<Curriculum Vitae>

Name: HEE HWANG
Current Status: Kakao Healthcare C.E.O
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General Career

1996. Graduated from Seoul National University College of Medicine
1997-1998. Intern, Seoul National University Hospital
1998-2002. Resident, Department of Pediatrics, Seoul National University Children's Hospital
2002-2004. Clinical Fellowship, Pediatric Neurology, Seoul National University Children's Hospital
2004-2021. Assistant Professor, Associate Professor, Professor, Division of Pediatric Neurology, Department of Pediatrics, Seoul National University Bundang Hospital
2011-2021. Chief Information Officer (CIO), Seoul National University Bundang Hospital
2014-2018. Chief, National Health IT strategy TF, Korea Health Industry Development Institute, Ministry of Health & Welfare, South Korea
2014-2018. Director, Department of Bio-healthcare department, Seoul National University Big Data Institute
2014-Current. Council Member, HIMSS AP
2018-2022. Digital Healthcare/Data Protection and Utilization Committee, Presidential Commission on the 4th Industrial Revolution
2021-2022. Member of the My Health Way Promotion Committee of the Ministry of Health and Welfare
2022-current. Member of the Data AI Subcommittee of the Data Platform Government Committee, president office

Healthcare IT related Career & Achievement (project)

2004, Chief, Clinical Data Warehouse Project, Seoul National University Bundang Hospital

2004-2011. Director. EMR operation & maintenance team, Seoul National University Bundang Hospital

2006-2010. Director, National Interoperability Pilot Project, Ministry of Health & Welfare, South Korea

2011-2021. Chief Information Officer (CIO), Seoul National University Bundang Hospital

2013-2021 Senior vice president, ezCaretech

2014-2018. Chief, National Health IT planning & strategy task force, Korea Health Industry Development Institute, Ministry of Health & Welfare, South Korea

2014-2018. Director, Department of Bio-healthcare department, Seoul National University Big Data Institute

2014-current. Council, HIMSS Asia-Pacific

Award & Accreditation

2012. Korean Child Neurology Society, Most papers award

2013. Korean Child Neurology Society, Best Paper Award

2014. CIO of the year, South Korea CIO Forum

2015. Presidential Medal of Honor, Industrial lifelong achievement, South Korea Government

2016. Hall of Fame, HIMSS AP

Publication number: 180 as of Oct. 2022 (137 of SCI or international, 43 of domestic)

Publication list_ SCI, SCIE

1. Chung YG, Jeon Y, Kim RG, Cho A, Kim H, Hwang H, Choi J, Kim KJ. Variations of Resting-State EEG-Based Functional Networks in Brain Maturation From Early Childhood to Adolescence. J Clin Neurol. 2022 Sep;18(5):581-593. doi:10.3988/jcn.2022.18.5.581. PMID: 36062776.

2. Jung H, Lee HY, Yoo S, Hwang H, Baek H. Effectiveness of the Use of Standardized Vocabularies on Epilepsy Patient Cohort Generation. Healthc Inform Res. 2022 Jul;28(3):240-246. doi: 10.4258/hir.2022.28.3.240. Epub 2022 Jul 31. PMID: 35982598; PMCID: PMC9388923.

3. Yoo S, Lim K, Jung SY, Lee K, Lee D, Kim S, Lee HY, Hwang H. Examining the adoption and implementation of behavioral electronic health records by healthcare professionals based on the clinical adoption framework. BMC Med Inform Decis Mak. 2022 Aug 8;22(1):210. doi: 10.1186/s12911-022-01959-7. PMID:35941636; PMCID: PMC9361668.

4. Wang S, Han J, Jung SY, Oh TJ, Yao S, Lim S, Hwang H, Lee HY, Lee H. Development and implementation of patient-level prediction models of end-stage renal disease for type 2 diabetes patients using fast healthcare interoperability resources. Sci Rep. 2022 Jul 4;12(1):11232. doi:10.1038/s41598-022-15036-6. PMID: 35789173; PMCID: PMC9253099.

