

Registry of the Egyptian specialized hypertension clinics: Sex-related differences in clinical characteristics and hypertension management among low socioeconomic hypertensive patients

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Abstract

Hypertension is a major modifiable risk factor for cardiovascular disease (CVD) which is a leading cause of death in developing countries affecting both genders. Gender dissimilarity in clinical characteristics and hypertension (HTN) management among hypertensive patients has been reported in several reports before. The aim was to detect sex differences in clinical characteristics and HTN management among Egyptian hypertensive patients. Data from 4701 hypertensive patients attending 9 university located Specialized Hypertension clinic (SHC) were collected from October 2014 to September 2017. The collected data included demographics, cardiovascular risk profile, hypertension-related history, anthropometric and blood pressure (BP) measurements, antihypertensive medications used, number of patients attending the follow-up visits, and HTN control rate. Females represented 58.5% of the recruited patients, they were younger, with higher BMI, lower education level, and employment rate compared with males. Females had lower mean office systolic and diastolic BP than males (144.2 ± 22.6 vs. 146.5 ± 22.0 mmHg and 88.1 ± 13.0 vs. 89.9 ± 12.6 mmHg, respectively) and lower rate of uncontrolled BP (54.8% vs. 61.1% in males $P < .001$). Antihypertensive drugs were comparable among both sexes except for angiotensin converting enzyme inhibitors which were more prescribed in males. Compliance to antihypertensive medications was better in females (63.6% vs. 60.1% in males, $P = .015$). To conclude, Egyptian hypertensive females have different clinical characteristics as compared to their counterpart males with better BP control, adherence to antihypertensive medications, lower systolic and diastolic BP, and no major differences in the prescribed antihypertensive distribution.

1 | INTRODUCTION

Hypertension (HTN) is a chief public-health problem challenging both economically developed and developing countries as it is highly coupled with cardiovascular and kidney disease morbidity

and mortality.¹ Annually, HTN is responsible for 10.4 million deaths worldwide and is the leading risk factor for disability-adjusted life years (DALYs) accounting for 218 million DALYs.²

At year 2000, the estimated prevalence of HTN was 26.4% among people aged ≥ 20 years with almost 2/3 of such people

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living in developing countries.¹ By 2010, the worldwide prevalence reached 31.1% with 7.7% increase of prevalence in developing countries and 2.6% decrease in developed countries when compared to year 2000.³

HTN is the most common modifiable risk factor for cardiovascular disease which is the leading cause of death in women.⁴ The predicted global prevalence of HTN in women at 2025 is 29.5% with 13% predicted increase in worldwide prevalence of HTN in women from 2000 to 2025% versus 11% in male.¹ In general, women showed better awareness, treatment, and control rate of HTN than men both in economically developed and developing countries.⁴

Data from the Egyptian National Hypertension Project (NHP) showed that prevalence of HTN was 26.3% among Egyptian adults with an awareness rate of 37.5% with 23.9% of patients receiving antihypertensive medications and control rate of only 8%.⁵

Specialized hypertension clinics (SHCs) are outpatient clinics specialized in treating hypertensive Egyptian patients. They were launched in 2014 in 9 university hospitals across Egypt. A well-formed and electronically coded registry website was initiated for data entry and data from 4700 hypertensive patients were collected until 2017.⁶

Since CVD is the leading cause of death in Egyptians (48.1%) and specifically in women (50.1%)⁷ and HTN is an important preventable risk factor, it looks appealing to address the characteristics of HTN in Egyptian women. The aim is to study the sex-related differences in HTN clinical characteristics, treatment, and control among patients visiting the SHCs.

2 | METHODS

The Egyptian SHCs began in 9 university hospitals, distributed along different geographical areas of Egypt. These regions included Great Cairo (Cairo, Ain Shams, and Helwan University Hospitals), Coastal regions (Alexandria and Suez Canal Universities), Upper Egypt (Assiut and Menia Universities), Lower Egypt (Beni Suef University), and Delta region (Zagazig University).

Data of 4701 hypertensive patients were collected between October 2014 and September 2017. The case report forms (CRF) included comprehensive data about demographic characteristics, such as age, sex, employment, and educational level (low educational level was used to describe illiterates and those who can barely read /write). Patients were interrogated about history and duration of HTN, risk factors and associated co-morbid conditions (eg, chronic obstructive airway disease, peripheral arterial disease, diabetes mellitus, coronary artery disease, chronic kidney disease, cerebrovascular disease), type, side effects and compliance to antihypertensive medications and consumption of other drugs that may affect the BP (eg, nasal decongestants, non-steroidal anti-inflammatory drugs (NSAID), corticosteroids, or oral contraceptive pills (OCPs). Smoking was defined as actively smoking or utilizing tobacco within the past 6 months.

