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Original Research Article

Prevalence and professional implication of updated versus previous hypertension classification

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ABSTRACT

Background: Hypertension remains the global challenge and the leading causes of worse cardiovascular event with 7.5 million toll deaths. The 2010 WHO estimate was 1.3 billion representing 31.1% of all adults with an astounding increase in low and middle-income countries including Sab-Saharan Africa.
Methods: This cross-sectional study was undertaken in two beverage industrial workplaces with a sample of 440 employees and their spouses during the period of 2016 to 2018. WHO stepwise questionnaire was used to collect data and biomedical samples were taken for predicting the 10-year cardiovascular risk by Cox regression model and multivariate logistic regression was run to determine the key factors associated with both Hypertension (HTN) classifiers. The data were coded and analyzed by SPSS 16.0 version.
Results: Overall HTN prevalence was 32.27%, male with 37.8% and female with 25.2% by previous HTN classifier. Whereas the updated classifier showed an overall prevalence of 61.81%, male with 67.1% and female with 55%. The findings showed a huge difference of 29.54% with $p<0.001$ between the two prevalence of previous and updated blood pressure classification. Employees had a relatively high HTN prevalence of 35.92% to 65.18%, compared to the spouses with 26.47% to 56.47%, $p<0.001$ by previous and updated classification, respectively.
Conclusions: The relatively rise prevalence of the HTN revealed by this study suggests new and combining health promotion tactics, cultural theories to fight this rampant silent killer.

Keywords: Hypertension, Previous and updated classification of blood pressure, Cardiovascular diseases risk, Health promotion

INTRODUCTION

Hypertension is a prominent risk factor which is highly associated with cardiovascular diseases occurrence due to its worldwide prevalence of 31.1% in 2010 premature death toll make it one of the three leading risk factors for global disease burden.[1,2] Almost 9.5 million deaths each year, or 16.5% of all deaths worldwide can be attributed to high blood pressure.[3]

The World Health Organization (WHO) estimated that, in 2008, 30% of the adults in the WHO European region and 23% in the WHO region of the Americas had high blood pressure. Hypertension always presents itself as a major risk factor, where its control provides a reduction of about 40% in mortality from cerebrovascular disease and a more modest 20% reduction in mortality from coronary heart disease.[4] Hypertension prevalence in three rural villages in Rwanda, Malawi and Tanzania, was found to affect 22.8%, 15.9% and 26.8% respectively, rates that are far from being

negligible.[5] The first measurement of hypertension was performed by Reverend Hales Stephen in 1733 and from that time many researchers intervened until Korotkoff revolutionized the practical sound use device and clinical auscultatory method in 1905.[6] Hypertension management was early surgically approached (sympathectomy and total adrenalectomy on essential hypertension) with major complications, more than 14 anti-hypertensive was discovered from 1900 to 2000. Although the development and discovery of anti-hypertensive drugs was found to be more successful, hypertension burden was continuously increasing until high morbidity and mortality currently nock to the door of many people.[1,8] Hypertension increased to 1.4 billion in 2010 and contributed to 18 million cardiovascular deaths annually with a projection that will exceed 1.6 billion in 2025.[9] That projection was processed based on previous hypertension definition and classification that set threshold on 140/90 mmHg.[2,8] This shows that the forgotten compartment between 130-140/80-90 mmHg between previous and updated hypertension classification guideline as created and published in 2017 by American College of Cardiology/American Heart Association, will rise hypertension prevalence far beyond 1.6 billion by 2025.[8,10]

Although updated guideline seems to increase more hypertension patients and apparently raise the follow up budget and disease rate. It will however impose health promotion plans and enabling population on the awareness responsibility and control over hypertension risk, cardiovascular event development risk by early lifestyle change alone, to fight hypertension and provide anti-hypertensive medication association maneuvers based on cardiovascular disease risk prediction and current Blood pressure measurement and comorbidities, to reduce blood pressure under the targeted low threshold: 130/80 mmHg in different vulnerable population. The definition of blood pressure levels of previous and updated classification in this study was based on the 2017 review of blood pressure threshold by ACC/AHA.[10]

This study aims to determine hypertension prevalence and compare previous and update hypertension classification in Sub-Saharan region in employees and their spouses of industrial workplace.

METHODS

This study was undertaken in Kigali city Kicukiro district and a rural city Rubavu district in North West of Rwanda in two beverage processing industries during period of 2016 to 2018.

Inclusion criteria

Study participants was to be a worker or a spouse of the worker in Kicukiro soft drink plant or in Rubavu brewery plant, participant ≥30 years to 75 years.

Exclusion criteria

Those who did not consent to participate in the study, visitors, and casual workers were not included in the study.

