AI-augmented multidisciplinary teams: hype or hope?

Over the past few years, the approach to treating diseases has switched from the solo expertise of a single specialist to treatment orchestrated by a multidisciplinary team, with the intention of merging the opinions of various experts in an optimum way to treat patients. Multidisciplinary teams are the backbone of the decision making that forms the basis of modern medicine. The multidisciplinary team offers a more hierarchical, high-level, and complex system compared with a single specialist, and aims to determine the most plausible differential diagnosis, relate this to the most probable prognosis, and select the best course of treatment. An incorrect differential diagnosis might lead to error cascades, the consequences of which are inaccurate expectations and imprecise treatments. However, multidisciplinary teams can still be limited by insufficient expertise of the single members, out-of-date knowledge on the relevant evidence-based medical literature, consolidated teams that are not open to new opinions or participants, and logistical or communication barriers.

In recent years, the use of artificial intelligence (AI) in medicine has greatly increased, although the field is still challenged by particular concerns and the absence of validation against the opinions of experts or across different populations[1] and by the absence of a standardised method of analysis.[2] AI methods can be used to help clinicians and surgeons with decision making, to reduce errors in judgment and improve differential diagnosis, and thereby improve the choice of treatment and patient outcome. The underlying fear of a dystopic challenge wherein AI is in competition with human experts can be overcome by viewing AI as a means to create a so-called augmented physician, with the expertise of specialists enhanced by AI. This alternative view would shift the paradigm from one of human-versus-machine, to human-and-machine.[3] Machines will not replace physicians, but physicians using AI will soon replace those not using it. Likewise, decisions from the multidisciplinary team meetings of the next generation are likely to be implemented by the machine, as AI will support more objective and reliable decision making, reducing the limitations of human error and subjectivity related to the single specialist or team. As stated by Enrico Coiera,[4] the way to prepare for these coming times is adapting clinical education to the digital world, to build the capacity for enhanced decision making and prognostication among physicians by means of AI. Continuous vigilance around advice validation will still be of paramount importance,[5] to avoid physicians blindly following the machine-tracked pathway over the course of a patient's diagnosis and therapy. In addressing the need to adapt in response to the fate of medicine in this time of AI,[4] the fate of multidisciplinary teams is to change as well.

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Antonio Di Ieva
antonio.diieva@mq.edu.au

Macquarie Neurosurgery and Computational Neurosurgery Laboratory, Department of Clinical Medicine, Faculty of Medicine and Health Sciences, Macquarie University, Sydney, NSW 2109, Australia

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Uncertainties in the GBD 2017 estimates on diet and health


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The Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2017 Diet Collaborators[1] use evidence from primarily observational data and short-term trials of intermediate outcomes to draw conclusions about the causal relationships between individual dietary components and death and disease. We applaud this analysis for raising the crucial importance of diet for overall health, but have some concerns about the potential policy and programmatic implications if results are interpreted literally.

Individual dietary components are not eaten separately, but rather are bundled together as diets. However, when individual components are statistically separated, strange conclusions emerge. For example, we question the biological plausibility that low consumption of whole grains specifically is a leading global dietary risk factor for death and non-communicable diseases (NCDs). Whole grains are not themselves a dietary requirement. Our ancestors lived virtually free from NCDs[2] and consumed essentially no grains for millions of years, yet had healthy diets high in micronutrients and fibre.[3] Even cultures that have maintained traditional diets and lifestyles post-industrial revolution have low NCD prevalence.[4,5]

Although increased consumption of whole grains and fruit would probably benefit some populations, a healthy diet can be achieved in many other ways, including by consuming a decreased quantity of refined grains and an increased amount of vegetables. We are surprised that dietary factors associated with the obesity and NCD epidemics (ie, refined grain, sugar, and oil)[3] were not taken into consideration—these might confound the reported associations. We have no doubt that the global food system needs to be changed urgently in favour of health and the environment, but we call for caution with how observational data is used to guide these changes.

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*Ty Beal, Lynnette M Neufeld, Saul S Morris
tbeal@gainhealth.org

Global Alliance for Improved Nutrition, Knowledge Leadership, Washington, DC 20005, USA (TB); Global Alliance for Improved Nutrition, Knowledge Leadership, Geneva, Switzerland (LMN); and Global Alliance for Improved Nutrition, Programme Services, London, UK (SSM)

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We wish to complement the important Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) analysis of diet and health.[1] The GBD 2017 Diet Collaborators state that "Globally, in 2017, dietary risks were responsible for 11 million (95% uncertainty interval [UI] 10–12) deaths (22% [95% UI 21–24] of all deaths among adults)".[1] However, it is unclear to us how these results were derived.

Population-attributable fraction (PAF) was defined as in the GBD 2017 comparative risk assessment as "the proportion by which the outcome would be reduced in a given population in a given year if the exposure to a risk factor in the past were reduced".[2] Thus, the Diet Collaborators assumed that attributable fraction calculations were estimates of the number of deaths due to exposure. Such a death burden is a burden of premature deaths because the inevitability of death is a fact.[3,4] Robins and Greenland[5] proved that numbers of premature deaths (so-called aetiological deaths) based on PAF are potentially biased. The attributable fraction has to be replaced by a factor F that is bounded by 1 and $(RR–1)/(RR^{RR/[RR–1]})$, where RR is the mortality rate ratio derived from epidemiological studies. F cannot be identified and the bounds of F cannot be narrowed by epidemiological data alone.[5–7]

For illustration, taking an average PAF of 22% and a corresponding RR of 1·28, the lower bound of deaths would be 4·5 million (0·41 × 11) and the upper bound 49·9 million (4·54 × 11). This example is a crude bias assessment, but it shows that the reported 95% UI limits are unreliable, as is the point estimate. Even if one argues that the lower bound might not hold for 2017 specifically, the upper bound might still be true. Clearly, as suggested by Nita G Forouhi and Nigel Unwin[8] in response to these latest GBD estimates, "While acknowledging the huge achievements and value of GBD risk estimates, it is vital to be critical to further improve credibility of outputs."

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*Peter Morfeld, Thomas C Erren
peter.morfeld@rub.de

Institute and Policlinic for Occupational Medicine, Environmental Medicine and Prevention Research of Cologne University, Cologne 50969, Germany

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Authors' reply

Ty Beal and colleagues noted that evidence from observational studies was used to assess the causal relationship between individual dietary factors and non-communicable diseases (NCDs) in the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD) 2017.[1] We acknowledge the limitations of observational studies in making causal inferences. However, evidence on the causal relationship of most behavioural risks with NCDs primarily comes from observational studies, and establishing causality for these risks without applying evidence from observational studies is nearly impossible. In the GBD analysis,[1] to establish causality for each risk–outcome pair, we systematically evaluated all existing epidemiological evidence and summarised the important characteristics of the relationship, including the magnitude of the effect size, the dose–response relationship, and biological plausibility. Then, using World Cancer Research Fund evidence grading criteria, we only included risk–outcome pairs for which the evidence was graded as convincing or probable.[2] In the case of diet and NCDs, evidence on their causal relationship largely came from studies evaluating the association of individual dietary components with disease endpoints. Additionally, both dietary guidelines and dietary policies focus on individual components of diet to improve health.[3] These factors make individual dietary components the preferred measure to assess health effects of diet across nations. For whole grains, evidence from prospective cohort studies has consistently shown the protective relation of whole grains on cardiovascular disease and diabetes.[4] Evidence from randomised trials has also shown the beneficial effects of