Health Sciences & Disease
The Journal of Medicine and Biomedical Sciences

Original Article

WHO/ISH Cardiovascular Risk Assessment Tools : Concordance Rate in a Hospital Based Malian Population

Outils d'évaluation du risque cardiovasculaire OMS/ISH : taux de concordance dans une population hospitalière malienne

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Key words : risk scores, cardiology, prediction charts, Mali.
Mots clés : scores de risque, cardiologie, outils de prédiction, Mali

ABSTRACT

Objective. To estimate the concordance rate and find the characteristics of discordant patients using the two versions of the WHO/ISH prediction charts in a population of outpatients in the University Hospital Gabriel Touré (UH-GT). **Methodology.** This study involved outpatients for whom cholesterol data was available. We use WHO/ISH Afro-D prediction charts with and without cholesterol to assess the 10-years cardiovascular risk score. IBM SPSS software was used for uni- and bivaluate analyses and Cohen's test for the reliability of both charts. **Results.** The concordance rate for both cholesterol free and available WHO/ISH risk scores was 74.1%. Patients showing discordant risk scores were older (p=0.012) and had higher systolic, diastolic pressures, respectively of 163.26 vs 137.54 mmHg with p<0.0001, 92.50 versus 85.67 mmHg with p=0.001. The agreement between the two WHO/ISH prediction tools was fair with a κ of 0.334 (95% CI, 0.316 to 0.351), p < 0.001.. **Conclusion.** The discordance rate was about one-fourth and only age and pressure values were higher in patients with discordant scores. Further large sample data are needed to confirm these findings, particularly in the setting of low resources. Identifying patients who will benefit from lipid checking is essential and could aid to save resources and their allocation.

RÉSUMÉ

Objectif. Estimer le taux de concordance et retrouver les caractéristiques des patients discordants à l'aide des deux versions des outils de prédiction OMS/ISH du risque cardiovasculaire (RCV) dans une population de patients ambulatoires du CHU Gabriel Touré (UH-GT). **Méthodes.** Cette étude portait sur des patients ambulatoires pour lesquels des données sur le cholestérol étaient disponibles. Nous avons utilisé les tableaux de prédiction OMS/ISH du RCV pour la zone Afro-D avec et sans cholestérol afin d'évaluer le score de risque cardiovasculaire à 10 ans. Le logiciel IBM SPSS a été utilisé pour les analyses uni- et bivariées ainsi qu'un test de Cohen pour l'accord entre les deux outils. **Résultats.** Le taux de concordance entre les scores de risque OMS/ISH avec ou sans cholestérol était de 74,1 %. Les patients présentant des scores de risque discordants étaient plus âgés (p=0,012) et avaient des pressions systolique et diastolique plus élevées, respectivement de 163,26 contre 137,54 mm Hg avec p<0,0001, 92,50 contre 85,67 mm Hg avec p=0,001. L'accord entre les deux outils de prédiction de l'OMS/ISH était passable avec un de 0,334 (IC à 95 %, 0,316 à 0,351), p < 0,001. **Conclusion.** Le taux de discordance était d'environ un quart et seules les valeurs d'âge et de pression étaient plus élevées chez les patients avec des scores discordants. Des données issues d'échantillons plus larges sont nécessaires pour confirmer ces résultats, en particulier dans le contexte de faibles ressources. L'identification des patients qui bénéficieront d'un bilan lipidique est essentielle et pourrait contribuer à économiser les ressources et leur affectation.

INTRODUCTION

Cardiovascular diseases (CVD) are the number one cause of death worldwide with nearly 17.9 million deaths in 2016, representing 31% of all global deaths, mainly in low- and middle-income countries (LMIC) (1). Another consequence of growing CVD is the increase of direct as well as indirect medical costs in developped (2) and in LMIC.

However, most cardiovascular diseases can be prevented by addressing behavioral risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity, and harmful use of alcohol using population-wide strategies (3,4).

Cardiovascular risk (CVR) reduction can be achieved using various strategies at population-, individual-level and through secondary prevention for patients with established cardiovascular diseases (3,5,6). As part of CVR reduction strategies, risk assessment is essential and several prediction tools have been developed to assess patients total cardiovascular risk and so guide prevention, treatment, and follow-up. Most of them have been developed for the population in high-income countries (HIC) (7–9). Moreover the World Health Organization and the International Society of Hypertension (WHO/ISH) have provided a tool which exists in two versions (with and without using cholesterol) for the different 14 regions (10). Even when each score system has its strengths and weakness (8,11–13), the scoring approach provides a rational mean of making decisions about intervening in a targeted way, thereby making the best use of the resources available to reduce cardiovascular risk (3). Several studies have tested these tools with contrasting results.