Study design

A cross-section study design was adopted with utilization of quantitative data approach.

The sample size was calculated using Cochran sample for large population.

i.e., $n = \frac{z^2 p\, q}{e^2}$

Where p, 50%= 0.5; q, 1-0.5=0.5 and n, 1.962×0.5×0.5 0.052=0.96040.0025=385.

The total sample size was 440 participants at the end of the study, where 10% was added to cover incompleteness or missing questionnaire and 4.2% added during data collection. Proportionate stratified random sampling was mixed with simple random sampling to select participants to ensure the representativity of all employees and their spouses.

Instruments

WHO stepwise standardized questionnaire with clinical and anthropometric measures forms, medical laboratory materials and cardiovascular risk prediction based on Framingham General Risk Score and formula was used.

Data collected and analysed using SPSS 16.0 version.

RESULTS

In the total of 440 participants among others 270 (61.8%) were employees and 170 (38.6) were their spouses, 58.9% and 41.1% were respectively located in Kicukiro and Rubavu plant. The median age was 45 years with IQR of 14. The age group was dominated by group of age <40 years with 35.7%. Males and females were 249 (56.6%) and 191 (43.4) respectively. Married, single and widow population were 401 (91.1%), 36 (8.2%) and 3 (0.7%) respectively. The education was dominated by secondary with 155 (35.2%) then bachelor's degree with 145 (33%), primary 70 (15.9%), diploma 36 (8.2%), A3 (3 years post primary certificate) 21 (4.8%), master's degree 11 (2.5%), uneducated 2(0.5%). The mean experience time was 14 years (SD±8.203) and the experience time was dominated by the group of experience <14 years with 35.4 (Table 1).

The overall mean systolic and diastolic value of all study participants were successively 133.2±13.77 mmHg and 79.5±12.22 mmHg. There is a significant difference of all age groups by gender in blood pressure (BP) mean values (systolic BP (SBP) male p=0.002, female p<0.001, the total mean SBP p<0.001, DBP male 80.22±12.78 mm Hg,

p<0.001, female 78.47±11.91 mm Hg, p<0.001. The highest SBP mean value of 144.82±11.65 mm Hg were among men and in (>60 years) age group comparatively to female with 141.00±1.41 mmHg in the same age group. The highest total mean value of SBP and DBP was in men than in female and respectively (Table 2).

Table 1: Distribution of background characteristic of the study participants (n=440).

Variables	N	%
Location		
Kicukiro	259	58.9
Rubavu	181	41.1
Age group (years)		
<40	157	35.7
40-50	151	34.3
>50	132	30
Gender		
Males	249	56.6
Females	191	43.4
Marital status		
Single	36	8.2
Married	401	91.1
Living together	0	0
Divorced	0	0
Widow	3	0.7
Participant status		
Employees	270	61.4
Spouses	170	38.6
Education		
None	2	0.5
Primary	70	15.9
A3 post primary certificate	21	4.8
Secondary	155	35.2
Diploma	36	8.2
Bachelor's degree	145	33
Master's degree	11	2.5
Experience years for employees		
<14	156	35.4
15-29	106	24
≥30	8	1.8

Table 2: Distribution of mean systolic and diastolic blood pressure (mmHg) by age and gender (n=440).

Age group (yrs)	N	Systolic BP (mean±SD)			Diastolic BP (mean±SD)		
		Male	**Female**	**Total**	**Male**	**Female**	**Total**
<35	84	130.32±11.27	122.25±9.89	127.63±11.43	74.39±9.97	70.57±8.94	73.12±9.75
35-40	73	132.19±12.97	126.78±11.61	129.45±12.51	75.33±13.71	74.70±11.42	75.01±12.52
40-45	65	132.55±16.20	130.03±12.32	131.23±14.25	79.16±12.85	78.82±11.90	78.98±12.27
45-50	86	137.33±16.16	133.23±14.77	135.23±15.51	84.10±13.92	83.25±10.95	83.66±12.42
50-55	89	137.24±13.58	136.71±11.75	137.01±12.77	82.84±12.76	79.11±11.87	81.25±12.46
55-60	30	141.14±11.36	139.25±8.65	140.63±10.60	86.27±8.40	89.62±8.12	87.17±8.32
>60	13	144.82±11.65	141.00±1.41	144.23±10.74	89.91±5.68	91.00±0.00	90.08±5.20
Total	440	135.06±14.03	130.83±13.09	133.22±13.78	80.22±12.78	78.47±11.91	79.46±12.43
Test of significance		F=3.663	F=5.604	F=8.488	F=6.496	F=6.321	F=12.324
		df=6	df=6	df=6	df=6	df=6	df=6
		p=0.002	p<0.001	p<0.001	p<0.001	p<0.001	p<0.001

