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A survey of hypertension prevalence, awareness, treatment, and control in health screening camps of rural central Punjab, Pakistan

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ABSTRACT

Hypertension is a global public health problem with increasing prevalence. There is limited updated information on the prevalence of hypertension in the Pakistani population. This is a cross-sectional study based on data collected during multiple health screening camps held at multiple locations in rural central Punjab, Pakistan in the period between 2008 and 2015. A total of 13,722 patients were included in this study. Crude prevalence of hypertension was 35.1% and age-standardized prevalence was 34.4%. Among patients with hypertension, 62.3% were aware of having high blood pressure; among these patients, 75.3% were already on treatment for hypertension. Blood pressure was controlled in 22.3% of all patients with hypertension. Among those on treatment for hypertension, blood pressure was controlled in 32.3%. Nearly one-third of patients in health screening camps of rural central Punjab had hypertension. Blood pressure control rate was poor among these patients.

1. Introduction

Hypertension is a significant public health problem, with a worldwide prevalence of 40.8% and a control rate of 32.3% [1]. Hypertension is a major risk factor for a number of serious health conditions, including cardiovascular disease [2], cerebrovascular disease [3], and chronic kidney disease [4]. Worldwide, 9.4 million deaths are attributed to complications from hypertension, including 45% of all deaths due to coronary artery disease and 51% of all deaths due to stroke [5].

Hypertension is more common in low-income countries [1], where nearly 80% of deaths due to cardiovascular disease occur [6]. In Pakistan, two large epidemiological studies—the first based on the 1990–1994 National Health Survey [7] and the second based on rural northern areas of the country [8]—reported hypertension prevalence rates of 19.1% and 14%, respectively. However, given that the data collection occurred 15–20 years ago, these studies are not representative of the current burden of disease. Studies from other countries have demonstrated global increases in the prevalence of hypertension over time due to population growth, aging, and modifications in behavioral risks [9]. Therefore, there is a need to provide updated data on the prevalence, awareness, treatment, and control of hypertension in Pakistan.

Punjab is the most populous province of Pakistan. Over the past 8 years, a large number of health screening camps were organized by a nephrology department of a tertiary care hospital in rural central Punjab to promote health and generate awareness among the general population regarding hypertension, diabetes mellitus, and chronic kidney disease. This study aims to provide updated data on the prevalence, awareness, treatment, and control of hypertension based on data collected during these health screening camps.

2. Methods

This is a cross-sectional study based on data collected during multiple health screening camps held at multiple locations in rural central Punjab, Pakistan in the period between 2008 and 2015. All patients older than 18 years were included in the study. The study was approved by the Institutional Review Board.

During the screening camps, a standard questionnaire was used to collect medical history from each patient. Age, sex, marital status, education, work history, smoking, alcohol intake, and physical activity level were recorded. Patients were also asked about personal and family history of hypertension, diabetes mellitus, cardiovascular disease, and chronic kidney disease. Blood pressure measurements were performed using a mercury sphygmomanometer for patients seated for 5 min with the arm positioned at heart level. Pressures were measured using manual auscultatory

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technique with the appropriate sized cuff for each patient. Blood pressure was checked twice, and then the average of the two readings was used. Height was measured on barefoot patients using a fixed stadiometer with the measurement taken to the nearest 0.1 cm. Weight was measured using a manual scale with accuracy up to 0.5 kg. Body mass index (BMI) was calculated as weight in kilograms divided by height in square meters. Healthcare professionals involved in data collection were trained beforehand to ensure consistency and accuracy.

2.1. Definitions

Hypertension was defined as a prior history of hypertension and/or medical treatment of hypertension and/or a systolic blood pressure above 140 mmHg or diastolic blood pressure above 90 mmHg at the health screening camp [10]. Awareness of hypertension among patients was defined as hypertension reported with a previous medical diagnosis of hypertension from a healthcare provider. Control of hypertension was defined as systolic blood pressure < 140 mmHg and diastolic blood pressure < 90 mmHg at the health screening camp based on Joint National Comittee 8 guidelines [10]. Physical activity was defined as any self-reported aerobic activity carried out either as a dedicated activity or as part of occupation or daily routine. Smokers were defined according to categories from the United States Centers for Disease Control and Prevention, with current smokers being those adults who have smoked 100 cigarettes in their lifetime and currently smoke cigarettes every day (daily) or some days (nondaily) [11]. Alcohol use was defined as the consumption of one drink per day for a woman or two drinks per day for a man, according to The Dietary Guidelines for Americans as moderate alcohol consumption [12]. BMI was categorized according to the World Health Organization criteria [13] into obese with a BMI $\geqslant$ 30 kg/m^2, overweight with a BMI between 25 kg/m^2 and 29.9 kg/m^2, normal with a BMI between 18.5 kg/m^2 and 24.9 kg/m^2, and underweight with a BMI < 18 kg/m^2. Patients with cardiovascular disease were defined as those who self-reported a past medical history of stroke or coronary artery disease. Patients with chronic kidney disease were defined either by the diagnosis of chronic kidney disease by a healthcare provider or by the presence of self-reported persistently abnormal renal function and/or persistent protein in urine for $\geqslant$3 months.

