



MMS Bulletin #167

The Determinants of Health and the Long Road to Health Equity

With its AI4HealthyCities initiative, the Novartis Foundation is deciphering what truly drives our health

Deciphering social, environmental and behavioral drivers of urban heart health

By Ann Aerts

Did you know? Only 20% of your health outcomes are determined by the healthcare you receive. Conversely, the conditions in which you are born, grow and work shape up to 80% (Hood, C.M. et al., 2016). And with the arrival of new technologies, we can analyze and understand what truly drives our health.



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The emergence of Artificial Intelligence (AI) systems in our daily lives has taken the world by storm - from providing instant human-like answers to our questions to protecting us from cyber threats and issuing warnings about potentially hazardous weather. However, AI can go beyond responding to prompts about cooking recipes and city-trip itineraries. Within healthcare, AI has the potential to bring significant benefits by overcoming barriers that may hinder people from receiving the care they need. Applying AI to analyze large and disconnected sets of health and health-influencing data can support a much-needed paradigm shift from reactive care systems into proactive, predictive, and preventive health systems that keep people healthy.

What determines our risk of developing a disease?

There is a broad public consensus about specific behaviors and habits that can be detrimental to our health. Take cardiovascular disease (CVD), the world's leading cause of death and disability (WHO, 2023) - one of the most important advances in CVD research within the last century has been the identification of risk factors such as smoking, unhealthy diets, and lack of physical activity to name only a few.

That said, there are many more factors that might tip the scales of your health: so called social determinants of health (SDoH) encompass economic (e.g., employment, financial situation), social (e.g., immigration status, acculturation), environmental (e.g., climate, air pollution, transportation), digital (e.g., access to internet or a computing device) and psychosocial factors (e.g., local language, literacy) that may influence our risk of developing a disease, our ability to receive healthcare, and our expected health outcomes (Powell-Wiley, T. M. et al., 2022). These determinants, however, are not well-understood yet.



Dr. Ann Aerts has been leading the Novartis Foundation since 2013. Photo: © Novartis Foundation

“Deciphering the true drivers of CVD and how they interact offers the potential to identify people at higher risk of cardiovascular events and thus transform the health of large populations,” explains Dr. **Ann Aerts**, Head of the Novartis Foundation. Such an increased understanding of the true determinants of cardiovascular events, like heart attacks or strokes, allows people, health professionals and health system managers alike to make informed decisions on where to allocate resources and capacities to improve population health.

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— Ann Aerts, Head of Novartis Foundation

AI4HealthyCities

AI4HealthyCities is an initiative by the Novartis Foundation in collaboration with Microsoft AI for Health and local partners, which brings together existent but disconnected sets of data within a city and using advanced analytics and AI to uncover cardiovascular risk factors its population.

With an aim to provide decision makers with insights into the origins of disparities in cardiovascular health outcomes in their jurisdiction, AI4HealthyCities gathers data from health- and health-related sectors and identifies relevant and informative patterns within the data. **Elizabeth Adamson**, Associate Director of Population Health at the Novartis Foundation, states “We aim to enable informed decision making and design effective interventions by local stakeholders and governments to address critical health problems like CVD:”

However, the need for complex data sets that allow for thorough analysis poses a particular challenge in lower income settings, where some of the highest burden of the disease exists. Therefore, the focus for AI4HealthyCities currently is on data-rich environments, with learnings and insights potentially to be applied to less data-rich environments. As **Bill Weeks**, Director at Microsoft AI for Health, states, “With enough longitudinal data, we could use AI to model anticipated effects of a change in social determinants of health on a cardiovascular outcome for a particular population.”

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— Elizabeth Adamson, Associate Director of Population Health at the Novartis Foundation

The AI advanced analytics steps that are implemented within AI4HealthyCities include:

- Identifying the determinants of health that characterize populations with poor cardiovascular outcomes
- Quantifying the impact of each of these determinants on cardiovascular outcomes, and that of their combinations
- Identifying which determinants are the main drivers of unequal cardiovascular outcomes (risk factors and events)
- Defining how modifying these (combinations of) determinants could change cardiovascular outcomes

Analyses in action

New York, where inhabitants of high-poverty neighborhoods are 2.4 times more likely to die prematurely from CVD than people living in wealthier parts of town (Gresia, V., et al., 2017), was the first city to launch AI4HealthyCities in September 2022.

Since its launch, New York has brought together the data from multiple public sources and from different electronic health records (EHR) to understand the factors driving disparities in cardiovascular health outcomes at an individual zip code or census tract level within New York and across the US. Examples of these different data include (but are not limited to)

- neighborhood data (including income, unemployment rate, and education levels);
- data on mental health conditions (such as depression, stress, anxiety, and substance abuse);
- and social needs captured in different sector data or in some hospital EHR systems (e.g., to understand concerns around paying bills, housing conditions and interpersonal violence).

