

PROMOTION RECOMMENDATION
THE UNIVERSITY OF MICHIGAN
MEDICAL SCHOOL
DEPARTMENT OF LEARNING HEALTH SCIENCES
DEPARTMENT OF INTERNAL MEDICINE
DEPARTMENT OF UROLOGY
SCHOOL OF INFORMATION

Karandeep Singh, M.D., M.M.Sc., assistant professor of learning health sciences, Department of Learning Health Sciences, assistant professor of internal medicine, Department of Internal Medicine, assistant professor of urology, Department of Urology, Medical School, and assistant professor of information, School of Information, is recommended for promotion to associate professor of learning health sciences, with tenure, Department of Learning Health Sciences, associate professor of internal medicine, without tenure, Department of Internal Medicine, associate professor of urology, without tenure, Department of Urology, Medical School, and associate professor of information, without tenure, School of Information.

Academic Degrees:

M.M.Sc.	2015	Harvard Medical School, Boston, MA.
M.D.	2008	University of Michigan, Ann Arbor, MI.
B.Sc.	2004	University of Michigan, Ann Arbor, MI.

Professional Record:

2019- present	Assistant Professor, Department of Urology, University of Michigan
2018- present	Assistant Professor, Department of Internal Medicine, Division of Nephrology, University of Michigan
2018- present	Assistant Professor, Department of Learning Health Sciences, University of Michigan
2017- present	Assistant Professor, School of Information, University of Michigan
2015- 2018	Clinical Assistant Professor, Department of Internal Medicine, Division of Nephrology, University of Michigan
2015- 2018	Clinical Assistant Professor, Department of Learning Health Sciences, University of Michigan
2011- 2012	Clinical Instructor, UCLA Medical Center, Los Angeles, CA

Summary of Evaluation:

Teaching: Dr. Singh has been actively engaged in teaching through his unique role as both a clinician and a biomedical information and data scientist which provides him with ample opportunities to introduce both students and colleagues to the real-world challenges of using machine learning and digital health in clinical settings. Dr. Singh's teaching takes place in a variety of venues: on the inpatient Nephrology Consult Service, in the classroom, through his service as a mentor, and through speaking engagements. As a clinician, Dr. Singh provides supervision to medical students, residents, and nephrology fellows on the inpatient nephrology consult service. Within the classroom setting, Dr. Singh has both designed, co-taught, and been the instructor of record for the graduate-level *Exploratory Data Science for Health* course. This

course is required for those in the Health Infrastructures and Learning Systems M.S. and Ph.D. programs, and it was an elective course in the Master of Health Informatics program. He has also guest lectured for several courses, including the Michigan PASQUAL Scholars Program, the Introduction to Health Informatics course, and the Medical School's Quality, Safety, and Complex Systems Path of Excellence. Mentoring others is yet another way that Dr. Singh has served to impart his knowledge to those at Michigan. In total, he has mentored three post-doctoral fellows, one internal medicine resident, and six doctoral candidates. Additionally, he has served as a secondary mentor to five other doctoral candidates, and he mentored three medical students, two undergraduates, and one high school student. His mentorship has resulted in fruitful collaborations whereby Dr. Singh served as senior author on several publications. He consistently receives excellent ratings and was honored in 2016 as the recipient of the Endowment for the Basic Sciences Teaching Award due to his innovativeness and success of his classroom teaching. Dr. Singh has also been invited to speak at national and regional meetings, with many of these talks focused on lessons learned from translating machine learning models from bench to bedside.

Research: Dr. Singh's scholarly interests focus on the entire lifecycle of machine learning models from development to deployment. Dr. Singh's research falls into three distinct categories: 1) developing machine learning models to predict risk, 2) evaluating machine learning model performance in the real world, and 3) developing and evaluating digital health applications. In his efforts to predict risks, Dr. Singh's projects have spanned across many clinical domains including nephrology, urology, ophthalmology, emergency medicine, and opioid use. In one such project as part of a contract funded by the Department of Veterans Affairs, Dr. Singh led the development of a series of models to predict kidney injury in over 100 Veterans Affairs hospitals. Within his second category of research interests, Dr. Singh is looking to understand the differences in the performance of models from when they are developed to when they are deployed. His work in this area led him to study the Epic Deterioration Index, a model widely used to predict the risk of clinical worsening in hospitalized patients. When applied to patients suffering from COVID, it was found that the model performed far less well than Epic had claimed which fixed national attention to the importance of algorithmic vigilance. Dr. Singh has also evaluated the quality of digital health applications. One such study looked at the issue of language barriers in diabetes applications. Dr. Singh's research has been continuously funded since 2016 and he is currently funded for this work as a multi-principal investigator of an R01 and is a co-investigator on 5 other R01-equivalent grants.

Dr. Singh currently has 54 peer-reviewed publications that appear in top-tier journals such as the *New England Journal of Medicine*, *Lancet*, *JAMA Internal Medicine*, and the *Journal of Urology*. Dr. Singh has written 26 book chapters and 16 abstracts. He has been invited on 21 occasions to present his research work regionally, nationally, and internationally including in Germany. Evidence of his stature in the field is noted by his invitations to provide ad-hoc peer-reviewed service for more than 20 journals including, *Nature*, *European Urology*, *Journal of the American Medical Informatics Association*, and *Journal of the American Society of Nephrology*. Additionally, this year Dr. Singh was a guest editor for a special topic in *Frontiers of Digital Health*.

