

Original Investigation

Prevalence of Hypertension in Outpatient Consultations in a Cardiology Department in West Africa in Dakar, Senegal According to "MY MEASURE MONTH"

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Abstract

Objectives: This study, conducted as part of the "My Measure Month" program in collaboration with the French Society of Hypertension, aimed to investigate the prevalence of hypertension, emphasize the importance of measuring blood pressure. **Methodology:** This was an observational and cross-sectional study conducted over one month in the outpatient department of a center specialized in hypertension management. The study included patients aged over 18 years. We examined hypertension data (duration, treatments, compliance) and cardiovascular risk factors. Blood pressure was measured. Three measurements were taken at one-minute intervals. In the bivariate analysis, a p-value ≤ 0.05 was considered statistically significant. **Results:** The prevalence of hypertension was 45.6%. Hypertension was more frequent in women (54.2%), and the most represented age group was 50 to 70 years, with a prevalence exceeding 70% in patients over 70 years old. In our sample, 13% of patients not previously known to be hypertensive had elevated blood pressure readings. Successive measurements showed variations in hypertension grades, with a progressive decrease in patients with grade II and III hypertension. Among hypertensive patients, 93% had no coverage for their medications. Most patients were on pharmacological treatment, but a significant proportion remained uncontrolled (36.2%), especially those on dual therapy. Bivariate analysis showed that age ≥ 65 years, smoking, dyslipidemia and heart failure were significantly associated with hypertension. **Conclusion:** An integrated strategy for prevention, screening, and treatment is crucial to reduce the burden of hypertension in this population, improve the quality of life for hypertensive patients.

Keywords

MY MEASURE MONTH, Hypertension, Cardiovascular Risk Factors, Dakar, Senegal

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1. Introduction

Hypertension (HTN) is a major public health issue worldwide, particularly in developing countries undergoing a significant epidemiological transition [1, 2]. Hypertension is the leading preventable risk factor for cardiovascular diseases and all-cause mortality globally [3]. As of 2014, the global prevalence of hypertension among adults aged 18 years and older was approximately 22% [4]. Today, nearly 1.2 billion people worldwide are affected by hypertension [5, 6], with prevalence expected to exceed 1.5 billion by 2025 [7, 8]. Hypertension is associated with 9 million deaths globally each year [9], a figure likely to rise due to global population growth and aging.

Generally, the prevalence of hypertension was higher in low-income countries compared to middle- and high-income countries in 2014 [4]. Similar to other regions, hypertension prevalence is higher in Africa, affecting 27% of adults [4]. Sub-Saharan Africa has high hypertension prevalence rates, ranging from 16% to 40%, and is projected to reach 150 million cases by 2025 [10].

In Senegal, according to the 2015 STEPS survey, the overall hypertension prevalence in the study population was 29.8% [11]. However, a general population study in the semi-urban area of Guéoul, Senegal in 2012 showed a hypertension prevalence of 46.4% [12].

Hypertension often progresses silently, leading to severe cardiovascular diseases. It is the main risk factor for heart attacks and strokes. Complications include heart failure, peripheral artery disease, kidney disease, dementia, retinal hemorrhage, and vision impairment. Hypertension is essential in 90% of cases, with no known cause but associated with several contributing factors (environmental factors such as obesity, sedentary lifestyle, excessive alcohol and salt consumption) or secondary in 10% of cases, usually in young individuals and due to known and treatable causes [5].

Hypertension in adults over 18 years is consensually defined as a systolic blood pressure of 140 mmHg or higher and/or a diastolic blood pressure of 90 mmHg or higher, measured in a medical office [13, 14]. The three-reading method is one of the most commonly used techniques for accurate diagnosis and monitoring of blood pressure in a clinical setting. This method involves taking three consecutive blood pressure readings at a few-minute intervals during a doctor's visit [15]. It is also important to measure blood pressure in both the right and left arms [16].

Despite the availability of antihypertensive medications, global data suggest that less than half of hypertensive individuals are aware of their condition. Furthermore, less than one-third of treated individuals achieve controlled blood pressure as recommended by international guidelines [4]. In 2010, only 13.8% of hypertensive patients worldwide had controlled blood pressure, 7% in Sub-Saharan Africa [17, 18], and 2.8% in Senegal according to the 2015 National survey on non-communicable diseases (STEPS) survey [11].