Examination included anthropometric measurements (body weight, height, and waist circumference) and supine and standing

heart rate and blood pressure (BP). The body mass index (BMI) was calculated as the weight in kilograms divided by the height in meters square.

Obesity was defined as a body mass index (BMI) ≥ 30 kg/m².⁸ Waist circumference (WC) measurements were taken using a measuring tape. WC was measured from the horizontal plane midway between the lowest lateral border of the rib cage and iliac crest with cutoff value of 93.5 cm for men and 92.5 cm for women.⁹

The BP was measured according to the standardized protocols using digitalized BP measuring devices (OMRON M-6, Japan), which is an FDA certified device. To reduce within-patient variability, patients were asked to rest for 5 minutes then BP was measured in the sitting position, three times in each arm, 1 minute apart. The first reading was omitted, and the next two readings were averaged. The arm with the higher BP was considered the reference arm in the follow-up visits. Standing BP was recorded once in the first visit after two minutes of standing. Hypertension was defined as systolic BP (SBP) ≥ 140 mmHg, and/or diastolic BP (DBP) ≥ 90 mmHg, and/or the use of antihypertensive medications. Controlled HTN was defined as BP $< 140/90$ mmHg in hypertensive patients on antihypertensive medications. Severity of HTN was defined as mild if BP = 140-159/90-99 mmHg, moderate if BP = 160-179/100-109 mmHg, and severe if BP $\geq 180/110$ mmHg.¹⁰

Diabetes mellitus (DM) was defined as a hemoglobin A1c (HbA1c) level of 6.5% or higher, fasting plasma glucose (FPG) level of 126 mg/dl or higher; or a 2-hour plasma glucose level of 200 mg/dl or higher; and/or a random plasma glucose of 200 mg/dl or higher. All measurements were taken at least twice.¹¹ Patients were also considered diabetics if they were previously diagnosed and are receiving anti-diabetic agents.

Dyslipidemia was considered when low density lipoprotein (LDL) cholesterol was ≥ 130 mg/dl, or high density lipoprotein (HDL) cholesterol ≤ 50 mg/dl in women and ≤ 40 mg/dl in men, increased triglycerides (TG) ≥ 150 mg/dl, or if the patient is currently receiving a lipid lowering agent.¹²

A cardiovascular global risk was assessed based on the Egyptian guidelines risk scoring system for hypertensive patients.¹³ Patients with established cardiovascular diseases (coronary artery disease, cerebrovascular disease, peripheral arterial disease) as well as patients with renal failure were considered at a very high risk for future cardiovascular events. Patients with diabetes mellitus, target organ damage and patients with more than 3 cardiovascular risk factors (male gender, female age > 55 or male age > 45 , current smokers, dyslipidemia, obesity) were categorized as a high-risk group, while patients with 1-3 cardiovascular risk factors were considered as an intermediate-risk group. Patients with no additional risk factors and no target organ damage presented the low-risk group.

2.1 | Statistical analysis

Statistical analysis was performed using SPSS 20 version. Qualitative data are presented as frequency and percentage while quantitative

Variable	Total (n = 4701)	Males (n = 1948)	Females (n = 2753)	P-value
Age, years, mean ± SD	51.8 ± 11.5	52.3 ± 11.4	51.5 ± 11.6	.01
BMI, kg/m ² , mean ± SD	32.4 ± 7.2	31.2 ± 6.5	33.3 ± 7.5	<.001
Waist circumference, cm	103.1 ± 15.2	101.8 ± 14.7	103.9 ± 15.5	<.001
Occupation, employed	1693 (36.0)	1050 (53.9)	643 (23.4)	<.001
Low educational level	2462 (52.3)	835 (42.8)	1627 (59.1)	<.001
Current smokers	1099 (23.4)	889 (45.6)	210 (7.6)	<.001

Note: Abbreviations: BMI; Body mass index, SD; Standard deviation.

TABLE 1 Demographic characteristics of the patients

data are presented as mean and standard deviation. Chi-square test was used to compare a 2x2 categorical data, and Student's *t* test was used to compare continuous variables between two groups. *P*-value of $\leq .05$ is considered significant.

3 | RESULTS

The study included 4701 Egyptian hypertensive patients, 2753 (58.6%) of them were females. Table 1 shows the demographic characteristics of males and females. Hypertensive females were younger, heavier, and less educated than hypertensive males. As more than three quarters of female patients were housewives, and as the clinic was in the morning at the working times, more hypertensive females visited the SHC as compared to males.

Female showed lower systolic and diastolic blood pressure values and had a higher rate of BP control compared with males. Despite the fact that most of the patients ($n = 3859$, 82.0%) were already known to have HTN before the first presentation to SHCs, yet only one third (34.6%) underwent previous HTN-related investigations and females were less investigated. Most females (62.5%) were in the low- and intermediate-risk categories, while half males were in the high- and very high-risk categories (Table 2).