Mali as LIC faces the problem of growing burden of cardiovascular diseases coupled with growing costs and shortage of health care resources. We already assessed the cardiovascular risk using the WHO-cholesterol free chart (14). Lipids are highly involved in the development of CVD and need therefore to be checked and appropriately addressed. However lipid checking in still costly and can not be done by each patient in our environment. In the situation of low-income, it is important to know for which patients both versions of the WHO_IHS prediction tool give the same or different results. To the best of our knowledge, concordance studies on Malian patients have not been performed using this tool, our study aims to fill this gap and determine the characteristics of patients with discordant risk scores of the WHO/ISH prediction charts in a population of outpatients in the University Hospital Gabriel Touré (UH-GT).

MATERIALS AND METHODS:

We assessed retrospectively CVR for patients consecutively seen in the outpatient unit of the cardiology department of the UH-GT.

Sample size and inclusion criteria

The study population of 228 patients stemmed from a previous study (14), involving patients with cholesterol available.

Inclusion was based on the availability of cholesterol data.

Data collection

Data were available on sociodemographic characteristics, anthropometric, and blood pressure besides laboratory tests including blood glucose, and cholesterol level.

Definition of terms

Education level was graded as followed:

- None: no school attending
- Primary : school attended for 1-9
- Secundary : school attended for 10-12
- University: school attended for 12 and more years

Income level was assessed as a multiple of the legal minimum salary for patients who respond to that question.

Work status was defined as no activity, in activity or retired based on patient response

Hypertension was defined as systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg or self-reported use of drug treatment for hypertension irrespective of measured blood pressure.

Mean arterial blood pressure (MBP) was calculated using the formula DBP+((SBP-DBP)/3) and pulsed pressure (PP) as the difference between systolic and diastolic blood pressure.

Weight in kilograms (Kg) and height *in* centimeters (cm) were used to calculate body mass index (BMI) in Kg/m^2 as Weight (Kg) / $Height(cm)^2$.

Waist circumference (WC) was assessed in cm at the narrowest point between the lowest rib and the iliac crest and hip circumference (HC) in cm at the widest point over the buttocks

Waist to Hip ratio (WHR) was calculated as WC in cm divided by HC in cm.

The cholesterol free version has been termed Chol(-) and that with cholesterol Chol(+)

Risk assessment

We used the WHO/ISH risk assessment charts for Afr-D subregion.

Required data were sex (male/female), age in full years, systolic blood pressure in mmHg, total cholesterol (in mmol/l), current smoking status (yes/no) and diabetes (yes/no). Details for using this chart have been described in a WHO-publication [10]. The 10-year risk of a fatal or nonfatal cardiovascular event was assessed with increasing risks ranging from < 10 to > 40% and < 10% classified as low risk and ≥ 20% as high risk (10).

Data processing and analyzing

Data were collected in a Microsoft Access database and then exported to Microsoft Excel for checking and statistical analyze was conducted using IBM SPSS version 20.

Data are presented as means for continuous variables and proportions for categorical variables.

Significance level was set at 0.05.

Data analysis began with the presentation of patient characteristics followed by concordance status estimation. A reliability analysis using the Kappa

statistic was performed to determine consistency between both prediction tools.
Finally, a cross-tabulation of concordance status with various socio-demographic and hemodynamic parameters was performed.

Ethical considerations

All patients gave their consent to participate in the initial study and there was no other intervention than needed for the usual patient management. Collected data has been treated with usual confidentiality rules.
The study has been approved by the institutional review board of the hospital.

RESULTS

In this population of 228 patients, female made 68%, the age group 60-69 years represented 36.4%. Patients with no formal education and whose in activity represented, respectively 53.9 and 86.0% (Table I).

