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ORIGINAL RESEARCH

Hypertension Prevalence, Awareness, and Control Among Parents of School-Aged Children in the United Arab Emirates

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Background: Increased blood pressure (BP) is a major cardiovascular disease risk factor. The study aimed to determine the prevalence and predictors of hypertension and its awareness and control among parents of school-aged children in the United Arab Emirates (UAE).

Methods: A total of 605 parents participated in this cross-sectional study. Information on socio-demographics, lifestyle factors, and history of chronic disease were collected through an adapted version of the World Health Organization STEPS questionnaire. Fasting blood glucose samples, BP measurements, body mass index (BMI), and waist and hip circumference were obtained using standard measurement protocols. Prevalence of hypertension was identified in the cohorts by defining hypertension using the 2017 American College of Cardiology (ACC) and the American Heart Association (AHA) guidelines (BP≥130/80 mmHg) and the World Health Organization-International Society of Hypertension Guidelines Orchid (BP≥140/90 mmHg) in association with antihypertensive medication use.

Results: The mean age of participants was 42.9±7.9 years. The prevalence of hypertension was 37.2% (95% CI: 33.5–41.2) and 18.0% (95% CI: 15.2–21.3), using the 2017 and the previous WHO definitions, respectively. Little over half of the sample (51.5%) who were aware of having hypertension reported using antihypertensive medications. Of those reporting the use of antihypertensive medications in the past two days, 13 of 33 patients (39.4%) had their hypertension under control (<140/90 mmHg). The independent correlates of hypertension included age [(adjusted odds ratio (AOR): 1.09 (1.05–1.13], male sex [AOR: 2.48 (1.41–4.34], college or higher education [AOR: 0.22 (0.09–0.56)], family history of hypertension [AOR: 2.03 (1.17–3.53)], obesity [AOR: 3.15 (1.24–7.12)], and moderate or vigorous physical activity [AOR: 0.50 (0.26–0.98)].

Conclusion: Hypertension is prevalent among parents of school-going children. Improving lifestyle, health literacy, and introducing innovative models to raise awareness and education about hypertension are essential to achieve sustainable development goals (SDGs).

Keywords: blood pressure, sustainable development goals, medication adherence, United Arab Emirates, primary care, parents, native population, Arabs

Introduction

High blood pressure (BP) constitutes a major modifiable risk factor for cardiovascular diseases (CVD) in developed and developing countries and is associated with an estimated substantial cost of >10% of all healthcare expenditures.[1,2] The current American College of Cardiology and the American Heart Association (ACC/AHA) 2017 guidelines define hypertension as systolic BP (SBP) of ≥130 mmHg or diastolic BP (DBP) of ≥80 mmHg.[3] In adults, an increase of 20 mmHg in SBP or 10 mmHg in DBP is associated with more than a two-fold increase in mortality owing to stroke and other cardiovascular diseases.[4] Hypertension accounts for 13% of premature deaths worldwide[5,6] and is the third leading cause of disability-adjusted life years.[7]

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Parents represent a unique group of the adult population as they are responsible for the health and well-being of themselves and their children. Parenting has become more challenging with more demand due to work pressure and parental responsibilities.[8] With increased stress and multiple responsibilities, less time is spent for lifestyle changes and personal care among parents.[9] During an index cardiovascular event, many younger and middle-aged people were unaware that they had hypertension or uncontrolled risk factors.[10–12] This contrasts with improving awareness and medication adherence among the population with cardiovascular risk factors.[13] According to a systematic review, the trends in hypertension prevalence increased between 2000 and 2010; population awareness increased from 58.2% to 67.0%, antihypertensive treatment from 44.5% to 55.6%, and control from 17.9% to 28.4% in high-income countries. However, such improvements were much lower in low- and middle-income countries.[14,15]

In 2015, The United Nations member countries adopted a framework of achieving 17 sustainable development goals (SDGs) targeting economic, social, and environmental development through national and global coalitions.[16] SDG-3 (Good health and well-being) aspired to reduce premature deaths due to non-communicable disease by one-third by 2030.17 Such goals highlight the importance of measuring prevalence, increasing awareness, treatment, and controlling hypertension.

