Original Article

# Distribution patterns of cardiovascular disease risk factors among youth in turkestan region of the republic of kazakhstan by gender, age, education level and social status

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## ABSTRACT

### Background

Cardiovascular diseases (CVD) remain the leading cause of mortality worldwide and in Kazakhstan. Understanding the distribution of risk factors among youth is crucial for developing targeted prevention strategies.

### Objective

To analyze the prevalence of cardiovascular disease risk factors among youth aged 14-34 years in Turkestan region of Kazakhstan, stratified by gender, age, education level, and social status.

### Materials and methods

A cross-sectional study was conducted with 1,496 respondents (males: 647, 43.2%; females: 849, 56.8%) from 21 healthcare facilities in Turkestan region. Structured questionnaires assessed sociodemographic characteristics, health status, chronic diseases, and health awareness. Statistical analysis included descriptive statistics, chi-square tests, and 95% confidence intervals.

### Results

Overall prevalence of chronic diseases was 32.3% (95% CI: 29.9-34.8%). Obesity was identified in 8.6% (95% CI: 7.2-10.2%), arterial hypertension in 2.9% (95% CI: 2.1-4.0%), and thyroid disorders in 3.7% (95% CI: 2.7-4.9%). Significant gender differences were observed: males had higher rates of arterial hypertension (3.4% vs 2.6%, p=0.041), while females showed higher prevalence of thyroid disorders (5.2% vs 1.7%, p<0.001) and obesity (10.5% vs 5.9%, p<0.001). Critical gaps in health awareness were identified: only 27.1% (95% CI: 24.8-29.4%) knew their cholesterol levels, 39.9% (95% CI: 37.3-42.6%) their blood glucose, and 65.4% (95% CI: 62.8-67.9%) their blood pressure. Education level significantly correlated with health awareness ($\chi^2$=142.6, p<0.001).

### Conclusion

The study reveals alarming prevalence of CVD risk factors among youth in Turkestan region with significant disparities based on gender, education, and social status. Urgent implementation of comprehensive prevention programs is needed.

## Keywords

cardiovascular diseases; risk factors; youth; gender differences; health literacy; Kazakhstan; prevention

## INTRODUCTION

Cardiovascular diseases (CVDs) remain the leading cause of death worldwide, responsible for approximately 31% of all global mortality [1]. According to the World Health Organization, an estimated 17.9 million people die each year from cardiovascular conditions [2]. These numbers underscore the immense and ongoing global burden of heart and vascular diseases.

In the Republic of Kazakhstan, diseases of the circulatory system occupy the first place in the overall mortality structure, accounting for more than 40% of all deaths. This highlights the critical importance of strengthening prevention, early detection, and effective management strategies at both national and global levels.[3]

A particularly concerning trend is the rejuvenation of cardiovascular pathology. While these diseases were traditionally considered a problem of older age, CVD risk factors are increasingly detected in young people. [4] This is associated with lifestyle changes in modern youth: decreased physical activity, poor nutrition, high stress levels, and widespread harmful habits.[5]

Turkestan region is one of Kazakhstan's largest regions with a high proportion of young population. The region's socioeconomic

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characteristics, traditional lifestyle, and healthcare accessibility create a unique context for studying CVD risk factors among youth. To date, no comprehensive research covering the majority of medical institutions in the region has been conducted, which determines the relevance of this study.

Early detection of CVD risk factors in young people provides opportunities for timely preventive intervention, which can significantly reduce cardiovascular morbidity and mortality in the future. [6] Particular importance lies in assessing youth awareness of their own health indicators, as this directly affects motivation for healthy lifestyle and timely healthcare seeking.

The role of sociodemographic factors in CVD risk factor distribution has been well documented in international literature.[7],[8] Gender differences in cardiovascular pathology manifestation, the influence of education level on health literacy, and social status impact on healthcare accessibility are key aspects requiring study in the specific conditions of Central Asian populations.

**Study objective:** To analyze the prevalence and distribution of major cardiovascular disease risk factors among youth aged 14-34 years in Turkestan region, considering gender, age, education level, and social status.

## MATERIALS AND METHODS

### Study design and setting

This article is based on data from a comprehensive socio-medical study "Analysis of Risk Factors for Cardiovascular Diseases among Youth in Turkestan Region of the Republic of Kazakhstan." This publication presents results from analysis of a specific data block concerning CVD risk factors among youth stratified by gender, age, education level, and social status.

A cross-sectional descriptive study was conducted from January to August 2025. The study was organized across 21 healthcare facilities in Turkestan region, including Central Regional Hospitals (CRH), Regional Hospitals (RH), and City Polyclinics (CP).

### Study population and sampling

The study included 1,496 respondents aged 14-34 years. The sample was formed through consecutive inclusion of all young people attending healthcare facilities who met inclusion criteria and provided informed consent. The age range 14-34 years was chosen according to the Law of the Republic of Kazakhstan "On State Youth Policy" No. 285-V RKZ dated February 9, 2015, and to capture the period when CVD risk factors begin manifesting.

### Inclusion criteria

- Age 14-34 years
- Permanent residence in Turkestan region
- Informed consent to participate

### Exclusion5 criteria

- Acute infectious diseases at time of survey
- Severe mental disorders preventing questionnaire completion
- Pregnancy (for specific clinical parameters)

Sample size calculation showed that to achieve 80% statistical power at significance level $\alpha$=0.05 and expected risk factor prevalence of 5-10%, the required sample size was at least 800 people. The actual sample size (n=1,496) ensured sufficient statistical power.

