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Management of hypertension at community level in sub-Saharan Africa (SSA): towards a rational use of available resources.

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Abstract

Hypertension is emerging in many developing nations as a leading cause of cardiovascular mortality, morbidity and disability in adults. In sub-Saharan Africa (SSA) countries it has specificities like occurring in young and active adults, resulting in severe complications dominated by heart failure and taking place in limited resource settings where individual access to treatment (affordability) is very limited.

Within this context of restrained economic conditions, the greatest gains for SSA in controlling the hypertension epidemic lie in its prevention. Attempts should be made to early detect hypertensive patients before irreversible organ damage becomes apparent, and to provide them with the best possible and affordable non-pharmacological and pharmacological treatment. Therefore, efforts should be made in detection and early management at the community level.

In this context, a standardized algorithm of management can help in rational use of available resources. Although many international and regional guidelines have been published, they cannot apply to SSA settings, because countries economy and patients' affordability do not allow access to advocated treatment. In addition, none of them suggest a clear algorithm of management for limited resources settings at the community level. In line with available data and analysing existing guidelines, a practical algorithm for management of hypertension at the community level including treatment affordability has been suggested in the present work.

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Introduction

According to the World Health Organization (WHO), hypertension is one of 7 diseases composing the entity of “cardiovascular diseases” (CVDs) (1). CVDs account for one third of the worldwide global mortality and one tenth of the worldwide global disease burden (2). Low- and middle-income countries (LMIC), contribute to 80% of this global CVD burden (2) where they cause twice as many deaths as HIV, malaria, and tuberculosis combined, becoming the number-one cause of death in the developing world (3, 4). By its target organ damage (TOD) hypertension remains an important cause of coronary heart disease, cerebrovascular disease, peripheral artery disease, and heart failure (5). Those latter account for more than 70% of CVD’s morbi-mortality worldwide (1, 3), making hypertension so far the major cardiovascular risk factor and major component of the CVD entity.

In the LMIC of sub-Saharan Africa (SSA), the mortality among patients hospitalized for hypertension-related disorders is over 20% (6). Hence, controlling major cardiovascular risk factors such as hypertension may reduce the CVD burden (7). But in SSA like in other LMIC, one of the major constraints for controlling CVD in general and hypertension in particular, is the limitation of resources for health care (7).

Primary prevention through a population-based, lifestyle-linked programme, as well as cost-effective methods for detection and management are synergistically linked. Cost-effective healthcare interventions to reduce the cardiovascular burden can only be implemented if the health services policy environment and financing enable implementation. The control of hypertension supposes an early detection. In this context, there are currently no useful guidelines to detect and treat hypertension at community level in SSA.

The guidelines for management of hypertension change constantly as research findings shed more insight into the disease mechanisms and as new classes of antihypertensive agents are

developed. Since management of hypertension depends on a number of factors including demographic and socio-economic realities, what is prescribed in developed countries may not be applicable in SSA. Up to now many guidelines have been published but they are scarcely implemented in SSA since they don't suggest any practical management algorithm for health professionals in low income countries (8). Additionally, restrained economic conditions in the developing world suggest that the greatest gains in controlling hypertension in SSA lie in its prevention and awareness of being hypertensive. Attempts should be made to early detect hypertensive patients before irreversible organ damage becomes apparent, and to provide them with the best possible and affordable non-pharmacological and pharmacological treatment.

This article analyses available data on hypertension complications in SSA and discusses the current hypertension management guidelines and ways to improve their implementation in SSA. The purpose is to interpret the available facts on the management of hypertension, to consider the realities of SSA and to suggest practical algorithms of hypertension detection and management at the community level in SSA low- and middle income settings.