Evidence suggests that hypertension clusters within families and a family history of hypertension are a strong predictor of high BP among the offspring.[17,18] Multiple opportunities are being missed regarding identification and preventing disability and death due to hypertension. Hypertension prevalence, population awareness, treatment, and control rates vary globally.[14] Given the asymptomatic nature of hypertension, identifying people with hypertension, providing appropriate treatment, and achieving BP control is a substantial challenge. In this current study, we hypothesized that the prevalence of hypertension is on the rise and could be due to the difference in awareness and control of hypertension with respect to patient sex and other variables. This study aims to determine the prevalence of hypertension using the 2017 ACC/AHA compared to the previous guidelines and identify correlates of hypertension and the level of awareness, treatment, and control of hypertension among parents of school-aged children in the UAE.

Methods

This cross-sectional study was conducted on a target population of parents with school-aged children studying in Al Ain, UAE. Prior to collecting data, the study and approval were obtained from Al Ain Medical District Human Research Ethics Committee (Ethical approval number AAMDHREC: 1018). The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all the study participants before the study, and the study objectives and procedures were clarified to each of the participants.

Setting

This study was conducted in Al Ain city, the emirates of Abu Dhabi. Abu Dhabi is the largest of the seven emirates that make up the UAE. Study participants included native Emiratis and Arab parents with school-going children. The current study is an ancillary to a primary study examining a random sample of 1186 adolescents aged between 12 and 18 from 114 private and public schools in Al Ain city. There were 114 schools and we selected a random sample of 8 schools. A detailed description of the inclusion and exclusion criteria, measurements, and description of a sampling frame is available elsewhere.[19]

Data Collection

The sample size of this study was based on the need to explore differences among subgroups. A difference of 1/3 standard deviation in continuous measures such as BP will usually include all levels of public health interest. For a significance level of 5% and a power of 80%, we would need 144 per group in a two-equal male and female group comparison. We estimated a sample size of 500 to be adequate to address the primary research question on the prevalence of hypertension. Our study questionnaire comprised of an adapted version of the "STEPS Methodology," developed by the World Health Organization (WHO) for the measurement and surveillance of non-communicable disease (NCD) risk factors at the country level.[20] Out of the 886 parents approached for the study, 604 agreed to participate.

Trained nurses conducted an interview in Muwaiji Primary Health Care Centre in Al Ain city. Information on socio-demographic characteristics; modifiable lifestyle risk factors including physical activity, family, and personal disease history; monthly salary in UAE dirhams (AED; AED 1.00 ≈ USD 3.67); and history of current and past cigarette smoking were obtained through a face-to-face interview. All interviewers completed a training program that familiarized them with the study objectives.

Subjects were classified as current smokers if they answered yes to the question, "Do you smoke cigarettes daily?". Former smokers were defined as having smoked at least 100 cigarettes in their lifetime. The variables used for the analysis were smoking and smokeless tobacco consumption during the past year. Information on physical activity was obtained using the International Physical Activity Questionnaire (IPAQ-short version).[21] The questionnaire has been validated in several studies.[22,23] We measured the frequency (days per week) and duration (minutes per day) of moderate- and vigorous-intensity physical activity that the patients indulged in, in the 7 days before carrying out the survey. Physical activity was based on recalling daily activity patterns in the last 7 days. We used the US guideline for physical activity, recommended by the Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM). We identified the proportion of participants reporting moderate-intensity physical activity for a minimum of 30 min for 5 days each week or vigorous-intensity physical activity for a minimum of 20 min for 3 days each week.[24]

We used the current 2017 ACC/AHA guidelines[25] and the previous guidelines by the World Health Organization/ International Society of Hypertension guidelines[26] to measure BP and identify the prevalence of hypertension in our study population. Resting brachial BP was measured using a calibrated automated device (Omron HEM-705cp) in a sitting position using the right upper arm and an appropriately sized cuff after 5 min of rest. Three measurements were taken, and the average of the last two measures was used for analyses. Hypertension was defined as a mean SBP≥140, a mean DBP≥90, or current hypertension treatment with prescription medication.