Despite that 3859 patients (82%) had chronic HTN, yet only 2949 (76.4%) of them were prescribed antihypertensive drugs. Among those who were prescribed drugs ($n = 2949$), 19.9% ($n = 587$) were non-compliant to their medications and compliance was better in females as compared to males (Table 3). More than one third of the patients were using other medications that were known to elevate the BP.

Table 4 shows the sex-related differences in the co-morbidities. Females had significantly lower prevalence of CAD, heart failure, and COPD but higher prevalence of thyroid diseases and arthritis.

More than half of the patients ($n = 2699$, 57.4%) who came to the SHC had uncontrolled HTN (Table 5 and Figure 1). Females with uncontrolled HTN had a bigger BMI and higher supine DBP and HR as compared to their counterpart males (Table 5).

After the first visit, all patients were asked to come to follow up their BP, but only a quarter of them ($n = 1182$, 25.1%) were compliant to their 2nd visit and even less patients came in the 3rd visit ($n = 547$, 11.6%). A progressively less number of patients attended

the subsequent clinic visits (Figure 2). Females were generally more compliant than males.

On the first visit, 1699 patients (57.4%) had uncontrolled HTN (systolic and/or diastolic), of those, 745 patients (43.8%) attended the second visit and the control rate among them was 44.4% ($n = 331$). On the third visit, 227 patients had uncontrolled HTN in the first and second visits, among whom, the rate of BP control was 44.5% ($n = 101$ patients). Figures 1, 3 and 4 show that uncontrolled HTN was higher in males in the first and second visits, while in the third visit, more females were uncontrolled as compared to males.

4 | DISCUSSION

HTN is a major controllable risk factor for CVD morbidity and mortality worldwide. There has been a paradigm shift in the prevalence of HTN from high-income to low- and middle-income countries in the preceding few decades.¹⁴ Given the high economic burden of HTN-related disabilities, a global target of reducing its prevalence by 25% at year 2025 compared with 2010 has been adopted.¹⁵ The current study is the first nationwide study that addresses sex-related differences in demographics, clinical characteristics, and HTN management among hypertensive Egyptians. It showed that females had a lower systolic (144.2 vs. 146.5 mmHg, $P = .001$) and a lower diastolic blood pressure (88.1 vs. 89.9 mmHg, $P < .001$) compared with males. Females had better BP control rate (45.2% vs. 38.9%, $P < .001$) and better compliance to antihypertensive medications (63.6% vs. 60.1%, $P = .015$).

Since 2007, HTN had become the leading risk factor for DALYs (disability-adjusted life years) in women.² Women are more susceptible to die from HTN-related CVD than men with the greatest lifetime risk of CVD in hypertensive women is between the age of 41-55.^{16,17} Despite the increase in absolute burden of HTN for both genders globally, there has been a decrease in absolute burden of HTN in women in the Middle East and North Africa.³ Each 1-SD decrease in 24-hour systolic BP in women is accompanied by a higher reduction of preventable CV events as compared to men (35.9% vs. 24.2%).¹⁸

The global age standardized prevalence of HTN is higher in men than women (24.1% vs. 20.1%) which has been the same in all specific age-groups below the age of 50 years.^{3,14} However, above the age of 50 years there is an increase in the prevalence of HTN

TABLE 2 Diagnosis of HTN and cardiovascular risk on the first visit

Variable	Total (n = 4701)	Males (n = 1948)	Females (n = 2753)	P-value
Recently discovered HTN	842 (18.0)	413 (21.3)	429 (15.7)	<.001
Presence of symptoms	3247 (69.8)	1359 (70.6)	1888 (69.5)	.35
Previous investigations of HTN	1334 (28.4)	602 (30.9)	732 (26.6)	.001
SBP, mmHg	145.2 ± 22.4	146.5 ± 22.0	144.2 ± 22.6	.001
DBP, mmHg	88.7 ± 12.9	89.9 ± 12.6	88.1 ± 13.0	<.001
Uncontrolled BP on first visit	2699 (57.4)	1191 (61.1)	1508 (54.8)	<.001
Stages of HTN on presentation				
Mild HTN	1417 (31.3)	650 (33.4)	821 (29.8)	.01
Moderate HTN	915 (19.5)	405 (20.8)	510 (18.5)	.053
Severe HTN	313 (6.7)	136 (7.0)	177 (6.4)	.454
Cardiovascular risk on 1st visit				
Low risk	381 (8.1)	0 (0)	381 (13.8)	NA
Intermediate risk	2305 (49.0)	965 (49.5)	1340 (48.7)	.56
High risk	1005 (21.4)	489 (25.1)	516 (18.7)	<.001
Very high risk	1010 (21.5)	494 (25.4)	516 (18.7)	<.001

Note: Abbreviations: DBP; Diastolic blood pressure, HTN; Hypertension, SBP; Systolic blood pressure.

