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## Using Doctors' Notes to Uncover Everyday Natural Experiments in Healthcare

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Genome-wide association studies (GWAS) have enabled the discovery of new gene-disease relationships through a paradigm of simultaneous, unbiased testing of multiple associations. Similar approaches have been used to discover new associations between diseases and environmental exposures in environment-wide association studies (EWAS) and between a single genetic variant and multiple phenotypes in phenome-wide association studies (PheWAS).

In contrast, modern epidemiologic approaches have not used this paradigm in the discovery of new predictors of health outcomes. This is partly due to the fact that data sources that would contain relevant information on exposures relevant to health are difficult to find and analyze on a large scale. Clinical notes contain a rich description of numerous epidemiologic exposures that can be unlocked using natural language processing software. Studying the links between thousands of epidemiologic exposures in clinical notes and health outcomes amounts to a set of natural experiments on the grandest scale. Discovering associations based on the clinical narrative carries the added complexity of an open cohort, where patients may enter and leave the cohort at various time points and may be lost to follow-up or experience competing events.

In this talk, I will present a new methodology, which I have termed a concept-wide association study (CWAS), for examining relationships between several thousand concepts extracted from clinical notes with the development of 2 health outcomes: kidney failure and medication non-adherence. We will critically examine and discuss how to interpret its findings as well as its limitations.

**Karandeep Singh, M.D., M.M.Sc.**, is a physician, researcher, and educator interested in studying learning health systems, making new discoveries about disease, and improving patient care through technology. His research areas include natural language processing of clinical notes, risk prediction using high-dimensional data, and mobile health. He is an assistant professor of Learning Health Sciences in the Division of Learning and Knowledge Systems and an assistant professor of Medicine in the Division of Nephrology at the University of Michigan Medical School. He teaches a course on applied data science in health to doctoral and masters students. Dr. Singh completed his internal medicine residency at UCLA Medical Center, where he served as chief resident, and a nephrology fellowship at Brigham and Women's Hospital in Boston. He completed his medical education at the University of Michigan Medical School and holds a master's degree in medical sciences in Biomedical Informatics from Harvard Medical School. He is board certified in internal medicine and nephrology.

The seminar series "Providing Better Healthcare through Systems Engineering" is presented by the U-M Center for Healthcare Engineering and Patient Safety: Our mission is to improve the safety and quality of healthcare delivery through a multi-disciplinary, systems-engineering approach. For additional information and to be added to the weekly e-mail for the series, please contact [genehkim@umich.edu](mailto:genehkim@umich.edu)

**Please note on location:** 1123 LBME is room 1123 in the Ann & Robert H. Lurie Biomedical Engineering Building (LBME). Street address is 1101 Beal Avenue, link to map and directions: <http://www.bme.umich.edu/about/directions.php>.



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