Participants' self-report of any previous hypertension diagnosis by a health care professional was used to define hypertension awareness. Treatment for hypertension was defined as self-reported current use of antihypertensive medication among individuals who had reported being told by a doctor or other health professional that they had high BP. Hypertension was considered controlled among those on treatment if the average BP was <140/90 mmHg. The World Health Organization/International Society of Hypertension defined grade 1 hypertension as a mean SBP of 140–159 mmHg and/or a mean DBP of 90–99 mmHg. Grade 2 included having a mean SBP of 160–179 mmHg and/or mean DBP of 100–109 mm Hg. Grade 3 hypertension included those with mean SBP of ≥180 and/or DBP ≥110 mm Hg. Based on the 2017 ACC/AHA guidelines,[3] hypertension was defined as a mean systolic BP≥130 mmHg, mean diastolic BP≥80 mmHg, or self-reported current use of antihypertensive medications. Prehypertension was defined as mean systolic BP of 120–129 mmHg and/or mean diastolic BP of 80–89 mmHg.[3]

Body weight was measured to the nearest 0.1 kg using a calibrated electronic scale with a mounted stadiometer to measure height to the nearest 0.1 cm (SECA Hamburg, Germany). Bodyweight and height measurements were completed with the participant wearing light clothing without shoes and standing motionless. Waist and hip circumference were measured using a flexible, non-stretch nylon tape measure (SECA Hamburg) with the subjects wearing light clothing. Waist circumference was measured midway between the lower rib margin and the top of the iliac crest, in cm to the nearest 0.1 cm. Hip circumference was measured at the point of maximal protrusion of the gluteal muscles nearest to 0.1 cm. Body mass index (BMI) was calculated as body weight in kilograms divided by the height in meters squared. World Health Organization cut-offs were used to classify overweight (25.0–29.9 kg/m^2) and obese (≥30.0 kg/m^2) adults.[27] We used a waist-to-hip ratio (WHR; waist in cm/hip circumference in cm) of ≥0.90 to define central obesity in our study population.[28] Participants were classified as having diabetes mellitus based on self-reported status and self-reported current use of insulin or oral hypoglycemic agents to lower blood sugar, or if having hemoglobin A1C (HbA1C) ≥6.5%, or fasting plasma glucose ≥126 mg/dL according to the American Diabetes Guidelines.[29]

Statistical Analysis

Data were entered into a computerized database using the Microsoft Access software and then imported into Stata version 13.0 (Stata Corp LP, College Station, TX, USA) for analysis. Percentages, means, and 95% confidence intervals were calculated for descriptive purposes. The chi-squared test was used for categorical variables, and *t*-test and analyses of variance were used for continuous variables. First, we evaluated the statistically significant socio-demographic, lifestyle and clinical predictors of hypertension using the chi-squared test in the univariate analysis. We entered, one by one those variables that were statistically significant in the univariable analyses, using the stepwise logistic regression analysis to examine the association of socio-demographic, lifestyle, and other factors with the odds of hypertension. We did not find any multicollinearity in our analysis. The logistic regression results were expressed as odds ratios (OR) with 95% confidence intervals (CI). We used multivariable logistic regression to adjust for potential confounding factors. Due to the small sample size, we could not conduct multivariable analysis for treatment and control. Two-tailed p-values ≤0.05 were considered to indicate statistically significant differences.

Results

Of 886 eligible subjects, 604 (68.3%) participated in the study. The mean age of participants was 42.9±7.9 years. Of 604 participants, 331 (54.7%) were male. Study subjects included Emirati nationals (52.6%) and Arabs (47.4%). Many study subjects had secondary (47.2%) and post-secondary level (45.8%) education. In addition, a high proportion of study subjects were overweight (35.7%), obese (50.2%), and about one in four study participants were smokers (25.2%). Of the total 604 study subjects, 113 (18.7%) had type 2 diabetes. In Table 1, we present the socio-demographic characteristics of our study population.