in women vs. men and the prevalence gap between both genders widens as age advances.³

The change of HTN prevalence in women with age is attributable to multiple factors.¹⁹ Sex hormonal changes with menopause may play an important role as it is associated with pronounced increase in

systolic BP and pulse pressure after menopause compared with men of the same age-group.²⁰ However, other factors may also contribute to this phenomenon including genetic predisposition, aging, obesity, and arterial stiffness.¹⁹ However, the main mechanisms underlying sex-related difference in HTN is still unknown, but this may be related

TABLE 3 Chronic medications

Variable	Total (n = 4701)	Males (n = 1948)	Females (n = 2753)	P-value
Antihypertensive medications				
Previous antihypertensive drugs	3149 (67.0)	1299 (66.7)	1850 (67.2)	.7
Type of antihypertensive drugs				
Beta-blocker	1439 (30.6)	568 (29.2)	871 (31.6)	.07
CCB	458 (9.7)	202 (10.4)	256 (9.3)	.22
ACEI	911 (19.4)	383 (19.7)	528 (19.2)	.68
ARBs	223 (4.7)	107 (5.5)	116 (4.2)	.04
Diuretics	420 (8.9)	165 (8.5)	255 (9.3)	.35
Compliance to antihypertensives	2922 (62.2)	1171 (60.1)	1751 (63.6)	.015
Drug side effects	391 (8.3)	157 (8.1)	234 (8.5)	.59
Other chronic drugs				
Nasal drops	117 (2.5)	45 (2.3)	72 (2.6)	.51
Corticosteroids	151 (3.2)	67 (3.4)	84 (3.1)	.46
NSAIDs	540 (11.4)	223 (11.4)	317 (11.5)	.94
OCPs		-	118 (4.3)	-

Note: Abbreviations: ACEI; Angiotensin converting enzyme inhibitor, ARBs; Angiotensin receptor blockers, CCB; Calcium channel blocker, NSAIDs; Non-steroidal anti-inflammatory drugs, OCPs; Oral contraceptive pills.

Variable	Total (n = 4701)	Males (n = 1948)	Females (n = 2753)	P-value
Associated medical condition	2598 (55.3)	1130 (58.0)	1468 (53.3)	.001
DM	1182 (25.1)	471 (24.2)	711 (25.8)	.20
Dyslipidemia	420 (8.9)	194 (10.0)	226 (8.2)	.038
CKD	132 (2.8)	64 (3.8)	68 (2.5)	.095
CAD	724 (15.4)	360 (18.5)	364 (13.2)	<.001
CVA	192 (4.1)	86 (4.4)	106 (3.9)	.34
PAD	37 (0.8)	16 (0.8)	21 (0.8)	.82
Arthritis	353 (7.5)	127 (6.5)	226 (8.2)	.03
Bronchial asthma	166 (3.5)	67 (3.4)	99 (3.6)	.77
Heart failure	147 (3.1)	80 (4.1)	67 (2.4)	.001
Depression/Anxiety	195 (4.1)	86 (4.4)	109 (4.0)	.44
Thyroid diseases	134 (2.9)	40 (2.1)	94 (3.4)	.006
COPD	92 (2.0)	55 (2.8)	37 (1.3)	<.001
Prostatic hypertrophy		91 (4.7)	-	
Erectile dysfunction		66 (3.4)	-	

Note: Abbreviations: CAD; Cerebrovascular disease, DM; Chronic kidney disease, COPD; Chronic obstructive pulmonary disease, CVA; Coronary artery disease, CKD; Diabetes mellitus, PAD; Peripheral arterial disease.

TABLE 4 The prevalence of comorbidities among the studied population

Variable	Total (n = 4701)	Males (n = 1948)	Females (n = 2753)	P-value
Age, years	52.6 ± 11.0	52.4 ± 11.0	52.8 ± 11.0	.35
BMI, Kg/m ²	32.6 ± 6.8	31.6 ± 6.1	33.3 ± 7.3	<.001
Supine SBP, 1st visit, mmHg	160.9 ± 27.1	161.0 ± 27.4	160.8 ± 26.9	.84
Supine DBP, 1st visit mmHg	95.2 ± 14.1	95.8 ± 16.4	94.7 ± 11.9	.046
Standing SBP, mmHg	142.4 ± 20.1	141.6 ± 19.4	143.0 ± 20.6	.38
Standing DBP, mmHg	87.6 ± 11.0	87.1 ± 10.5	87.9 ± 11.4	.32
Supine HR, bpm	80.0 ± 13.5	78.8 ± 12.2	80.9 ± 14.3	<.001
Standing HR, bpm	74.5 ± 31.2	73.8 ± 26.0	75.1 ± 34.8	.27

Note: Abbreviations: BMI; Body mass index, DBP; Diastolic blood pressure, HR; Heart rate, SBP; Systolic blood pressure.