2.2. Statistical analysis

Continuous parametric variables were reported as mean ± standard deviation; nonparametric continuous variables were reported as median with 25–75 interquartile range (IQR); and categorical variables were expressed as percentages. Age standardization was calculated using the World Health Organization standard population [14]. Multivariate logistic regression analysis was performed to determine predictors of hypertension, awareness, and control of hypertension. Predictor variables were selected according to clinical relevance (age, BMI, sex, marital status, education, work history, smoking, alcohol intake, physical activity, individual medical history of hypertension, diabetes mellitus, cardiovascular disease and chronic kidney disease, and family history of hypertension and cardiovascular disease). Age and BMI were treated as continuous variables. For multivariate analysis, all variables were included, and forward selection and likelihood ratios were used to determine the most efficient model. Both unadjusted and adjusted odds ratios for significant variables were calculated from the logistic regression analysis. All statistical analyses were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). For all tests, p values of <0.05 were considered statistically significant.

3. Results

A total of 13,722 patients were included in this study. Crude prevalence of hypertension was 35.1% and age-standardized prevalence was 34.4%. Among patients with hypertension, 62.3% were aware of having high blood pressure; among these patients, 75.3% were already on treatment for hypertension. Blood pressure was controlled in 22.3% of all patients with hypertension. Among those on treatment for hypertension, blood pressure was controlled in 32.3%. Among all patients, 9934 patients had no comorbid conditions like diabetes mellitus, cardiovascular disease, or

Table 1
Demographic, educational, and work status of participants of health screening camps.

	All patients N = 13,722	Patients with hypertension N = 4812	Hypertensive patients with awareness of hypertension N = 3000	Hypertensive patients with control of hypertension N = 1062
Age groups (y)				
18–30	3440 (25.1)	546 (15.8)	328 (60.1)	196 (35.9)
31–40	3654 (26.6)	1066 (29.1)	656 (61.5)	300 (28.1)
41–50	3318 (24.3)	1414 (42.3)	908 (64.2)	254 (17.9)
51–60	1946 (14.2)	1010(51.9)	628 (63.1)	174 (17.2)
61–70	974 (7.1)	594 (60.9)	374 (62.9)	108 (31.6)
71–80	320 (2.3)	150 (46.8)	78 (52)	26 (17.4)
>81	70 (0.5)	32 (45.7)	18 (56.2)	4 (12.5)
Sex				
Male	8366 (61)	2578 (30.8)	1484 (58)	518 (20.1)
Female	5356 (39)	2234 (41.7)	1506 (67.8)	544 (24.3)
Marital status				
Married	11,672 (85.1)	4518 (38.7)	2866 (63.4)	992 (21.9)
Unmarried	2050 (14.9)	294 (14.4)	134 (45.6)	70 (23.8)
Educational status				
None	4196 (30.6)	1608 (38.4)	966 (60.1)	384 (23.8)
Primary	1352 (9.9)	492 (36.4)	328 (66.6)	108 (21.9)
Secondary/high school	4188 (30.5)	1398 (33.3)	880 (62.9)	300 (21.5)
College	3986 (28.9)	1310 (32.8)	822 (62.7)	268 (20.5)
Work status				
Not working	6344 (46.1)	2648 (41.7)	1756 (66.3)	440 (16.6)
Working	7378 (53.8)	2162 (29.3)	1242 (57.4)	620 (28.6)

Data are presented as n (%).

chronic kidney disease. Of these patients, age adjusted prevalence of hypertension was 28%. Awareness and control of hypertension were found in 52.1% and 19.9%, respectively, in these patients with hypertension. The median age of all patients regardless of hypertensive status was 40 years (IQR, 30–50 years), while the median age of all patients with hypertension was 47 years (IQR, 38–56 years). The median ages of patients with awareness of hypertension and control of hypertension were 47 years (IQR, 38–56 years) and 42 years (IQR, 35–54 years), respectively.