Table 1 Characteristics of Study Population and Prevalence of Hypertension (N=604)

Characteristic	Overall N	Hypertension		p value
		No n (%)	Yes n (%)	
All	604	495 (81.9)	109 (18.1)	
Age, mean (SD)	42.9 (7.9)	41.7 (7.4)	48.3 (8.2)	<0.001
23–34	84	78 (92.9)	6 (7.1)	<0.001
35–44	259	235 (90.7)	24 (9.3)	
45–54	188	136 (72.3)	52 (27.7)	
55–64	74	46 (63.1)	27 (36.9)	
Sex				
Women	330	292 (88.5)	38 (11.5)	<0.001
Men	274	203 (74.1)	71 (25.9)	
Nationality				
Emirati nationals	317	271 (85.5)	46 (14.5)	0.018
Arabs	287	224 (78.1)	63 (21.9)	
Educational level				
Middle or lower	42	24 (57.1)	18 (42.9)	<0.001
Secondary	281	235 (83.6)	46 (16.4)	
College or above	274	230 (83.9)	44 (16.1)	
Employment status				
Not employed	288	236 (81.9)	52 (18.1)	0.996
Employed	316	259 (81.9)	57 (18.1)	
Marital status				
Married	577	472 (81.8)	105 (18.2)	0.347
Divorced or widowed	20	18 (90.0)	2 (10.0)	

(*Continued*)

Table 1 (Continued).

Characteristic	Overall N	Hypertension		p value
		No n (%)	Yes n (%)	
Monthly household income (AED)				
<5000	93	74 (79.6)	19 (20.4)	0.329
5000–10,000	108	87 (80.6)	21 (19.4)	
>10,000	100	87 (87.0)	13 (13.0)	
Family history of hypertension				
No	216	189 (87.5)	27 (12.5)	0.011
Yes	324	256 (79.1)	68 (20.9)	
Diabetes, fasting plasma glucose (FPG)				
FPG <100 mg/dL	264	234 (88.6)	30 (11.4)	<0.001
FPG 100–125 mg/dL	227	184 (81.1)	43 (18.9)	
FPG ≥126 mg/dL	113	77 (68.1)	36 (31.9)	
BMI categories				
<25	84	76 (90.5)	8 (9.5)	0.018
25.0–29.9	213	179 (84.1)	34 (15.9)	
≥30.0	299	233 (77.9)	66 (22.1)	
Waist-to-hip ratio				
≥0.90 cm (men). ≥0.85.0 cm (women)	366	316 (86.3)	50 (13.7)	<0.001
<0.90 cm (men). <0.85 cm (women)	237	179 (75.5)	58 (24.5)	
Current smoker				
No	452	379 (83.8)	73 (16.2)	0.037
Yes	152	116 (76.3)	36 (23.7)	
Moderate, vigorous physical activity				
Yes	128	116 (90.6)	12 (9.4)	0.004
No	476	379 (79.6)	97 (20.4)	

A high proportion of study participants (91.2%) had undergone BP check-up in the past. However, more males (93.4%) had a BP checkup than their female counterparts (89.4%, p=0.083). The prevalence of hypertension, awareness, antihypertensive medication use, types of drugs used, and BP control among males and females are detailed in Table 2. The overall prevalence of hypertension was 37.2% (95% CI: 33.5–41.2) based on the 2017 ACC/AHA guidelines and 18.0% (95% CI: 15.2–21.3) based on the previous guidelines (BP≥140/90 mmHg). Compared to the previous guidelines, the new guidelines suggested that more than twice the proportion of study participants will require antihypertensive medications. The prevalence of hypertension using 2017 ACC/AHA was 30.2% (95% CI: 25.4–35.6) among Emirati nationals and 44.9% (95% CI: 39.2–50.8) among Arab nationals. Per the previous WHO guidelines, the prevalence of hypertension was much lower in Emiratis (14.5% [95% CI: 11.0–18.8]) than Arab nationals (21.9% [95% CI: 17.5–27.1]). Among participants with self-reported

Table 2 Blood Pressure Measurement, Population Awareness, Medication Use and Hypertension Control Among Study Participants by Gender (n=604)