TABLE 5 Profile of patients with uncontrolled HTN on the first visit to SHCs

to the fact that the main mechanisms involved in the pathogenesis of HTN as the rennin-angiotensin system, the sympathetic nervous activity, the sex hormones, endothelin-1, and the immune system have different effects in females and males.²¹ Also the socioeconomic status may play a role as there may be different gender-related response to the effect of socioeconomic status on lifestyle behavior, social support, and access to health care services.²²

This study showed a better BP control in females compared with males. These results are concordant with various reports from different continents.^{23,24} Same results were reported from other Middle Eastern countries as Kingdom of Saudi Arabia (KSA), where females showed a better BP control rate (41.1% vs. 32.0% in males).²⁵ Data from Turkey proved a better control rate in females

as well (37.3% vs. 18.9%, $P < .001$).²⁶ On the contrary to the previous reports, the (I-SEARCH) study showed a better control of BP in males (34% vs. 31%).²⁷ This can be explained by the fact that 60% of women in that study were above the age of 60 years, an age-group that is associated with a lower BP control rate when compared to females less than 60 years (23% vs. 38%) as was demonstrated by the Framingham study.²⁸

Despite the baseline demographic differences between both sexes in our study, the better control rate of BP in females may be attributable to the finding that females were more compliant to their antihypertensive treatment than males.

Our study showed no significant difference in the rate of treatment between both sexes. This result is similar to the results reported

from KSA regarding treatment rates (69.9% females vs. 74.2% males, $P = .662$).²⁵ However, other reports from Germany,²³ Turkey,²⁶ and National Health and Nutrition Examination Study (NHANES)²⁹ showed that treatment rates were significantly higher in females than males. This discrepancy may be related to the lower education level and the lower rate of employment in our female cohort which may be associated with limited access to health care facilities. This may also explain why hypertensive females were less subjected to HTN-related investigations compared with males.

Apart from discouragement of renin-angiotensin blocker use during childbearing period, there should be no sex-specific preference in the choice of available antihypertensive medications.²³ However, disparities in the prescribed medications among both genders have been reported. It was found that females were more likely prescribed diuretics and β -blockers while males were more likely prescribed rennin-angiotensin and calcium channel blockers.^{16,27} This disparity of prescribed medications may be explained by the difference in comorbidities between both genders which influence the

choice of the prescribed antihypertensive medications and the fact that drugs have sex-related side effect as it was found that females experience more dry cough with ACE inhibitors and more lower limb edema with calcium channel blockers.^{30,31} On the other hand, beta blockers are associated with sexual dysfunction in men, an adverse effect which is rarely reported by women on β -blockers.³²

Similar to a German study addressing the gender gap in HTN,²³ our study showed no difference in drug distribution between both genders except for ARBS which was more prescribed in males than females.

Adherence to the antihypertensive medications is crucial to achieve guidelines recommended BP goals. However, adherence is affected by multiple factors interacting together in different ways.³³ Such factors include the class of the prescribed drug and whether it is a single (whether monotherapy or combination pill) or multiple pills with the highest discontinuation rate reported with diuretics monotherapy.³⁴ Also, adherence is affected by associated diseases and their nature with better compliance seen in patients with associated CVD compared with those with non-CVD.³³ Our study showed better drug compliance in females which is in contrast to what reported by Manica et al³³ This discrepancy may be related to social and environmental differences between the two studied groups.

The results of our study are similar to that reported by NHP more than 2 decades ago, where Egyptian females showed a higher control rate (10.9% vs. 4.8%) and a higher treatment rate than males (8.2% vs. 4.3%).⁵ However, there has been substantial improvement in the control and treatment rates in both sexes since the NHP results were demonstrated as shown by our study.

The main limitation of this study is that all of the recruited patients came from a low socioeconomic environment which represented the main population visiting the SHCs at the allocated university hospitals and thus the results of this study could not be a reflection to the whole Egyptian hypertensive population. A larger

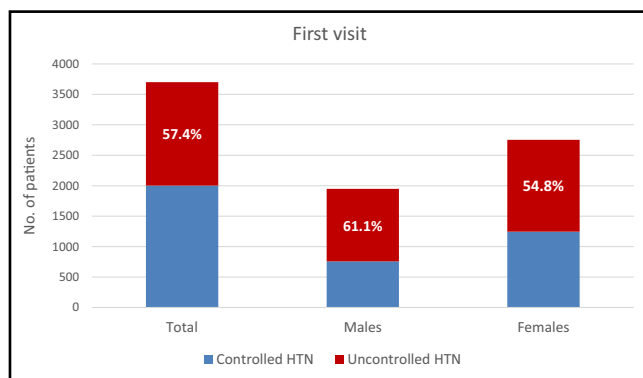


FIGURE 1 Rate of HTN control in both genders at the first visit (P -value < .001)

