**PROPOSAL TITLE:** HEAD-GAIN: Improving Access, Reducing Overutilization

**References**

1. Callaghan BC, Kerber KA, Pace RJ, Skolarus L, Cooper W, Burke JF. Headache neuroimaging: Routine testing when guidelines recommend against them. *Cephalalgia*. 2015;35(13):1144-1152. doi:10.1177/0333102415572918

2. Callaghan BC, Kerber KA, Pace RJ, Skolarus LE, Burke JF. Headaches and Neuroimaging: High Utilization and Costs Despite Guidelines. *JAMA Intern Med*. 2014;174(5):819. doi:10.1001/jamainternmed.2014.173

3. Rosenberg A, Agiro A, Gottlieb M, et al. Early Trends Among Seven Recommendations From the Choosing Wisely Campaign. *JAMA Intern Med*. 2015;175(12):1913. doi:10.1001/jamainternmed.2015.5441

4. Workum JD, Van De Sande D, Gommers D, Van Genderen ME. Bridging the gap: a practical step-by-step approach to warrant safe implementation of large language models in healthcare. *Front Artif Intell*. 2025;8:1504805. doi:10.3389/frai.2025.1504805

5. Migraine and other headache disorders. Accessed December 3, 2024. https://www.who.int/news-room/fact-sheets/detail/headache-disorders

6. Bonafede M, Cai Q, Cappell K, et al. Factors Associated with Direct Health Care Costs Among Patients with Migraine. *J Manag Care Spec Pharm*. 2017;23(11):1169-1176. doi:10.18553/jmcp.2017.23.11.1169

7. Estimating the Economic Burden of Migraine on US Employers. *Am J Manag Care*. 2020;26(12):e403-e408. doi:10.37765/ajmc.2020.88547

8. Ahmed F. Headache disorders: differentiating and managing the common subtypes. *Br J Pain*. 2012;6(3):124-132. doi:10.1177/2049463712459691

9. Lipton RB, Fanning KM, Serrano D, Reed ML, Cady R, Buse DC. Ineffective acute treatment of episodic migraine is associated with new-onset chronic migraine. *Neurology*. 2015;84(7):688-695. doi:10.1212/WNL.0000000000001256

10. Mortel D, Kawatu N, Steiner TJ, Saylor D. Barriers to headache care in low- and middle-income countries. *eNeurologicalSci*. 2022;29:100427. doi:10.1016/j.ensci.2022.100427

11. *The High Cost of Avoidable Hospital Emergency Department Visits*. UnitedHealth Group; 2019. https://www.unitedhealthgroup.com/newsroom/posts/2019-07-22-high-cost-emergency-department-visits.html#:~:text=According%20to%20UnitedHealth%20Group%20research,and%20not%20an%20actual%20emergency.

12. McDermott K. *Characteristics and Costs of Potentially Preventable Inpatient Stays, 2017*. Healthcare Cost and Utilization Project; 2020. https://hcup-us.ahrq.gov/reports/statbriefs/sb259-Potentially-Preventable-Hospitalizations-2017.jsp#:~:text=In%202017%2C%203.5%20million%20potentially,costs%20for%20all%20nonobstetric%20stays.

13. Ney JP, Johnson B, Knabel T, Craft K, Kaufman J. Neurologist ambulatory care, health care utilization, and costs in a large commercial dataset. *Neurology*. 2016;86(4):367-374. doi:10.1212/WNL.0000000000002276

14. Evans RW, Burch RC, Frishberg BM, et al. Neuroimaging for Migraine: The American Headache Society Systematic Review and Evidence‐Based Guideline. *Headache J Head Face Pain*. 2020;60(2):318-336. doi:10.1111/head.13720

15. Zhong XM, Zhao LC, Peng LL, Li L, Li CQ. Rationale for issuing neuroimaging requests for patients with primary headaches in China. *Brain Behav*. 2024;14(6):e3583. doi:10.1002/brb3.3583

16. Friedman KG, Fulton DR. Reducing Cost Through Standardization. *Curr Treat Options Pediatr*. 2016;2(4):296-310. doi:10.1007/s40746-016-0068-2

17. Hawasli AH, Chicoine MR, Dacey RG. Choosing Wisely: A Neurosurgical Perspective on Neuroimaging for Headaches. *Neurosurgery*. 2015;76(1):1-6. doi:10.1227/NEU.0000000000000560

18. Minen MT, Malhotra NA, Waire EK, Swiderski HZ, Riggins NY, Sprouse‐Blum AS. The American Headache Society First Contact—Headache in Primary Care program: Current metrics, knowledge assessments, and direction for future initiatives. *Headache J Head Face Pain*. Published online November 5, 2024:head.14852. doi:10.1111/head.14852

19. Rayhill ML, Rosen N, Robbins MS. Headache Education Adaptation During the COVID-19 Pandemic: Impact on Undergraduate and Graduate Medical Education. *Curr Pain Headache Rep*. 2022;26(11):827-833. doi:10.1007/s11916-022-01084-0

20. Workforce Gap Analysis in the Field of Headache Medicine in the United States - Begasse de Dhaem - 2020 - Headache: The Journal of Head and Face Pain - Wiley Online Library. Accessed December 3, 2024. https://headachejournal.onlinelibrary.wiley.com/doi/10.1111/head.13752

21. Hernando-Requejo V. Neurophobia: why, how much, consequences and solutions. *MedEdPublish*. 2020;9:3. doi:10.15694/mep.2020.000003.1