Characteristics	Total N (%)	Men n (%)	Women n (%)	p-value
Systolic blood pressure (SBP), mean (SD)	121.1 (± 15.7)	127.8 (± 14.8)	115.5 (± 14.2)	<0.001
Diastolic blood pressure (DBP), mean (SD)	74.2 (10.5)	77.6 (9.8)	71.3 (± 10.2)	<0.001
Measured blood pressure of un-diagnosed (n=521)				
Normal SBP <120 and /or DBP <80 mm Hg	372 (71.4)	127 (57.5)	245 (81.7)	<0.001
Pre-hypertension, SBP 120–139, DBP 80–89 mmHg	106 (20.4)	68 (30.8)	38 (12.7)	
Grade 1, SBP 140–159 and/or DBP 90–99	36 (6.9)	22 (9.9)	14 (4.7)	
Grade 2, SBP 160–179 and/or DBP 100–109	5 (0.9	2 (0.9)	3 (1.0)	
Grade 3, SBP ≥ 180 and/ or DBP ≥110	2 (0.4)	2 (0.9)		
Participants with self-reported hypertension (n=84)				
Normal SBP <120 and /or DBP <80 mm Hg	25 (29.0)	10 (17.0)	15 (50.0)	0.005
Pre-hypertension, SBP 120–139, DBP 80–89 mmHg	27 (32.5)	22 (41.5)	5 (16.7)	
Grade 1, SBP 140–159 and/or DBP 90–99	22 (26.5)	13 (24.5)	9 (30.0)	
Grade 2, SBP 160–179 and/or DBP 100–109	6 (7.2)	6 (11.3)	1 (3.3)	
Grade 3, SBP ≥ 180 and/ or DBP ≥110	4 (4.8)	3 (5.7)		
Hypertension (≥140/90 mmHg or medication)	109 (18.0)	71 (25.9)	38 (11.5)	<0.001
Hypertension (≥130/80 mmHg or medication)	225 (37.2)	147 (53.6)	78 (23.6)	<0.001
History of BP checking in the past				
No	53 (8.8)	18 (6.6)	10 (89.4)	0.083
Yes	552 (91.2)	256 (93.4)	296 (89.4)	
Aware of hypertension				
No	46 (40.3)	29 (39.2)	17 (56.4)	<0.001
Yes	68 (59.6)	45 (60.8)	22 (55.3)	
Age of hypertension diagnosis, mean (SD)	41.0 (± 12.8)	44.1 (13.3)	34.8 (9.2)	0.003
Hypertensive persons currently receiving drugs				
No	35 (51.5)	19 (42.2)	16 (69.6)	
Yes	33 (48.5)	26 (57.8)	7 (30.4)	0.033
Currently receiving medicine				
BP ≥140/90 mm Hg	20 (60.6)	16 (61.5)	4 (57.1)	0.833
BP <140/90 mm Hg	13 (39.4)	10 (38.5)	3 (42.9)	
Types of medication used				
Angiotensin receptor blockers (ARBS)	19 (59.4)	16 (61.5)	3 (50.0)	0.852
Angiotensin Converting enzyme inhibitors (ACE)	7 (21.9)	5 (19.2)	2 (33.3)	
Calcium channel blocker (CCB)	5 (15.6)	4 (15.4)	1 (16.7)	
Beta blockers (BB)	1 (3.1)	1 (3.9)	0	

hypertension and those with measured hypertension, a significant proportion of the participants had stage 1 and stage 2 hypertension.

A high proportion of males compared to females, were aware of their hypertensive status, used antihypertensive medications, and had better control of hypertension (BP<140/90 mmHg) among those who reported the use of antihypertensive medications in the past 2 days.

Among those who reported various classes of antihypertensive medications, a high proportion (59.4%) reported using angiotensin receptor blockers (ARB), followed by angiotensin-converting enzyme inhibitors (ACE) (21.9%), calcium channel blockers (CCB) (15.6%), and beta-blockers (BB) (3.1%). We also classified the prevalence of hypertension by patient sex with respect to various characteristics of the study participants. The prevalence of hypertension was significantly higher among men than women. The prevalence increased with increasing age, and it was higher in Arabs than in their Emirati counterparts in men and women. The prevalence of hypertension was also higher among those with low or medium education level. Those with a family history of hypertension had a higher prevalence of hypertension. In addition, participants with hypertension were more likely to have prediabetes and/or diabetes than those without. People with hypertension were more likely to be current smokers and have central obesity. Women with diabetes and men with central obesity were more likely to have a higher prevalence of hypertension than others. By contrast, participants reporting moderate or vigorous physical activity in the past week were less likely to be hypertensive.