The study findings showed a significant difference of prevalence within blood pressure classifiers by gender and age group. The updated classifier shifts a number of patients from normal and pre-hypertension of previous classifier into stage 1 and 2 of updated classifier more in SBP than in DBP where their p values was <0.001 (Table 3). We observed a decrease of normal SBP participants from 238 (54.1%) to 58 (13.2%) and an increase of BP from pre-hypertension of 58 (13.2%) to elevated BP of 145 (33.0), a reduction of stage 1 and an increase of stage 2 from 12 (2.7%) to 144 (32.7) by the systolic updated classifier while the diastolic classifier increased the 39 (8.6%) to stage 1 and 67 (15%) to stage 2 of diastolic hypertension. The high proportion of SBP and DBP were found in Kicukiro plant where previous systolic classifier (PSC) 91 (20.7%), previous diastolic classifier (PDC) 63 (14.3%) and updated systolic classifier (USC) 147 (33.4%), updated diastolic classifier (UDC) 130 (29.5%) were employees and spouses while PSC 53 (12%), PDC 30 (6.8%) and USC 90 (20.4%), UDC 69 (15.6%) were Rubavu plant employees and spouses, respectively (Table 4).

Table 3: Hypertension prevalence of previous and update classification of blood pressure by gender and age group among study participants.

Variable age group (years) of the study participants test of significance									
	N	**<35**	**35-40**	**40-45**	**45-50**	**50-55**	**55-60**	**>60**	
Previous systolic classifier									
Men									
Normal	29	6 (20.6)	5 (17.2)	7 (24.1)	4 (13.7)	5 (17.2)	2 (6.8)	0 (0.0)	χ^2=34.21 df=18 P=0.001
Pre-HTN	129	42 (32.5)	22 (17.0)	13 (10.0)	18 (13.9)	22 (17.0)	7 (5.4)	5 (3.8)	
HTN-1	82	7 (8.5)	8 (9.7)	10 (12.1)	18 (21.9)	21 (25.6)	13 (15.8)	5 (6.0)	
HTN-2	9	1 (11.1)	1 (11.1)	1 (11.1)	2 (22.2)	3 (33.3)	0 (0.0)	1 (11.1)	
Women									
Normal	29	8 (27.5)	7 (24.1)	4 (13.7)	7 (24.1)	3 (10.3)	0 (0.0)	0 (0.0)	χ^2=41.49 df=18 P=0.001
Pre-HTN	109	20 (18.3)	24 (22.0)	25 (22.9)	19 (17.4)	18 (16.5)	3 (2.7)	0 (0.0)	
HTN-1	50	0 (0.0)	6 (12.0)	4 (8.0)	17 (34.0)	16 (32.0)	5 (10.0)	2 (4.0)	
HTN-2	3	0 (0.0)	0 (0.0)	1 (33.3)	1 (33.3)	1 (33.3)	0 (0.0)	0 (0.0)	
Previous diastolic classifier									
Men									
Normal	139	41 (29.4)	23 (16.5)	20 (14.3)	19 (13.6)	28 (20.1)	7 (5.0)	1 (0.7)	χ^2=41.34 df=18 P=0.001
Pre-HTN	52	10 (19.2)	7 (13.4)	7 (13.4)	10 (19.2)	7 (13.4)	8 (15.3)	3 (5.7)	
HTN-1	40	3 (7.5)	5 (12.5)	3 (7.5)	6 (15.0)	12 (30.0)	5 (12.5)	6 (15.0)	
HTN-2	18	2 (11.1)	1 (14.2)	1 (14.2)	7 (38.8)	4 (22.2)	2 (11.1)	1 (14.2)	
Women									
Normal	102	23 (22.5)	25 (24.5)	18 (17.6)	19 (18.6)	17 (16.6)	0 (0.0)	0 (0.0)	χ^2=45.37 df=18 P<0.001
Pre-HTN	54	5 (9.2)	7 (12.9)	12 (22.2)	12 (22.2)	13 (24.0)	5 (9.2)	0 (0.0)	
HTN-1	28	0 (0.0)	4 (14.2)	2 (7.1)	10 (35.7)	8 (28.5)	2 (7.1)	2 (7.1)	
HTN-2	7	0 (0.0)	1 (14.2)	2 (28.5)	3 (42.8)	0 (0.0)	1 (14.2)	0 (0.0)	
Updated systolic classifier									
Men									
Normal	29	6 (20.6)	5 (17.2)	7 (24.1)	4 (13.7)	5 (17.2)	2 (6.8)	0 (0.0)	χ^2=40.74 df=18 P=0.002
elevated	68	24 (35.2)	12 (17.6)	9 (13.2)	11 (16.1)	11 (16.1)	1 (1.4)	0 (0.0)	
HTN stage1	61	18 (29.5)	10 (16.3)	4 (6.5)	7 (11.4)	11 (18.0)	6 (9.8)	5 (8.19)	
HTN stage2	91	8 (8.7)	9 (9.8)	11 (12.0)	20 (21.9)	24 (26.3)	13 (14.2)	6 (6.5)	
Women									
Normal	29	8 (27.5)	7 (24.13)	4 (13.7)	7 (24.13)	3 (10.3)	0 (0.0)	0 (0.0)	χ^2=46.162 df=18 P<0.001
elevated	77	16 (20.7)	20 (25.9)	16 (20.7)	14 (18.1)	9 (11.6)	2 (2.5)	0 (0.0)	
HTN stage1	32	4 (12.5)	4 (12.5)	9 (28.1)	5 (15.6)	9 (28.1)	1 (3.1)	0 (0.0)	
HTN stage2	53	0 (0.0)	6 (11.3)	5 (9.4)	18 (33.9)	17 (32.0)	5 (9.4)	2 (3.7)	
Updated diastolic classifier									
Men									
Normal	139	41 (29.4)	23 (16.5)	20 (14.3)	19 (13.6)	28 (20.1)	7 (5.0)	1 (0.7)	χ^2=31.81 df=12 P=0.001
HTN-1	53	10 (18.8)	7 (13.2)	7 (13.2)	10 (18.8)	7 (13.2)	8 (15.0)	4 (7.5)	
HTN-2	57	5 (8.7)	6 (10.5)	4 (7.0)	13 (22.8)	16 (28.0)	7 (12.2)	6 (10.5)	
Women									
Normal	102	23 (22.5)	25 (24.5)	18 (17.6)	19 (18.6)	17 (16.6)	0 (0.0)	0 (0.0)	χ^2= 38.10