Recent and Significant Publications:

- Singh K, Murali A, Stevens H, Vydiswaran VGV, Bohnert A, Brummett CM, Fernandez AC, “Predicting Persistent Opioid Use After Surgery Using Electronic Health Record and Patient-Reported Data,” *Surgery* 172(1): 241-248, 2022. PMID: 35181126
- Ötles E, Denton B, Qu B, Murali A, Merdan S, Auffenberg G, Hiller S, Lane BR, George AK, Singh K, “Development and Validation of Models to Predict Pathological Outcomes of Radical Prostatectomy in Regional and National Cohorts,” *J Urol* 207(2): 358-366, 2022. PMID: 34551595
- Wong A, Otles E, Donnelly JP, Krumm A, McCullough J, DeTroyer-Cooley O, Pestrue J, Phillips M, Konye J, Penza C, Ghous M, Singh K, “External Validation of a Widely Implemented Proprietary Sepsis Prediction Model in Hospitalized Patients,” *JAMA Intern Med* 181(8):1065–1070, 2021. PMID: 34152373
- Singh K, Valley TS, Tang S, Li BY, Kamran F, Sjoding MW, Wiens J, Otles E, Donnelly JP, Wei MY, McBride JP, Cao J, Penza C, Ayanian JZ, Nallamothu BK, “Evaluating a Widely Implemented Proprietary Deterioration Index Model Among Hospitalized Patients with COVID-19,” *Ann Am Thorac Soc* 18(7): 1129-1137, 2020. PMID: 33357088
- Auffenberg GB, Ghani KR, Ramani S, Usoro E, Denton B, Rogers C, Stockton B, Miller DC, Singh K, “Michigan Urological Surgery Improvement Collaborative. askMUSIC: Leveraging a Clinical Registry to Develop a New Machine Learning Model to Inform Patients of Prostate Cancer Treatments Chosen by Similar Men,” *Eur Urol* 75(6): 901/907, 2019. PMID: 30318331

Service: Dr. Singh provides excellent patient care at the University of Michigan. Institutionally, he is the chair of the Michigan Medicine Clinical Intelligence Committee and the associate director for implementation within the Precision Health Initiative. Additionally, he has chaired the Qualifying Exam Committee, the Health Infrastructures and Learning Systems (HILS) Ph.D. Program, and has been a member of the HILS Program Committee. Regionally, Dr. Singh has been a member of the Michigan Urological Surgery Improvement Collaborative (MUSIC) Coordinating Center since 2017. Nationally, Dr. Singh began serving as a co-lead for the American Society of Nephrology Augmented Intelligence and Digital Health Task Force. Internationally, he was invited to be a member of the STARD-AI Reporting Guideline Consensus Panel and began serving as a member of both the DECID-AI Reporting Guideline Consensus Panel and the TRIPOD-AI Reporting Guideline Consensus Panel. From these and other activities, it is clear that Dr. Singh is engaged and dedicated to his profession and the people it serves.

External Reviewers:

Reviewer A: “Dr. Karandeep Singh, MD, MS’s has a reasonable history of grant acquisition he is an MPI on a large NIH NIDDK grant regarding Cardiac Surgery and the prevention of Kidney injury (\$3,279,341), and he has other grants as a co-investigator on many others grants and grant applications under review. More impressive is his strong history of team science as Dr. Karandeep Singh, MD, MS has contributed to the success of many other scientists work.”

Reviewer B: “Dr. Singh has consistently led and disseminated some of the most impactful, interdisciplinary research spanning the domains of biomedical informatics, implementation science, and clinical medicine. Specifically, Dr. Singh’s contributions have earned him national recognition as an accomplished clinician-scientists and thought leader in the application and

evaluation of artificial intelligence (AI) and data science to enable learning health systems and advance clinical care.”

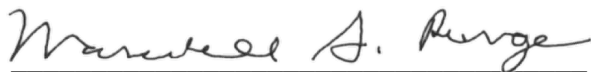
Reviewer C: “His most recent work independently evaluating proprietary models, including the first published evaluations of the Epic Deterioration Index and the Epic Sepsis Model, have deservedly garnered enormous attention in academic medicine and in the lay press. In a little over a year since their publication, each of these papers have been cited more than 100 times.”

Reviewer D: “Dr. Singh has used his clinical and informatics skills well, participating on several international and national committees to develop clinical practice guidelines for assisting treatment decisions in important areas of medical practice. He has done some work on national scientific program committees and proposal-review panels.”

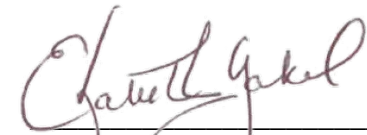
Reviewer E: “He is now an emerging leader in this area, and had established his methods expertise well beyond nephrology, with leading publications in journals related to surgical outcomes and intensive care/sepsis outcomes. He has created collaborations locally (as evidenced by awarded grants) and nationally/internationally and is progressing towards international leadership in his area of study.”

Summary of Recommendation:

Dr. Singh is recognized for his expertise in predictive modeling using machine learning approaches. He has made substantial contributions to the field through his research, clinical work, teaching, and service. Therefore, we enthusiastically recommend Karandeep Singh, M.D., M.M.Sc. for promotion to associate professor of learning health sciences, with tenure, Department of Learning Health Sciences, associate professor of internal medicine, without tenure, Department of Internal Medicine, associate professor of urology, without tenure, Department of Urology, Medical School, and associate professor of information, without tenure, School of Information.



Marschall S. Runge, M.D., Ph.D.
Executive Vice President for Medical Affairs
Dean, Medical School



Elizabeth Yakel
Interim Dean, School of Information

May 2023