A significant impact on morbidity and mortality and a massive reduction in the burden of hypertension-related diseases can be achieved by increasing public awareness through improved hypertension screening [1].

In this context, in collaboration with the French Society of Hypertension through its "My Measure Month" program, we conducted this one-month study. The objectives were to investigate the prevalence of hypertension, emphasize the importance of blood pressure measurement, identify individuals needing management to lower their blood pressure, facilitate the care of identified hypertensive individuals, provide dietary and lifestyle advice to participants with elevated blood pressure, and use the study data to alert governments about undiagnosed hypertensive individuals to improve local screening policies.

2. Methodology

2.1. Study Design and Inclusion Criteria

This was an international, observational, and cross-sectional study involving over a hundred countries, including Senegal, aimed at assessing blood pressure in 1 million participants aged over 18 years. The study was conducted over a one-month period from October 24 to November 24, 2022. Participants in this study were recruited from the outpatient department of Idrissa Pouye General Hospital in Dakar, Senegal, a center specialized in hypertension management.

Participants were given an information note and a non-opposition statement, and the detailed project was explained to provide patients the opportunity to ask any necessary questions. Participants then completed a questionnaire, and qualified personnel took their blood pressure three times (with one-minute intervals between each measurement). Depending on the results, participants were given dietary advice and encouraged to adopt a "healthy lifestyle." If hypertension was detected, participants were advised to consult a healthcare professional or their general practitioner. No changes in care or follow-up were imposed by participation in the study.

2.2. Ethical Considerations

Written consent was obtained from participants, and those who refused to participate were excluded without any impact on their care and follow-up in the department. All patients were informed of the confidential nature of the study, and no questions allowing direct or indirect identification of participants were asked. The collected data were strictly anonymized. The study included patients over 18 years old who did not oppose the use of their data.

2.3. Measurement Method

We studied demographic and social data (age, sex, ethnicity, education level), hypertension data (history, treatments, compliance, previous participation in an MMM campaign), cardiovascular risk factors (history of cardiovascular disease, smoking status, alcohol consumption, diabetes), gynecological-obstetric data (pregnancy-induced hypertension, treatments, pregnancy status), and clinical examination data (systolic and diastolic blood pressure, heart rate, weight, height). These parameters were collected via a questionnaire and recorded on a data sheet. Blood pressure was measured in all participants while seated for at least 15 minutes, with an empty bladder, and no coffee or other stimulants. Three measurements were taken at one-minute intervals. Additionally, all participants underwent an electrocardiogram while lying down.

2.4. Statistical Analysis

Data analysis was performed using Epi Info version 7 and R Studio version 4. In the descriptive analysis, qualitative variables were described in frequencies and percentages, while quantitative variables were described as means with standard deviations, extremes, and medians. In the bivariate analysis, we used the binary logistic regression method. All variables with a p -value ≤ 0.05 were included in the modeling of poor prognosis. We used a stepwise modeling approach. Adjusted odds ratios (ORs) with their 95% confidence intervals were calculated for each variable retained in the final model. To assess the goodness-of-fit of the model, we performed the Hosmer-Lemeshow test to verify its adequacy.

3. Results

In our observational study, we enrolled 610 patients, of which 284 were hypertensive, representing a frequency of 46.5% of all consultations. The average age of participants was 54 years, with a range from 18 to 85 years. The most represented age group was 50 to 70 years, comprising 36.6% of the patients (Figure 1). Our study population was predominantly female, with 58.4% women, resulting in a sex ratio of 0.712.

The study of cardiovascular risk factors revealed that hypertension (HTN) was present in 46.5% of the patients. It was more frequent in women (54.2%) than in men (35.7%), and the most representative age group was 50 to 70 years. The prevalence increased from 0% in patients aged 18 to 30 years to over 70% in patients over 70 years. In our sample, 13% of patients who were not previously known to be hypertensive had elevated blood pressure readings.