Table I: sociodemographic characteristics of 228 patients by whom risk score has been estimated using both WHO/ISH prediction charts in the cardiology outpatients unit in the UH-GT

Socio-demographics (N=228)		Sexe (%)		Total (%)	p
		F	M		
Age group (in years)	40-49	13.6	01.3	12.7	0.004
	50-59	21.5	06.6	28.1	
	60-69	21.5	14.9	36.4	
	>= 70	13.6	09.2	22.8	
Education level	None	39.9	14.0	53.9	0.018
	Primary school	12.7	04.8	17.5	
	Secundary school	11.8	08.3	20.2	
	University	03.5	04.8	08.3	
Income level	NA*	33.3	11.4	44.7	0.266
	≤ 1 x smig**	07.9	03.5	11.4	
	2x smig	04.8	02.6	07.5	
	3x smig	10.1	05.3	15.4	
	≥ 4x smig	11.8	09.2	21.1	
Work status	In activity	61.4	24.6	86.0	0.011
	Retired	06.1	07.5	13.6	
	No activity	00.4	0	00.4	
Number of risk factors	0	02.6	02.2	04.8	0.002
	1	17.5	12.3	29.8	
	2	28.5	15.8	44.3	
	3	18.9	01.8	20.6	
	4	00.4	0	00.4	

**** smig: salaire minimum interprofessionnel garanti (minimal legal guaranteed salary)**

Male patients were older (64.77 versus 59.82), taller (169.75 versus 160.79 cm), heavier (74.97 versus 70.28), and had a higher WHR (0.94 versus 0.90) whereas female patients had higher BMI (28.98 versus 24.31), WC (95.6 versus 89.5), HC (104.43 versus 93.11), HR (82.31 versus 78.93) and higher systolic (144.98 versus 142.24) and diastolic blood pressure (87.39 versus 86.39) (Table II).

Table II: means of anthropometric data of 228 patients by who risk score has been estimated using both WHO/ISH prediction charts in the cardiology outpatients unit in the UH-GT

		Mean	SD^x	CI^{xx} 95%	
Age (years)	Female	59.82	9.942	58.24	61.40
	Male	64.77	9.396	62.57	66.96
Weight (Kg)	Female	74.97	18.405	72.04	77.90
	Male	70.28	17.069	66.24	74.32
Height (cm)	Female	160.79	6.591	159.74	161.84
	Male	169.75	7.843	167.89	171.60
BMI^+ (Kg/m2)	Female	28.98	6.895	27.88	30.08
	Male	24.31	5.408	23.03	25.59
Waist circumference	Female	95.63	14.784	93.27	97.99
	Male	89.50	15.021	85.92	93.08
Hip circumference	Female	104.43	16.242	101.62	107.62
	Male	93.11	11.154	90.26	95.97
WHr*	Female	0.92	0.078	0.90	0.93
	Male	0.96	0.070	0.94	0.98
Heart rate	Female	82.31	15.756	79.61	85.00
	Male	78.93	14.932	75.31	82.54
SBP (mmHg)**	Female	144.98	26.076	140.84	149.12
	Male	142.24	26.650	135.97	148.50
DBP* (mmHg)**	Female	87.89	12.782	85.86	89.92
	Male	86.39	15.206	82.82	89.96

^{x} Standard deviation ^{xx} confidence intervall $^+$ Body mass index
*** Waist-to-hip ratio ** systolic blood pressure**
****** diastolic blood pressure**

The risk scores of Chol(-) chart were 78.9, 10.5, 5.3, 3.5, and 1.8%, respectively, for < 10, 10 - < 20, 20 - < 30, 30 - < 40 and > 40. Using the Chol(+) chart has given 72.4, 16.7, 4.4, 3.9, and 2.6% as risk scores, respectively, for < 10, 10 - < 20, 20 - < 30, 30 - < 40 and > 40% (Diagram 1).

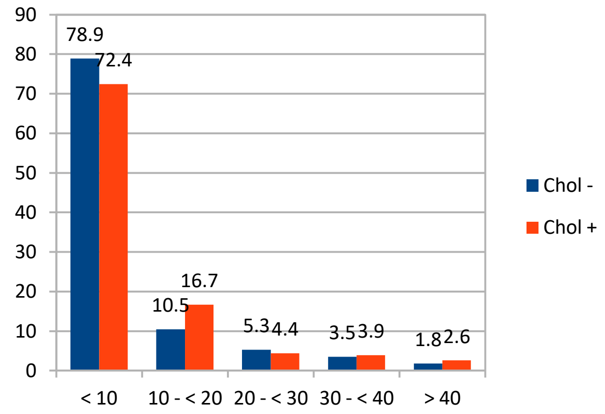

Diagram 1: risk distribution using both cholesterol free and with cholesterol WHO/ISH charts

The concordance rate for both Chol(-) and Chol(+) risk scores was 74% (meaning 26% discordance) (Diagram 2).

The highest concordance rates were 66.7, 3.5, 1.8, 1.3 and 0.9% respectively in the risk groups < 10, 10-<20, 20-<30, 30-<40 and > 40 with 0.9% (Diagram 3).