5. Jung H, Yoo S, Kim S, Heo E, Kim B, Lee HY, Hwang H. Patient-Level Fall Risk Prediction Using the Observational Medical Outcomes Partnership's Common Data Model: Pilot Feasibility Study. JMIR Med Inform. 2022 Mar 11;10(3):e35104. doi:10.2196/35104. PMID: 35275076; PMCID: PMC8957002.

6. Han JY, Kim SY, Kim H, Hwang H, Choi J, Chae JH, Kim KJ, Cheon JE, Lim BC. Clinico-

radiological characteristics of anti-myelin oligodendrocyte glycoprotein antibody-associated autoimmune encephalitis in children. Dev Med Child Neurol. 2022 Aug;64(8):998-1007. doi: 10.1111/dmcn.15174. Epub 2022 Feb 2. PMID:35106761.

7. Ko YJ, Yoo IH, Lee J, Lee J, Yum MS, Ko TS, Kim H, Hwang H, Kim SY, Chae JH, Choi JE, Kim KJ, Lim BC. The Role of Focal Epilepsy Features in Defining *SCN1A* Mutation-positive Dravet Syndrome as Generalized and Focal Epilepsy. J Epilepsy Res. 2021 Dec 31;11(2):127-135. doi: 10.14581/jer.21019. PMID: 35087721; PMCID: PMC8767227.

8. Jung SY, Lee K, Hwang H. Recent trends of healthcare information and communication technologies in pediatrics: A systematic review. Clin Exp Pediatr. 2021 Dec 15. doi: 10.3345/cep.2020.01333. Epub ahead of print. PMID: 34922424.

9. Kang SH, Baek H, Cho J, Kim S, Hwang H, Lee W, Park JJ, Yoon YE, Yoon CH, Cho YS, Youn TJ, Cho GY, Chae IH, Choi DJ, Yoo S, Suh JW. Management of cardiovascular disease using an mHealth tool: a randomized clinical trial. NPJ Digit Med. 2021 Dec 3;4(1):165. doi: 10.1038/s41746-021-00535-z. PMID: 34862449; PMCID: PMC8642390.

10. Chung YG, Jeon Y, Yoo S, Kim H, Hwang H. Big data analysis and artificial intelligence (AI) in epilepsy - common data model analysis and machine learning- based seizure detection and forecasting. Clin Exp Pediatr. 2021 Nov 26. doi: 10.3345/cep.2021.00766. Epub ahead of print. PMID: 34844397.

11. Lee YJ, Yoo S, Yi S, Kim S, Lee C, Cho J, Ahn S, Choi S, Hwang H, Lee YA, Shin CH, Yoon HJ, Kim K, Song E, Choi JH, Yoo HW, Kim YH, Oh JS, Kang EA, Baek GK, Kim JH. Trajectories in glycated hemoglobin and body mass index in children and adolescents with diabetes using the common data model. Sci Rep. 2021 Jul 16;11(1):14614. doi: 10.1038/s41598-021-94194-5. PMID: 34272437; PMCID: PMC8285411.

12. Lee G, Yoon S, Ahn B, Kim HR, Jang SJ, Hwang HS. Blood Vessel Invasion Predicts Postoperative Survival Outcomes and Systemic Recurrence Regardless of Location or Blood Vessel Type in Patients with Lung Adenocarcinoma. Ann Surg Oncol. 2021 Nov;28(12):7279-7290. doi: 10.1245/s10434-021-10122-x. Epub 2021 May 26. PMID: 34041629.

13. Choi SA, Lim K, Baek H, Yoo S, Cho A, Kim H, Hwang H, Kim KJ. Impact of mobile health application on data collection and self-management of epilepsy. Epilepsy Behav. 2021 Jun;119:107982. doi: 10.1016/j.yebeh.2021.107982. Epub 2021 May 1. PMID: 33946011.

14. No JH, Kim K, Kim YB, Suh DH, Yang EJ, Hwang H, Yoo S. Effects of an activity tracker with feedback on physical activity in women after midline laparotomy: A randomized controlled trial. J Obstet Gynaecol Res. 2021 Jul;47(7):2544-2550. doi: 10.1111/jog.14807. Epub 2021 Apr 25. PMID: 33899302.

