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Social Determinants in Machine Learning Cardiovascular Disease Prediction Models: A Systematic Review

Yuan Zhao, MPH [1] · Erica P. Wood, MPH [2] · Nicholas Mirin, BA [2] · Stephanie H. Cook, DrPH [2,3] · Rumi Chunara, SM, PhD [3,4] ✉

Affiliations & Notes ⌄   Article Info ⌄

Abstract

Introduction

Cardiovascular disease is the leading cause of death worldwide, and cardiovascular disease burden is increasing in low-resource settings and for lower socioeconomic groups. Machine learning algorithms are being developed rapidly and incorporated into clinical practice for cardiovascular disease prediction and treatment decisions. Significant opportunities for reducing death and disability from cardiovascular disease worldwide lie with accounting for the social determinants of cardiovascular outcomes. This study reviews how social determinants of health are being included in machine learning algorithms to inform best practices for the development of algorithms that account for social determinants.

Methods

A systematic review using 5 databases was conducted in 2020. English language articles from any location published from inception to April 10, 2020, which reported on the use of machine learning for cardiovascular disease prediction that incorporated social determinants of health, were included.

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Most studies that compared machine learning algorithms and regression showed increased performance of machine learning, and most studies that compared performance with or without social determinants of health showed increased performance with them. The most frequently included social determinants of health variables were gender, race/ethnicity, marital status, occupation, and income. Studies were largely from North America, Europe, and China, limiting the diversity of the included populations and variance in social determinants of health.

Discussion

Given their flexibility, machine learning approaches may provide an opportunity to incorporate the complex nature of social determinants of health. The limited variety of sources and data in the reviewed studies emphasize that there is an opportunity to include more social determinants of health variables, especially environmental ones, that are known to impact cardiovascular disease risk and that recording such data in electronic databases will enable their use.

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