Debate Article

Screening of Cardiovascular Disease Risk in Diabetes: Questions Concerning Prediabetes and Low-Mid Income Countries

Phillip Taderera Bwititi[1], Ezekiel Uba Nwose[2,3]

[1]School of Biomedical Sciences, Charles Sturt University, Wagga Wagga, Australia, [2]School of Community Health, Charles Sturt University, Orange, Australia, [3]College of Health Sciences, Novena University, Ogume, Nigeria

Abstract

Background: The prevalence of prediabetes is increasing world-wide and this condition predisposes to substantially increased risk of cardiovascular disease in addition to developing diabetes mellitus (DM). This article debates screening for early identification and intervention of cardiovascular risk in prediabetes. **Discussion:** Screening methods exist for cardiovascular disease, but the models have diabetes and smoking status as dichotomous variables. A [Yes or No] response in regards to diabetes then ignores dysglycemia in prediabetes individuals who may nevertheless have hyperglycemia-induced oxidative stress. Therefore, the sufferers are treated like healthy persons in such screening models. The problem is worse especially in the low - mid income countries where diagnostic services are either inaccessible or unaffordable for comprehensive testing. **Conclusion:** To improve early intervention of cardiovascular risk in subclinical diabetes, a model that employs a combination of blood glucose level and an index of oxidative damage is imperative to cater for prediabetes.

Keywords: Diabetes prevention, Dysglycaemia, Low-mid income countries, Prediabetes, Primary healthcare

Address for correspondence: Dr. Ezekiel Uba Nwose, School of Community Health, Charles Sturt University, Orange NSW 2800, Australia.
E-mail: nwoseeu@gmail.com

Background and Aims

The prevalence of diabetes may differ between countries or regions, but an estimated 304 million people in the world had prediabetes in 2003 and this is expected to increase to 472 million by 2025.[1] With such figures showing the prevalence of diabetes on the rise there is a call to screen for diabetes and prediabetes with a view to prevent the disease and its complications. In this debate article, prediabetes (whether impaired fasting glucose or impaired glucose tolerance) should be viewed as synonymous to diabetes in terms of dysglycemia, which predisposes to increased risk of developing cardiovascular diseases.[2]

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Imagine a hypothetical situation whereby you are a medical or allied health practitioner and faced with two cases involving yourself and/or members of your family [Table 1]. The debate question is regarding "assessment of the risk of cardiovascular disease (CVD) in first and second person: which of the model formula is useful in assessing the risk of CVD in prediabetes?"

In a previously published scenario, a hypothetical apparently non-diabetic and non-smoking person aged 49-years-old presents with total cholesterol/ high density lipoprotein (HDL) ratio 6.5 mmol/L, fasting blood sugar 5.9 mmol/L and blood pressure 140/90 mmHg[3] Given that fasting blood sugar 5.9 mmol/L is dysglycemia/ hyperglycemia/prediabetes, which is not provided for in the available models of screening CVD in diabetes mellitus (DM); the question is "how would the patient with dysglycemia be classified or accounted for during screening?"

In low-mid income countries, evidence-base pathology practice is limited, especially in the rural communities where diagnostic laboratory services are either

inaccessible or unaffordable. The New Zealand Guidelines group (NZGG) model requires lipid profile,[4] which is unavailable in rural communities and most urban health services. Similarly, British United Provident Association (BUPA) model requires "history of coronary artery disease" [Figure 1],[5] and this can be problematic because such information may be unavailable in rural communities and some urban health services. The same reason applies to Framingham model of "General CVD risk prediction using lipids" [Figure 2].[6] Thus, the third question is "Which of the three models is best applicable to people in the rural communities of low-middle income society?"

The objective of this debate is to propagate the need for a separate model chart for the screening of future CVD in people with prediabetes or undiagnosed diabetes. Another objective is to discuss the necessity for governmental agencies or primary health care departments from rural and low-middle income countries to have a fact sheet regarding cost effectiveness and feasibility to adopt a screening model, based on data generated from comparative study done in their areas.