15. Kim W, Cho JS, Shim YK, Ko YJ, Choi SA, Kim SY, Kim H, Lim BC, Hwang H, Choi J, Kim KJ, Kim MJ, Seong MW, Chae JH. Early-onset autosomal dominant GTP-cyclohydrolase I deficiency: Diagnostic delay and residual motor signs. Brain Dev. 2021 Aug;43(7):759-767. doi: 10.1016/j.braindev.2021.02.006. Epub 2021 Apr 17. PMID: 33875303.

16. Jung SY, Hwang H, Lee K, Lee D, Yoo S, Lim K, Lee HY, Kim E. User Perspectives on Barriers and Facilitators to the Implementation of Electronic Health Records in Behavioral Hospitals: Qualitative Study. JMIR Form Res. 2021 Apr 8;5(4):e18764. doi: 10.2196/18764. PMID: 33830061; PMCID: PMC8063095.

17. Chun JY, Song KH, Lee DE, Hwang JH, Jung HG, Heo E, Kim HS, Yoon S, Park JS, Choe PG, Chung JY, Park WB, Bang JH, Hwang H, Park KU, Park SW, Kim NJ, Oh MD, Kim ES, Kim HB. Impact of a computerised clinical decision support system on vancomycin loading and the risk of nephrotoxicity. Int J Med Inform. 2021 May;149:104403. doi: 10.1016/j.ijmedinf.2021.104403. Epub 2021 Feb 4. PMID: 33592353.

18. Kim SY, Jang SS, Kim H, Hwang H, Choi JE, Chae JH, Kim KJ, Lim BC. Genetic diagnosis of infantile-onset epilepsy in the clinic: Application of whole-exome sequencing following epilepsy gene panel testing. Clin Genet. 2021 Mar;99(3):418-424. doi: 10.1111/cge.13903. Epub 2021 Jan 3. PMID: 33349918.

19. Jung SY, Lee HY, Hwang H, Lee K, Baek RM. How IT preparedness helped to create a digital field hospital to care for COVID-19 patients in S. Korea. NPJ Digit Med. 2020 Dec 3;3(1):157. doi: 10.1038/s41746-020-00366-4. PMID: 33299090; PMCID: PMC7712873.

20. Ryu B, Yoon E, Kim S, Lee S, Baek H, Yi S, Na HY, Kim JW, Baek RM, Hwang H, Yoo S. Transformation of Pathology Reports Into the Common Data Model With Oncology Module: Use Case for Colon Cancer. J Med Internet Res. 2020 Dec 9;22(12):e18526. doi: 10.2196/18526. PMID: 33295294; PMCID: PMC7758167.

21. Fitzsimons M, Hwang H. Creating the conditions for a learning epilepsy care system. Epilepsia. 2021 Jan;62(1):217-219. doi: 10.1111/epi.16783. Epub 2020 Dec 6. PMID: 33280094.

22. Chung YG, Jeon Y, Choi SA, Cho A, Kim H, Hwang H, Kim KJ. Deep Convolutional Neural Network Based Interictal-Preictal Electroencephalography Prediction: Application to Focal Cortical Dysplasia Type-II. Front Neurol. 2020 Nov 5;11:594679. doi: 10.3389/fneur.2020.594679. PMID: 33250854; PMCID: PMC7674929.

23. Lee K, Lim K, Jung SY, Ji H, Hong K, Hwang H, Lee HY. Perspectives of Patients, Health Care Professionals, and Developers Toward Blockchain-Based Health Information Exchange: Qualitative Study. J Med Internet Res. 2020 Nov 13;22(11):e18582. doi: 10.2196/18582. PMID: 33185553; PMCID: PMC7695529.

24. Shim Y, Kim SY, Kim H, Hwang H, Chae JH, Choi J, Kim KJ, Yum MS, Ko TS, Kim YO, Byeon JH, Lee J, Lee J, Kim JS, Lim BC. Clinical outcomes of pediatric Anti- NMDA receptor encephalitis. Eur J Paediatr Neurol. 2020 Nov;29:87-91. doi: 10.1016/j.ejpn.2020.10.001. Epub 2020 Oct 6. PMID: 33046392.