Methods and the literature search

A thorough literature search was done on existing global and regional hypertension management guidelines. Country based guidelines were skipped. Additionally, an analysis was done on published hospital data about prevalence of hypertension and its complications in SSA. In this review, 202 studies reporting hospital data from SSA were retrieved from the following databases: MEDLINE through PubMed, Mbase, African Index Medicus and WHO Global Cardiovascular InfoBase. Following search terms were used: Sub-Saharan Africa /Africa, hypertension/high blood pressure, prevalence, hypertension complications, less developed countries / developing countries or nations, hospital/healthcare surveys, primary health care, African continental ancestry group, stroke, coronary (heart) diseases, heart failure, end-stage renal disease/renal failure and epidemiology. Additional searches were done manually using references cited in reviews and original studies and no language exclusion was applied. To obtain data close to the current situation, only studies reporting data about prevalence and complications published between 1998 and 2008 were included. The reported prevalences were extracted as it is (in %), and overall results were expressed as medians. The retrieved articles included 167 papers using the current definition of hypertension. The reported prevalences (Table 1) were obtained in specialised cardiology centres (49 studies), internal medicine departments (21 studies) or in the entire hospital (97 studies).

Results and discussion

Are international guidelines on management of hypertension applicable to SSA?

Four main international or regional guidelines for the management of hypertension were analyzed. They include [1] the 2003 WHO/ISH Statement on Management of Hypertension (9); [2] the European guideline, issued by European Society of Hypertension (ESH) and European society of cardiology (ESC): the 2007 ESH/ESC guidelines (10) and [3] the United States of America (US) guideline, issued by the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the 2003 JNC 7 report (11) and [4] Recommendations for prevention, diagnosis and management of hypertension and cardiovascular risk factors in sub-Saharan Africa (12).

Besides those main guidelines other documents and reports have been published to help in management of hypertension in particular settings, including: [1] the consensus statement of the Hypertension in African-Americans working group of the International Society on Hypertension in Blacks (13), and [2] the 2002 WHO Cardiovascular Risk Management Package in Low- and Medium-Resource Settings (14).

In sub-Saharan Africa, efforts to establish a guideline for hypertension management have been started but so far only one guideline exists since 2003 (12). This guideline has been criticized for not considering cost-effectiveness, or cost-savings issues, in the rational choice of antihypertensive drugs (15). Moreover, this guideline is limited to the hospital setting and is not suitable for the community level. In addition, it is mainly based on blood pressure level threshold rather than the total cardiovascular risk and may yield a high number of people to treat (16), whereas many SSA countries with limited resources cannot treat everyone with a blood pressure (BP) beyond the defined thresholds ($BP \geq 140/90$ mmHg) (9, 17). Because of a lack of clear risk stratification, it has been poorly implemented and health professionals in SSA tried rather to implement the international guidelines or to treat hypertension according

to their daily experience (18). This practice led to irrational use of available resources and a lack of harmonization in hypertension treatment in SSA region, which can have an impact on treatment optimization (19, 20).

Differences in hypertension risk between western countries and SSA countries

Inhabitants of SSA have higher risk to become hypertensive

Recognition of the special importance of hypertension in populations of African ancestry emerged in the USA in the 1930s (21). By the 1960s surveys have established the two-fold greater prevalence of this disorder in Blacks than in Whites (21). In contrast, the relatively low prevalence of hypertension in black people living in SSA may mistakenly suggest that the risk for hypertension is lower in SSA compared to western countries. Although the prevalence of hypertension was lower in SSA than in England and USA, the prevalence of hypertension adjusted to the WHO standard population was higher in SSA than in England and similar to USA (Table 2). In addition, the analysis of age-specific prevalence data shows that the hypertension prevalence is higher at younger ages (up to 45 yrs) in SSA compared to western countries. The prevalence in old people is lower in SSA than in western countries. The plausible explanation is linked to low accessibility to treatment: by lacking adequate treatment people with hypertension died at younger age (around 45-54 years). People with hypertension at older age are likely new cases or survivors. The present data also show that country prevalence data can be misleading as indicator of the risk for becoming hypertensive.

Differences in risk from hypertension

The particular context of SSA containing poverty and illiteracy contributes to the low awareness, control and treatment rate of hypertension (22). The limited resources devoted

toward health care limit the number of health facilities added to the inexistence of health insurance scheme (23). In such context, the cases of malignant hypertension and target organ damage are frequent (24). As no official data on risk from hypertension or cardiovascular morbidity and mortality exist, data on risk from hypertension in SSA are mainly estimated from hospital data.