Continued.

Variable age group (years) of the study participants test of significance									
	N	<35	35-40	40-45	45-50	50-55	55-60	>60	df=12 P<0.001
HTN-1	54	5 (9.2)	7 (12.9)	12 (22.2)	12 (22.2)	13 (24.0)	5 (9.2)	0 (0.0)	
HTN-2	35	0 (0.0)	5 (14.2)	4 (11.4)	13 (37.1)	8 (22.8)	3 (8.5)	2 (5.7)	

Table 4: Distribution of hypertension prevalence by site plant, and status of study participants (n=440).

	Total N (%)	Kicukiro worksite			Rubavu worksite		
		Employee	Spouse	Total	Employee	Spouse	Total
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)
Previous SBP							
Normal	238 (54.1)	83 (18.9)	40 (9.1)	123 (28.0)	64 (14.5)	51 (11.6)	115 (26.1)
Pre-HTN	58 (13.2)	21 (4.8)	24 (5.5)	45 (10.2)	9 (2.0)	4 (0.9)	13 (3.0)
HTN stage1	132 (30.0)	52 (11.8)	35 (8.0)	87 (19.8)	31 (7.0)	14 (3.2)	45 (10.2)
HTN stage2	12 (2.7)	4 (0.9)	0 (0.0)	4 (0.9)	6 (1.4)	2 (0.5)	8 (1.8)
Total	440 (100)	160 (36.4)	99 (22.5)	259 (58.9)	110 (25.0)	71 (16.1)	181 (41.1)
Updated SBP							
Normal	58 (13.2)	21 (4.8)	24 (5.5)	45 (10.2)	9 (2.0)	4 (0.9)	13 (3.0)
Elevated	145 (33.0)	45 (10.2)	22 (5.0)	67 (15.2)	37 (8.4)	41 (9.3)	78 (17.7)
HTN stage1	93 (21.1)	38 (8.6)	18 (4.1)	56 (12.7)	27 (6.1)	10 (2.3)	37 (8.4)
HTN stage2	144 (32.7)	56 (12.7)	35 (8.0)	91 (20.7)	37 (8.4)	16 (3.6)	53 (12.0)
Total	440 (100)	160 (36.4)	99 (22.5)	259 (58.9)	110 (25.0)	71 (16.1)	181 (41.1)
Previous DBP							
Normal	241 (54.8)	84 (19.1)	45 (10.2)	129 (29.3)	69 (15.7)	43 (9.8)	112 (25.5)
Pre-HTN	106 (24.1)	36 (8.2)	31 (7.0)	67 (15.2)	20 (4.5)	19 (4.3)	39 (8.9)
HTN stage1	68 (15.5)	29 (6.6)	21 (4.8)	50 (11.4)	11 (2.5)	7 (1.6)	18 (4.1)
HTN stage2	25 (5.7)	11 (2.5)	2 (0.5)	13 (3.0)	10 (2.3)	2 (0.5)	12 (2.7)
Total	440 (100)	160 (36.4)	99 (22.5)	259 (58.9)	110 (25.0)	71 (16.1)	181 (41.1)
Updated DBP							
Normal	241 (54.8)	84 (19.1)	45 (10.2)	129 (29.3)	69 (15.7)	43 (9.8)	112 (25.5)
HTN stage1	107 (24.3)	36 (8.2)	31 (7.0)	67 (15.2)	21 (4.8)	19 (4.3)	40 (9.1)
HTN stage2	92 (20.9)	40 (9.1)	23 (5.2)	63 (14.3)	20 (4.5)	9 (2.0)	29 (6.6)
Total	440 (100)	160 (36.4)	99 (22.5)	259 (58.9)	110 (25.0)	71 (16.1)	181 (41.0)