For the first measurements, 66.39% of patients had normal blood pressure, 20.82% had grade I HTN, 10.82% had grade II HTN, and 1.97% had grade III HTN. For the second measurements, 65.41% of patients had normal blood pres-

sure, 23.77% had grade I HTN, 7.87% had grade II HTN, and 2.95% had grade III HTN. During the third measurements, 69.34% of patients had normal blood pressure, 24.75% had grade I HTN, 3.93% had grade II HTN, and 1.97% had grade III HTN. Thus, successive measurements showed variation in HTN grades, with a progressive decrease in patients with grade II and III HTN, suggesting some improvement or the effect of repeated measurements (Figure 2).

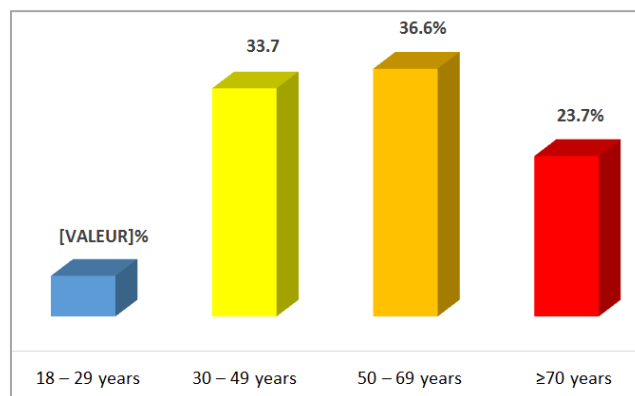


Figure 1. Distribution of Patients by Age Group.

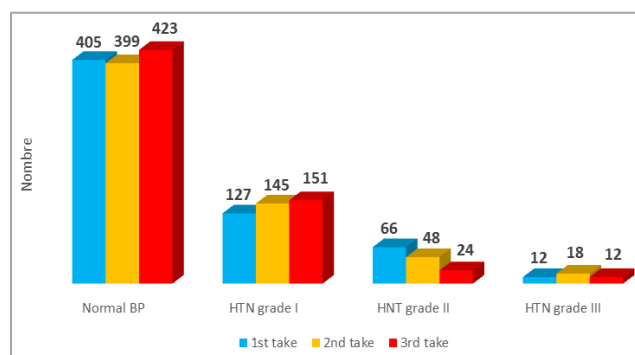


Figure 2. Summary Figure of Different Measurements in Relation to Blood Pressure Values.

From a therapeutic perspective, among the 284 hypertensive patients, 260 paid for their consultations entirely, representing 91.5% of the patients, while 18 paid only a part of their consultations, accounting for 6.4%. More than 93% of hypertensive patients did not have coverage for their medications. Additionally, 8.5% of the patients were not on treatment, 36.1% were on monotherapy, 38.3% on dual therapy, 12.8% on triple therapy, and 4.3% on quadruple therapy. Among these treated patients, 63.8% were well controlled, including 6.7% under lifestyle and dietary measures, 46.7% on monotherapy, 30% on dual therapy, 10% on triple therapy, and 6.6% on quadruple therapy (Figure 3). However, 36.2% of hypertensive patients on treatment were not controlled, with more than half of them on dual therapy (52%).

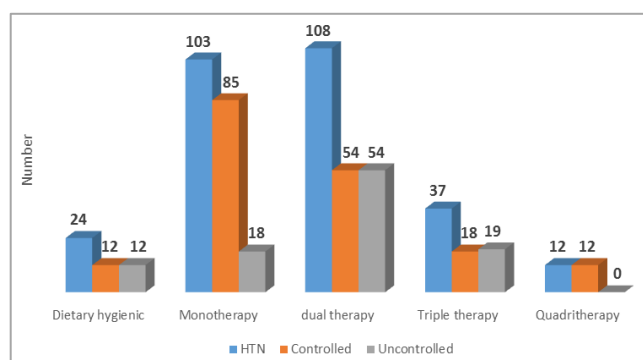


Figure 3. Distribution of Controlled and Uncontrolled Hypertensive Patients by Number of Medications.