Data from in-hospital studies show that the most frequent complication reported downward are heart failure, renal failure, stroke and coronary heart disease (CHD) (Table 1). The reported prevalences were obtained in specialized cardiology centers, internal medicine departments or in the whole hospital. Only few studies reported the mean age of the patient sample (15 out of 167 hospital studies), and this mean age ranged from 42.5 ± 21.4 years to 53.8 ± 17.0 years. The total range of age reported in hospital studies was 26-84 years.

Within 60 studies reporting cardiovascular accidents, only 17 studies reported coronary heart disease (CHD) with a rather low prevalence. CHD is relatively uncommon in SSA, probably because blacks in SSA have lower serum cholesterol levels and higher high-density lipoprotein cholesterol levels (12). Some authors (25) merely link the CHD to mainly hypertension in SSA settings, and stress that CHD primary prevention should focus mainly on anti-hypertensive measures.

Heart failure was most frequently reported (74 hospital studies) as a clinical consequence attributed to hypertension. Other potential cause of heart failure like rheumatic heart disease (24) or myocarditis (presumably linked to infectious diseases like streptococcus and HIV infections (26, 27) are frequent in SSA settings. However, the uncontrolled blood pressure remains the major factor for left ventricular hypertrophy (LVH) (28) and heart failure (29, 30). The same holds for stroke (24, 31, 32) and renal failure (33-35). Despite insufficiency of statistical data about a relationship between hypertension and End-Stage Renal disease

(ESRD) in SSA, current hospital data (Table 1) place ESRD at second position as hypertension complication.

Like in western countries stroke is also in SSA a more common complication of hypertension and cause of death than myocardial infarction (36). Stroke cases are presumed to occur at home and seldom reach the hospital. Therefore, it is likely that stroke is a more common complication than reported by hospital data. This is supported by investigations carried out in rural/urban areas; those reported data (32) show a high prevalence of stroke in black Africans in SSA, even higher than in western countries (31) and it is suggested that untreated hypertension is an important factor (32, 37).

The current findings, in line with other reports from developing countries (38, 39), show that hypertension is emerging as a cardiovascular leading cause of mortality, morbidity and disability in adults in many developing nations. They illustrate also the economic consequences of hypertension in low- and middle income countries of SSA. In this economic context, hypertension complications which occur at much earlier ages in SSA, result in a greater number of years of potential life lost. Because of its high prevalence, the treatment of hypertension put economic pressure on the SSA community.

Differences in total cardiovascular risk

The uncontrolled blood pressure is the main factor for target organ damage, and in SSA setting its proportion may be higher than in western countries. Other risk factors, related to metabolic syndrome, diabetes and overweight which were considered to be lower in some regions of SSA, will increase with urbanization and lifestyle change with modernization (40). Despite the lower total cholesterol levels in SSA, the level of blood pressure may bring the total cardiovascular risk at the same magnitude as in western countries. In addition, hypertension bears the particularity of hitting the active young people, and then affecting the SSA economy (41).

Different focus in preventive strategies

The preventive actions concern habits and lifestyle monitoring. Two important low (or no)-cost preventive measures are first, a reduction in dietary salt intake (13), and second, a greater awareness of the implications of obesity (42). There is good evidence that a reduction in salt intake reduces blood pressure and that black people are more sensitive than white people in this regard (43). Other measures as increased physical exercise (44), decreased obesity, cessation of smoking and limited alcohol consumption (45) are all as important in black subjects as in whites in prevention and control of hypertension. As hypertension is occurring at younger age in SSA than in western countries, regular check of blood pressure for all (also young) adult people should be promoted.

Diet control in SSA remains a great challenge. The diet is highly linked to the population culture, to the food conservation, cooking, and other existing infrastructures. Salt reduction may be difficult in populations using it for food conservation. The implementation of controlled diets like promoted in Dietary Approaches to Stop Hypertension (DASH) (46, 47), may be difficult in SSA settings because those measures require change in preparation, conservation and other infrastructures and resources not available in SSA. Since the conservation of food in SSA can be difficult, fresh food should be promoted.

