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Review Article

Risk assessment in the prevention of cardiovascular disease in low-resource settings

Sandra N. Ofori *, Osaretin J. Odia

Department of Internal Medicine, University of Port Harcourt Teaching Hospital, Rivers State, Nigeria

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ABSTRACT

Introduction: Cardiovascular disease (CVD) prevalence is increasing in low- and middle-income countries. Total risk assessment is key to prevention.
Methods: Studies and guidelines published between 1990 and 2013 were sought using Medline database, PubMed, and World Health Organization report sheets. Search terms included 'risk assessment' and 'cardiovascular disease prevention'. Observational studies and randomized controlled trials were reviewed.
Results: The ideal risk prediction tool is one that is derived from the population in which it is to be applied. Without national population-based cohort studies in sub-Saharan African countries like Nigeria, there is no tool that is used consistently. Regardless of which one is adopted by national guidelines, routine consistent use is advocated by various CVD prevention guidelines.
Conclusions: In low-resource settings, the consistent use of simple tools like the WHO charts is recommended, as the benefit of a standard approach to screening outweighs the risk of missing an opportunity to prevent CVD.

1. Introduction

Cardiovascular disease (CVD) is a progressive consequence of atherosclerosis that begins early in life with a long latency period before the first manifestation.[1] It is the cause of death in about a third of the world population.[2] This mortality is projected to increase to 24 million deaths by 2030.[3] In Europe, over 4.3 million deaths annually are due to CVD, half of which is from coronary heart disease (CHD) and a third from stroke. It imposes a considerable burden on the economy as it costs the European Union about €192 billion annually.[4] Eighty percent of the CVD burden occurs in low- and middle-income countries (LMIC).[5] In Nigeria, although CVD lags behind infectious disease as the commonest cause of death, it accounts for higher age-specific mortality when compared to developed countries.[2,6] According to the Global Burden of Disease study 2013, in all countries, ischemic heart disease was the greatest contributor to death among middle-aged individuals especially among men.[2] Even in most countries in sub-Saharan Africa, cardiovascular diseases including cardiomyopathy were leading contributors to mortality burden in the region.[2] Apart from being leading causes of death, stroke and ischemic heart disease were the top two causes of years of life lost (an index of morbidity) in many regions of the world including Central and East Asia.[2]

The underlying risk factors for CVD are similar worldwide, as the INTERHEART study showed that nine modifiable risk

* Corresponding author.
E-mail address: sandytom77@yahoo.com (S.N. Ofori).
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factors (smoking, low consumption of fruits and vegetables, lack of regular physical activity, abdominal obesity, hypertension, abnormal lipids, diabetes mellitus, alcohol consumption, and stress) accounted for more than 90% of the risk for incident myocardial infarction.[7] The increasing age of the population in addition to the rising prevalence of obesity and diabetes (especially among ethnic minorities) are important factors that drive up the prevalence of CVD.[8] Although improved treatment modalities reduce mortality from CVD, the index presentation may be with sudden death or for those who survive an event, long-term disability. Furthermore, majority of individuals with CVD are asymptomatic; therefore, preventive measures remain mandatory.