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— Bill Weeks, Director at Microsoft AI for Health



Even within the same city, health outcomes can differ vastly between neighborhoods across town. Photo: © Novartis Foundation

Collating these vast amounts of data for New York requires extensive time and effort and has been the focus of **NYU School of Global Public Health** and **Weill Cornell Medicine** over the last year. **Yongkang Zhang**, Assistant Professor of Population Health Sciences at Weill Cornell working on this initiative, mentions that “the unique aspect of this program, compared to many other previous ones, is that we will be using very comprehensive data to enable more accurate predictions.”

Insights may soon shed light on the factors contributing to poor cardiovascular outcomes among individuals residing in one zip code/census tract in New York as compared to those living in a neighboring zip code or tract just a short stroll away.

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— Yongkang Zhang, Assistant Professor of Population Health Sciences

From data analysis to translation into action

The next step in New York will be to use the newly generated data insights to create a roadmap for improving cardiovascular health outcomes in the city population, and to provide city authorities at the Department of Health and Mental Hygiene with the tools and insights that allow them to target resources for CV health so that they can have the largest impact on

the health of the greatest number of people. The data-driven insights may also require involvement of other governing bodies, which could go as far as the departments for urban planning, transport, or education. To support such fundamental data-driven decision making, the AI in the AI4HealthyCities initiative hopes to enable simulations of cost and effectiveness of different population health interventions, so that decision makers can assess the benefit of different types of interventions on cardiovascular outcomes in the city population.

AI cannot replace human knowledge however, and neither can it properly understand a community's health context; local and cultural knowledge of community perspectives and priorities are also needed. That's why the city of New York has announced the creation of an expert council to guide the implementation and translation of AI4HealthyCities findings into action. It will provide expert guidance on the preliminary results from the advanced analytics within the local AI4HealthyCities program and ensure independent feedback on how to proceed with cardiovascular health interventions at the population level.

Through the power of data and strong multi-sector partnerships, AI4HealthyCities has the potential to narrow health inequities worldwide. Since 2022, the initiative has launched in other major cities including Singapore, Lausanne and Basel, Switzerland, and soon Helsinki, Finland.

Learn more about the Novartis Foundation and AI4HealthyCities at
www.novartisfoundation.org/AI4HealthyCities.

Quotes

- Ann Aerts, Head of Novartis Foundation: "Deciphering the true drivers of CVD and how they interact offers the potential to identify people at higher risk of cardiovascular events and thus transform the health of large populations."
- Elizabeth Adamson, Associate Director of Population Health, Novartis Foundation: "We aim to enable informed decision making and design effective interventions by local stakeholders and governments to address critical health problems like CVD."
- Bill Weeks, Microsoft AI for Health: "With enough longitudinal data, we could use AI to model anticipated effects of a change in social determinants of health on a cardiovascular outcome for a particular population."
- Yongkang Zhang, Assistant Professor of Population Health Sciences: "the unique aspect of this program, compared to many other previous ones, is that we will be using very comprehensive data to enable more accurate predictions."

References

- Gresia V, Wright M, Li W, Jasek J, Sun Y, Di Lonardo S, Chamany S. Premature Heart Disease and Stroke Deaths in New York City. New York City Department of Health and Mental Hygiene: Epi Data Brief (95); November 2017.
<https://www.nyc.gov/assets/doh/downloads/pdf/epi/d...>

- Hood, C. M., Gennuso, K. P., Swain, G., & Catlin, B. B. (2016). County health rankings. *American Journal of Preventive Medicine*, 50(2), 129–135.
<https://doi.org/10.1016/j.amepre.2015.08.024>
- Powell-Wiley, T. M., Baumer, Y., Baah, F. O., Baez, A. S., Farmer, N., Mahlobo, C. T., Pita, M. A., Potharaju, K. A., Tamura, K., & Wallen, G. R. (2022). Social determinants of cardiovascular disease. *Circulation Research*, 130(5), 782–799.
<https://doi.org/10.1161/circresaha.121.319811>
- World Health Organization (2023). Cardiovascular diseases. Retrieved August 17, 2023, from https://www.who.int/health-topics/cardiovascular-diseases#tab=tab_1



Dr. Ann Aerts, Head of the Novartis Foundation. Ann Aerts has been leading the Novartis Foundation since January 2013, where she and her team design and implement population health programs to improve the lives of as many people as possible. With her work, Ann and the Novartis Foundation seek to support a paradigm shift from reactive systems of care to predictive and proactive systems of health that keep people healthy. The current initiatives and projects of the Novartis Foundation lean heavily on data, AI and advanced analytics to decipher the true drivers behind the two most pressing challenges: cardiovascular disease and health inequities. The aim is to enable evidence-based decision making and provide policy makers with concrete policy proposals to improve quality of life in their communities. Ann holds a Degree in Medicine and a Master's in Public Health from the University of Leuven, Belgium, and a Degree in Tropical Medicine from the Institute of Tropical Medicine in Antwerp, Belgium. Ann has authored numerous publications and is a member of the Broadband Commission for Digital Development, the Governing Council of the UN Technology Bank for Least Developed Countries and the International Advisory Board of the Commonwealth Centre for Digital Health. Email

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