HEALTH-GEOMATICS INTERFACE AND THE FUTURE OF DISEASE GOVERNANCE

Why should the August 27th KAD CME be exciting to health professionals?

A talk on:

Modelling COVID-19 Scenarios: Global, Africa, Kenya

by

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Geomatics professional with expertise and research interest in applied dynamic modelling. He will share his models that reveal key decision metrics on COVID-19

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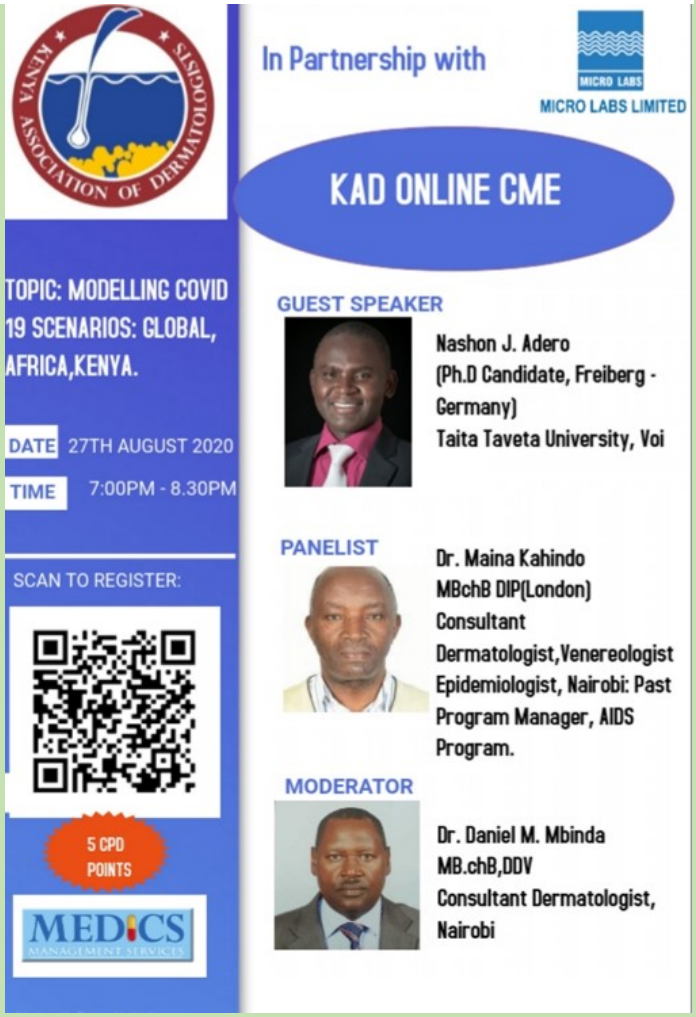

Introducing my profession in familiar territories

Have you ever described a dream as distant, a claim as far-fetched, or a judgement as sloping? Life is full of such spatial metaphors. Daily, we perceive and interpret distance and direction in our physical and mental worlds. The 2014 Nobel prize in Medicine or Physiology recognised the key finding that the brain has grid cells and place cells, an "inner GPS" which maps out space by encoding coordinates to guide memory and navigation. Our understanding of nature cannot be divorced from the four mysteries of nature: **light, gravity, space,** and **time**. A look at the sun, a near star, gives us a view of about nine minutes of history, and millions of years of history for distant stars. The concept of space and time, from which we derive the term "spatial" and "temporal" respectively, together form the fundamental space-time or "spatio-temporal" philosophy for abstracting, organising, perceiving, and interpreting the world. Why does water seem to flow uphill in Kituluni, Kenya? Geodesy, a sub-discipline of geomatics, has the answer. How does *Uber* service locate you and the driver so precisely? How does your car navigator estimate your arrival time in Nakuru adaptively as the variables of the road condition, traffic situation, driving speed, stops along the way, among others, come into play? Walking around the German parliament buildings (Bundestag), a pocket narrator immerses you in a flawless location-based description of your immediate surroundings. Walk faster and it will fast-forward to retrieve the story matching your new position, sharing with you the relevant directions as well.

