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Global risk assessment of cardiovascular disease in resource constrained settings

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BACKGROUND

- Cardiovascular disease (CVD) is an emerging problem in Sub-Saharan Africa.

- Many current guidelines recommend using global risk assessment (GRA) to quantify the risk for developing CVD and to guide treatment and policy.

- Most GRA tools require lipid measures which are not readily available in resource-constrained settings. Of the 3 most published non-laboratory based tools: Gaziano and Framingham substitute BMI for cholesterol; WHO does not include BMI or cholesterol.
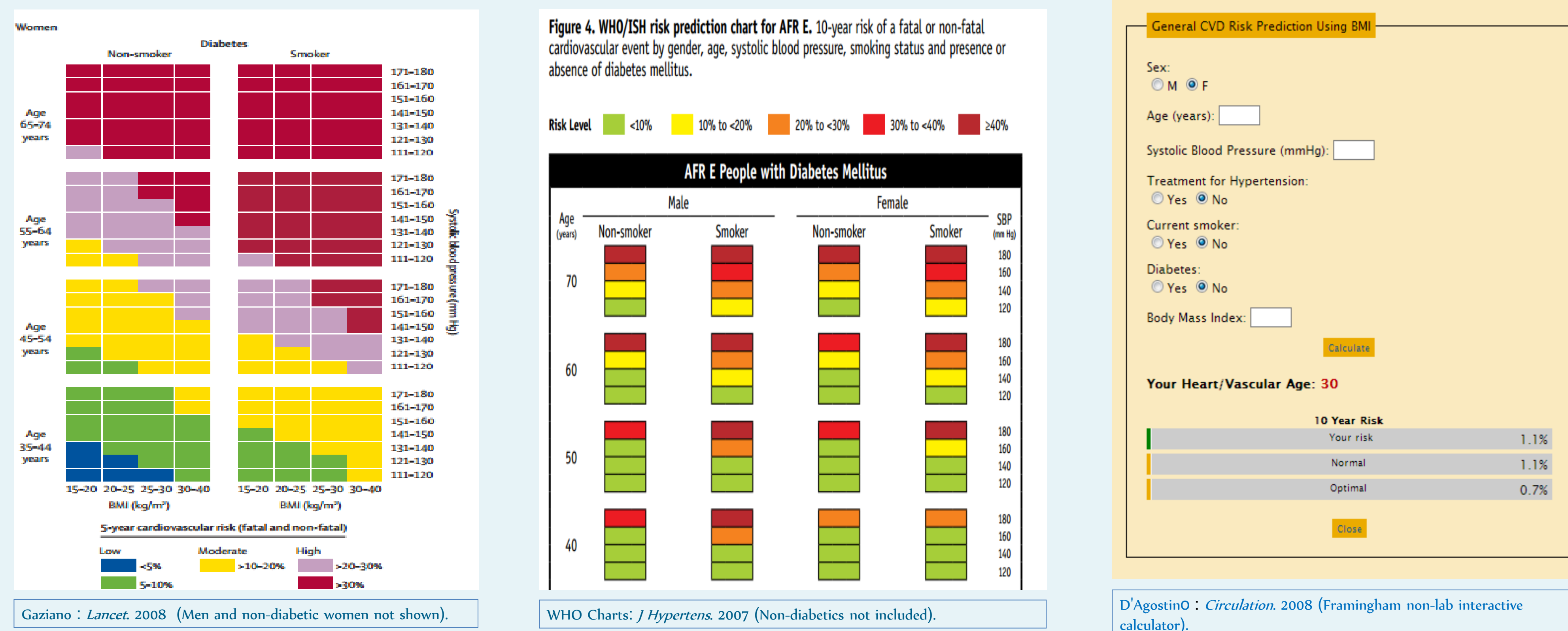
RESEARCH QUESTIONS/HYPOTHESIS

- Is it feasible to implement GRA at the point-of-care in a resource constrained country?
- In this convenience sample, are the Gaziano, Framingham and WHO global risk score (GRS) estimates similar?

METHODS

- A convenience sample of consecutive patients were screened/ treated for CV risk factors had risk factors measured.

- US/Kenyan teams used validated protocols for physiologic/ behavioral measures at 5 Kenyan community health clinics.

- Gaziano and Framingham covariates (age, gender, smoking, diabetes, SBP, BMI, antihypertensive Rx); WHO covariates (age, gender, smoking, diabetes, SBP).

- Gaziano GRS was calculated with paper tool at the point-of-care and recalculated by the researchers; Framingham and WHO GRS was calculated from the dataset by researchers.

- Clinical data was abstracted and analyzed using Stata©.

- US/Kenyan IRB approval was obtained.