Discussion

This debate article is mindful of the fact that the prevalence of prediabetes is on the increase and predisposes to substantially increased risk of CVD in addition to developing diabetes.[2] Most of these individuals at risk are unknown and therefore their condition is unmanaged. The risk abounds due to ongoing hyperglycaemic toxicity vis-à-vis oxidative damage. Screening to identify such individuals at risk has the potential to initiate appropriate early interventions as well as improve quality of life and reduce health care costs.

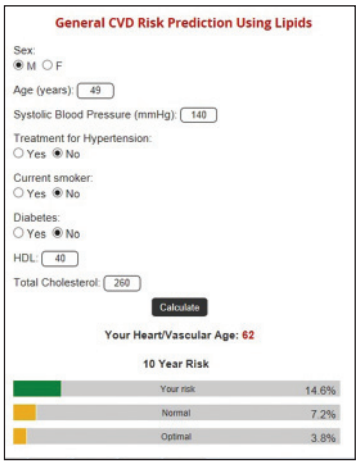

Figure 1: CVD risk assessment of a hypothetical 49-year-old male by Framingham models

Although, screening models for CVD exist, the models have diabetes and smoking status as dichotomous ("Yes" or "No") variables. The high blood glucose level in the prediabetes person is over-looked via a "No" answer. Furthermore, the non-smoking individual who may be suffering other forms of stress-induced CVD risk is also over-looked by a "NO" answer.

People with prediabetes are at increased risk of developing diabetes, CVD and other macrovascular disease. Management includes reducing CVD risk factors, specifically lipid and blood pressure abnormalities, and smoking-cessation as well as provision of counseling. While the prescription of anti-hyperglycaemic agents may still be another topic of debate, the importance of early identification and intervention is important. The preferred treatment is intensive lifestyle management and aggressive pharmacologic therapies directed toward individual coronary heart disease risk factors.[7,8]

It is pertinent to emphasize that considering hyperglycemia in relation to cardiometabolic syndrome (CMS) and the risk of CVD after adjusting for all conventional risk factors; addition of CMS to diabetes does not change the CVD risk, but such addition to prediabetes increases the risk of CVD by 250%.[9] Interestingly, it has been reported from a population study that the prevalence of impaired fasting glucose (IFG) in CMS is about 250% of diabetes in CMS.[10] This means, for example, that categorical "yes or no"

Table 1: Hypothetical two family members having diabetes and prediabetes

Age range	1st person*	2nd person**
≤40yo	Yourself	Your parents ≥ 50yo
41-55yo	Your 20-years-old child	Your parents ≥ 60yo
≥56yo	Yourself	Your 38-years-old child

*prediabetics; **diabetes mellitus

Figure 2: CVD risk assessment of a hypothetical 49-year-old male by BUPA method

diabetes would be unhelpful in assessing the true CVD risk in an obese or overweight individual; whereas CMS plus hyperglycemia equate to higher risk. Thus, there is at least one group of persons, the CMS individuals without diabetes, in whom prediction of incidence of CVD could be helped by considering the prediabetes status.

It is important to acknowledge that there have been great developments, courtesy of D'Agostino *et al*., on the Framingham model,[6] as well as BUPA.[5] This debate article calls for effort to improve, not duplicate, what is already achieved. The prediabetes and/or oxidative damage sufferer is being treated like a healthy person in the current screening models. The problem being emphasized is that the significance of dysglycemia in contributing to, and predicting, future CVD is inadequately assessed. Therefore, the recommended combination of blood glucose level (BGL), blood pressure (BP), erythrocyte glutathione (GSH) and total count (TC) to provide a clinically acceptable standard for identifying CVD risk in individuals with prediabetes,[3] is hereby revisited.

Conclusion

With a view to prevent or slow-down the developments of diabetes and its complications it is important to consider dysglycemia toxicity in the prediabetes. It is also imperative to consider adoptability of any suggested model of risk assessment in rural communities of low-mid income countries, especially considering the need for availability and affordability of composite screening tests.

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