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# Prevalence, awareness, treatment and control of arterial hypertension in Astana, Kazakhstan. A cross-sectional study

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ABSTRACT

*Objective:* Very little is known about prevalence of common cardiovascular risk factors in Central Asia. The aim of the study was to assess the prevalence, awareness, treatment and control of arterial hypertension, and factors associated with these indices in a population sample of Astana, the new capital city of Kazakhstan.

*Design:* Cross-sectional study of subjects registered in eight outpatient policlinics in Astana.

*Methods:* A total of 497 adults (response rate 56%) aged 50–75 years randomly selected from registers of the policlinics were examined. Hypertension was defined as a mean systolic and/or diastolic blood pressure of ≥140/90 mm Hg and/or antihypertensive medication use during the last two weeks. Awareness and treatment were based on self-report. Hypertension control was defined as blood pressure <140/90 mm Hg among hypertensive subjects.

*Results:* The overall prevalence of hypertension was 70%. Among hypertensive subjects, 91% were aware of their condition, 77% took antihypertensive medications, and 34% had blood pressure controlled (<140/90 mm Hg). The prevalence of hypertension and its awareness, treatment and control was more common in women, among persons aged 60 years or more and (except control) among those with high body mass index. None of several available socio-economic or lifestyle measures was associated with any of hypertension indices.

*Conclusions:* The levels of awareness, treatment and control of hypertension were higher than in most Eastern European and Central Asian populations with available data, most likely reflecting high education and large proportion of civil servants in the new capital city. However, even in this privileged population the rates of successful control of hypertension were modest.



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## Introduction

Arterial hypertension affects approximately one billion persons worldwide and considered to be the leading preventable cause for cardiovascular mortality; it has been estimated that raised blood pressure currently kills 7.5 million people every year.[1] Therefore, timely diagnostics, treatment and control of hypertension in primary care is crucial for reducing cardiovascular disease (CVD) morbidity and mortality in both high and lower income countries. In this respect, population data on prevalence and awareness of high blood pressure are essential for the development and implementation of public health policies to improve identification, treatment and control of this hypertension.[2]

Kazakhstan and other countries of the Commonwealth of Independent States (CIS), formed after the dissolution of the former Soviet Union, have among the highest rates of CVD mortality worldwide. In Kazakhstan in 2010, age-standardised CVD mortality was 636 per 100,000, almost 6-times higher than in United Kingdom (112 per 100,000) and higher than in the Russia Federation (531 per 100,000) (WHO Global Health Observatory Data Repository, http://apps.who.int/ghodata/). CVDs are estimated to account for more than a half (53%) of all deaths in Kazakhstan.

Despite the high CVD mortality and the importance of hypertension as cardiovascular risk factor, there are very few reliable data on hypertension in the Central Asian republics of the former Soviet Union. The WHO has estimated that in Kazakhstan in 2008, the age-standardized prevalence of hypertension at all ages was 45%, compared to 38% in the UK and 30% in the US (WHO Global Health Observatory Data Repository, http://apps.who.int/ghodata/), although it is not clear from which data these estimates were derived. The authors were unable to identify any published reports on hypertension prevalence in Central Asia with a clearly stated methodology.

The aim of the study was to provide estimates of the prevalence, awareness, treatment, and control of hypertension and factors associated with these characteristics in a population sample of Astana city, the new capital of Kazakhstan.

## Methods

### Study design and subjects

A cross-sectional study of men and women aged 50–75 years old resident in Astana and registered in any of the eight clinics in Astana were conducted. The study sample was randomly selected (after stratifying for age and 5-year age group) from the lists of all inhabitants in this age range who were registered at a clinic (such registration is mandatory in Kazakhstan). Between November 2012 and August 2013, 888 subjects were invited to participate and 497 participated (response rate 56%). The study protocol was approved by the ethical committees of Center for Life Sciences, Nazarbayev University and each participant provided a signed informed consent.