25. Jung SY, Lee K, Lee HY, Hwang H. Barriers and facilitators to implementation of nationwide electronic health records in the Russian Far East: A qualitative analysis. Int J Med Inform. 2020 Nov;143:104244. doi: 10.1016/j.ijmedinf.2020.104244. Epub 2020 Aug 2. PMID: 32942224; PMCID: PMC7396132.

26. Murray CJL, Alamro NMS, Hwang H, Lee U. Digital public health and COVID-19. Lancet Public Health. 2020 Sep;5(9):e469-e470. doi: 10.1016/S2468-2667(20)30187-0. Epub 2020 Aug 10. PMID: 32791051; PMCID: PMC7417165.

27. Jung SY, Hwang H, Lee K, Lee HY, Kim E, Kim M, Cho IY. Barriers and Facilitators to Implementation of Medication Decision Support Systems in Electronic Medical Records: Mixed Methods Approach Based on Structural Equation Modeling and Qualitative Analysis. JMIR Med Inform. 2020 Jul 22;8(7):e18758. doi: 10.2196/18758. PMID: 32706717; PMCID: PMC7407246.

28. Yoo IH, Kim W, Shim Y, Choi SA, Kim SY, Kim H, Lim BC, Hwang H, Choi J, Kim KJ, Kim Y, Hyun JW, Kim SH, Choi K, Kim HJ, Chae JH. Clinical Spectrum of Myelin Oligodendrocyte Glycoprotein-Immunoglobulin G-Associated Disease in Korean Children. J Clin Neurol. 2020 Jul;16(3):461-469. doi: 10.3988/jcn.2020.16.3.461. PMID: 32657068; PMCID: PMC7354962.

29. Kim H, Yoo S, Jeon Y, Yi S, Kim S, Choi SA, Hwang H, Kim KJ. Characterization of Anti-seizure Medication Treatment Pathways in Pediatric Epilepsy Using the Electronic Health Record-Based Common Data Model. Front Neurol. 2020 May 12;11:409. doi: 10.3389/fneur.2020.00409. PMID: 32477256; PMCID: PMC7235379.

30. Ji H, Kim S, Yi S, Hwang H, Kim JW, Yoo S. Converting clinical document architecture documents to the common data model for incorporating health information exchange data in observational health studies: CDA to CDM. J Biomed Inform. 2020 Jul;107:103459. doi: 10.1016/j.jbi.2020.103459. Epub 2020 May 26. PMID: 32470694.

31. Choi SA, Kim H, Kim S, Yoo S, Yi S, Jeon Y, Hwang H, Kim KJ. Analysis of antiseizure drug-related adverse reactions from the electronic health record using the common data model. Epilepsia. 2020 Apr;61(4):610-616. doi: 10.1111/epi.16472. Epub 2020 Mar 12. PMID: 32162687.

32. Choi J, Kim SY, Kim H, Lim BC, Hwang H, Chae JH, Kim KJ, Oh S, Kim EY, Shin JS. Serum α-synuclein and IL-1β are increased and correlated with measures of disease severity in children with epilepsy: potential prognostic biomarkers? BMC Neurol. 2020 Mar 9;20(1):85. doi: 10.1186/s12883-020-01662-y. PMID: 32151248; PMCID: PMC7061464.

33. Yoo IH, Kim W, Cho J, Kim H, Lim BC, Hwang H, Chae JH, Choi J, Kim KJ. Erratum to: Elevated Serum Uric Acid in Benign Convulsions with Mild Gastroenteritis in Children. J Clin Neurol. 2020 Jan;16(1):181. doi: 10.3988/jcn.2020.16.1.181. Erratum for: J Clin Neurol. 2019 Oct;15(4):496-501. PMID: 31942784; PMCID: PMC6974815.

34. Kim WJ, Shim YK, Choi SA, Kim SY, Kim H, Hwang H, Choi J, Kim KJ, Chae JH, Lim BC. Clinical and Genetic Spectrum of *ATP1A3*-Related Disorders in a Korean Pediatric Population. J Clin Neurol. 2020 Jan;16(1):75-82. doi: 10.3988/jcn.2020.16.1.75. PMID: 31942761; PMCID: PMC6974827.