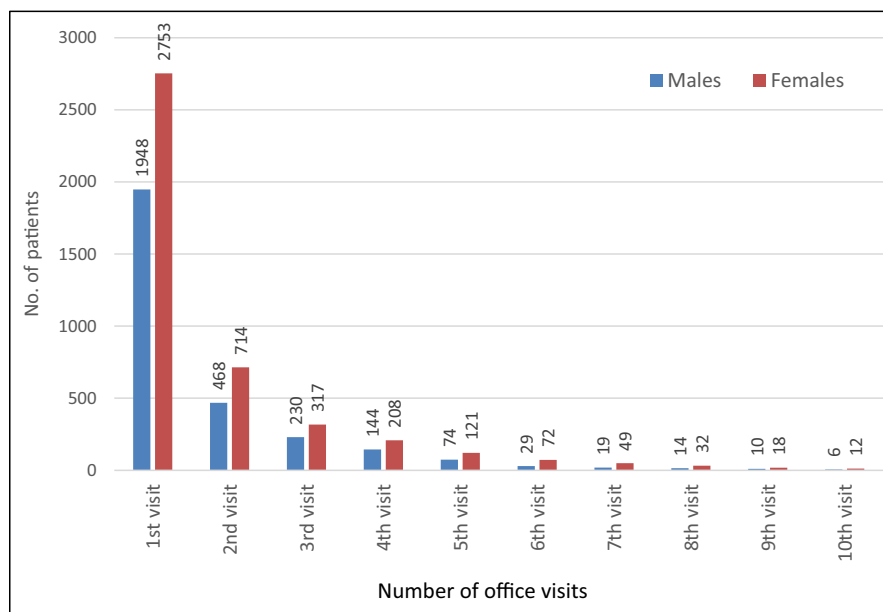


FIGURE 2 Number of patients attending the follow-up visits

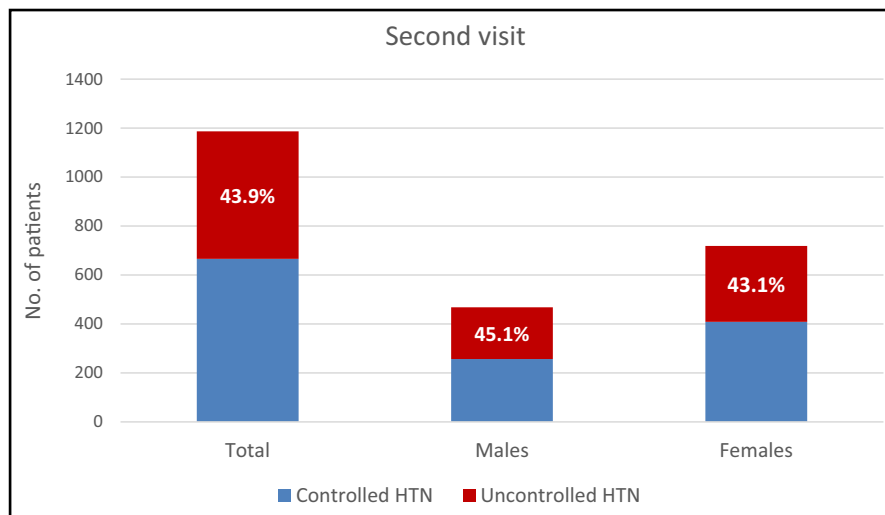


FIGURE 3 Rate of HTN control in both genders at the second visit (P-value = .50)

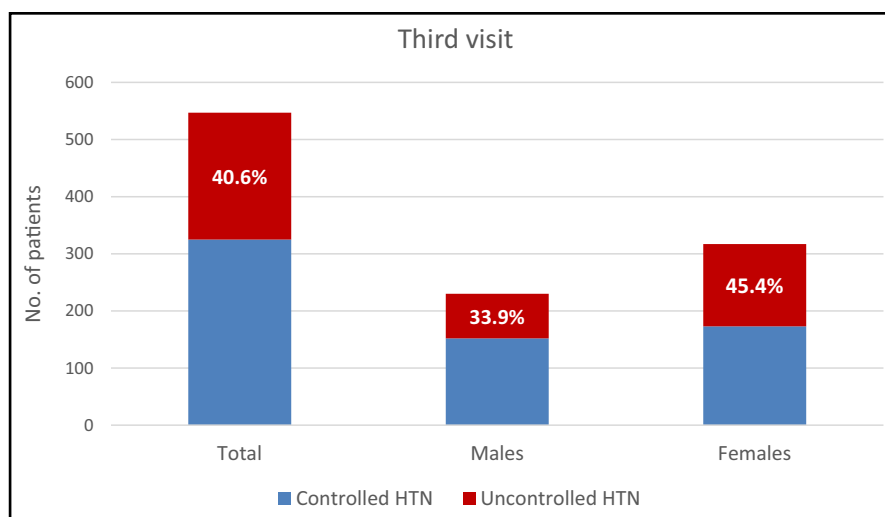


FIGURE 4 Rate of HTN control in both genders at the third visit (P-value = .007)

study including patients from different socioeconomic backgrounds is needed to support the results of this study.

