JACC: ASIA VOL. 4, NO. 6, 2024

EDITORIAL COMMENT

Refining the Cardiovascular Health Score in Patients With Type 2 Diabetes

Challenges and Opportunities*

Steven Ho Man Lam, PhD,[a] Uazman Alam, PhD,[a,b] Gregory Yoke Hong Lip, MD[a,c]

Type 2 diabetes (T2D) remains a global health burden.[1] It affects approximately 537 million people worldwide in 2021 and the number is predicted to increase to around 693 million by 2045.[2] T2D contributed to 6.7 million diabetes-associated deaths in 2021.[3] Notably, the increased mortality in patients with T2D is mainly driven by cardiovascular disease (CVD). Patients with T2D suffer from around 2-4 times increased risk of developing CVD compared with patients without diabetes.[4,5] It is crucial to ascertain effective tools to promote cardiovascular (CV) health, thereby attenuating the onset of CVD.

A CV risk assessment score is an important tool to evaluate the risk at an individual level. Traditionally, the risk is estimated primarily with clinical, demographic, and anthropometric factors. Modern CV risk scores have incorporated health behaviors into the calculation of CV risk. With the move toward more holistic or integrated care management of CVD, comprehensive "cardiovascular health" rehabilitation places much emphasis on lifestyle management.[6]

In 2010, the American Heart Association has designed a CV health assessment score consisting of 7 CV health indicators, Life's Simple 7 (LS7) and, in 2022, the American Heart Association updated the LS7 with an added health indicator (sleep health) to form the new Life's Essential 8 (LE8).[7,8] The design of LS7 and LE8 promotes a paradigm shift from a focus primarily on treating diseases to one inclusive of positive health behaviors.

LE8 comprises 8 metrics of CV heath that can be categorized into 2 domains, health behaviors and health factors.[7] The health behaviors include diet, physical activity, nicotine exposure, and sleep, whereas the health factors consist of body mass index, blood lipid, blood glucose, and blood pressure. Each metric has a score ranging from 0-100 points and is summed up then averaged to form a composite CV score that also ranges from 0-100 points. A lower point corresponds to a worse CV health. The LE8 is constructed positively, which encourages people to adopt and maintain healthy lifestyles that promote positive CV health.

The development and validation of LE8 have originated from the general population, therefore, whether LE8 can be applied effectively to patients who develop specific chronic illnesses such as T2D remains uncertain. To obtain a valid CV health profile for patients with T2D is crucial for both clinicians and researchers.

In this issue of *JACC: Asia*, Li et al[9] examine the associations between LE8 score and future CVD events and mortality among 19,915 patients with T2D in China. Their study demonstrates that increased LE8 score was associated with reduced CVD events and all-cause mortality. The study design also used follow-up data to predict the risks of CVD and mortality compared with previous studies with only baseline predictors; LE8 score was used as a time-varying variable reflecting the impact of the score variation longitudinally on the risks of CVD and mortality.

However, the results may be less generalizable to non-Chinese Asian populations given the diet

*Editorials published in *JACC: Asia* reflect the views of the authors and do not necessarily represent the views of *JACC: Asia* or the American College of Cardiology.

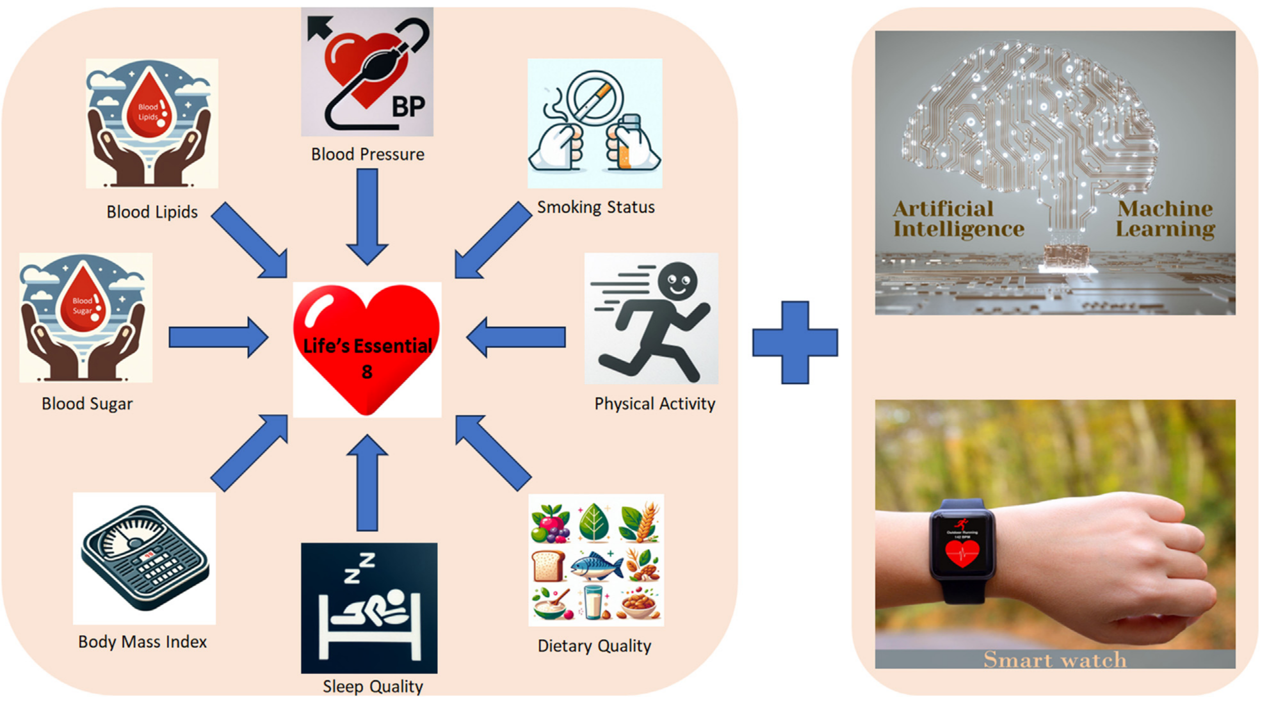
From the [a]Liverpool Centre for Cardiovascular Science at University of Liverpool, Liverpool John Moores University and Liverpool Heart & Chest Hospital, Liverpool, United Kingdom; [b]Department of Medicine, Liverpool University NHS Foundation Trust, Liverpool, United Kingdom; and [c]Danish Center for Health Services Research, Aalborg University, Aalborg, Denmark.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