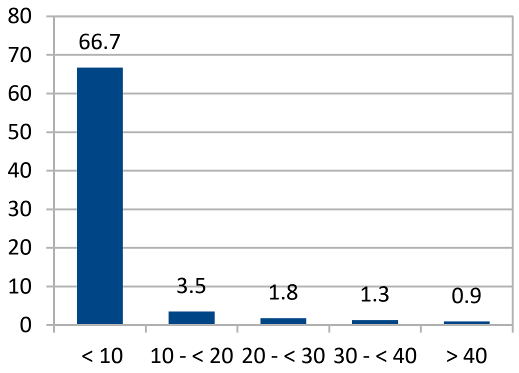

Diagram 3: global concordance rate for 228 outpatients in WHO/ISH risk score levels

Medical insurance status, sex, education level as well as income level were not statistically different by concordance status. Age group reached statistically significance, but no linear relationship was clear. Highest discordance rate was found among patients in the age group 60-69 years with 37.3% and the highest concordance rate for patients between 50 and 59 years with 90.6% (Table III).

Table III: sociodemographic characteristics related to Concordance status for 228 patients by whom risk score has been estimated using both WHO/ISH prediction charts

		Concordance		Total	p
Variables		**Yes**	**No**		
Medical insurance	No	73.9	26.1	111	0.933
	Yes	74.4	25.6	117	
Age group (years)	40-49	79.3	20.7	29	0.001
	50-59	90.6	09.4	64	
	60-69	62.7	37.3	83	
	>= 70	69.2	30.8	52	
Sex	Male	74.2	25.8	073	0.972
	Female	74.0	26.0	155	
Education level	None	70.7	29.3	123	0.481
	Primary	80.0	20.0	40	
	Secondary	73.9	26.1	46	
	University	84.2	15.8	19	
Income level	NA*	76.5	23.5	102	0.573
	1	76.9	23.1	26	
	2	58.8	41.2	17	
	3	77.1	22.9	35	
	4	70.8	29.2	48	

* Not available

Means according to risk level discordance were significantly different for age and pressure parameters. Patients showing discordant risk scores were older (64.20 vs. 60.43, p=0.012) and had higher systolic, diastolic, mean and pulsed pressures respectively of 163.26 vs. 137.54 mmHg with p<0.0001, 92.50 versus 85.67mmHg with p=0.001, 116.09 versus 102.75 mmHg with p<0.0001 and 70.76 versus 51.87 mmHg with p<0.0001 (Table IV).

Table IV: Means for continuous variables related to discordance status for 228 patients by whom risk score has been estimated using both WHO/ISH prediction charts

	Concordance		p
	Yes Mean (N)	**No Mean (N)**	
Age (years)	60.43 (169)	64.20 (59)	0.012
Weight (Kg)	73.80 (166)	72.63 (59)	0.669
Height (cm)	164.14 (166)	162.14 (59)	0.104
BMI* (Kg/m^2)	27.48 (166)	27.58 (59)	0.926
WC** (cm)	93.68 (164)	93.76 (59)	0.972
HC+ (cm)	100.87 (144)	100.73 (48)	0.958
WHR++	0.92 (144)	0.94 (48)	0.266
Heart Rate	80.14 (146)	83.86 (56)	0.128
Systolic BP	137.54 (169)	163.26 (58)	<0.0001
Diastolic BP	85.67 (169)	92.50 (58)	0.001
Mean BP	102.75 (169)	116.09 (58)	<0.0001
Pulsed Pressure	51.87 (169)	70.76 (58)	<0.0001

* Body mass index ** Waist circonference + Hip circonference ++ Waist-to-hip ratio BP : blood pressure

Among the traditional cardiovascular risk factors, diabetes and hypertension reached statistically significance with 35.9 and 29.2% discordance compared to 22 and 08.3 % for patients without diabetes and hypertension. Moreover the number of risk factors showed less strong difference with an increasing discordance rate from 0 for patients without known risk factor to 100 for patients with 4 risk factors (p=0.044) (Table V).