As defining the problem is the first step to solving it, we think that the initiation of SHCs may be the first step in the right way for proper management of HTN and associated CVS risk factors aiming to reduce cardiovascular morbidity and mortality among Egyptians. It could be the cornerstone for the establishment of nationwide HTN control program which may be a part of a bigger project for prevention of cardiovascular diseases similar to the North Karelia Project which was first established in low socioeconomic province of North Karelia in east of Finland and then applied all over Finland.³⁵ The North Karelia project was associated with significant reduction in mean systolic pressure in both genders and more than 80% reduction in the annual age-adjusted cardiovascular mortality proving the efficacy of such program.³⁵ Another useful program for the prevention of cardiovascular diseases within integration of hypertension management is the HEART program of the WHO.³⁶ Applying this stepwise strategic approach for the diagnosis, management and follow-up may improve the overall health care provided and the compliance of hypertensive patients. Initiation of such programs in Egypt

should be tailored to target the sex-related differences demonstrated in this study and develops a protocol to overcome the poor adherence to follow up visits present in both sexes.

5 | CONCLUSION

This study demonstrates the sex-based differences in demographic, clinical characteristics, and HTN management among Egyptian hypertensive patients. Despite the lower education level, employment rate, and the larger BMI, Egyptian hypertensive females showed a better BP control rate, a lower systolic and diastolic BP, and a better adherence to the antihypertensive medications.

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CONFLICT OF INTEREST

The authors have nothing to declare.

AUTHOR CONTRIBUTION

AA, GY, and WE had drafted the manuscript and revised it critically for important intellectual content. AA, GY, AE, DE, HE, WE, and MMI had substantial contributions to the conception or design of the work; the acquisition, and the interpretation of data for this work. All authors agreed to all aspects of the work and ensured that questions related to the accuracy or integrity of any part of the work were appropriately investigated and resolved.