Demographic, educational, and occupational characteristics of all patients are described in Table 1. The study population predominantly consisted of men; however, hypertension was more common among women. The majority of patients were married. Nearly one-third of patients were uneducated and slightly less than half reported some form of employment.

Social, medical, and family histories of all patients are shown in Table 2. Over half of patients were overweight or obese. Among all patients, 20.7% were smokers; 15.5% had diabetes mellitus, and 60% of patients with diabetes had hypertension; 13.2% had self-reported chronic kidney disease and 49.4% of patients with chronic kidney disease had hypertension.

Multivariate logistic regression analysis with unadjusted and adjusted odds ratios of statistically significant variables associated with a diagnosis of hypertension is presented in Table 3. Age, BMI, family history of hypertension, and individual history of chronic kidney disease, diabetes mellitus, and cardiovascular disease were associated with a diagnosis of hypertension. Male sex and being a worker were inversely associated with a diagnosis of hypertension.

Multivariate logistic regression analysis with unadjusted and adjusted odds ratios of statistically significant variables associated with the awareness of hypertension in hypertensive patients is shown in Table 4. A history of diabetes mellitus, chronic kidney disease, cardiovascular disease, family history of hypertension, and being married were associated with an awareness of hypertension. Among hypertensive patients, male sex was inversely associated with an awareness of hypertension.

Multivariate logistic regression analysis with unadjusted and adjusted odds ratios of statistically significant variables associated with the control of hypertension is shown in Table 5. Family history of hypertension, history of cardiovascular disease, and being married were associated with the control of hypertension. Age, BMI, and being a worker were inversely associated with the control of hypertension.

4. Discussion

Our study showed that the age-standardized prevalence, treatment, and control of hypertension in patients who participated in health screening camps in central Punjab, Pakistan were 34.4%, 62.3%, and 22.3%, respectively. To our knowledge, this is the largest epidemiological study of hypertension in rural areas of central Punjab, Pakistan.

The age-standardized prevalence of hypertension in our study was 34.4%, which is significantly higher than the estimates from previous, large-scale epidemiological studies executed in Pakistan. For example, the prevalence of hypertension was found to be 19.1% overall and 17.3% specifically in the Punjabi population based on

Table 2
Social, personal, and family history of medical diseases of participants of health screening camps.

	All Patients $N = 13,722$	Patients with hypertension $N = 4812$	Hypertensive patients with awareness of hypertension $N = 3000$	Hypertensive patients with control of hypertension $N = 1062$
Physical activity (min/d)				
None	206 (1.5)	98 (47.5)	72 (73.4)	26 (26.5)
<30	888 (6.5)	440 (49.5)	300 (68.2)	106 (24.1)
30–60	2182 (15.9)	916 (41.9)	584 (26.7)	160 (17.5)
>60	10,412 (76)	3350 (32.2)	2040 (19.5)	768 (22.9)
Smoking				
Yes	2848 (20.7)	834 (29.2)	470 (56.3)	170 (20.3)
No	10,868 (79.2)	3972 (36.5)	2524 (63.5)	890 (22.4)
Alcohol				
Yes	308 (2.2)	80 (26)	46 (57.5)	22 (27.5)
No	13,414 (97.7)	4728 (35.2)	2950 (62.3)	1038 (21.9)
Body mass index (kg/m^2)				
<18.5	814 (6)	192 (23.5)	110 (57.2)	78 (40.6)
18.5–24.9	5100 (37.1)	1288 (25.2)	788 (61.1)	324 (25.1)
25–29.9	4500 (34.1)	1700 (37.9)	1022 (60.1)	352 (20.7)
⩾30	2794 (20.3)	1426 (51)	928 (65)	248 (17.3)
Diabetes mellitus				
Yes	2138 (15.5)	1282 (60)	986 (76.9)	308 (24)
No	11,578 (84.4)	3530 (30.4)	2014 (57.1)	754 (21.3)
Cardiovascular disease				
Yes	544 (4)	394 (72.4)	370 (94)	134 (34)
No	13,172 (96)	4418 (34)	2700 (61.1)	928 (21)
Chronic kidney disease				
Yes	1816 (13.2)	898 (49.4)	680 (75.7)	240 (27)
No	11,900 (86.7)	3914 (33.)	2320 (59.3)	822 (21)
Family history of hypertension				
Yes	6324 (46.1)	2668 (42.1)	1858 (73.4)	772 (25.2)
No	7388 (53.9)	2140 (28.9)	1038 (48.2)	388 (18.1)
Family history of cardiovascular disease				
Yes	3166 (23.1)	1258 (40)	894 (71)	328 (26)
No	105,44 (76.9)	3550 (33.8)	2102 (59.2)	732 (21)

Data are presented as *n* (%).

