6   Di Dalmazi G, Pasquali R, Beuschlein F, Reincke M. Subclinical hypercortisolism: a state, a syndrome, or a disease?. *Eur J Endocrinol* 2015; **173:** M61–71.

7   Brown JM, Siddiqui M, Calhoun DA, et al. The unrecognized prevalence of primary aldosteronism: a cross-sectional study. *Ann Intern Med* 2020; **173:** 10–20.

8   Chen Y, Scholten A, Chomsky-Higgins K, et al. Risk Factors associated with perioperative complications and prolonged length of stay after laparoscopic adrenalectomy. *JAMA Surg* 2018; **153:** 1036–41.

9   Drake FT, Beninato T, Xiong MX, et al. Laparoscopic adrenalectomy for metastatic disease: retrospective cohort with long-term, comprehensive follow-up. *Surgery* 2019; **165:** 958–64.

Diabetes, like COVID-19, is a wicked problem

Diabetes has long been mistaken as a tame problem. Following a recipe, playing chess, and doing open-heart surgery are tame problems. Tame problems can be solved by having engineers, clinicians, and scientists develop guidelines, algorithms, and systems that achieve easily measured outcomes that matter to these same stakeholders. For example, the longstanding and accepted approach in diabetes has been to empower experts to create algorithms, therapies, technologies, and models to manage glucose within controlled conditions, which are then offered to people with diabetes and their clinicians. Invariably, there is little effort to understand much about the anticipated users beyond their biology. This quantified approach also mistakenly assumes that if a variable cannot be measured, it is probably not important.[1] These attempts to solve the problem of diabetes have, so far, been authoritative (eg, authorising self-proclaimed experts to develop clinical guidelines that are assumed to be adopted widely, or economic rationing of access to new devices and therapies by payers) or on the basis of free-market competition (eg, allowing pharmaceutical and medical device industries to develop independent approaches without collaboration). Needless to say, diabetes has not been solved, and that is because diabetes is not a tame problem.

Diabetes, like COVID-19, is a wicked problem. The concept of a wicked problem arose in the 1960's, based on the realisation that purely scientific solutions to societal problems are doomed to fail.[2] Wicked problems are impossible to solve because of contradictory and changing requirements, the absence of equality, and ever-evolving social complexities. Poverty, crime, and climate change are wicked problems. COVID-19 is also a classic wicked problem, as evidenced by the unanticipated and disproportionate effect of the virus on minority racial and ethnic populations and individuals who have experienced health disparities.[3]

A wicked problem persists in perpetuity because of incomplete information, multiple (often selfish) stakeholder interests, a large economic burden, and a ripple effect whereby every action triggers a reaction with other wicked problems. For example, during the COVID-19 pandemic, the exclusion of undocumented residents from the funding given to US taxpayers by the federal government reduced their purchasing power amid a looming recession, contributing further to both the public health and economic crises in US states such as California.[4] COVID-19 is also a wicked problem for telehealth. COVID-19 has caused us to move away from in-person healthcare toward virtual visits. However, for telehealth to be successful, it is important that people have access to the technology required for virtual visits. In reality, in the USA one in four adults with Medicare do not have digital access (whether via a desktop or laptop computer with a high-speed internet connection, or via a smartphone with a wireless data plan) at home, making it unlikely that these people can participate in telehealth video visits with doctors. The proportion of people without digital access is notably higher among people of colour than among other populations.[5] As the COVID-19 example shows, there is no single, correct, definite answer to a wicked problem. A wicked problem cannot be solved, merely resolved.