### Measurements

Participants were invited to one outpatient policlinic, where they were interviewed by a trained general practitioner using a structured questionnaire and underwent a short physical examination. The questionnaire covered patient's health, medical history, lifestyle and socio-economic indicators, and the examination included anthropometry, blood pressure measurement and assessment of cognitive and physical functions. The questionnaire was based largely on the Health, Alcohol and Psychosocial factors In Eastern Europe (HAPIEE) study;[3] questions were translated from English into Russian and Kazakh languages, piloted locally and back-translated into English to ensure accuracy and cultural appropriateness. Questions on hypertension awareness and use medication in the last two weeks were taken from the WHO MONICA Project.[4]

Blood pressure was measured after 5 min rest three times on the right arm in the sitting position with Omron M6 (validated by the International Protocol[5,6]), with a 2 min interval between measurements. The average of the second and third measurements was used in the analyses. Hypertension was defined as systolic blood pressure (SBP) $\geq$140 mm Hg, and/or a diastolic blood pressure (DBP) $\geq$90 mm Hg, and/or the use of antihypertensive medication. Participants who reported that a doctor or another health worker ever told them they had hypertension were considered aware of their disease, and those who confirmed antihypertensive medications in the last two weeks were considered under treatment. Participants who were using antihypertensive medication and who had both SBP and DBP pressure lower than 140/90 mm Hg were classified as having controlled hypertension.

### Covariates

In addition to age and sex, the following sociodemographic characteristics were used. Marital status was grouped into married vs. unmarried (widowed, divorced and single). Education was categorized into primary or less; vocational/secondary and university. The ethnicity of participants was classified as Kazakhs, Russians and others. Car ownership was used as marker of the economic status. Based on three questions how often participants do not have enough money for food, clothes and paying bills for their households, three groups of material deprivation (high, intermediate and low) were defined. In addition to sociodemographic variables, body mass index (BMI) categorized according to WHO classification to three groups: normal (BMI 18.5–24.9 kg/m$^2$), overweight (BMI 25–29.9 kg/m$^2$), and obese (BMI over 30 kg/m$^2$) were also used.

### Statistical analysis

In descriptive analysis, unadjusted frequencies by each predictor variable were tabulated. The association between hypertension, awareness, treatment and control as the outcomes and socio-economic characteristics and BMI were estimated in logistic regression: all models were adjusted for age and sex. A complete case analysis was conducted. All analyses were performed using STATA software, version 12 (College Station, Texas, USA).

## Results

Table 1 shows descriptive characteristics of the study sample. The age groups were equally distributed and the majority of the respondents (72%) were married. There was large difference in marital status between male and female participants; the large proportion of unmarried women was largely due to high percentage of widows, reflecting much higher male mortality. The proportion of individuals with higher education was 44% and it was higher in men than in women.

Table 2 presents the prevalence, awareness, treatment and control of hypertension. The overall prevalence of hypertension was 70%. Among hypertensive subjects, 91% were aware of their condition, 77% took antihypertensive medications, and 34% had blood pressure controlled (<140/90 mm Hg). Among those aware of the condition, 84% were taking medication, among those taking medication, 44% had controlled hypertension (i.e. blood pressure below 140/90 mm Hg). All indicators were higher in women than in men; for example, 90% of women aware of their condition took medication, compared with 75% of men.

Table 3 shows the results of logistic regression analysis to identify correlates of hypertension prevalence, awareness, treatment and control. In age and sex adjusted model, the prevalence of hypertension and awareness, treatment and control were higher in women, in persons older than 60 years and, except control, with high body mass index. None of several other sociodemographic measures was statistically significantly associated with any of hypertension indices, although the higher prevalence in non-Kazakh ethnic groups and lower odds of control in unmarried persons were marginally significant. Similarly, smoking and alcohol were not significantly associated with hypertension indices. In a multivariate model, controlling for all variables in the table, the associations between the prevalence of hypertension with age, sex and body mass index remained statistically significant (not shown in table).