At the core of these solutions that have profoundly transformed life, work, and play through civilisations is the applied science of measurements, geometry, positioning, navigation and mapping, which underpin **geomatics**; this is my area of training. **Geomatics** combines traditional and modern aspects of surveying and mapping including airborne and spaceborne technologies, essentially using location-based data (spatial data) to deliver accurate and precise metrics which are critical to demarcating land and property boundaries for registering ownership rights (cadastral surveys); land administration; land use planning; engineering and construction projects; positioning and navigation on, below or above land and water; and providing actionable location-based intelligence in aid of planning, management and monitoring assignments for business, public and civil society sectors. In an era when decision support increasingly demands Geographic Information Systems (GIS), big data and reliable real-world information from satellites, these application areas are gaining currency and prominence. The Industrial Revolution, now in the fourth stage (Industry 4.0), continues to push the boundaries of precision for data-driven decision making. Modern-day sensors and computing technologies, a digital revolution that can handle vast databases of geographically referenced data, have advanced the interdisciplinary practice of

Geomatics. The science of positioning and navigation has inspired key developments in emerging subjects such as **cognitive neuroscience**, **computational neuroscience**, security and warfare intelligence, precision agriculture, smart transportation, smart mining, among others.

Why this talk?

John Wheeler's renowned quote in physics goes, "Space-time tells matter how to move; matter tells space-time how to curve." **Johannes Kepler** said that mathematics is the language that describes the rational order in creation. **Michael Faraday**, among the few who **Albert Einstein** recognised, only got 13 years of formal education then did the rest under home schooling and apprenticeship as a book binder. **Thomas Bayes** was a Presbyterian pastor but is better known for statistics, Bayes Theorem. **Isaac Newton** was a professor in natural philosophy. Love for knowledge was the common denominator of these great people. They did not identify themselves as *"exclusive subject owners"* who are reluctant to seek opinion from other disciplines as we do witness today. They were immersed in philosophy, mathematics, astronomy, history, and service of humanity through various occupations to almost equal depths. Who are their equivalents today?

A clear message emerges. Our brains were not created to have subject boundaries. Those imaginary disciplinary boundaries are self-imposed by our prejudices and conditioned loss of curiosity as we grow up, making us miss out on the simple definition of every great scientist and innovator as a grown-up child – in terms of childlike curiosity, of course. COVID-19 has made more compelling the case for multidisciplinary collaboration towards finding solutions to the common and urgent problems facing humanity today. This talk is based on the premise that the cross-fertilisation of disciplines is critical to progressive research and innovation. Health experts have something to gain from geomatics experts, and vice-versa.

How can geomatics leverage healthcare delivery?

The quality of a nation's healthcare system is a critical strand in the fabric of life and livelihoods. The 1854 discovery by Dr John Snow in London of the cause of cholera was a triumph of mapping techniques. Like the present ravaging COVID-19 pandemic, many diseases demonstrate an evident nexus between **people**, **place**, and **time**. Where we live determines the air, water, soil, and communities we interact with routinely. As written about widely by Bill Davenhall of Esri, there exist certain chronic **skin** or health conditions that are far removed from **genotype** and

lifestyle, leaving environmental factors as the most convincing explanation. Effective disease governance, therefore, has strong spatio-temporal dimensions. To live up to their *raison d'être* as the foremost disease detectives, modern **medical epidemiologists** can draw much intelligence from Geographic Information Systems (GIS) to combat infectious diseases and protect communities against exposure risks.

Geomedicine as an emerging field utilises the spatial intelligence extracted from the environment using technologies such as terrestrial, airborne and satellite-based navigation and mapping to enhance solutions to individual and public health. **Medical diagnostic experience has traditionally been an enterprise rich in keeping the records of a patient's medical history. To date, the medical records have been lean on the health-geography interface.** This state of affairs denies clinicians access to the expanding pool of location-based intelligence they need to tap into for a more precise clinical understanding of the links between patients' health and where they live, work, and play. Various kinds of prognosis and diagnosis, as well as preventive and predictive healthcare, stand to gain from geospatial technologies. Using modern information technology to map at scale and deliver **geomedical informatics and intelligence** on a patient's potential exposure risks to diseases in the living environment, geomedicine equips modern clinicians to improve the quality and quantity of diagnostic results and strategic interventions, which is a key requirement for containing pandemics such as COVID-19.

Conclusion

Health is too important a sector to be left out of the mainstream of innovations availed by the emerging Fourth Industrial Revolution.
COVID-19 only makes this call more compelling. The future of healthcare and disease governance grows brighter with predictive mapping, supported by the Internet, location sensors, big data, automation, and artificial intelligence (AI). With these developments, telemedicine is assured of reaching saturation in the rapidly evolving technology marketplace.