ISSN 2772-3747 https://doi.org/10.1016/j.jacasi.2024.04.004

JACC: ASIA, VOL. 4, NO. 6, 2024
JUNE 2024:465-467

FIGURE 1 CV Health Model in Patients With T2D



Integration of wearable devices and ML with the LE8 score for predicting CV risk among patients with T2D. CV = cardiovascular; LE8 = Life's Essential 8; ML = machine learning; T2D = type 2 diabetes

component of LE8 is primarily focused on Chinese dietary patterns. In particular, tea consumption is less in other populations and was used as one of the diet quality indicators. Dietary behavior is influenced by cultural and socio-economics factors; the estimation of the dietary quality will likely be ethnic specific. Differences in diet are quite pronounced even within Asian populations (eg, Chinese vs Indian vs Thai).

Although LE8 is a promising adjunct to improve and track CV health among patients with T2D, we propose several future directions for promoting CV health among patients with T2D that are required to refine and fully use LE8.

Patients with T2D are usually treated with either oral hypoglycemic drugs or insulin or the combination of both. However, the influence of these diabetic medications on the score is not fully incorporated into LE8, which is particularly relevant given the availability of new drugs that impact CV outcomes, such as sodium-glucose transport protein 2 inhibitors and glucagon-like peptide 1 agonists. Also, the impact of diabetes complications, such as diabetic retinopathy, diabetic neuropathy, and diabetic foot, are not incorporated and perhaps need to be incorporated in LE8 given their strong associations with future CV events and mortality.

The current LE8 score is usually stratified into 3 risk groups: low-risk group (80-100 points); moderate-risk group (50-79 points); and high-risk group (0-49 points). Whether this recommended stratification is sensitive and specific enough in predicting future CV events among patients with T2D needs investigation. Also, the effectiveness of LE8 for predicting venous thromboembolism (VTE) among the general population has also been questioned in a recent study that found no association between LE8 and VTE events.[10] VTE risk is higher in patients with T2D compared with the general population,[11] and as such these nuances require integration within the scoring paradigm. This is relevant given that an unfavorable lifestyle has been associated with a substantially higher risk of VTE, regardless of underlying genetic risk predisposition.[12]

Future development of LE8 and risk scores could incorporate data from wearable devices, eg, smart watches used to evaluate and monitor CV health in patients with T2D. Wearable devices are able to detect the periodic changes in blood glucose (including measures of variance), blood pressure, and physical activity objectively through detecting walking or running distance and pace.[13] This would help to obtain a more accurate profile of health and behaviors among patients.

Lastly, machine learning (ML) could be used to identify residual risks and health factors that may improve the accuracy of the CV health score. ML is capable of detecting and extracting subtle patterns or clusters and has demonstrated ability to improve CV risk prediction compared with traditional CV risk scores. In a UK Biobank cohort with more than 470,000 participants and 10 years of follow-up, the performance of a ML model was compared against certain traditional CV risk scores.[14] The observed area under the receiver operating characteristic curve of the ML model was 0.762, which was higher than the area under the receiver operating characteristic curves of existing clinical CV risk scores ($P <$ 0.001). In the Silesia Diabetes-Heart Project, we showed used ML algorithms could identify patients with diabetes at a high risk of new CV events based on a small number of interpretable and easy-to-obtain patients' parameters.[15] The integration of additional health factors, including socioeconomic status and health technology data, with the advances in ML could be an emerging field for "real time" CV health and risk profiling among patients with CVD in the future,[16] and certainly applied to those with T2D (**Figure 1**).