Other identified risk factors included overweight (28.7%), obesity (19.8%), sedentary lifestyle, dyslipidemia (15.8% each), diabetes (10.9%), smoking (9.9%), and alcohol consumption (4%). Heart failure was the most frequent comorbidity, found in 5% of cases, followed by stroke and COVID-19 (4% each), and arrhythmia and heart attack (3% each).

Bivariate analysis identified several parameters significantly associated with hypertension: age ≥ 65 years ($p = 0.000$), smoking ($p = 0.036$), dyslipidemia ($p = 0.005$) (Table 1) and Heart Failure ($p = 0.023$).

Table 1. Correlation Between Hypertension and Cardiovascular Risk Factors or Comorbidities.

Factor/Comorbidity	Odds Ratio (OR)	95% Confidence Interval (CI)	p-value
Age 65 years	3.5	2.1 – 5.8	0.000
Smoking	1.8	1.1 – 2.9	0.036
Dyslipidemia	2.2	1.3 – 3.6	0.005
Obesity	1.5	0.9 – 2.4	0.071
Sedentary lifestyle	1.6	1.0 – 2.6	0.056
Diabetes	1.4	0.8 – 2.3	0.092
Alcohol	1.3	0.7 – 2.2	0.112
Heart Failure	2	1.1 – 3.5	0.023
Stroke	1.7	0.9 – 3.1	0.068
COVID-19	1.5	0.8 – 2.8	0.091
Arrhythmia	1.6	0.8 – 3.2	0.104
Heart Attack	1.4	0.7 – 2.9	0.122

4. Discussion

During our study, we encountered various difficulties, primarily due to the non-receptiveness and lack of cooperation from some of the patients interviewed. A majority of them refused to answer our questions. Additionally, we faced challenges related to a lack of information provided to patients upon admission; some were poorly informed about their condition and many were unaware of their treatment details.

The parameters of this study were carried out in a public hospital located on the outskirts of the capital, where hypertension care is primarily used by patients from low and middle-income groups. Consequently, the results of this study cannot be extrapolated to patients belonging to a higher socio-economic group due to differences in psychosocial factors

and living standards. These difficulties may have impacted the quality of the data collected and, consequently, the conclusions of the study. It is pertinent to consider these limitations when interpreting the results and to propose improvements for future studies.

Our observational study highlighted several key aspects of the prevalence and management of hypertension among the patients consulted. This study showed that nearly half (46.5%) of the patients consulting for various reasons suffered from hypertension. This underscores the importance of systematically screening for hypertension in this population. Our significant prevalence was lower than that found in a systematic review and other studies which highlighted the high prevalence of hypertension, with contemporary estimates ranging from 50% to 72% in general medical/surgical and cardiologic populations [19-21].

The average age of participants was 54 years, and the prevalence of hypertension increased with age, reaching over 70% in patients over 70 years old. This trend is consistent with the literature, which shows that age is a major risk factor for hypertension. This is similar to most data reported in Tunisia by Omezzine (64.1 years) [22], in Douala by Essomba (58 years) [23], and in Abidjan by Malik (59.1 years) [24].

Regarding gender distribution, our hypertensive study population was predominantly female (58.4%). These results suggest a gender disparity in hypertension prevalence, which could be related to hormonal, behavioral, or socio-economic factors. A female predominance is reported in Burkina Faso by Konin (59.5%) [25] and in Togo by Pio (56.19%) [26]. Articles analyzed by Mouhtadi et al. (2018) [27] indicated that hypertension mainly affects women. However, AlWabel in 2018 [28] and Liu in 2017 [29] both reported a higher male/female ratio. Substance abuse and tobacco use were the most modifiable risk variables among study participants. Tobacco and alcohol use is more common among men in India [28, 29].

Regarding blood pressure assessment, during the three blood pressure measurements, we observed a progressive decrease in patients with grade II and III hypertension. This could be explained by repeated measurements reducing the "white coat effect." However, there remains a significant proportion of patients with high blood pressure readings requiring special attention. The majority of hypertensive patients (91.5%) paid for their consultations in full, and over 93% had no coverage for their medications. This could pose a barrier to therapeutic adherence and effective hypertension control. Among those on treatment, 63.8% were well controlled, which is encouraging. However, 36.2% of treated hypertensive patients remained uncontrolled, with the majority being on dual therapy, which might indicate the need to optimize therapeutic regimens or intensify non-pharmacological measures. These results were better than those reported in the literature in Tunisia by Omezzine [22] and in Douala [23] with 40.9% and 25.3% controlled hypertensive patients, respectively.