Normal blood pressure was reduced from 298 (67.22%) to 168 (38.18%) by the updated blood pressure classifier while the full hypertension was increased from 18.63% to 37.72%. The isolated systolic hypertension was increase from 50 (11.36%) to 73 (16.59%) while the isolated diastolic hypertension was also increased from 10 (2.27%) to 33 (7.50%). The total additional of hypertension was from 142 (32.27%) to 272 (61.81%) with a total difference of 130 (29.54%). The increased was subdivided in 270 employees, from 97 (35.92%) to 176 (65.18%) and in 170 spouses, from 45 (26.47%) to 96 (56.47%). The percentage of hypertension of employees is relatively 5.8% superior to the spouses comparatively (Table 5).

The change of classification caused a mean risk shift and difference where the previous classification was relatively showing a high mean risk of 6% prehypertension, 17% hypertension stage 1, 40% hypertension stage 2 while the updated classification mark reduction of mean risk of 4% on elevated SBP, 9% hypertension stage 1, 19% hypertension stage 2. All the blood pressure classifications showed intergroup significant difference with p<0.001 (Figure 1).

With multivariate logistic regression of associated factors, as per reduced models by previous and updated hypertension classification. The odds of being hypertensive was higher among the male subjects with (adjusted odds ratio (AOR: 0.736) and (AOR: 0.205), eldest age group of >50 years with (AOR: 3.787) and (AOR: 3.383), being employees (AOR: 0.229) and (AOR: 0.316), family history with hypertension (AOR: 0.314) and (AOR: 0.498), taking alcohol within 30 days (AOR: 0.541) and (AOR: 0.792), with moderate central obesity (AOR: 2.063) and (AOR:2.958), being with high waist circumference (AOR: 1.235) and (AOR: 6.964), being diabetic (AOR: 0.719) and (AOR: 1.328), being moderately stressed (AOR: 0.206) and (AOR: 0.267), smoking (AOR: 0.282) and (AOR: 0.2418) by previous and update hypertension classification, respectively with significant p value <0.05 except male, high waist circumference and being diabetic in previous hypertension classification reduced model and mild stress, being diabetic and taking alcohol within 30 days with p value >0.05 in only updated hypertension classification (Table 6).

Table 5: Distribution of normal, hypertension, systolic and diastolic isolated hypertension by status of participants (n=440).

Variables	Total	Normal BP	Hypertension	Isolated S HTN	Isolated D HTN
	N (%)	N (%)	N (%)	N (%)	N (%)
Status of participants					
Previous-C					
Employees	270 (61.36)	173 (64.07)	56 (20.74)	35 (12.96)	6 (2.22)
Spouses	170 (38.64)	125 (73.52)	26 (19.29)	15 (8.82)	4 (2.35)
Total	440 (100%)	298 (67.22)	82 (18.63)	50 (11.36)	10 (2.27)
Update-C					
Employees	270 (61.36)	94 (34.81)	100 (37.03)	60 (22.22)	16 (5.92)
Spouses	170 (38.64)	74 (43.52)	66 (38.82)	13 (7.64)	17 (10.00)
Total	440 (100%)	168 (38.18)	166 (37.72)	73 (16.59)	33 (7.50)