FUNDING SUPPORT AND AUTHOR DISCLOSURES

Dr Lip has reported that he has served as a consultant and speaker for BMS/Pfizer, Boehringer Ingelheim, Daiichi-Sankyo, and Anthos. No fees were received personally. He is a National Institute for Health and Care Research Senior Investigator and co-Principal Investigator of the AFFIRMO project on multimorbidity in atrial fibrillation (grant agreement no. 899871), TARGET project on digital twins for personalized management of atrial fibrillation and stroke (grant agreement no. 101136244), and ARISTOTELES project on artificial intelligence for management of chronic long-term conditions (grant agreement no. 101080189), which are all funded by the European Union's Horizon Europe Research & Innovation program. All other authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Prof Gregory Yoke Hong Lip, Liverpool Centre for Cardiovascular Science, William Henry Duncan Building, 6 West Derby Street, Liverpool L7 8TX, United Kingdom. E-mail: gregory.lip@liverpool.ac.uk.

REFERENCES

1. GBD 2021 Diabetes Collaborators. Global, regional, and national burden of diabetes from 1990 to 2021, with projections of prevalence to 2050: a systematic analysis for the Global Burden of Disease Study 2021. *Lancet*. 2023;402:203–234.

2. Sun H, Saeedi P, Karuranga S, et al. IDF diabetes atlas: global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract*. 2022;183:109119.

3. Magliano DJ, Boyko EJ, Committee IDFDAtes. *IDF Diabetes Atlas*. International Diabetes Federation; 2021:2021.

4. Sarwar N, Gao P, Seshasai SR, et al. Diabetes mellitus, fasting blood glucose concentration, and risk of vascular disease: a collaborative meta-analysis of 102 prospective studies. *Lancet*. 2010;375:2215–2222.

5. Shah AD, Langenberg C, Rapsomaniki E, et al. Type 2 diabetes and incidence of cardiovascular diseases: a cohort study in 1·9 million people. *Lancet Diabetes Endocrinol*. 2015;3:105–113.

6. Buckley BJR, Lip GYH. Current concepts: comprehensive "cardiovascular health" rehabilitation-an integrated approach to improve secondary prevention and rehabilitation of cardiovascular diseases. *Thromb Haemost*. 2022;122:1966-1968.

7. Lloyd-Jones DM, Allen NB, Anderson CAM, et al. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health: A Presidential Advisory From the American Heart Association. *Circulation*. 2022;146:e18–e43.

8. Lloyd-Jones DM, Hong Y, Labarthe D, et al. Defining and setting national goals for cardiovascular health promotion and disease reduction. *Circulation*. 2010;121:586–613.

9. Li W, Xing A, Xu W, et al. Life's Essential 8 in relation to cardiovascular disease and mortality in individuals with diabetes. *JACC: Asia*. 2024;4:456–464.

10. Isiozor NM, Laukkanen JA, Voutilainen A, Bensenor IM, Kunutsor SK. Life's Essential 8 is associated with atherosclerotic cardiovascular disease but not venous thromboembolism in men: a prospective cohort study. *Ann Med*. 2023;55:2233894.

11. Bai J, Ding X, Du X, Zhao X, Wang Z, Ma Z. Diabetes is associated with increased risk of venous thromboembolism: a systematic review and meta-analysis. *Thromb Res*. 2015;135:90–95.

12. Zhang YJ, Li ZH, Shen D, et al. Association of combined lifestyle and polygenic risk with incidence of venous thromboembolism: a large population-based cohort study. *Thromb Haemost*. 2022;122:1549–1557.

13. Williams GJ, Al-Baraikan A, Rademakers FE, et al. Wearable technology and the cardiovascular system: the future of patient assessment. *Lancet Digital Health*. 2023;5:e467–e476.

14. You J, Guo Y, Kang J-J, et al. Development of machine learning-based models to predict 10-year risk of cardiovascular disease: a prospective cohort study. *Stroke Vasc Neurol*. 2023;8:475–485.

15. Nabrdalik K, Kwiendacz H, Drożdż K, et al. Machine learning predicts cardiovascular events in patients with diabetes: the Silesia Diabetes-Heart Project. *Curr Probl Cardiol*. 2023;48:101694.

16. Guo Y. A new paradigm of "real-time" stroke risk prediction and integrated care management in the digital health era: innovations using machine learning and artificial intelligence approaches. *Thromb Haemost*. 2022;122:5-7.

KEY WORDS cardiovascular disease, cardiovascular health score, type 2 diabetes