22. Kalani M, Anjankar A. Revolutionizing Neurology: The Role of Artificial Intelligence in Advancing Diagnosis and Treatment. *Cureus*. Published online June 5, 2024. doi:10.7759/cureus.61706

23. Sezgin E. Redefining Virtual Assistants in Health Care: The Future With Large Language Models. *J Med Internet Res*. 2024;26:e53225. doi:10.2196/53225

24. Levra AG, Gatti M, Mene R, et al. A large language model-based clinical decision support system for syncope recognition in the emergency department: A framework for clinical workflow integration. *Eur J Intern Med*. Published online September 2024:S0953620524004059. doi:10.1016/j.ejim.2024.09.017

25. Rao A, Kim J, Kamineni M, Pang M, Lie W, Succi MD. Evaluating ChatGPT as an Adjunct for Radiologic Decision-Making. Published online February 7, 2023. doi:10.1101/2023.02.02.23285399

26. Nazi ZA, Peng W. Large Language Models in Healthcare and Medical Domain: A Review. *Informatics*. 2024;11(3):57. doi:10.3390/informatics11030057

27. Hager P, Jungmann F, Holland R, et al. Evaluation and mitigation of the limitations of large language models in clinical decision-making. *Nat Med*. 2024;30(9):2613-2622. doi:10.1038/s41591-024-03097-1

28. Barabucci G, Shia V, Chu E, Harack B, Laskowski K, Fu N. Combining Multiple Large Language Models Improves Diagnostic Accuracy. *NEJM AI*. 2024;1(11). doi:10.1056/AIcs2400502

29. Eriksen AV, Möller S, Ryg J. Use of GPT-4 to Diagnose Complex Clinical Cases. *NEJM AI*. 2024;1(1). doi:10.1056/AIp2300031

30. Rutledge GW. Diagnostic accuracy of GPT ‐4 on common clinical scenarios and challenging cases. *Learn Health Syst*. 2024;8(3):e10438. doi:10.1002/lrh2.10438

31. Barile J, Margolis A, Cason G, et al. Diagnostic Accuracy of a Large Language Model in Pediatric Case Studies. *JAMA Pediatr*. 2024;178(3):313. doi:10.1001/jamapediatrics.2023.5750

32. Hirosawa T, Harada Y, Yokose M, Sakamoto T, Kawamura R, Shimizu T. Diagnostic Accuracy of Differential-Diagnosis Lists Generated by Generative Pretrained Transformer 3 Chatbot for Clinical Vignettes with Common Chief Complaints: A Pilot Study. *Int J Environ Res Public Health*. 2023;20(4):3378. doi:10.3390/ijerph20043378

33. Goh E, Gallo R, Hom J, et al. Large Language Model Influence on Diagnostic Reasoning: A Randomized Clinical Trial. *JAMA Netw Open*. 2024;7(10):e2440969. doi:10.1001/jamanetworkopen.2024.40969

34. Moura L, Jones DT, Sheikh IS, et al. Implications of Large Language Models for Quality and Efficiency of Neurologic Care: Emerging Issues in Neurology. *Neurology*. 2024;102(11):e209497. doi:10.1212/WNL.0000000000209497

35. Oniani D, Wu X, Visweswaran S, et al. Enhancing Large Language Models for Clinical Decision Support by Incorporating Clinical Practice Guidelines. Published online January 23, 2024. doi:10.48550/arXiv.2401.11120

36. Aristidou A, Jena R, Topol EJ. Bridging the chasm between AI and clinical implementation. *The Lancet*. 2022;399(10325):620. doi:10.1016/S0140-6736(22)00235-5

37. Li RC, Asch SM, Shah NH. Developing a delivery science for artificial intelligence in healthcare. *Npj Digit Med*. 2020;3(1):107. doi:10.1038/s41746-020-00318-y

38. Stubberud A, Langseth H, Nachev P, Matharu MS, Tronvik E. Artificial intelligence and headache. *Cephalalgia*. 2024;44(8):03331024241268290. doi:10.1177/03331024241268290

39. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211. doi:10.1177/0333102417738202

40. Funk AT Giancarlo Pasquini, Alison Spencer and Cary. 60% of Americans Would Be Uncomfortable With Provider Relying on AI in Their Own Health Care. Pew Research Center. February 22, 2023. Accessed December 2, 2024. https://www.pewresearch.org/science/2023/02/22/60-of-americans-would-be-uncomfortable-with-provider-relying-on-ai-in-their-own-health-care/

41. Burke JF, Skolarus LE, Callaghan BC, Kerber KA. Choosing Wisely: Highest‐cost tests in outpatient neurology. *Ann Neurol*. 2013;73(5):679-683. doi:10.1002/ana.23865

42. *MRI Costs*. Imaging Technology News https://www.itnonline.com/content/mri-costs

43. Dookeran KA, Groh JM, Ritacco DG, Marcus LR, Wang Y, Khan JY. An assessment of prevalence and expenditure associated with discharge brain MRI in preterm infants. Baud O, ed. *PLOS ONE*. 2021;16(3):e0247857. doi:10.1371/journal.pone.0247857

44. Pugel S, Stallworth JL, Pugh LB, et al. Choosing Wisely in Georgia: A Quality Improvement Initiative in 25 Adult Ambulatory Medicine Offices. *Jt Comm J Qual Patient Saf*. 2018;44(12):699-707. doi:10.1016/j.jcjq.2018.05.010