When considering diabetes as a wicked problem, the aim should be a resolution with the least bad outcome for the majority. Now there are efforts to personalise diabetes care, allowing for the categorisation of subpopulations on the basis of biological and genetic variables.[6] This approach allows identification of clusters of people with different characteristics and risks that could be responsive to targeted therapeutic interventions. However, beyond using genetic and biological factors to identify these subgroups, it is now recognised that sociocultural influences are also important factors in determining risk of progression
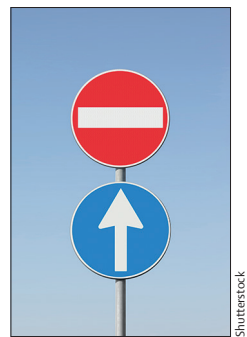
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of diabetes.[7] People with diabetes vary psychosocially, not just biologically, and this should be reflected in the development of new technologies and approaches to the delivery of diabetes care. In other words, to resolve diabetes as a problem, social and biological influences should be integrated within technological developments and regulatory processes to create compassionate technology: technology that benefits the majority by focusing on the uniqueness of individuals.[8]

There is a need to create a digital diabetes ecosystem that is equitable. A digital diabetes ecosystem that can help to resolve diabetes as a wicked problem ideally should connect personal consumer (eg, food choices), physiological (eg, sleep patterns), behavioral (eg, physical activity), psychological (eg, mood), environmental (eg, air quality), and genetic data with an understanding of social preferences (eg, family meals vs eating alone).[9] This ecosystem should both be integrated with clinician workloads and have empathy with the user. Creating an ecosystem will be an obstinate task, given that personal goals vary among individuals, and shift with time owing to the ripple effect of other wicked problems. Finding the problem centre (ie, a modifiable driver of the problem), and choosing the type and timing of an intervention, can be challenging. Technologies should be adaptive, adaptable, and affordable, both in terms of financial cost and personal burden for the user.

Primary care physicians already understand that diabetes is a wicked problem, and that data and algorithms alone are insufficient. For scientists and engineers, illness affects the human condition in ways that can be frustratingly illogical and unpredictable. Machines can be created to provide sincerity, but without compassion and empathy, their value for providing human-like interactions is markedly low. Good clinicians are skilled at locating problems by finding where in a causal network the trouble truly lies and deciding what actions will actually work, thereby narrowing the gap between what is and what ought to be—the essence of addressing a wicked problem. That is also the challenge, and opportunity, for the diabetes community.

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1 Cukier K, and Mayer-Schönberger V. The dictatorship of data. *MIT Technology Review,* May 31, 2013. https://www.technologyreview.com/s/514591/the-dictatorship-of-data/ (accessed Aug 8, 2020).
2 Rittel HWJ, Webber MM. Dilemmas in a general theory of planning. *Policy Sci* 1973; **4:** 155–69.
3 Alcendor DJ. Racial disparities-associated COVID-19 mortality among minority populations in the US. *J Clin Med* 2020; **9:** E2442.
4 Hinojosa-Ojeda R, Robinson S, Zhang J, et al. Essential but disposable: undocumented workers and their mixed-status families. Aug 10, 2020. https://irle.ucla.edu/wp-content/uploads/2020/08/Essential-Undocumented-Workers-Final-w-Cover.pdf (accessed Aug 19, 2020).
5 Roberts ET, Mehrotra A. Assessment of disparities in digital access among Medicare beneficiaries and implications for telemedicine. *JAMA Intern Med.* 2020; published online Aug 3. doi:10.1001/jamainternmed.2020.2666.
6 Ahlqvist E, Storm P, Käräjämäki A, et al. Novel subgroups of adult onset diabetes and their association with outcomes: a data driven cluster analysis of six variables. *Lancet Diabetes Endocrinol* 2018; **6:** 361–69.
7 Morales J, Glantz N, Larez A, et al. Understanding the impact of five major determinants of health (genetics, biology, behavior, psychology, society/environment) on type 2 diabetes in US Hispanic/Latino families: Mil Familias—a cohort study. *BMC Endocr Disord* 2020; **20:** 4.
8 Strudwick G, Zhang T, Inglis F, et al. Delivery of compassionate mental health care in a digital technology-driven age: protocol for a scoping review. *BMJ Open* 2019; **9:** e027989.
9 Kerr D, Axelrod C, Hoppe C, Klonoff DC. Diabetes and technology in 2030: a utopian or dystopian future? *Diabetic Med* 2018; **35:** 498–503.