Different focus in therapeutic strategies

Beyond prevention measures (48-50), the management of hypertension includes also non-pharmacological (19, 51) and pharmacological treatment (52) and both bear specificities in SSA. Although the content of non-pharmacological treatment mainly based on lifestyle change and promoted by a patient education package remains similar in western countries and SSA, a difference in outcome can be expected from the high illiteracy rate in SSA. This

may require different educational methods. Moreover, the population cultures and the real way of living (activities, historic habits like salt intake, etc) must be taken into account. Furthermore, since resources for managing hypertension are limited, it is important that interventions are guided by cost-effectiveness for low- and middle-income countries (4). Hence, it is vital to use the scarce resources with maximum efficiency and guidelines should include drug affordability as main management component.

Hypertension management in public health perspective

Setting up a suitable guideline for the management of hypertension in SSA taking into account the local situation remains the great challenge (8). To author's knowledge, this is the first paper to suggest an algorithm for early detection and management of hypertension at the community level in low-and middle income countries.

Beyond protocols suggested in the 2002 WHO Cardiovascular Risk Management Package in Low- and Medium-Resource Settings (14), we propose a set of algorithms (Figure 1-4) for detecting and managing hypertension in SSA at the community level. Since the SSA region has its own disparities between countries, proposed algorithms offer the flexibility to be adapted to the countries' situation. As at the community level it's not feasible to have all parameters used in scoring total cardiovascular risk (such as total cholesterol), the proposed algorithm for the community level mainly relies on the blood pressure level which is the main component in calculating the total cardiovascular risk (53). In addition, the algorithm largely takes into account drug affordability. This algorithm is not suitable at hospital level, where other guidelines based on risk prediction charts (10, 54) may apply. The proposed algorithm for community level is based on [1] a two level management: at health advisor/worker and at health center; [2] detection and prevention of hypertension and nonpharmacological treatment at both levels, [3] prescription of a limited number (two) of low dose affordable antihypertensive drugs limited to the health center, [4] a management based on blood

pressure level and presence of other cardiovascular risk factors, and [5] referral of high risk patients to the hospital.

Prerequisites are first, to provide at the community health advisor and health center level the blood pressure devices and second, to provide the core drugs (hydrochlorothiazide or other thiazides diuretics, and prazosin and/or reserpine) at the health center level. The good storage of medicines at the health centre, the training of nurses and organization of population sensitization programs are also pre-requisite to implement the suggested algorithm. Implementation of the proposed algorithm may implicate new investment and a reorganization of the health sector in some places.

As recommended by World Bank publication “*Better Health for Africa*” (55), at the community level (village), in a majority of SSA countries there are elected persons called “village health workers”. Even if those delegates have no formal medical training, they are generally the most educated of the population and they can be trained in taking just blood pressure at their offices where they hold regular meetings with the population and give advice on non pharmacological treatment and hypertension prevention.

Health centers have nurses and other health professionals, but rarely a medical doctor (56). The use of pre-established flowcharts for the management of hypertension at the community level is likely to increase patients’ accessibility to health care. Sticks for detection of proteinuria and urine glucose are frequently available. If an electrocardiogram (ECG) can be done, the nurse must be trained to make a proper ECG recording, and to calculate the Cornell product for left ventricular hypertrophy detection (57). Because of its high specificity and better sensitivity the Cornell product is preferred over other indexes such as Sokolow-Lyon voltage (58) and the 12 lead-QRS product (57) .

Low dose thiazide diuretics proposed in the present algorithm, are still proposed as backbone of the hypertension treatment in general (59-62) since they have a good affordability in most

SSA countries (63). In addition, at this low dose, dangerous side effects like hypokalemia (which can induce arrhythmias) are less expected.