Table1. Covariates, end points and risk categories of non-laboratory based CV risk prediction algorithms

Algorithms	Covariates									
	Sex	Age	Smoking	BP	HTN treatment	BMI	Diabetes	History (hx)	Endpoints	Risk Categories
Non-laboratory based-Framingham[12]	M or F	30-74	⟨ Yes, current smoker ⟨ No, never or previous smoker	Systolic 120-160	⟨ Yes based on self-report ⟨ No based on self-report	kg/m²	⟨ Yes, on insulin or oral hypoglycemic medications, or FBS ≥126 mg/dL ⟨ No, none of the above criteria	NA	10-year risk of general and individual CVD events (coronary, cerebro-vascular, and peripheral arterial disease and heart failure)	0-6%, 6-20%, >20%
Non-laboratory based-Gaziano[10]	M or F	35-74	⟨ Yes, past or current smoker ⟨ No, never	Systolic 111- 180	⟨ Yes to current treatment ⟨ No current treatment	kg/m²	⟨ Yes, diabetes reported ⟨ No, diabetes not reported	NA	5-year risk for first-time fatal and non-fatal cardiovascular disease events.	<5% 5-10% 10-20% 20-30% >30%
Non-laboratory based-WHO/ISH[14]	M or F	40-70	⟨ Yes, current or ex smoker <1yr ⟨ No, never or ex-smoker >1yr	Systolic 140-180	NA	NA	⟨ Yes, on insulin or oral hypoglycemic drugs; or FBS ≥126 mg/dl; or postprandial plasma glucose 200 mg/l on two ⟨ Yes, none of the above criteria.	10-year combined risk for acute myocardial infarction and stroke (Fatal and nonfatal).	<10%, 10–20% 20–30% 30–40% ≥40%

NON LABORATORY BASED GRA TOOLS

Gaziano : *Lancet*. 2008 (Men and non-diabetic women not shown).

Figure 4. WHO/ISH risk prediction chart for AFR E. 10-year risk of a fatal or non-fatal cardiovascular event by gender, age, systolic blood pressure, smoking status and presence or absence of diabetes mellitus.

WHO Charts: *J Hypertens*. 2007 (Non-diabetics not included).

D'AgostinO : *Circulation*. 2008 (Framingham non-lab interactive calculator).

RESULTS

Sample Characteristics

	All (N=941)	
	n	%
Age (mean/SD±)	48.6	18.70
Women	734	78.76
Tribe (Kikuyu)	812	87.88
Hx HTN	207	26.30
Anti-HTN Rx	170	18.12
Hx DM	64	6.89
Hx Obesity	94	10.28
Hx High Chol	28	3.03
Hx CVD	58	6.24
Current Smoking	55	6.29

Distribution of Risk Factors by Clinical Cut Points

	All		Stratified by Gender				
			Men		Women		
	n	%	n	%	n	%	p value
Mean Blood Pressure [SBP 137.61, SD 23.61(N=941)]							
SBP ≥ 140 mmHg	383	40.07	88	44.44	290	39.51	0.21
Mean Blood Glucose [97.53, SD 38.7, (n=935)]							
FBS≥126 or Non FBS>200	39	4.82	8	4.76	31	4.87	0.95
BMI [24.89, SD 4.92, (n=893)]							
BMI ≥ 25	398	44.57	44	23.40	353	50.72	0.00
BMI ≥ 30	139	15.57	9	4.79	129	18.53	0.00

SBP = Systolic blood pressure; prehypertension 120-139/90 mmHg; Stage 1= 140-159/90 mmHg; Stage 2 = ≥ 160/90 mmHg

RBS = Random blood sugar; glucose intol ≥ 110 mg/dL; Diabetes ≥ 126 mg/dL fasting; ≥ 140 mg/dL non-fasting

BMI = Body mass index; malnourished <18; normal 18-25; overweight 25-29; obese ≥ 30

Number of Risk Factors

Composite Risk	n	%
0 Risk Factors	123	22.69
1 Risk Factor	146	26.94
2+ Risk Factors	273	50.37

Key: Composite risk includes age, SBP, BMI, smoking, DM, CVD, high chol.

Absolute Risk	Gaziano GRA		Non-lab Framingham		Non-lab WHO	
	n	%	n	%	n	%
Low	486	56.32	556	55.88	815	94.55
Moderate	150	17.38	258	25.90	33	3.83
High	227	26.30	181	18.20	14	1.62

Key: Global Risk Scores for Framingham & WHO Indicates 10 year risk of developing CVD while Gaziano GRA indicates 5 year risk of developing GVD.
Gaziano: Low <10%; Moderate >=10% to <20%; High >=20%
Framingham: Low <6%; Moderate >=6% to <20%; High >=20%
WHO: Low <10%; Moderate >=10% to <30%; High >=30%

RESULTS

Pairwise Correlation of the 3 Global Risk Scores (GRS)

	FRscore	GAZ	WHO
FRscore	1.0000		
GAZ	0.8652	1.0000	
	0.0000		
WHO	0.3606	0.3332	1.0000
	0.0000	0.0000	

FRscore = Non-lab Framingham GRS
GRS = Gaziano non-lab GRS
WHO = WHO non-lab GRS

CONCLUSIONS

- GRA scores can be generated at the point-of-care using simple screening information and paper tools with 79.24% accuracy.

- The population screened had a high clustering of CV risk factors and high risk GRA scores; and that information can be available in real-time to guide clinicians in delivering evidence-based treatment.

- Gaziano GRS was highly correlated with Non-lab Framingham (0.87) but WHO GRS had low correlation with Framingham and Gaziano (0.36; 0.33). [Limitations; the survival data used to calculate Framingham GRS is based on US population; WHO is based on a hypothetical dataset.]

- At the population level GRA might be helpful to assess country-specific CVD risk, to plan risk reduction strategies and to guide health services policy in this resource-constrained country but the best tool is unclear.

- Population based cohort studies are needed to validate these tools in low income countries.