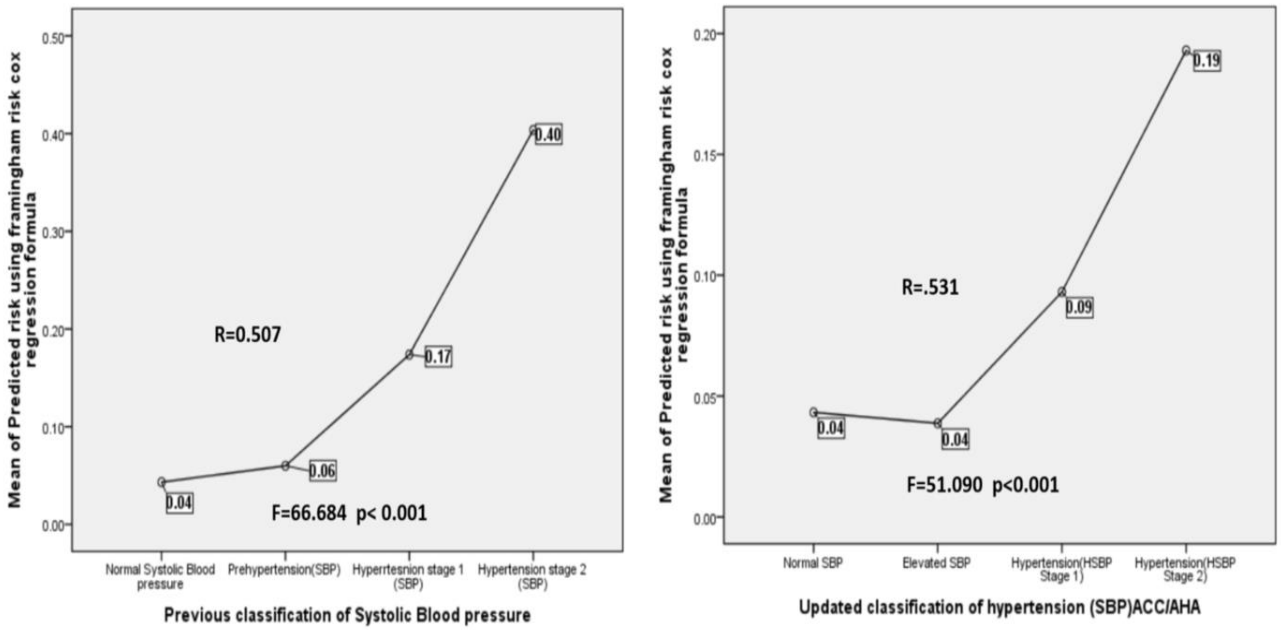

Figure 1: Distribution of predicted cardiovascular risk mean by 100 (Framingham risk cox regression) by previous and updated SBP classification.

Table 6: Distribution of Odds ratio of modifiable and non-modifiable risk factors to hypertension.

Variables	Odds ratio (CI 95%)	P value	Odds ratio	P value
	Reduced model previous HTN		Reduced model update HTN	
Gender				
Female	1.0 (reference)		1.0 (reference)	
Male	0.736 (0.345-1.568)	0.42	0.205 (0.092-0.458)	<0.001
Age category (yrs)				
<40	1.0 (reference)		1.0 (reference)	
40-50	2.710 (1.429-5.140)	0.002	1.416 (0.841-2.382)	0.190
>50	3.787 (1.985-7.224)	<0.001	3.383 (1.884-6.074)	<0.001
Status of participants				
Spouse	1.0 (reference)		1.0 (reference)	
Employee	0.229 (0.121-0.435)	<0.001	0.316 (0.122-0.815)	0.017
Family history				
Without HTN	1.0 (reference)		1.0 (reference)	
With HTN	0.314 (0.190-0.518)	<0.001	0.498 (0.303-0.819)	0.006

Continued.

Variables	Odds ratio (CI 95%)	P value	Odds ratio	P value
	Reduced model previous HTN		Reduced model update HTN	
Alcohol take in 30 days				
No	1.0 (reference)		1.0 (reference)	
Yes	0.541 (0.310- 0.944)	0.031	0.792 (0.486-1.289)	0.348
Central obesity				
Normal WC	1.0 (reference)		1.0 (reference)	
Moderate WC	2.063 (1.068-3.984)	0.031	2.958 (1.588-5.508)	0.001
High WC	1.235 (0.592-2.576)	0.572	6.964 (3.456-14.029)	<0.001
Diabetes				
Normal	1.0 (reference)		1.0 (reference)	
Diabetes	0.719 (0.342-1.514)	0.386	1.328 (0.582-3.029)	0.500
Stress level				
Low stress	1.0 (reference)		1.0 (reference)	
Mild stress	0.112 (0.013-0.947)	0.044	0.458 (0.235-0.126)	0.235
Moderate stress	0.206 (0.109-0.389)	<0.001	0.267 (0.124-0.574)	<0.001
High stress	-	-	-	-
Smoking				
No	1.0 (reference)		1.0 (reference)	
Yes	0.282 (0.111-0.715)	0.008	0.2418 (0.075- 0.773)	0.017