In Table 3, we present the results of our multivariable logistic regression analysis. After adjusting for several socio-demographic and other factors, we found that increasing age by year (adjusted OR [AOR]: 1.09 [1.05–1.13]), male sex (AOR: 2.48 [1.41–4.30]), higher education (AOR: 0.22 [0.09–0.56]), family history of hypertension (AOR: 2.03 [1.17–3.53]), obesity

Table 3 Independent Correlates for Hypertension Based on Multivariable Logistic Regression Analysis

Characteristic	Hypertension Adjusted OR (95% CI)	p value
Age, years	1.09 (1.05–1.13)	<0.001
Sex		
Women	Reference	<0.001
Men	2.48 (1.41–4.34)	
Nationality		
Emirati nationals	Reference	0.536
Arabs	1.18 (0.69–2.01)	
Educational level		
Middle or lower	Reference	
Secondary	0.26 (0.10–0.65)	<0.004
College or above	0.22 (0.09–0.56)	<0.001
Family history of hypertension		
No	Reference	
Yes	2.03 (1.17–3.53)	0.012
Diabetes, fasting plasma glucose (FPG)		
FPG <100 mg/dL	Reference	
FPG 100–125 mg/dL	1.05 (0.59–1.85)	0.856
FPG ≥126 mg/dL	1.37 (0.71–2.66)	0.349

(*Continued*)

Table 3 (Continued).

Characteristic	Hypertension Adjusted OR (95% CI)	p value
BMI categories		
<25	Reference	
25.0–29.9	2.22 (0.85–5.81)	0.102
≥30.0	3.15 (1.24–7.12)	0.016
Waist-to-hip ratio		
<0.90 cm (men); <0.85 cm (women)	Reference	
≥0.90 cm (men); ≥0.85.0 cm (women)	1.29 (0.66–2.50)	0.445
Moderate or vigorous physical activity versus none	0.50 (0.26–0.98)	0.044
Current smoker		
No	Reference	0.387
Yes	0.79 (0.72–2.28)	

(AOR: 3.15 [1.24–7.12]), and moderate or vigorous physical activity (AOR: 0.50 [0.66–2.50]) were independent correlates of hypertension in our study population.

Discussion

We found a relatively high prevalence of hypertension in a cohort of parents of school-aged children in the UAE. A considerably high proportion of hypertensive individuals remained untreated and/or had uncontrolled disease despite the high proportion of the population having been screened for hypertension. In addition, we observed significant differences between men and women regarding hypertension screening, treatment, and control. Using multivariable-adjusted logistic regression models, we verified that well-known predictors of hypertension had significant associations in our study population.

The prevalence of hypertension among Arabs and Emiratis were lower than South Asian male migrants (30.5%) in Al Ain city, UAE.[30] In our current research, 91.2% of the study sample (93.4% men and 89.4% women) had their BP measured. Male Emiratis of older age, with lower educational level, increased waist circumference and/or obesity, and family history of hypertension were more likely to have hypertension. Further, in this study, more women (56.4%) were unaware of their hypertensive status than men (39.2%), and this disparity in hypertension awareness was statistically significant ($p<0.001$). Hypertension in the adult population was 37.2% based on the 2017 ACC/AHA guidelines (BP≥130/80 mmHg), as compared to 18.0% using the previous hypertensive guidelines (BP≥140/90 mmHg). Most individuals with high BP were younger and deemed to have a normal BP using the previous BP thresholds.

Our findings of a high prevalence of hypertension in the UAE is consistent with previous reports from the UAE and neighbouring countries. A cross-sectional household survey done by Mamdouh et al in the nearby Dubai Emirate revealed that >33% of the residents had high BP.[31] In another study in the Middle East countries, the crude prevalence of hypertension was 31%.[32] In a US-based National Health and Nutrition Examination cross-sectional survey, the prevalence of hypertension rose from 32% to 46% among US adults, wherein BP was defined as BP≥130/80 mmHg.[33]

In our study, for several reasons, we estimated the prevalence of hypertension using the ACCA/AHA guidelines instead of the other available European Society of Cardiology and European Society of Hypertension (ESC/ESH)[34] and the National Institute for Health and Care Excellence.[35] First, we assumed our cohort population of parents with school-aged children to be middle-aged adults who will need to be identified earlier to prevent cardiovascular disease (CVD) with a lower definition of hypertension than other guidelines. Furthermore, using a lower cut-off BP will further increase awareness of hypertension among the participants, encourage lifestyle changes, and initiate treatment to intensify management to reduce CVD risk.[33] Nevertheless, applying the 2017 ACC/AHA hypertension guidelines will substantially increase the proportion of participants defined as hypertensive. Moreover, intensive treatment for BP would be required to achieve the 2017 ACC/AHA guideline BP goal for those individuals who have already been diagnosed with hypertension. Thus, lower BP thresholds, as proposed by the ACCA/AHA guidelines, would have major public health consequences and lead to a significant impact on clinical care in the UAE.