**Table 1 – Descriptive characteristics of the study population.**

| Variable name | Males | Females | Both sexes |
|---|---|---|---|
| **Total** | 233 (100%) | 264 (100%) | 497 (100%) |
| **Systolic blood pressure, mean (SD)** | 136.1 (22.8) | 134.2 (22.9) | 135.1 (22.8) |
| **Diastolic blood pressure, mean (SD)** | 87.4 (13.6) | 88.0 (13.8) | 87.7 (13.7) |
| **BMI, mean (SD)** | 28.6 (4.5) | 30.6 (5.1) | 29.7 (5.0) |
| **BMI groups** | | | |
| 18–24.9 | 21% | 12% | 17% |
| 25–29.9 | 42% | 35% | 38% |
| Over 30 | 37% | 53% | 45% |
| **Age groups (years)** | | | |
| 50–54 | 27% | 24% | 25% |
| 55–59 | 21% | 20% | 20% |
| 60–64 | 22% | 21% | 22% |
| 65–69 | 15% | 17% | 16% |
| 70–75 | 15% | 18% | 17% |
| **Marital status** | | | |
| Married | 92% | 54% | 72% |
| Unmarried | 8% | 46% | 28% |
| **Education** | | | |
| 1 Primary | 29% | 41% | 35% |
| 2 Secondary | 20% | 22% | 21% |
| 3 Higher | 51% | 37% | 44% |
| **Car ownership** | | | |
| No | 32% | 46% | 39% |
| Yes | 68% | 54% | 61% |
| **Ethnicity** | | | |
| Kazakh | 64% | 51% | 57% |
| Russian | 19% | 32% | 26% |
| Other | 17% | 17% | 17% |
| **Deprivation level** | | | |
| 1 Low level | 49% | 39% | 44% |
| 2 Intermediate | 31% | 28% | 29% |
| 3 High level | 20% | 33% | 27% |

## Discussion

This study aimed to fill the gap on evidence on hypertension in the Central Asian republics of the former Soviet Union. In this population sample of older residents of Astana, the new capital of Kazakhstan, the prevalence of hypertension was similar to other populations while the levels of awareness, treatment and control were relatively high, and were positively associated with female sex, higher age and high BMI.

When interpreting the results, several limitations should be kept in mind. First, the representativeness of the study sample needs to be considered. The study is clearly not representative for the whole country. Astana is a new capital; over the past 15 years, its population increased about 5-fold, and its growth has attracted well educated persons employed in large civil service and thriving private business. For this reasons, Astana population is considerably more affluent, and healthier, than the national average. In addition, although registration with a policlinic is mandatory in Kazakhstan, more affluent persons may be more likely to adhere to this rule. The response rate was modest, although similar to most recent studies in Europe and elsewhere; unfortunately, the authors did not have the resources to conduct home visits. Response rate is usually positively associated with socioeconomic status, as reflected in high education and car ownership in the study sample. It has been reported that respondents in epidemiological surveys are more healthy and more health conscious than non-respondents. These factors are likely to affect the results, although they are aware that the bias can affect the results either way.

In comparison to the national population, participants in this study were more affluent and had a better access to health care, and this may explain their high rates of awareness, treatment and control of hypertension. Although the response rate calculation may be an under-estimate, as the sampling frame did not cover recent out- and in-migration, the sample cannot be seen as representative for the Kazakh national population. On the other hand, it is unlikely that non-response and potentially incomplete sampling frame substantially affected the (lack of) relationships between hypertension indices and covariates.

The second limitation is the cross-sectional design which may complicate the assessment of temporality of association. In this study, only few covariates were related to hypertension

**Table 2 – Prevalence, awareness, treatment and control of arterial hypertension in Astana.**

| | Males (n = 233) | | Females (n = 264) | | Both sexes (n = 497) | |
|---|---|---|---|---|---|---|
| | Estimate (95% CI) | Cases/all | Estimate (95% CI) | Cases/all | Estimate (95% CI) | Cases/all |
| Prevalence of hypertension among all | 65% (59–71) | 151/233 | 75% (70–81) | 199/264 | 70% (66–74) | 350/497 |
| Awareness among all cases of AH | 87% (82–93) | 132/151 | 93% (89–97) | 185/199 | 91% (87–94) | 317/350 |
| Treatment among all cases of AH | 66% (59–74) | 100/151 | 84% (79–90) | 168/199 | 77% (72–81) | 268/350 |
| Treatment among aware | 75% (68–82) | 99/132 | 90% (85–94) | 166/185 | 84% (79–88) | 265/317 |
| Control among all cases of AH | 25% (18–32) | 38/151 | 41% (34–48) | 81/199 | 34% (29–39) | 119/350 |
| Control among treated | 38% (28–48) | 38/100 | 48% (41–56) | 48/168 | 44% (38–50) | 119/268 |

indices, and it possible that this lack of associations is due to changes in behaviour or socio-economic status among subjects who have been previously diagnosed with hypertension. However, it is not believed that this bias played a major role in the results.