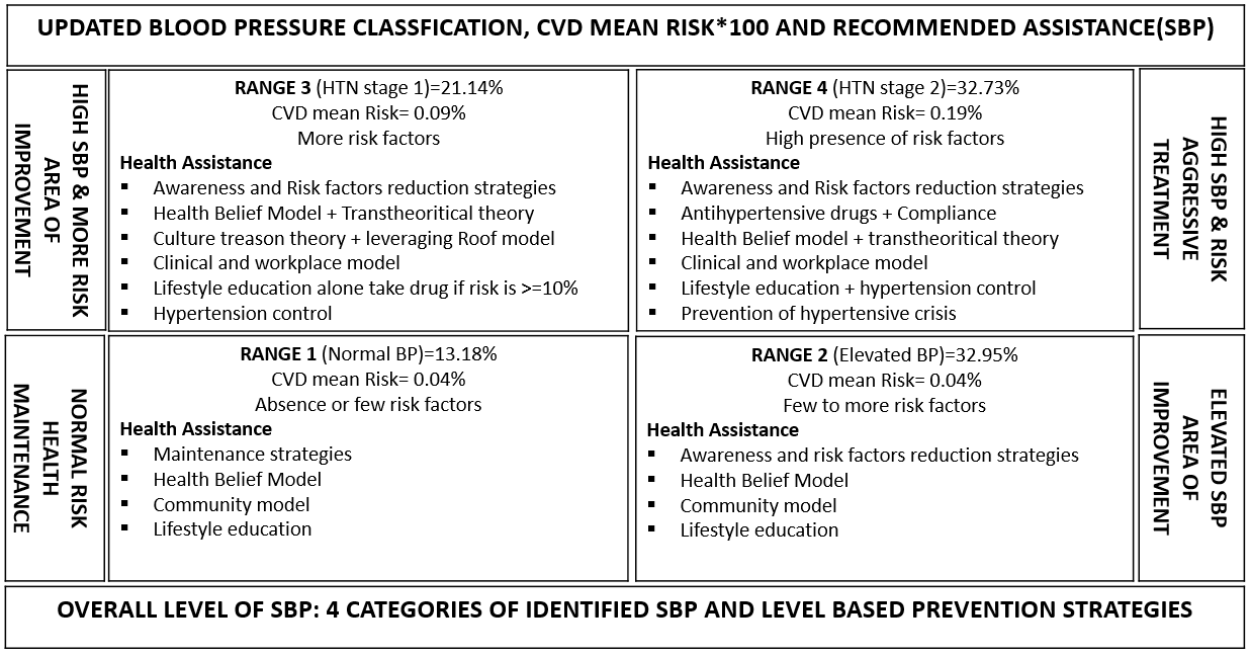

Figure 2: Updated blood pressure classification and level-based prevention strategies.

DISCUSSION

This study findings have shown a prevalence of 32.27% by previous blood pressure classification, which is not very high compared to other studies which showed a prevalence of 26% of workers participant of four African countries, 46% and 35% in two different studies of African region, 52% in south African nurse study, 55.2% in the whole Africa, 34.9% worldwide prevalence, and has increased to 61.81%, (38% for male, 23.8% for female) by the updated blood pressure classification with a difference increase of 29.54%, employees have a relatively high hypertension prevalence of 35.92% to 65.18% compared to the spouses with 26.47% to 56.47% by previous and updated classification, respectively (Table 5).[12-16]

This second classifier can rise the prevalence and cause astounding low quality of health delivery due to low number of health professionals to support the high percentage of patients and increases of drugs use prescription and laboratory testing.[17]

Normally pharmacological intervention is considered very crucial to sensibly reduce blood pressure and it is applied to patients with advanced level of hypertension that could not be reduced with non-pharmacological intervention

alone, however current strategy wait people at health facility which rampantly imply the increase of hypertension beyond the normality and causes the failure of application of non-pharmacological alone which would be considered important in early application, due to cultural resistance of patients and halting hypertension consequences.[18,19]

However clinging to the previous blood classification can hide the obvious rising burden of hypertension diseases and its cardiovascular mean risk of 4% for normal blood pressure, 6% for prehypertension, 17% for hypertension stage 1, 40% for hypertension stage 2 by previous classification and Framingham risk score (FRS) prediction show high risk to stage 1 and stage 2 hypertension because of retaining a big number of people, who always and unknowingly develop high hypertension without benefit of any health prevention strategy. On the other hand, updated classification shows a minimized mean risk of 4% on elevated blood pressure, 9% and 19% on hypertension stage 1 and 2, respectively (Figure 1). The second classification uncover the reality of hypertension prevalence and its cardiovascular diseases associated risk which really requires public health urgent interventions to maintain people in the normality and prevent progression of poor controlled hypertensions, non-hypertensive drugs compliant toward hypertensive crisis, which will mark the intersection of cardiology and health promotion.[18]

Table 7: The recommended nonpharmacological intervention by 2017 guideline.