Table 3
Multivariate logistic regression analysis showing unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of statistically significant variables associated with hypertension.[a]

	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Age	1.045 (1.041–1.049)	<0.001	1.048 (1.043–1.053)	<0.001
Male sex	0.62 (0.56–0.68)	<0.001	0.71 (0.59–0.84)	<0.001
Working	0.58 (0.52–0.64)	<0.001	0.83 (0.71–0.98)	0.03
Family history of HTN	1.79 (1.62–1.97)	<0.001	2.04 (1.80–2.30)	<0.001
History of chronic kidney disease	1.99 (1.73–2.29)	<0.001	1.85 (1.57–2.17)	<0.001
History of diabetes mellitus	3.41 (2.98–3.90)	<0.001	1.95 (1.68–2.27)	<0.001
History of cardiovascular disease	5.2 (3.97–6.82)	<0.001	2.98 (2.20–4.0)	<0.001
Body mass index	1.08 (1.07–1.09)	<0.001	1.06 (1.05–1.07)	<0.001

HTN = hypertension.
[a] Other variables tested but excluded from the final model due to lack of statistical significance included smoking, marital status, educational status, physical activity, alcohol intake, and family history of cardiovascular disease.

Table 4
Multivariate logistic regression analysis showing unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of statistically significant variables associated with awareness of hypertension in hypertensive patients.[a]

	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Male sex	0.64 (0.54–0.76)	<0.001	0.56 (0.47–0.68)	<0.001
Married	2.07 (1.48–2.91)	<0.001	1.85 (1.29–2.66)	0.001
Family history of hypertension	2.92 (2.47–3.47)	<0.001	3.02 (2.51–3.62)	<0.001
History of chronic kidney disease	2.14 (1.69–2.71)	<0.001	1.94 (1.51–2.50)	<0.001
History of diabetes mellitus	2.51 (2.04–3.08)	<0.001	2.06 (1.65–2.57)	<0.001
History of cardiovascular disease	10.48 (5.81–18.91)	<0.001	9.57 (5.1–17.93)	<0.001

[a] Other variables tested but excluded from the final model due to lack of statistical significance included age, educational status, smoking, work status, alcohol intake, body mass index, physical activity, and family history of cardiovascular disease.

Table 5
Multivariate logistic regression analysis showing unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) of statistically significant variables associated with control of hypertension (HTN) in hypertensive patients.[a]

	Unadjusted OR (95% CI)	p	Adjusted OR (95% CI)	p
Age	0.97 (0.96–0.98)	<0.001	0.97 (0.96–0.97)	<0.001
Married	0.91 (0.61–1.34)	0.64	2.01 (1.3–3.2)	0.002
Family history of HTN	1.52 (1.25–1.86)	<0.001	1.6 (1.3–1.9)	<0.001
History of cardiovascular disease	1.95 (1.43–2.67)	<0.001	2.6 (1.8–3.6)	<0.001
BMI	0.95 (0.94–0.97)	<0.001	0.93 (0.92–0.95)	<0.001
Working	0.83 (0.68–1.01)	0.05	0.73 (0.59–0.90)	0.003

BMI = body mass index.
[a] Other variables tested but excluded from the final model due to lack of statistical significance, included sex, education history, smoking, alcohol, physical activity, family history of cardiovascular disease, history of chronic kidney disease, and diabetes mellitus.

the 1990–1994 National Health Survey of Pakistan [7]. In another remote study conducted in the rural part of northern areas of Pakistan, the prevalence of hypertension was found to be 14% [8]. Our results highlight that the prevalence of hypertension has radically increased with time in our population. Factors such as a difference in sampling methodology and geographical region can also contribute to the difference in the results. Other factors like changes in diet, life style, and the rising prevalence of obesity may be contributing factors towards finding of higher prevalence of hypertension in our study [15]. However, our results are consistent with some other recent regional epidemiological studies. Prevalence of hypertension was found to be 30.8%, 29.6%, 29.8%, and 41.8% in South Asian immigrants of the United Arab Emirates (UAE), China, India, and Iran, respectively [16–19]. By contrast, hypertension was prevalent in only 17.1% of the population according to a study conducted in Bangladesh [20]. Our study results are also consistent with hypertension prevalence rates recently reported from other parts of the world. For example, the prevalence of hypertension is 30% in Germany, 30.5% in men and 28.5% in women in the United States, 9.3–70.8% in Africa, 29.5% in Arab countries, and 40.8% worldwide [1,21–24].