Other cardiovascular risk factors were prevalent, dominated by obesity (19.8%), sedentary lifestyle, dyslipidemia (15.8% each), and diabetes (10.9%), thus increasing the overall risk of cardiovascular complications and necessitating a comprehensive approach to prevention and treatment. Our diabetes figures are close to the prevalence found by Pessinaba S (10.4%) in Saint Louis [30] and Youzan Bi Koi J in Mali (15.42%) [31]. The World Health Organization (WHO) estimated the global diabetes prevalence at 9% in 2012, projecting it to reach 10.1% by 2035 [32]. Diabetes screening often occurs at the complication stage, with few Senegalese undergoing routine check-ups, leading to underdiagnosis in our regions. The presence of these comorbidities (heart failure, stroke, and COVID-19) highlights the severity of uncontrolled hypertension and the importance of holistic manage-

ment for hypertensive patients.

The factors significantly associated with hypertension (age ≥ 65 years, smoking, and dyslipidemia) reinforce current knowledge on hypertension risk factors and underscore the need to target these populations for preventive and therapeutic interventions.

5. Conclusion

This observational study, conducted in the outpatient cardiology department in Dakar, Senegal, as part of the "My Measure Month" program initiated by the French Society of Hypertension, highlighted a high prevalence of hypertension (HTN) in the studied population, with significant challenges in screening, management, and therapeutic care. This prevalence is underestimated and increases significantly with cardiovascular risk factors.

It is crucial to improve access to healthcare and medications, intensify educational and health promotion interventions, and adopt an integrated approach to manage multiple cardiovascular risk factors. These measures will help better control hypertension and reduce the burden of cardiovascular diseases in this population.

Abbreviations

HTN	Hypertension
MMM	My Measure Month
STEPS	National Survey on Non-communicable Diseases
WHO	World Health Organization

Author Contributions

Aliou Alassane Ngaide, and Abdoul Kane designed the study protocol, participated in the data collection and writing of the draft manuscript.

Ngone Diaba Gaye and Alassane Diouf oversaw the execution of the study, participated in data analysis and critically revised the manuscript for important intellectual content.

Zineb Zinia and Mouhamadou Bamba Ndiaye participated in study design and in data analysis.

Joseph Salvador Mingou participated in statistical analysis and interpretation of results.