More than half the study participants were aware of their hypertensive status and received antihypertensive medications, but there was a sex-based disparity, given that a significantly higher proportion of women (69.6%) did not take antihypertensive medications despite being aware of having hypertension. All of the study participants were using newer classes of antihypertensive medications including ARBs. Despite clinical trials documenting beneficial effects of cheaper drudrugs, such thiazide and BBs, very few participants reported using these drugs.[36]

In this study, the mean age of male parents diagnosed with hypertension with school-aged children was 41 years, and that of women was ~35 years old. This is in line with similar findings from Saudi Arabia.[37] Similar findings were reported in Europe, whereas Central Asia had a lower mean age (36 years) of hypertensive adults. Participants from East Asia, the Pacific,[38] and Latin American countries were slightly older (52 years) at the time of hypertension diagnosis.[39]

In our study, hypertension was undertreated and poorly controlled, although 91% had their BP checked in the past. This phenomenon is not unique to the UAE. This trend was noted across both developed and developing countries.,[39–42] with some countries showing improved hypertension management over time.[39] Intensive education, lifestyle changes, population awareness, and treatment optimization contributed to this improvement.[39] Our results indicate an urgent need to aggressively introduce such public health interventions in our region. The proportion of individuals aware of hypertension varies over different geographical areas. The reported proportions in Latin America and Korea are 60%[41] and 65%,[42] respectively. Awareness was higher in Saudi Arabia (76%)[37] and Canada (83%),[39] while it was much lower in Laos (29%).[43] Interestingly, our current rates of population awareness are quite similar to the data reported in the US about 40 years ago (69%).[44] However, this is somewhat disconcerting; in our study, 39% of the cohort that received antihypertensive medication had their BP controlled which was lower than that in a Canadian cohort (64.6%),[39] while it differed from the neighboring Iran (37.4%),[40] and Laos (16.7%).[43] This is encouraging because it suggests that targeting antihypertensive therapy and achieving hypertension control constitutes a reasonable goal with significant public health benefits for individuals compliant with current medical management guidelines.

Our findings of a positive association of hypertension with age, BMI, educational attainment, and family history of hypertension align with previous studies.[45–48] In a prospective cohort of 1298 participants from the Framingham Heart Study, Vasan et al reported a significant association of hypertension with age.[3,46] The prevalence and incidence of hypertension increased with increasing BMI in both sexes of different ethnic groups, both in children and adults.[3,49,50] We also observed significant differences in the prevalence of hypertension based on educational attainment. It has been suggested that increased educational attainment is associated with an increased awareness of health status and wellness, and education may exert its influence through lifestyle and dietary habits.[3,45,47] Furthermore, previous studies have shown a positive association between hypertension and plasma glucose levels, and hypertension often co-exists with type 2 diabetes mellitus.[51–53] The association between physical activity and hypertension has been well-documented.[54–57] Our results show that people engaging in moderate-to-vigorous–intensity physical activity have a 50% lower risk of having hypertension than inactive people. Recent meta-analyses suggested a linear inverse dose–response relationship between physical activity and hypertension, and moderate-to-vigorous physical activity was associated with a 6–33% lower risk of hypertension across studies.[56,58] Our findings of no significant associations of hypertension with fasting plasma glucose levels and smoking status might reflect a lack of statistical power for these sub-group analyses.