Although alpha-blockers like prazosin may be an alternative to thiazides and cheaper, they have the disadvantage of a three times daily intake, which can reduce treatment adherence. Other side effects of alpha-blockers like the "first-dose effect" (inducing orthostatic hypotension) can be limited by starting the treatment with a low dose and increasing the dose slowly. For these reasons, alpha-blockers may not be first-line drugs at the health center level. Reserpine or rauwolfia extracts offer the advantage of low cost and a once-daily administration. Side effects like nasal congestion or depression are less frequent provided the dosage of reserpine does not exceed 0.1 mg once daily. These drugs are proposed in third line at the health center setting. They could be chosen in second line when compliance with prazosin is bad or when side effects occur.

Conclusions

Hypertension is emerging as a cardiovascular leading cause of mortality, morbidity and disability in adults in many developing nations. In contrast with western countries there's higher risk for hypertension in SSA and the higher risk is particularly found at the young age (<45 yr). Hypertension complications in SSA are dominated by heart failure. To prevent complications efforts should be made in early detection and management at the community level. International guidelines for hypertension management cannot apply to SSA settings, where limited resources and patients' affordability do not allow access to advocated treatment. A practical algorithm for management of hypertension at the community level including treatment affordability has been proposed in the present work.

Conflict of interest statements

We declare that we have no conflict of interest.

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Tables

Table 1. Summary of hospital reported data

Source of Data		Age in years: median (range) [3]	Reported prevalence of complications in % (and range)							
			Heart failure		Coronary Heart Disease – CHD (when reported alone)		Stroke (when reported alone)		End Stage Renal Disease [2]	
	number of studies		n [1]	Median (range)	n	Median (range)	n	Median (range)	n	Median (range)
<i>Specialised cardiology centre</i>	49	47.1 (26 – 84)	28	61.8 (29.0 – 79.2)	7	13.9 (2.4 – 35.0)	8	19.4 (10.1 – 45.8)	7	14.4 (1.0 – 39.3)
<i>Internal medicine department</i>	21	56.2 (45 – 68)	7	29.0 (11.3 – 37.9)	8	4.1 (1.9 – 8.9)	8	9.8 (2.0 – 20.4)	4	10.3 (0.7 – 27.8)
<i>Entire hospital</i>	97	50.3 (40 – 77)	25	13.7 (0.7 – 32.3)	16	0.6 (0.3 – 7.2)	18	1.2 (0.6 – 11.0)	12	3.8 (0.6 – 15.9)
Total	167	54.5 (26 – 84)	60	16.1 (0.7 – 79.2)	31	0.9 (0.3 – 35.0)	34	2.8 (0.6 – 45.8)	25	4.1 (0.6 – 39.3)
Ratio's versus stroke prevalences, from studies reporting both complications. (read as “x times frequent vs stroke”)			3.60±3.77 (23 studies)		0.78±0.63 (21 studies)		1		0.45±0.38 (12 studies)	

Notes: [1] “n” means number of studies; [2] most of cases are probably transferred in other specific unities like dialyses or intensive care, underestimating the frequency in cardiology based or internal medicine centers; [3] Median of the studies reporting the mean age of the patients’ sample (15 out of 167).

Table 2. Comparison between SSA pooled data and developed countries surveys.

Age-range[a]	Crude hypertension prevalence in % (number of diagnosed hypertensive people/sample size)			Statistical comparison test p-value		
	[1]SSA(64)	[2] England(65)	[3] USA(66)	Within all	SSA vs England	SSA vs USA
15-34	8.3 (2,454/29,725)	4.2 (33,461/798,390)	6.0 (178/2,971)	<0.001	<0.001*	<0.001*
35-44	17.1 (1,993/11,653)	12.3 (60,128/487,692)	16.0 (135/846)	<0.001	<0.001*	NS
45-54	28.8 (2,395/8,317)	26.3 (102,484/389,053)	31.0 (242/781)	<0.001	<0.001*	NS
55-64	44.0 (2,969/6,747)	45.8 (162,533/355,094)	48.0 (312/650)	0.045	0.004	NS
≥65	60.1 (1,511/2,514)	61.2 (333,947/545,786)	71.4 (849/1,189)	<0.001	NS	<0.001
Overall	16.2 (11,322/58,956)	26.9 (692,553/2,576,015)	28.4 (1,716/6,437)	<0.001	<0.001	<0.001
Prevalence standardized for WHO standard population [4]	23.3	18.4	21.6	<0.001	<0.001*	NS

