilitation can occur. This source is trustworthy as it is from Mayo Clinic, a reliable source for medical information in general and employs many healthcare researchers and professionals. The strengths of this page are that it accurately describes the various forms of rehabilitation. A weakness of the page is that it may be too surface level and need to be expanded on for more detail on our website. This source was used for looking at and describing the various forms of therapy for stroke. Additionally, the various places that rehabilitation can take place were used to describe the benefits and drawbacks of each location such as being far from the hospital versus close to home.

18. Stroke rehabilitation [Internet]. Heart and Stroke Foundation of Canada. [cited 2026 Apr 7]. Available from: <https://www.heartandstroke.ca/stroke/recovery-and-support/stroke-care/stroke-rehabilitation>

This source describes very generally the rehabilitation process for post stroke patients. It also shares some patient stories and explains to the common person how stroke recovery works and what they need to do. This source is trustworthy as it comes from the official Heart and Stroke foundation which is a well established source on stroke and also heart diseases. The benefits and strengths of this source is that it is highly accurate as it comes from medical professionals and it also explains the different therapies in layman terms meaning they are easily translatable to our website. A weakness of this webpage is that it does not go into depth about the different therapies but rather describes the mechanism it takes. This caused us to need to look at different sources in order to find various methods. This article was used in the project to describe neuroplasticity and the mechanism on why therapy after stroke works.

19. Camilo O, Goldstein LB. Seizures and Epilepsy After Ischemic Stroke. [Internet] Stroke. 2004 Jul;35(7):1769–75. [cited 2026, Apr 7] <https://doi.org/10.1161/01.STR.0000130989.17100.96>

The researchers from Duke University and Durham VA Medical Center present a review of studies that examines the relation between seizures, epilepsy, and stroke. It provides detailed information on epidemiology by outlining occurrence rates, time of occurrence, and risk factors. In addition, the article also discusses pathophysiological mechanisms, including the cellular and biochemical changes that lead to post ischemia stroke seizures. Finally, the article incorporates relevant anatomical information about the brain and related structures while also reviewing potential treatment strategies. The source was very well-rounded and informative, with statistics such as rates of occurrence, time of occurrence, and cellular and biochemical mechanisms being used extensively in the post stroke complications section. Despite its strengths, an important limitation of this article is that it was published in 2004. As a result, it does not reflect more recent findings in stroke research. Overall, this source was valuable in providing understanding and information on post-ischemic stroke seizures.

20. Chohan S, Venkatesh P, How C. Long-term complications of stroke and secondary prevention: an overview for primary care physicians. Singapore Medical Journal [Internet]. 2019 Dec;60(12):616–20. [cited 2026, Apr 7] Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7911065/>

The doctors from Changi General Hospital and SingHealth Duke-NUS Academic Medical Centre provide a brief overview of stroke related complications by giving a general description of related mechanisms and common treatment methods. The article described a wide range of late medical, musculoskeletal, and psychosocial complications including post stroke seizures, urinary and bowel incontinence, cognitive impairment, spasticity and hypertonicity, shoulder pain, wrist and hand flexion, post stroke depression, emotional lability, and mood changes. These were useful in providing research direction for the project. It is important to note that the article was meant to be a guide for primary care physicians. This means that many mechanisms are only briefly summarized. Due to its generalized nature, the article was used to provide structure for the complication section, provide information on treatment practices, and brief descriptions for less important complications.

21. Kuo CL, Hu GC. Post-stroke Spasticity: A Review of Epidemiology, Pathophysiology, and Treatments. International Journal of Gerontology [Internet]. 2018 Dec;12(4):280–4. [cited 2026, Apr 7] Available from: <https://www.sciencedirect.com/science/article/pii/S1873959818300073>

The researchers from Mackay Memorial Hospital provide a relatively recent and comprehensive review of studies on post stroke spasticity. In contrast with the previous citation, this source provides detailed information on the epidemiology of post-stroke

spasticity, including the rates of occurrence and time of occurrence. On top of this, the source also details the pathophysiological mechanisms, highlighting how damage to upper motor neurons disrupts the balance of signals and leads to spasticity. Finally, the article outlines and compares several treatment methods for this complication, providing directions for future research. A notable limitation of this article is that it does not differentiate between ischemic and hemorrhagic stroke. This may reduce the specificity of its epidemiology and conclusions. Despite this limitation, the article was especially useful for this project, with information on rates of occurrence, time of occurrence and the pathophysiological mechanisms being used extensively in the spasticity portion of the complication section.