Lifestyle strategies	Intervention	Dose	Approximate impact on sbp	
			Hypertension	Normotension
Weight loss	Weight or body fat	Best goal is ideal body weight, but aim for at least a 1-kg reduction for most adults who are overweight. Expect about 1 mmHg for every 1-kg reduction in body weight.	-5 mmHg	-2/3 mmHg
Healthy diet	DASH dietary pattern	Consume a diet rich in fruits, vegetables, and whole grains, and low fat dairy products, with reduced content of saturated and total fat	-11 mmHg	-3 mmHg
Reduced intake of dietary sodium	Dietary sodium	Optimal goal is <1500mg/d, but at least aim for a 1000mg/d reduction in most adults.	-5/6 mmHg	-2/3 mmHg
Enhanced intake of dietary potassium	Dietary potassium	Aim for 3500-5000/d, preferably by consumption of diet rich in potassium.	-4/5 mmHg	-2 mmHg
Physical activity	Aerobic	90-150 min/week 65-75% heart rate reserve	-5/8 mmHg	-2/4 mmHg
	Dynamic resistance	90-150min/week 50%-80% 1 rep maximum 6 exercises, 3set/exercise, 10repetitions/set	-4 mmHg	-2 mmHg
	Isometric resistance	4x2 min (hand grip),1min rest between exercises, 30%-40% maximum voluntary contraction, 3sessions/week,8-10week	-5 mmHg	-4 mmHg
Moderation in alcohol intake	Alcohol consumption	In individual who drink alcohol, reduce alcohol to men: ≤2 drinks daily; women: ≤1drink daily	-4 mmHg	-3 mmHg

We observed that the association of unchangeable factors such as gender, age, family history and being employee or spouses was significant with a p value <0.05 for reduced model of two blood pressure classification except gender for single previous classification with p value of 0.42 (Table 6).[20,21] On the other hand, changeable factors such as central obesity which was more associated with 2 to 6 fold on two reduced models, alcohol taking in 30 days, diabetes, stress level, and smoking, was also significantly associated with hypertension except alcohol taking which was not significant on single previous classification reduced model.[22-25] Although diabetes is a major risk factor of hypertension, it was not significant on two reduced models of the previous and updated classification of blood pressure (Table 6).[26]

Overall, these astounding findings bring up the crucial need of early and primary prevention of hypertension using constructive, structured and effective socio-cultural strategies and psychological behavior change whereby some of which was consisting to other studies to their effective use, such as health believe model where the improved result was significant with p=0.03), planned behavior and planned action, social cognitive theory, stage of change theory or trans-theoretical model, with even consideration of workplace clinical and community approaches to improve the level of health promotion success.[26-30]

Health promotion recommendation

Relying on the current lower threshold of hypertension as published in 2017 by American College of Cardiology/American Heart Association (ACC/AHA) guideline for the prevention detection, evaluation, and management of high blood pressure in adults (2017

guideline), and the 2018 guideline of European Society of Cardiology/European Society of Hypertension (ESC/ESH) on life style change and the present research findings we recommend to redefine health promotion goals of hypertension prevention by establishing lifestyle oriented multilevel prevention strategies and redeploy health promoters teams to sensitize in the three pools (awareness pool, treatment pool and control pool) to know how and why they have to keep their blood pressure under the 130/80 mmHg before crossing this current redline (Figure 2 and Table 7).[10,31]

CONCLUSION

This study results revealed that blood pressure reclassification to the lower hypertension thresholds has a measure impact in public health by increasing antihypertensive drugs, as well as cause poor healthcare delivery due to the increase of the line in medical consultation rooms. The observed discrepancy of hypertension prevalence between workplace community and their spouses showed the crucial need of tailored hypertension workplace of non-pharmacological intervention to deal with this silent killer. This suggest the application and combination of new public health tactics with strong cultural theory-based technique, structured health promotion goals that aim to maintain the high proportion of people in their normal range compartment by delaying the transition and progression of incremental blood pressure, stopping and reversing some biological process through modifiable risk factors in this industrial workplace and in the population at large.

Contribution of the current study to learning

This study revealed a difference of hypertension prevalence between the employees and their spouses to inform the world of work and their administration "Employer" to plan a safe worksite environment.

It also revealed the differential results of blood pressure previous and updated classification in Rwandan population with target of home and workplace-based hypertension prevention.

Inform the policy makers to develop employee policy protection to deal with this rising trend of hypertension in the current Sub-Saharan region as well as Rwanda with industrialization vision.

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