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REFERENCES

- Kearney PM, Whelton M, Reynolds K, Muntner P, Whelton PK, He J. Global burden of hypertension: analysis of worldwide data. *Lancet*. 2005;365(9455):217-223.
- Collaborators GBD. Global, regional, and national comparative risk assessment of 84 behavioural, environmental and occupational, and metabolic risks or clusters of risks for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet*. 2018;392(10159):1923-1994.
- Mills KT, Bundy JD, Kelly TN, et al. Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation*. 2016;134(6):441-450.
- Oparil S. Women and hypertension: what did we learn from the Women's Health Initiative? *Cardiology in review*. 2006;14(6):267-275.
- Ibrahim MM, Rizk H, Appel LJ, et al. Hypertension prevalence, awareness, treatment, and control in Egypt. Results from the Egyptian National Hypertension Project (NHP). NHP Investigative Team. *Hypertension*. 1995;26(6 Pt 1):886-890.
- El Faramawy A, Youssef G, El Aroussy W, et al. Registry of the Egyptian specialized hypertension clinics: patient risk profiles and geographical differences. *J Hum Hypertens*. 2019.
- Central agency of public mobilization and statistics report 2017 [Available from: <http://www.capmas.gov.eg/HomePage.aspx>].
- Jensen MD, Ryan DH, Apovian CM, et al. 2013 AHA/ACC/TOS guideline for the management of overweight and obesity in adults: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines and The Obesity Society. *Circulation*. 2014;129(25 Suppl 2):S102-S138.
- Ibrahim MM, Elamragy AA, Girgis H, Nour MA. Cut off values of waist circumference and associated cardiovascular risk in Egyptians. *BMC Cardiovasc Disord*. 2011;11:53.
- Mancia G, Fagard R, Narkiewicz K, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). *Eur Heart J*. 2013;34(28):2159-2219.
- American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes Care*. 2010;33(Suppl 1):S62-S69.
- Reiner Z, Catapano AL, De Backer G, et al. ESC/EAS Guidelines for the management of dyslipidaemias: the Task Force for the management of dyslipidaemias of the European Society of Cardiology (ESC) and the European Atherosclerosis Society (EAS). *Eur Heart J*. 2011;32(14):1769-1818.
- The Egyptian Hypertension Society. Egyptian hypertension guidelines. *The Egyptian Heart journal*. 2014;66(2):79-132.
- NCD Risk Factor Collaboration. Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19.1 million participants. *Lancet*. 2017;389(10064):37-55.
- WHO. Global Action Plan for the Prevention and Control of NCDs 2013–2020 2013 [Available from: https://www.WHO.int/nmh/events/ncd_action_plan/en/].
- Muiesan ML, Salvetti M, Rosei CA, Paini A. Gender differences in antihypertensive treatment: myths or legends? *High blood pressure & cardiovascular prevention*. 2016;23(2):105-113.
- Allen N, Berry JD, Ning H, Van Horn L, Dyer A, Lloyd-Jones DM. Impact of blood pressure and blood pressure change during middle age on the remaining lifetime risk for cardiovascular disease: the cardiovascular lifetime risk pooling project. *Circulation*. 2012;125(1):37-44.
- Boggia J, Thijs L, Hansen TW, et al. Ambulatory blood pressure monitoring in 9357 subjects from 11 populations highlights missed opportunities for cardiovascular prevention in women. *Hypertension*. 2011;57(3):397-405.
- Wenger NK, Arnold A, Bairey Merz CN, et al. Hypertension across a woman's life cycle. *J Am Coll Cardiol*. 2018;71(16):1797-1813.
- Martins D, Nelson K, Pan D, Tareen N, Norris K. The effect of gender on age-related blood pressure changes and the prevalence of isolated systolic hypertension among older adults: data from NHANES III. *J Gen Intern Med*. 2001;4(3):pp. 10–3, 20.
- Song JJ, Ma Z, Wang J, Chen LX, Zhong JC. Gender differences in hypertension. *Cardiovasc Transl Res*. 2020;13(1):47-54.
- Neufcourt L, Deguen S, Bayat S, Zins M, Grimaud O. Gender differences in the association between socioeconomic status and hypertension in France: A cross-sectional analysis of the CONSTANCES cohort. *PLoS One*. 2020;15(4):e0231878.
- Sarganas G, Neuhauser HK. The persisting gender gap in hypertension management and control in Germany: 1998 and 2008–2011. *Hypertens Res*. 2016;39(6):457-466.
- Gu Q, Burt VL, Dillon CF, Yoon S. Trends in antihypertensive medication use and blood pressure control among United States adults with hypertension: the National Health And Nutrition Examination Survey, 2001 to 2010. *Circulation*. 2012;126(17):2105-2114.
- Saeed AA, Al-Hamdan NA, Bahnassy AA, Abdalla AM, Abbas MA, Abuzaid LZ. Prevalence, awareness, treatment, and control of hypertension among Saudi adult population: a national survey. *International journal of hypertension*. 2011;2011:174135.
- Sengul S, Akpolat T, Erdem Y, et al. Changes in hypertension prevalence, awareness, treatment, and control rates in Turkey from 2003 to 2012. *J Hypertens*. 2016;34(6):1208-1217.
- Thoenes M, Neuberger HR, Volpe M, Khan BV, Kirch W, Böhm M. Antihypertensive drug therapy and blood pressure control in men and women: an international perspective. *J Hum Hypertens*. 2010;24(5):336-344.
- Lloyd-Jones DM, Evans JC, Levy D. Hypertension in adults across the age spectrum: current outcomes and control in the community. *JAMA*. 2005;294(4):466-472.
- Mozaffarian D, Benjamin EJ, Go AS, et al. Heart disease and stroke statistics–2015 update: a report from the American Heart Association. *Circulation*. 2015;131(4):e29-322.
- Os I, Bratland B, Dahlöf B, Gisholt K, Syvertsen JO, Tretli S. Female preponderance for lisinopril-induced cough in hypertension. *Am J Hypertens*. 1994;7(11):1012-1015.

31. Kloner RA, Sowers JR, DiBona GF, Gaffney M, Wein M. Sex- and age-related antihypertensive effects of amlodipine. The Amlodipine Cardiovascular Community Trial Study Group. *Am J Cardiol.* 1996;77(9):713-722.
32. Grimm RH Jr, Grandits GA, Prineas RJ, et al. Long-term effects on sexual function of five antihypertensive drugs and nutritional hygienic treatment in hypertensive men and women. Treatment of Mild Hypertension Study (TOMHS). *Hypertension.* 1997;29(1 Pt 1):8-14.
33. Mancia G, Zambon A, Soranna D, Merlino L, Corrao G. Factors involved in the discontinuation of antihypertensive drug therapy: an analysis from real life data. *J Hypertens.* 2014;32(8):1708-1715.
34. Corrao G, Parodi A, Zambon A, et al. Reduced discontinuation of antihypertensive treatment by two-drug combination as first step. Evidence from daily life practice. *J Hypertens.* 2010;28(7):1584-1590.
35. Puska P, Jäini P. The North Karelia project: prevention of cardiovascular disease in Finland through population-based lifestyle interventions. *American journal of lifestyle medicine.* 2020;14(5):495-499.
36. WHO. Cardiovascular disease, HEARTS technical package [Available from: https://www.WHO.int/cardiovascular_diseases/hearts/en/].

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