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Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Risk Factors Associated With Hypertension in Young Adults: A Systematic Review Meghanad Meher, 1 Sourabh Pradhan, 1 and Soumya Ranjan Pradhan. *Cureus*. 2023 15(4): e37467. <https://doi.org/10.7759/cureus.37467>
- [2] Junwang Gu, Qi Wang, Wei Qiu, Fen Lin, Chunmei Wu, Ming Hao and Ping Wu Prevalence of Hypertension and Associated Factors among Residents Aged ≥ 18 Years in Ganzhou, China: A Cross-Sectional Study. *International Journal of Hypertension* 2023, Article ID 5486139, 11 pages <https://doi.org/10.1155/2023/5486139>
- [3] Fuchs F. D. and Whelton P. K., High blood pressure and cardiovascular disease, *Hypertension* 2020; 75(2): 285-292. <https://doi.org/10.1161/HYPERTENSIONAHA.119.14240>
- [4] World Health Organization. Hypertension. <https://www.who.int/fr/news-room/fact-sheets/detail/hypertension>
- [5] Servier, International Society of Hypertension. Because I Say So: <https://servier.com/wp-content/uploads/2020/09/CP-CampagneBISS2020.pdf> 2020, 3 p.
- [6] INEAS. La prise en charge de l'hypertension artérielle chez l'adulte: https://www.ineas.tn/sites/default/files/gpc_hta_13_avril_2021-2.pdf 2021, 120 p.
- [7] Lip G. Y. H., Coca A., Kahan T., Boriani G., Manolis A. S and al. Hypertension and cardiac arrhythmias: executive summary of a consensus document from the European heart rhythm association (EHRA) and ESC council on hypertension, endorsed by the heart rhythm society (HRS), asia-pacific heart rhythm society (APHRS), and sociedad latinoamericana de Estimulación cardíaca y electrofisiología (SOLEACE), *European Heart Journal - Cardiovascular Pharmacotherapy*. 2017; 3(4): 235-50. <https://doi.org/10.1093/europace/eux091>
- [8] Kearney PM, Whelton M, Reynolds K, et al. Global burden of hypertension: analysis of worldwide data. *Lancet*. 2005; 365(9455): 217-23. [https://doi.org/10.1016/S0140-6736\(05\)17741-1](https://doi.org/10.1016/S0140-6736(05)17741-1)
- [9] Noubiap J. J., Nansseu J. R., Nyaga U. F., Sime P. S., Francis I., and Bigna J. J., Global prevalence of resistant hypertension: a meta-analysis of data from 3.2 million patients, *Heart*. 2019; 105(2): 98-105. <https://doi.org/10.1136/heartjnl-2018-313599>
- [10] Foucarde L, Mafart B, Paule P. Hypertension artérielle en Afrique subsaharienne - Actualité et perspectives. *Médecine Tropicale*. 2007; 559-67.
- [11] ANSD. Enquête nationale sur les facteurs de risque des maladies non transmissibles. http://www.ansd.sn/ressources/publications/DV-STEPPS-1-06-2016%20-%20MF-fin_ANSD%20vf.pdf, 2016, 69 p.
- [12] A. Mbaye et al. Prevalence des facteurs de risques cardiovasculaire en milieu semi rural au Senegal. *Annales de Cardiologie et d'Angéiologie*, 2018; 67; 264-9. <https://doi.org/10.1016/j.ancard.2018.04.005>
- [13] Monique R. Hypertension artérielle de l'adulte. Un chapitre du *Référentiel des Collèges Santé publique*. Elsevier Connect. Disponible sur: <https://www.elsevier.com/fr-fr/connect/etudes-de-medecine/item-221-hypertension-artérielle-de-ladulte>, 2019.
- [14] Mancia, Kreutz et al. The Task Force for the management of arterial hypertension of the European Society of Hypertension. 2023 ESH Guidelines for the management of arterial hypertension. *Journal of Hypertension*. 2023; 41: 13-14
- [15] Williams B, Mancia G, Spiering W, Agabiti Rosei E, Azizi M, Burnier M, et al. 2018 ESC/ESH Guidelines for the management of arterial hypertension: The Task Force for the management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension: The Task Force for the management of arterial hypertension of the European Society of Cardiology and the European Society of Hypertension. *J Hypertens* 2018; 36: 1953-2041 <https://doi.org/10.1093/eurheartj/ehy339>
- [16] Cardiologie pratique. *Journal/article/0010688-faut-il-vraiment-prendre-la-pression-artérielle-aux-deux-bras*: <https://www.cardiologie-pratique.com/journal/article/0010688-faut-il-vraiment-prendre-la-pression-artérielle-aux-deux-bras>, 8 p.
- [17] Mills KT, Bundy JD, Kelly TN, Reed JE, Kearney PM, Reynolds K, et al. Global Disparities of Hypertension Prevalence and Control: A Systematic Analysis of Population-based Studies from 90 Countries. *Circulation*. 9 août 2016; 134(6): 441-50. <https://doi.org/10.1161/CIRCULATIONAHA.115.018912>
- [18] Ataklte F, Erqou S, Kaptoge S, Taye B, Echouffo-Tcheugui JB, Kengne AP. Burden of undiagnosed hypertension in sub-saharan Africa: a systematic review and meta-analysis. *Hypertension*. 2015; 65(2): 291-8. <https://doi.org/10.1161/HYPERTENSIONAHA.114.04394>
- [19] R. Neal Axon, Laura Cousineau and Brent M. Egan. Prevalence and Management of Hypertension in the Inpatient Setting: A Systematic Review. *Journal of Hospital Medicine*. September 2011; 6(7). <https://doi.org/10.1002/jhm.804>
- [20] Giantin V, Franchin A, Toffanello ED, et al. Masked and white-coat hypertension in two cohorts of elderly subjects, ambulatory and hospitalized patients. *Arch Gerontol Geriatr*. 2009; 49(1): 125-8. <https://doi.org/10.1016/j.archger.2009.09.021>
- [21] A European Society of Cardiology survey of secondary prevention of coronary heart disease: principal results. EUROASPIRE Study Group. *European Action on Secondary Prevention through Intervention to Reduce Events*. *Eur Heart J*. 1997; 18: 1569-82. <https://doi.org/10.1093/oxfordjournals.eurheartj.a015136>
- [22] Omezzine R, Akkara A, Abdelkafi Koubaa A, Asma BS, Rdissi A, Amamou K. Predictors of Poor Adherence to Hypertension Treatment. *La Tunisie médicale*. 2019; 97: 564-71.