Further research is required to understand the impact of parental health problems that can influence children. There are many ways by which such practices of poor control of hypertension can be transmitted to children, such as through parental modelling, family socialization practices, and family influences of behaviors and lifestyles.[59] We propose further research to identify factors that could enhance the early identification of parental health problems. Evidence suggests that parental health literacy as an interventional tool has been used to manage obesity in children and reduce medication errors.[60]

The current study has several implications. Having hypertension at a younger age reflects the current lifestyle changes adopted in the UAE.[61–63] Increased BP can cause death or disability due to CVD, which may have profound economical and social effects on these families with school-aged children. The stakeholders must bring in multiple strategies, such as dietary regulation of salt,[64] reduction in trans-fats, policies to reduce consumption of dense caloric fast foods, smoking cessation, increasing physical activity, reducing body weight, and reducing stress. Creating policies to curtail lifestyle factors will effectively control BP.[65,66] Furthermore, implementing policies to address barriers relating to poor medication adherence are essential to control BP.[67–69]

The current coronavirus disease 2019 (COVID-19) pandemic[70] has brought in many challenges with increased stress altered lifestyle behaviour, which may have a further impact on the increase in the prevalence of poor control of hypertension.[71,72] Our study also shows that many of the younger parents have been unaware or undiagnosed or do not meet the targets of controlled BP. In contrast, evidence suggests that only one-third patients with high BP can have controlled BP even with appropriate treatment. Hence, promoting health literacy and other lifestyle interventions are paramount and shown to be effective in controlling BP.[73]

Designing and implementation of innovative strategies within the school and the community for both school children and parents for healthy living through improved public health interventions and education are essential. One innovative way is the use of digital technology. A study conducted in India found using mobile health to be an effective educational resource to improve health literacy among the vulnerable population.[74] Similarly, home monitoring of BP[75] along with the utilization of other technologies, such as artificial intelligence, machine learning, and use of Big Data will aid in early identification and management of BP.[76] One of the successful ways of identifying and managing BP is the implementation of programs similar to the highly successful Canadian Hypertension Education Program (CHEP), which focuses on improving the awareness, treatment, and control of hypertension through education and practice.[77] The developed models should encompass core principles such as involving the participants with a baseline assessment, health literacy, and educational interventions so that the parents can understand the associated risk factors for BP, perceived benefits and barriers of BP control, and how they can be modified. Furthermore, controlling hypertension will go a long way in achieving not only SDG 3 (Health and healthy-being) but also SDG1 (No poverty) and SDG 8 (Decent work and economic growth).

Strengths and Limitations

To our knowledge, this is the first study to review the prevalence, predictors, and control of hypertension among parents of school-aged children in the UAE. Our investigation identifies an increased prevalence of BP in younger populations within the UAE. Furthermore, those with raised BP have poor control of hypertension. The study calls policymakers for public health interventions that can address both children's and parents' health, thereby creating a healthy family.

Our study has some limitations. First, the cross-sectional study design does not permit to comment on potential causal associations between evaluated risk factors and hypertension. Second, our sample size was relatively small to undertake further specific subgroup analyses. Hence with the small sample size the results with regard to the awareness and control needs to be interpreted with caution. In addition, the definition of diabetes was based on self-reports with associated reliability issues. Third, using a convenience sample of adults could not allow us to exclude potential selection bias; however, the point estimates of hypertension prevalence are less likely to be affected.

Conclusions

Our study findings suggest that the prevalence of hypertension is relatively high in the UAE and could be even higher if applying the newer 2017 ACC/AHA guidelines. In addition, we have found significant differences in screening and management of hypertension between men and women, which is worthy of further attention. Furthermore, our study highlights the importance of targeting major cardiovascular disease risk factors in the population, which is significantly correlated with hypertension. These findings validate the current need for innovative policies, clinical guidelines, and healthcare models to identify and manage hypertension among the public so that CVD and other similar catastrophic sequelae are prevented. Further research is needed to target the younger population in identifying and managing the early stages of hypertension and to improve medication adherence.

Abbreviations

AED, Emirati dirham; AOR, adjusted odds ratio; BMI, body mass index; BP, blood pressure; CI, confidence interval; DBP, diastolic blood pressure; DPSC, disease prevention and screening center; HbA1c, glycated hemoglobin; IPAQ, International Physical Activity Questionnaire; NCD, non-communicable chronic diseases; SBP, systolic blood pressure; SDG, sustainable development goal; UAE, United Arab Emirates; USA, United States of America; USD, United States Dollar; WHO, World Health Organization; WC, waist circumference; WHR, waist-to-hip ratio.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors declare that they have no conflicts of interest in relation to this work.

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