35. Yoo S, Lim K, Baek H, Jang SK, Hwang GY, Kim H, Hwang H. Developing a mobile epilepsy management application integrated with an electronic health record for effective seizure management. Int J Med Inform. 2020 Feb;134:104051. doi: 10.1016/j.ijmedinf.2019.104051. Epub 2019 Dec 4. PMID: 31837500.

36. Han JY, Choi SA, Chung YG, Shim YK, Kim WJ, Kim SY, Kim H, Lim BC, Hwang H, Chae JH, Choi J, Kim KJ. Change of centrotemporal spikes from onset to remission in self-limited epilepsy with centrotemporal spikes (SLECTS). Brain Dev. 2020 Mar;42(3):270-276. doi: 10.1016/j.braindev.2019.11.005. Epub 2019 Dec 5. PMID: 31813543.

37. Cho M, Kim K, Lim J, Baek H, Kim S, Hwang H, Song M, Yoo S. Developing data-driven clinical pathways using electronic health records: The cases of total laparoscopic hysterectomy and rotator cuff tears. Int J Med Inform. 2020 Jan;133:104015. doi: 10.1016/j.ijmedinf.2019.104015. Epub 2019 Oct 16. PMID: 31683142.

38. Park SK, Park HA, Hwang H. [Development and Evaluation of Electronic Health Record Data-Driven Predictive Models for Pressure Ulcers]. J Korean Acad Nurs. 2019 Oct;49(5):575-585. Korean. doi: 10.4040/jkan.2019.49.5.575. PMID: 31672951.

39. Choi J, Choi SA, Kim SY, Kim H, Lim BC, Hwang H, Chae JH, Kim KJ, Oh S, Kim EY, Shin JS. Association Analysis of Interleukin-1β, Interleukin-6, and HMGB1 Variants with Postictal Serum Cytokine Levels in Children with Febrile Seizure and Generalized Epilepsy with Febrile Seizure Plus. J Clin Neurol. 2019 Oct;15(4):555-563. doi: 10.3988/jcn.2019.15.4.555. PMID: 31591845; PMCID: PMC6785474.

40. Yoo IH, Kim W, Cho J, Kim H, Lim BC, Hwang H, Chae JH, Choi J, Kim KJ. Elevated Serum Uric Acid in Benign Convulsions with Mild Gastroenteritis in Children. J Clin Neurol. 2019 Oct;15(4):496-501. doi: 10.3988/jcn.2019.15.4.496. Erratum in: J Clin Neurol. 2020 Jan;16(1):181. PMID: 31591838; PMCID: PMC6785459.

41. Jang SS, Kim SY, Kim H, Hwang H, Chae JH, Kim KJ, Kim JI, Lim BC. Diagnostic Yield of Epilepsy Panel Testing in Patients With Seizure Onset Within the First Year of Life. Front Neurol. 2019 Sep 13;10:988. doi: 10.3389/fneur.2019.00988. PMID: 31572294; PMCID: PMC6753218.

42. Choi SA, Cho A, Kim SY, Kim WJ, Shim YK, Lee JS, Jang SS, Lim BC, Kim H, Hwang H, Choi JE, Kim KJ, Kim MJ, Seong MW, Chae JH. Importance of early diagnosis in LMNA-related muscular dystrophy for cardiac surveillance. Muscle Nerve. 2019 Dec;60(6):668-672. doi: 10.1002/mus.26700. Epub 2019 Sep 30. PMID: 31498906.

43. Jung H, Park HA, Hwang H. Improving Prediction of Fall Risk Using Electronic Health Record Data With Various Types and Sources at Multiple Times. Comput Inform Nurs. 2020 Mar;38(3):157-164. doi: 10.1097/CIN.0000000000000561. PMID: 31498252.

44. Kim W, Shim YK, Choi SA, Kim SY, Kim H, Lim BC, Hwang H, Choi J, Kim KJ, Chae JH. Chronic inflammatory demyelinating polyneuropathy: Plasmapheresis or cyclosporine can be good treatment options in refractory cases. Neuromuscul Disord. 2019 Sep;29(9):684-692. doi: 10.1016/j.nmd.2019.06.010. Epub 2019 Jun 19. PMID: 31473049.