Table V: traditional cardiovascular risk factors related to discordance status for 228 outpatients

Variables		Concordance (%)		p
		Yes	**No**	
Tobacco smoking	No (206)	75.2	24.8	0.237
	Yes (22)	63.6	36.4	
Diabetes	No (164)	78.0	22.0	0.030
	Yes (64)	64.1	35.9	
Hypertension	No (36)	91.7	08.3	0.009
	Yes (192)	70.8	29.2	
Alcohol consumption	No (226)	73.9	26.1	0.401
	Yes (002)	100	0	
Sedentary behavior	No (143)	75.5	24.5	0.531
	Yes (85)	71.8	28.2	
Obesity	No (195)	73.8	26.2	0.817
	Yes (33)	75.8	24.2	
HIV infection	No (225)	73.8	26.2	0.303
	Yes (003)	100	0	
Number of risk factors	0 (011)	100	0	0.044
	1 (068)	77.9	22.1	
	2 (101)	74.3	25.7	
	3 (047)	63.8	36.2	
	4 (001)	0	100	

Running Cohen's κ to determine the degree of agreement between the two WHO/ISH prediction tools, we found a κ of 0.334 (95% CI, 0.316 to 0.351), p < 0.001 (Table VI).

Table VI : Cross tabulation with symetric measures for interreliability of cholesterol free and cholesterol available WHO/ISH prediction charts.

Risk level		Cholesterol available					
		< 10	10 - < 20	20 - < 30	30 - < 40	≥ 40	Total
Cholesterol free	< 10	152	27	1	0	0	180
	10 - < 20	12	8	2	1	1	24
	20 - < 30	0	2	4	4	2	12
	30 - < 40	1	1	2	3	1	8
	≥ 40	0	0	1	1	2	4
	Total	165	38	10	9	6	228

DISCUSSION

Our study is the first to assess cardiovascular risk using WHO/ISH prediction charts both without and with cholesterol in a population of 228 patients.

As can be read from tables I and II, the sample reflects the population structure in most West African countries with a majority of subjects with no formal education, women with higher BMI, WC, and HC. It has been reported that male subjects have a higher blood pressure and heart rate (HR) (15, 16) and in rural areas as reported by Raghu et al (17). However in our study these hemodynamical parameters showed higher values for women. We found no satisfactory explanation for this situation.

Risk prediction using WHO/ISH prediction charts

As can be read from Diagram 1, most patients in our study (78.9 and 72.4%, respectively, using Chol(-) and Chol(+) prediction charts) had less than 10% risk score, similar to reports by Norhayati (18) and Premanandh (19). Higher low risk scores have been reported by Mendis et al. in Nigeria, Cuba, China, Iran, or Sri Lanka with more than 90% (20). More recently Pedro et al (21) published data from Angola with 87.6% of patients having a risk under 10%. A study of Porfirio et al. found a similar proportion of low-risk patients with 82.7% but a great difference between male (65.7%) and female (91.9%) subjects (22). Data among risk estimations are contrasting even in the same country with 54% of low risk for Kadiyala (23) and only 1.7% of participants among supporting staff with a risk >10% (24).

Concordance

We found a concordance in a proportion of 74% which is low compared to data reported by Fatema with a concordance of 89.5% in a study in Bangladesh (25) or by Raghu et al. in India with only 14.5% discordance (17), both studies at population level. The fact that our study was conducted in a hospital with high prevalence of cardiovascular risk factors such diabetes and hypertension in our sample could be responsible for the 26% discordance rate. This discordance was significantly associated only with age, pressure values, diabetes, hypertension, and the number of risk factors. Discordant patients were older and with higher pressure values (p=0.001), probably related to modification of the vessel structure with aging. Among the traditional risk factors, diabetes, hypertension, and the increasing number of risk factors were associated with discordance. Raghu et al. (17) found a higher discordance rate with 31% and presented a point-of-care algorithm to identify patients who are likely to benefit from cholesterol testing using the WHO/ISH prediction charts.

In our study, the reliability for the 2 prediction tools was found to be fair with kappa = 0.334 (p <.0.001), 95% CI (0.316, 0.351). Most studies have compared WHO/ISH prediction charts to others risk scores (26).

These findings lead to the think that older patients and patients with higher blood pressure will benefit from lipid checking as well as those with diabetes, hypertension.

Limits

Performing a lipid test is costly in our setting, leading to perform the study with a relative small sample size and that situation could probably favor patients with medical insurance or with higher income. These findings have to be confirmed in a larger sample.

CONCLUSION

Most patients in this study had low risk with a fair reliability between Chol(-) and Chol(+) prediction charts. The discordance rate was about one-fourth and only age and pressure values were higher in patients with discordant scores. Further large sample data are needed to confirm these findings, particularly in the setting of low resources. Identifying patients who will benefit from lipid checking is essential because it can save resources and aid to plan their allocation.

Conflicts of Interest

Authors declare any conflict of interest related to this manuscript

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