Third, the diagnosis of hypertension may be inaccurate, as blood pressure levels were based on readings taken during one visit to the policlinic. In addition, the automated blood pressure monitor used is not very common in Kazakhstan. This may overestimate the hypertension prevalence, because of the white coat effect,[7] and because diagnosis of hypertension should be based on persistent high blood pressure established in several occasions. Finally, the survey had relatively small sample size and therefore low statistical power; it is possible that some associations with covariates were not detected.

To the knowledge of the authors, this is the first report attempting to estimate prevalence, awareness, treatment and control of hypertension in Kazakhstan, and it is likely to be one of the first studies using a standard methodology in any Central Asian republic of the former Soviet Union. High level of all hypertension indices compared to results published in

**Table 3 – Association of selected factors with the prevalence, awareness, treatment and control of arterial hypertension, OR (95% CI) age and sex adjusted.**

| | Prevalence OR (95% CI) | Awareness[a] OR (95% CI) | Treatment[a] OR (95% CI) | Control[a] OR (95% CI) |
|---|---|---|---|---|
| **Sex** | | | | |
| Males | 1 | 1 | 1 | 1 |
| Females | 1.69 (1.13–2.51) | 1.74 (1.20–2.53) | 2.31 (1.60–3.34) | 2.28 (1.47–3.53) |
| **Age groups, yrs** | | | | |
| 50–54 | 1 | 1 | 1 | 1 |
| 55–59 | 1.58 (0.91–2.75) | 1.83 (1.07–3.15) | 2.24 (1.30–3.87) | 2.58 (1.33–5.02) |
| 60–64 | 2.09 (1.19–3.67) | 2.07 (1.21–3.52) | 2.91 (1.69–4.99) | 2.45 (1.27–4.73) |
| 65–69 | 2.79 (1.44–5.39) | 2.49 (1.37–4.55) | 2.42 (1.35–4.35) | 1.93 (0.93–3.99) |
| 70–75 | 2.39 (1.27–4.52) | 2.43 (1.35–4.41) | 2.66 (1.48–4.75) | 1.97 (0.97–4.00) |
| **BMI** | | | | |
| 18–24.9 | 1 | 1 | 1 | 1 |
| 25–29.9 | 1.92 (1.11–3.29) | 1.80 (1.05–3.09) | 1.44 (0.83–2.50) | 1.16 (0.62–2.20) |
| ≥30 | 4.19 (2.38–7.37) | 4.25 (2.44–7.40) | 2.94 (1.69–5.10) | 0.94 (0.50–1.76) |
| **Marital status** | | | | |
| Married | 1 | 1 | 1 | 1 |
| Unmarried | 1.26 (0.76–2.07) | 1.38 (0.86–2.22) | 1.09 (0.68–1.73) | 0.65 (0.40–1.08) |
| **Education** | | | | |
| 1 Primary | 1 | 1 | 1 | 1 |
| 2 Vocational | 0.86 (0.50–1.47) | 0.88 (0.53–1.47) | 0.92 (0.55–1.53) | 0.91 (0.49–1.66) |
| 3 Higher | 1.19 (0.75–1.89) | 1.13 (0.73–1.74) | 1.28 (0.83–1.96) | 1.29 (0.79–2.11) |
| **Car ownership** | | | | |
| Yes | 1 | 1 | 1 | 1 |
| No | 1.22 (0.80–1.87) | 1.24 (0.83–1.85) | 1.18 (0.79–1.75) | 1.19 (0.75–1.87) |
| **Deprivation** | | | | |
| 1 Low level | 1 | 1 | 1 | 1 |
| 2 Intermediate | 0.72 (0.45–1.14) | 0.71 (0.46–1.11) | 0.67 (0.43–1.04) | 0.68 (0.40–1.15) |
| 3 High level | 1.20 (0.72–2.00) | 1.58 (0.97–2.57) | 1.46 (0.92–2.34) | 0.98 (0.59–1.63) |
| **Ethnicity** | | | | |
| Kazakh | 1 | 1 | 1 | 1 |
| Russian | 1.56 (0.94–2.60) | 1.24 (0.78–1.98) | 1.37 (0.87–2.15) | 0.95 (0.57–1.58) |
| Other | 1.70 (0.95–3.04) | 1.54 (0.90–2.65) | 1.38 (0.82–2.31) | 1.00 (0.55–1.82) |