45. Kim SY, Jang SS, Kim JI, Kim H, Hwang H, Choi JE, Chae JH, Kim KJ, Lim BC. Dissecting the phenotypic and genetic spectrum of early childhood-onset generalized epilepsies. Seizure. 2019 Oct;71:222-228. doi: 10.1016/j.seizure.2019.07.024. Epub 2019 Jul 31. PMID: 31401500.

46. Park SK, Park HA, Hwang H. Development and Comparison of Predictive Models for Pressure Injuries in Surgical Patients: A Retrospective Case-Control Study. J Wound Ostomy Continence Nurs. 2019 Jul/Aug;46(4):291-297. doi: 10.1097/WON.0000000000000544. PMID: 31274856.

47. Jung SY, Kim JW, Hwang H, Lee K, Baek RM, Lee HY, Yoo S, Song W, Han JS. Development of Comprehensive Personal Health Records Integrating Patient-Generated Health Data Directly From Samsung S-Health and Apple Health Apps: Retrospective Cross-Sectional Observational Study. JMIR Mhealth Uhealth. 2019 May 28;7(5):e12691. doi: 10.2196/12691. PMID: 31140446; PMCID: PMC6658253.

48. Kang S, Baek H, Jung E, Hwang H, Yoo S. Survey on the demand for adoption of Internet of Things (IoT)-based services in hospitals: Investigation of nurses' perception in a tertiary university hospital. Appl Nurs Res. 2019 Jun;47:18-23. doi: 10.1016/j.apnr.2019.03.005. Epub 2019 Mar 27. PMID: 31113540.

49. Choi HS, Chung YG, Choi SA, Ahn S, Kim H, Yoon S, Hwang H, Kim KJ. Electroencephalographic Resting-State Functional Connectivity of Benign Epilepsy with Centrotemporal Spikes. J Clin Neurol. 2019 Apr;15(2):211-220. doi: 10.3988/jcn.2019.15.2.211. PMID: 30938108; PMCID: PMC6444134.

50. Kim SY, Lim BC, Lee JS, Kim WJ, Kim H, Ko JM, Kim KJ, Choi SA, Kim H, Hwang H, Choi JE, Cho A, Moon J, Seong MW, Park SS, Lee YJ, Kim YO, Kim JS, Kim WS, Kwon YS, Park JD, Ahn Y, Hwang JY, Park HY, Lee Y, Choi M, Chae JH. The Korean undiagnosed diseases program: lessons from a one-year pilot project. Orphanet J Rare Dis. 2019 Mar 20;14(1):68. doi: 10.1186/s13023-019-1041-5. PMID: 30894207; PMCID: PMC6427886.

51. Choi SA, Kim SY, Kim WJ, Shim YK, Kim H, Hwang H, Choi JE, Lim BC, Chae JH, Chong S, Lee JY, Phi JH, Kim SK, Wang KC, Kim KJ. Antiepileptic Drug Withdrawal after Surgery in Children with Focal Cortical Dysplasia: Seizure Recurrence and Its Predictors. J Clin Neurol. 2019 Jan;15(1):84-89. doi: 10.3988/jcn.2019.15.1.84. PMID: 30618221; PMCID: PMC6325372.

52. Kang S, Baek H, Jun S, Choi S, Hwang H, Yoo S. Laboratory Environment Monitoring: Implementation Experience and Field Study in a Tertiary General Hospital. Healthc Inform Res. 2018 Oct;24(4):371-375. doi: 10.4258/hir.2018.24.4.371. Epub 2018 Oct 31. PMID: 30443425; PMCID: PMC6230526.

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55. Kim H, Kim SY, Lim BC, Hwang H, Chae JH, Choi J, Kim KJ, Dlugos DJ. Spike persistence and normalization in benign epilepsy with centrotemporal spikes - Implications for management. Brain Dev. 2018 Sep;40(8):693-698. doi: 10.1016/j.braindev.2018.04.011. Epub 2018 May 10. PMID: 29754875.

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Jan;139:54-59. doi: 10.1016/j.eplepsyres.2017.11.012. Epub 2017 Nov 27. PMID: 29197666.

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