[a] Age range for USA prevalence starts from 18 years, for England are from 16 years and for SSA are from 15 years; **[1]** Results from a compilation of population-based studies (64); **[2]** Results from the Health Improvement Network (THIN) database & Health Survey for England (HSE)(65); **[3]** NHANES III continuous(66); **[4]** WHO standard population adjusted prevalence; **NS:** Not statistically significant *SSA is statistically higher.

Table 3. The present paper summary

<i>What is known on the topic</i>	<i>What this paper adds</i>
<ul style="list-style-type: none"> • Hypertension is emerging in many developing nations as a leading cause of cardiovascular mortality, morbidity and disability in adults. • Many international and regional guidelines for hypertension management have been published but few of them propose a clear algorithm for management at the community level in limited resources settings. 	<ul style="list-style-type: none"> • In sub-Saharan Africa (SSA), hypertension has specificities like occurring in young and active adults, resulting in severe complications and taking place in limited resource settings where individual access to treatment (affordability) is very limited. • The reported hospital complications are dominated by heart failure. • A proposal of a practical algorithm for early detection and management of hypertension at the community level including treatment affordability, in line with available data and analysis of existing guidelines.

Figures legends/captions

Figure 1. Hypertension management strategy at the community level : At least, where a health advisor/worker is available.

Legends:

NPT: Non-pharmacological treatment; **SBP:** Systolic blood pressure; **DBP:** Diastolic blood pressure

Notes:

() Symptoms to ask (Yes means the person answers yes at least to one of following questions):*

- Shortness of breath on small exercise (like climbing a small distance, walking, etc)*
- Both feet swollen.*

*(**)Non pharmacological treatment (NPT) includes:*

- Stop smoking (keep in mind all kind of tobacco use)*
- Overweight reduction and Recommendation of a regular physical activity*
- Dietetic measures: (Salt reduction, promote fresh fruits and vegetables intake, fatty food limitation, minimizing alcohol intake)*

Figure 2. Hypertension management algorithm at the health centre: the first step**Legends:**

ECG= Electrocardiography; **NPT**: Non-pharmacological treatment; **CVR**: Cardiovascular risk factors; **SBP**: Systolic blood pressure; **DBP**: Diastolic blood pressure

Notes:

[1] *Minimal equipment: urine sticks for protein and glucose and preferentially a standard Electrocardiography.*

[2] *At CVR evaluation “Yes” means at least one cardiovascular risk factor is present; the cardiovascular factors to detect are:*

- (a) Proteinuria (using dipsticks)*
- (b) Glucosuria (using dipsticks). If positive follow also instructions for diabetes.*
- (c) The left ventricular hypertrophy(LVH) on ECG; defined by a Cornell product parameter
(positive if $>2440 \text{ mm} \cdot \text{msec}$). The parameter is calculated as follows:*

- Cornell product = $(\text{RaVL} + \text{SV3}) \times \text{QRS duration}$ (meaning the product of QRS duration with the sum of the R wave in lead “aVL” and the “S” wave in lead “V3”). The RaVL, SV3, QRS and V3 being ECG waves.*
- To measure QRS duration on ECG, recorded at a speed of 25 mm/sec:*
- Principles:*
 - $1\text{mV}=10\text{mm}$ in the vertical direction.*
 - Each small 1-mm square represents 0.04sec (40msec) in time and 0.1mV in voltage.*
 - QRS duration: counting 1-mm square cell of the ECG, paper corresponding to the beginning and the end of QRS complex (horizontally), and then multiply the number by 40 msec.*
- R and S wave voltage are obtained by counting the number of 1-mm square cell (vertically) corresponding to the wave height (amplitude).*

[3] *The patient’s affordability is evaluated based on socio-economic data provided in his medical record (file) and on patient interview.*

[4] *The (*) and (**) signs refer to the same legend as in figure 1.*

Figure 3. Drug treatment algorithm at the health centre in hypertensives with low affordability (following the first step of management showed in Figure 2).