- [23] Essomba NE, Hamadou B, Koum DCK, Atemkeng A, Coppieters Y. Facteurs de Non Observance au Traitement Anti Hypertenseur chez les Adultes à Douala. *Health Sciences and Diseases* 2017; 18(3): 51-57.
<https://doi.org/10.5281/hsd.v18i3.794>
- [24] Malik SK, Kouassi SE, Adoubi AK, Kouamé J, Acka F, Bissouma AC, et al. Environnement Familial et Observance du Traitement de l'Hypertension Artérielle dans une Population d'Hypertendus à Abidjan. *Health Sciences and Diseases*. 2020; 21(2): 68-72.
<https://doi.org/10.5281/hsd.v21i2.1678>
- [25] Konin C, Adoh A, Coulibaly I, Kramoh E, Safou M, N'Guetta R, et al. Black Africans' compliance to antihypertensive treatment. *Journal of Hypertension*. 2007; 25(12): A11.
- [26] Pio M, Baragou S, Afassinou Y, Pessinaba S, Atta B, Ehlan K, et al. Observance thérapeutique de l'hypertension artérielle et ses facteurs dans le service de cardiologie du CHU Tokoin de Lomé The Pan African Medical Journal. 2013; 14: 48.
<https://doi.org/10.1684/mst.2016.0536>
- [27] Mouhtadi BB, Kanaan RM, Iskandarani M, Rahal MK, Halat DH. Prevalence, awareness, treatment, control and risk factors associated with hypertension in Lebanese adults: a cross sectional study. *Glob Cardiol Sci Pract*. 2018; 2018: 6.
<https://doi.org/10.21542/gcsp.2018.6>
- [28] AlWabel AH, Almufadhi MA, Alayed FM, Aloraini AY, Alobaysi HM, Alalwi RM. Assessment of hypertension and its associated risk factors among medical students in Qassim University. *Saudi J Kidney Dis Transpl*. 2018; 29: 1100-8.
<https://doi.org/10.4103/1319-2442.243959>
- [29] Liu X, Xiang Z, Shi X, Schenck H, Yi X, Ni R, Liu C. The risk factors of high blood pressure among young adults in the Tujia-nationality settlement of China. *Biomed Res Int*. 2017; 2017: 8315603. https://doi.org/10.4103/jfmmpc.jfmmpc_1231_21
- [30] Pessinaba S, Mbaye A, Yabáa GAD, Harouna H, Sib AE, Kane AD, et al. Enquête de prévalence des facteurs de risque cardiovasculaire en population générale à Saint-Louis (Sénégal). In: *Annales de Cardiologie et d'Angéologie*. Elsevier; 2013: 253-8.
<https://doi.org/10.1016/j.ancard.2013.02.005>
- [31] Youzan BKJ. Aspects sociodémographiques et cliniques des pathologies cardiovasculaires dans le service de médecine et endocrinologie de l'hôpital du Mali. Thèse Médecine. Université des sciences techniques et des technologies de Bamako. 2019: 14-27.
<https://www.bibliosante.ml/handle/123456789/2081>
- [32] Organisation mondiale de la santé Rapport sur la situation mondiale des maladies non transmissibles. OMS 2010.
<https://apps.who.int/iris/handle/10665/44579>