[a] Among persons with hypertension.

the literature from many lower-income countries and comparable to reports from high-income countries were found. For example, in the US in 1990s–2000s, the levels of awareness, treatment and control were around 70%, 59% and 34%;[8] a more recent study reported the proportion of controlled hypertension as 27% in England, 53% in the US and 66% in Canada.[9] In the Czech Republic, results were very similar to those found in this study.[10] In contrast, recently published data from the SAGE study in six lower- and middle-income countries have shown prevalence of awareness ranging between 23% in Ghana to 72% in Russia, and prevalence of controlled hypertension between 4% in Ghana to 14% in India.[11] An earlier study in Krasnodar, Russia, reported the awareness, treatment and control of hypertension of 78%, 71% and 4%, respectively.[12] An early study from Uzbekistan in the 1980s suggested awareness of 40% and control of 4% before a hypertension control programme.[13] The results are therefore more similar to high-income countries than to lower income countries and to other former Soviet countries, such as Russia and Uzbekistan. On the other hand, as multicountry study in eight post Soviet countries found much lower levels of regular antihypertensive treatment use (27%) in Kazakhstan;[14] however, differences in methodology make direct comparison difficult.

In the SAGE study, the associations between hypertension indices and socio-economic circumstances were inconsistent between countries.[11] Awareness and control of hypertension were often but not always higher in subjects with higher education and higher income. In Russia, a country historically close to Kazakhstan, awareness of hypertension was positively associated with both education and wealth while hypertension control was positively associated with wealth but not with education. It is not clear why the consistent social gradients in hypertension indices in the data are not found. This could be due to high access to health services in this study sample that is available in Astana. Unfortunately, the exact job titles and place of work are not recorded, and this hypothesis was not explored further. It is also possible that, given the modest response rate, self-selection of participants may have resulted in a very health conscious sample with high levels of treatment in all socio-economic groups. Alternatively, the Kazakh population may still be at an earlier stage of the epidemiological transition and the western-type of socio-economic gradient has not yet been established.

In conclusion, high levels of awareness and treatment were found, and the proportion of controlled hypertensive subjects was higher than in most low- and middle-income countries, including Eastern Europe and Central Asia, possibly due to high level of education and large proportion of civil servants in this population sample. Although the study suggested good access to health services and treatment, the levels of hypertension control were lower than those achieved in some high-income countries, potentially suggesting less effective use of medication.

Given the very high prevalence of hypertension in this sample, and since Astana is not nationally representative, there is urgent need for a nationwide study, or at least surveys including rural areas, to understand the burden of hypertension and to design an appropriate strategy to control hypertension in Kazakhstan. It is important to obtain reliable and internationally comparable estimates of the prevalence, awareness and treatment of hypertension in different sections of the Kazakh population, particularly in rural areas and in lower socio-economic groups. Finally, the results from Astana suggest that, even in affluent populations with high levels of treatment, achieving successful control is difficult; adoption of and adherence to modern management guidelines in primary care will be essential.

## Author statements

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### *Competing interests*

The authors declare that they have no competing interests.

### *Authors' contribution*

AS and MB jointly designed the study, analysed the data and drafted and finalized the manuscript. TN and ZZ participated in the study design, helped to obtain funding to set up field work, and critically revised the manuscript. AK and LU participated in data collection and data management and critically revised the manuscript.

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