We found that age, female sex, BMI, history of diabetes mellitus, chronic kidney disease, cardiovascular disease, and family history of hypertension were associated with a diagnosis of hypertension in our patient population. Age [1,8,16,18,19,24,25] and BMI [8,17,18] have been consistently shown to be associated with hypertension in several other studies. We also found an association between hypertension and chronic diseases such as diabetes mellitus, chronic kidney disease, and cardiovascular disease; this has not been demonstrated in previous epidemiological studies in Pakistan. In addition, our study found a higher prevalence of hypertension among women. This was consistent with results from the 1990–1994 National Health Survey of Pakistan, in which women from the higher age group had a higher prevalence of hypertension [26]. Hypertension was also found to be more prevalent in women according to the studies performed in Iran and Arab countries [19,24].

In our study, 62.3% of all patients showed awareness of hypertension. Awareness of hypertension was 15.4% in men and 36% in women in the 1990–1994 National Health Survey of Pakistan [26]. Local research performed in low-income communities of Karachi in 2004 revealed a hypertension awareness rate of 42% [27]. Thus, our results suggest that awareness of hypertension may have increased over time. In regional comparisons with South Asian immigrants of UAE, China, Bangladesh, Iran, and India, the awareness rate of hypertension in our study is slightly higher than that in

these countries (24%, 42.6%, 50%, 46.2%, and 25.3–42%, respectively) [17–21]. However, awareness of hypertension in our study population is lower than that in Western countries such as Germany (82%) [21] and the United States (69.7–80.7%) [22]. History of diabetes mellitus, chronic kidney disease, cardiovascular disease, family history of hypertension, female sex, and being married were associated with awareness of hypertension in our study. The association between diagnosis of chronic diseases and awareness of hypertension is a significant finding, because awareness is the first significant step towards control of hypertension and the reduction of morbidities in these patients. Female sex has been found to be associated with awareness of hypertension in the 1990–1994 National Health Survey of Pakistan [9] and other studies [19,23]. In contrast to some other studies [1,19,23], we did not find any association between awareness of hypertension and age, BMI, or educational status.

The overall hypertension control rate was 22.3% in our study. Among patients on treatment, only 32.3% had their blood pressure controlled despite 75.3% of these patients being aware of continued hypertension. The control rate in our study population, despite being low, is significantly improved as compared with 3% among hypertensive patients in the 1990–1994 National Health Survey of Pakistan [7]. The hypertension control rate in our study population is also higher than in South Asian immigrants of UAE, China, and India, reported at 8.3%, 9.3%, and 10.2–20%, respectively [16–18]. However, it is lower than the 32.1% and 50% control rates reported in Iran and Bangladesh, respectively [19,20]. The control rate in our patient population is also lower than that reported for Western countries such as Germany (51%) and the United States (40.3–56.3%) and then the worldwide control rate (32.5%) [1,21,22]. Our study has looked at factors associated with the control of hypertension that have not been elucidated in prior local epidemiological studies. We found that age, BMI, and being a worker were inversely associated with control of hypertension, while a family history of hypertension, cardiovascular disease, and being married were associated with better control of hypertension. Additional factors not evaluated in our study that could be responsible for inadequate control include lack of resources, lack of access to healthcare facilities, inadequate education regarding the importance of medication adherence and lifestyle changes, and lack of awareness or inertia among healthcare providers.

Our study has several limitations. First, the study population included patients who had participated in health screening camps, rather than based on a population-based random sample. This may have resulted in an over- or under-estimation of prevalence, awareness, and treatment rates in our study; although results are relatively comparable to those in other regional studies. Secondly, history of chronic illnesses was based on self-reporting and not on thorough history, physical examination, and diagnostic work-up. In addition, we did not collect information on use of traditional remedies in our patients which could have an association with hypertension diagnosis or control. Nonetheless, our study population is the largest to date out of epidemiological studies previously reported from Pakistan, and highlights a significantly rising prevalence of hypertension, the association of hypertension with chronic diseases, and dismal control rates of hypertension.

In summary, our study shows that nearly one-third of patients in health screening camps of rural central Punjab had hypertension. Although awareness and treatment rates have improved, control of hypertension among these patients was still poor at 22.1%. Further study is needed to determine hypertension prevalence, treatment, and control rates in well-designed population based studies. In addition, strategies need to be developed to reduce the risk of hypertension, increase awareness, and improve control rates in patients with hypertension.

Conflicts of interest

The authors have nothing to disclose.

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