Legends:

HCTZ= Hydrochlorothiazide

Notes:

The patient's treatment adherence is evaluated by patient and near neighbourhood interviews. The goal to be achieved are stipulated in figure 2.

Figure 4. Drug treatment algorithm at the health centre in hypertensives with high affordability (following the first step of management showed in Figure 2).

Notes:

The patient's treatment adherence is evaluated by patient and near neighbourhood interviews. The goal to be achieved are stipulated in figure 2.

Figure 1.

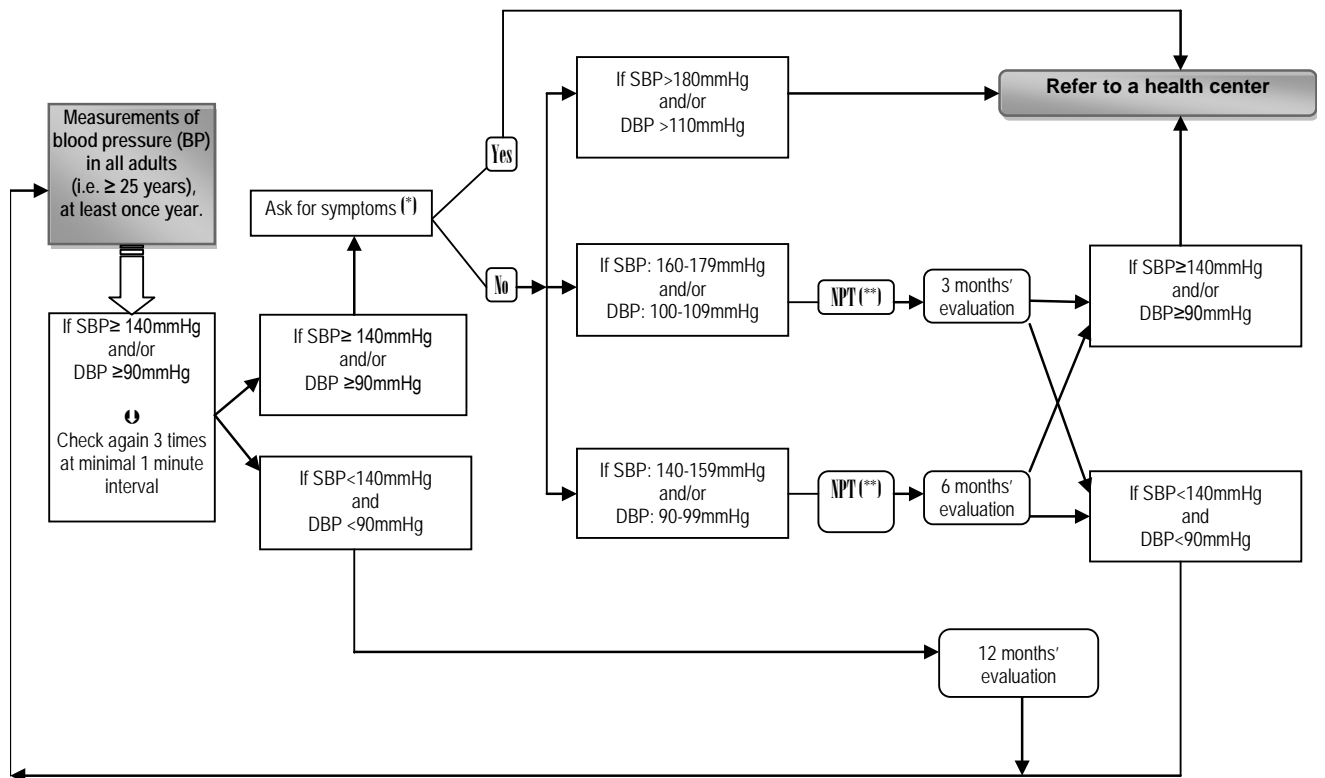


Figure 3.