In order to prevent CVD in an appropriate and cost-effective manner, the total-risk approach is recommended.[9,10] This involves the assessment of an individual's risk of developing CVD, taking into account several risk factors that may be present. Treatment to reduce the risk is then instituted above a pre-defined threshold that is considered high-risk. It represents a paradigm shift from the traditional method of screening for and treating single risk factors.[9] This is because moderate levels of several risk factors that interact multiplicatively confer a higher absolute risk of CVD on an individual than a markedly elevated level of one risk factor.[11] Moreover, assessments based on total risk leads to better CVD prevention as was shown in a review of randomized controlled trials (RCT) where treatment benefit in terms of absolute risk reduction was a function of an individual's pre-treatment total CVD risk rather than the specific level of any single risk factor.[12] Several tools for estimating total cardiovascular risk are available and recommended by national and international guidelines.[1,9,13] They are available as paper charts or online calculators with the latter incorporating more variables. Risk assessment is a key component of national policies like Putting Prevention First in the United Kingdom.[13,14] In developing countries in sub-Saharan Africa like Nigeria, the situation is different. There have been no population-based cohort studies done, so whatever information there is about cardiovascular risk factors is obtained mostly from hospital-based and small community cross-sectional studies. The effect of these risk factors on cardiovascular outcomes in this environment remains largely unknown. There are no national guidelines on risk assessment at this time; therefore, in practice, clinicians assess risk mostly from guidelines produced in developed nations. This articles aims to review the various tools available to assess and predict cardiovascular risk and highlight areas that can be applied to low-resource settings.

2. Risk estimation, advantages, and disadvantages of the risk estimation tools

Risk estimation aids a clinician to identify individuals at high multifactorial risk for CVD and tailors the intensity of interventions to baseline total cardiovascular risk. A risk assessment tool that has been validated and evaluates relevant non-modifiable and modifiable risk factors is required to calculate the absolute risk. Absolute risk is determined by the synergistic effect of all the cardiovascular risk factors present and is defined as the probability that an individual will have a cardiovascular event in a defined period, usually 10 years.[9] Individuals at high absolute risk benefit the most from intervention.[1,9,13] Some of the tools are not exactly accurate, as other variables like diet and exercise are not included, so it remains important to individualize any interventions.

Risk assessment of an individual starts with identifying his/her risk factors, some of which may be modifiable. These factors, their implications for health, and the recommended goals should be discussed with them. The risk assessment tools (in Table 1) available to estimate absolute risk vary slightly in the risk factors they incorporate; therefore, the calculated absolute risk will vary.[1,9,13] Jackson et al. pointed out that single risk factors like blood pressure (BP) and cholesterol on their own have a minor effect on a patient's absolute risk but in the presence of others can have a major effect.[12] In the Multiple Risk Factor Intervention Trial, at all levels of BP and cholesterol, an additional risk factor like smoking multiplied the absolute CVD risk even further.[15]

The use of equations to estimate CVD risk has been shown to be better than clinical judgment alone.[16] The tools include:

- Joint British Societies 2 (JBS2) risk calculator (based on the Framingham risk score)
- Pooled Cohort Equations
- World Health Organization (WHO) charts
- The INTERHEART modifiable risk score
- SCORE (Systematic Coronary Risk Evaluation)
- QRISK2 risk calculator
- QRISK Lifetime cardiovascular risk calculator
- ASSIGN score (Scotland only)

2.1. JBS2

The JBS2 guidelines recommend risk assessment with the JBS2 cardiovascular risk prediction chart or calculator modeled on a Framingham function which is based on the data derived from middle class white Americans in the 70–80s.[17] Its advantages include that it is a well-established model, has been validated in different populations, and includes a set of core risk factors, i.e., age, gender, smoking, total cholesterol: high-density lipoprotein cholesterol ratio, and blood pressure while excluding diabetes. Diabetics are considered high-risk and do not require risk assessment. An important weakness of this risk model is that it omits ethnicity.[18] Although the risk can be adjusted by multiplying with a constant, e.g., 1.5 for South-Asian origin, the various South-Asian populations differ in their risk for CVD.[19] The electronic calculator incorporates these variables. In addition, it assesses the risk of CHD alone and does not encompass other CVD such as stroke. Currently in Europe, Framingham-based risk scores overestimate risk, as CVD mortality is declining, especially in people who reside in affluent areas.[20] The National Institute for Health and Clinical Excellence recently withdrew its recommendation to use Framingham equations as the tool of choice for risk assessment.[21]

2.2. Pooled Cohort Equations

These are sex- and race-specific Pooled Cohort Equations developed from multiple, community-based large cohort