22. Liang D, Bhatta S, Gerzanich V, Simard JM. Cytotoxic edema: mechanisms of pathological cell swelling. [Internet] *Neurosurgical Focus*. 2007 May; 22(5):1–9. [cited 2026, Apr 7] <https://doi.org/10.3171/foc.2007.22.5.3>

The researchers from the University of Maryland School of Medicine provide a comprehensive review of studies on cytotoxic edema, offering detailed insight into its underlying pathophysiology. The article places particular emphasis on the cellular and molecular mechanisms involved, including the role of ion channels and transport systems in maintaining homeostasis. For our project, the article was used to explain how the abrogation of oxidative phosphorylation leads to rapid ATP depletion, which in turn causes failure of ATP-dependent ion pumps such as the Na⁺/K⁺ ATPase. This failure disrupts ionic gradients, resulting in an influx of sodium and water into cells and subsequent cellular swelling. The review also touches on the breakdown of the blood-brain barrier, although it does not explicitly link this process to the transition toward vasogenic edema. Nevertheless, the article serves as a strong complement to our first citation, helping to build a more cohesive explanation of how cytotoxic edema develops and how it can escalate to vasogenic edema in the complication section.

23. González-Fernández M, Ottenstein L, Atanelov L, Christian AB. Dysphagia after stroke: an overview. *Current Physical Medicine and Rehabilitation Reports* [Internet]. 2013 May 3; 1(3):187–96. [cited 2026, Apr 7] Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4066736/>

The researchers from Johns Hopkins Hospital provide a comprehensive overview of dysphagia following stroke, presenting a detailed discussion of its clinical and physiological aspects. The article highlights key areas such as epidemiology, normal swallowing physiology, neural control mechanisms, and current approaches to screening, diagnosis, and treatment. It demonstrates that dysphagia affects a large proportion of acute stroke patients, with many experiencing improvement within the first two weeks. The article also mentions that in rare cases, some may develop persistent swallowing difficulties that can significantly impact recovery and quality of life. For this project, the article was primarily used to support epidemiological data, including rates of occurrence and times of occurrence, as well as to describe physiotherapy-based and

rehabilitative treatment strategies of dysphagia in the complication section. However, its use remains somewhat limited, as the source focuses largely on clinical management and normal swallowing function rather than the underlying mechanisms driving dysphagia after stroke. Despite this limitation, the article complements our next citation effectively and contributes to a more well-rounded understanding of post-stroke dysphagia.

24. Molla Dessalegn Nigus, Sendek EM, Mulugeta Biyadgie Ewunetu, Cherkos AB, Awol Arega Yimer. Post stroke aspiration pneumonia, associated factors, and treatment outcome among stroke patients admitted to Tibebe Ghion Specialized Hospital, Bahir Dar, Ethiopia. [Internet] *Frontiers in Stroke*. 2024 Nov 8. [cited 2026, Apr 7]. <https://doi.org/10.3389/fstro.2024.1410657>

The researchers from Bahir Dar University published a study on post stroke aspiration pneumonia. This study explored in detail on the epidemiology, physiopathology, risk factors, occurrence, and treatment of both dysphagia and post stroke aspiration pneumonia. The source was particularly useful for our project as it helped us to explore concepts such as how ischemic stroke causes the loss of CNS control over swallowing networks, which can result in dysphagia. The study also explains how dysphagia can complicate when patients inadvertently inhale food, liquids, saliva, and foreign objects into airways. This can cause infections and acute respiratory failure, ultimately leading to post-stroke aspiration pneumonia. Despite its strengths, the study's primary focus remains to be aspiration pneumonia, and does not specify some dysphagia related information. Nonetheless, the source complements well with our previous citation, contributing to a deepened understanding of post stroke dysphagia and the potential risk of post stroke aspiration pneumonia.

25. Medeiros GC, Roy D, Kontos N, Beach SR. Post-stroke depression: A 2020 updated review. *General Hospital Psychiatry* [Internet]. 2020 Sep 1;66(1):70–80. [cited 2026, Apr 7] Available from: <https://www.sciencedirect.com/science/article/pii/S0163834320300955>

The researchers from the University of Maryland School of Medicine, University of Texas Southwestern Medical Center, John Hopkins University School of Medicine, and Massachusetts General Hospital presented a comprehensive review of studies on post-stroke depression. The article provides valuable insight into the prevalence, proposed mechanisms, and clinical implications of post stroke depression. In addition, the source also demonstrates how post-stroke depression is a common yet underdiagnosed and undertreated complication. The article then discusses the proposed mechanisms of development as multifactorial and complex, with influence from various biological, psychological, and social factors. Although the authors did not differentiate between ischemic and hemorrhagic stroke in certain sections, they did note that most of their evidence were derived from ischemic stroke populations, contributing to the relevancy of this article. Overall, the article was useful for this project, with information such as risk of

occurrence, risk factors, and the underdiagnosed and undertreated nature of post stroke depression being highlighted in the complication section.