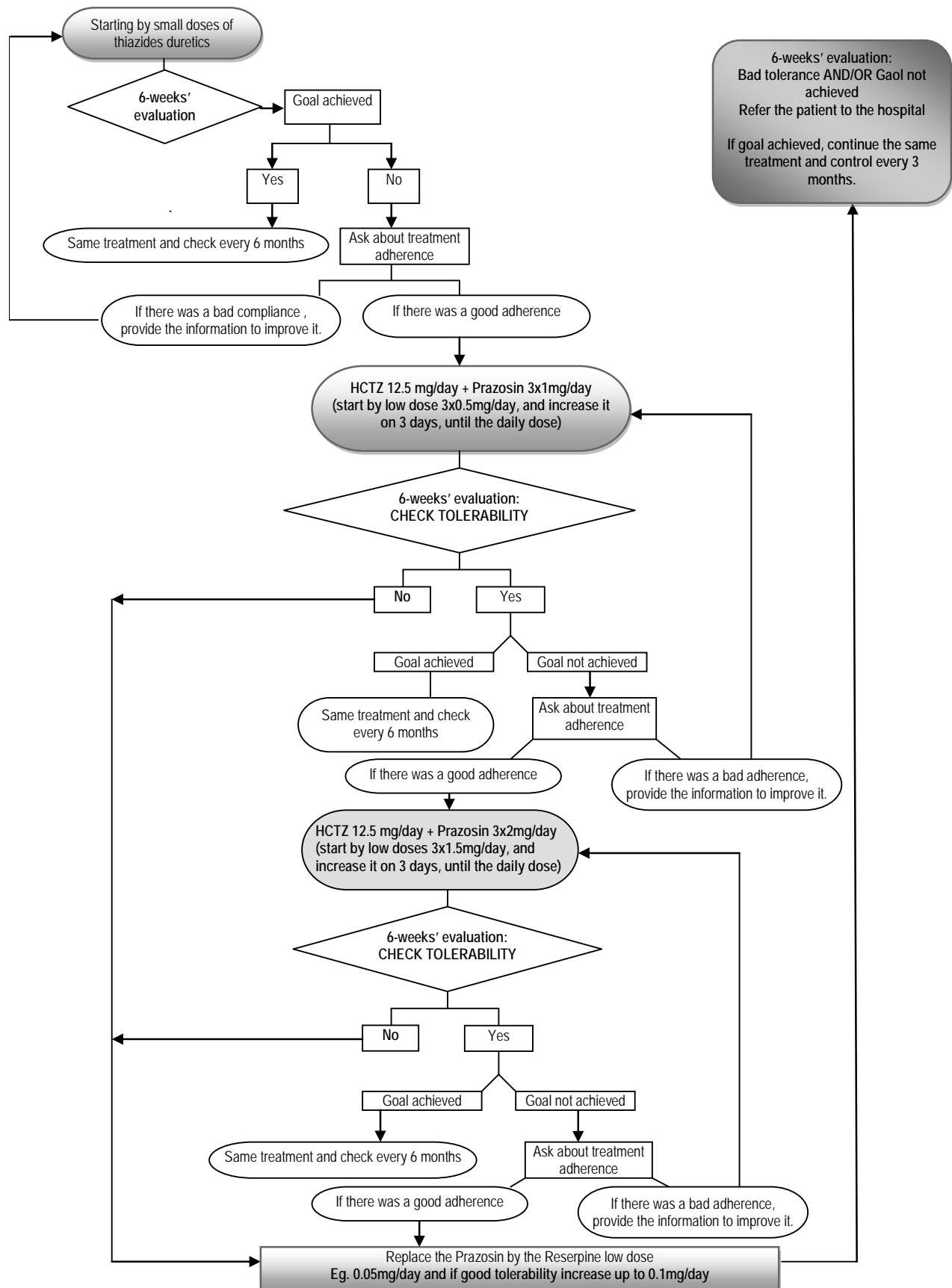


Figure 4.