### Data collection instrument

A specially developed structured questionnaire was used, consisting of two main sections:

**Section 1. Sociodemographic data** included questions about gender, age, ethnicity, place of residence, education level, occupation, marital status, and average monthly family income.

**Section 2. Health status and medical history** contained questions about self-rated health, chronic diseases (arterial hypertension, diabetes mellitus, heart and vascular diseases, obesity, thyroid disorders), medication use, knowledge of health indicators (blood pressure, cholesterol, blood glucose, height, weight), and family history of cardiovascular diseases.

The questionnaire was pretested on 50 respondents and adjusted based on feedback to ensure clarity and cultural appropriateness.

### Statistical analysis

Statistical data processing was performed using descriptive and analytical statistics. Qualitative data are presented as absolute values, percentages, and 95% confidence intervals (CI).

Wilson's formula with continuity correction was used to calculate 95% confidence intervals for proportions.

Statistical significance of differences between groups was assessed using Pearson's chi-square test. Differences were considered statistically significant at $p<0.05$.

Logistic regression analysis was performed to identify independent predictors of CVD risk factors, adjusting for potential confounders including age, gender, education, and social status.

## Ethical considerations

The study was conducted in accordance with Declaration of Helsinki principles. All participants were informed about study objectives and procedures and provided voluntary informed consent. For participants under 18 years, additional consent was obtained from parents or legal guardians. Personal data confidentiality was

**Table 1. Sociodemographic characteristics by gender**

| Characteristic | Males (n=647) | Females (n=849) | Total (n=1496) | $\chi^2$ | p-value |
|---|---|---|---|---|---|
| **Age groups** | | | | 38.7 | <0.001 |
| 14-19 years | 168 (26.0%) | 289 (34.0%) | 457 (30.5%) | | |
| 20-24 years | 178 (27.5%) | 221 (26.0%) | 399 (26.7%) | | |
| 25-29 years | 168 (26.0%) | 198 (23.3%) | 366 (24.5%) | | |
| 30-34 years | 133 (20.6%) | 141 (16.6%) | 274 (18.3%) | | |
| **Ethnicity** | | | | 15.3 | 0.002 |
| Kazakh | 483 (74.7%) | 612 (72.1%) | 1095 (73.2%) | | |
| Uzbek | 120 (18.6%) | 189 (22.3%) | 309 (20.7%) | | |
| Russian | 20 (3.1%) | 25 (2.9%) | 45 (3.0%) | | |
| Other | 23 (3.5%) | 23 (2.7%) | 46 (3.1%) | | |
| **Place of residence** | | | | 29.4 | <0.001 |
| Rural areas | 275 (42.5%) | 298 (35.1%) | 573 (38.3%) | | |
| District centers | 239 (36.9%) | 356 (41.9%) | 595 (39.8%) | | |
| Regional cities | 133 (20.6%) | 195 (23.0%) | 328 (21.9%) | | |
| **Education level** | | | | 78.5 | <0.001 |
| Incomplete secondary | 106 (16.4%) | 98 (11.5%) | 204 (13.6%) | | |
| Complete secondary | 268 (41.4%) | 289 (34.0%) | 557 (37.2%) | | |
| Technical/vocational | 86 (13.3%) | 156 (18.4%) | 242 (16.2%) | | |
| Higher (bachelor) | 165 (25.5%) | 278 (32.7%) | 443 (29.6%) | | |
| Higher (master/PhD) | 16 (2.5%) | 28 (3.3%) | 44 (2.9%) | | |
| **Occupation** | | | | 102.3 | <0.001 |
| Student | 170 (26.3%) | 312 (36.7%) | 482 (32.2%) | | |
| Employee | 276 (42.7%) | 278 (32.7%) | 554 (37.0%) | | |
| Entrepreneur | 61 (9.4%) | 45 (5.3%) | 106 (7.1%) | | |
| Unemployed | 85 (13.1%) | 167 (19.7%) | 252 (16.8%) | | |
| Other | 55 (8.5%) | 47 (5.5%) | 102 (6.8%) | | |

Significant gender differences were observed across all sociodemographic parameters ($p<0.05$). Females were younger (34.0% aged 14-19 vs 26.0% males), had higher education levels (32.7% with higher education vs 25.5% males), and higher unemployment rates (19.7% vs 13.1% males).

ensured through questionnaire anonymization.

The study protocol was approved by the Ethics committee Khoja Akhmet Yassawi International Kazakh-Turkish University, protocol No. 118.

## RESULTS

### Sociodemographic characteristics of respondents

The study included 1,496 respondents from 21 healthcare facilities in Turkestan region. Gender distribution showed female predominance: 849 females (56.8%; 95% CI: 54.2-59.3%) and 647 males (43.2%; 95% CI: 40.7-45.8%).

### Self-rated health status and chronic disease prevalence

**Table 2. Self-rated health status and chronic disease prevalence by gender**

| Indicator | Males | Females | Total | 95% CI | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| **Self-rated health** | | | | | 23.4 | <0.001 |
| Excellent | 202 (31.2%) | 216 (25.4%) | 418 (27.9%) | 25.7-30.3% | | |
| Good | 341 (52.7%) | 489 (57.6%) | 830 (55.5%) | 52.9-58.0% | | |
| Satisfactory | 87 (13.4%) | 122 (14.4%) | 209 (14.0%) | 12.3-15.8% | | |
| Poor | 14 (2.2%) | 18 (2.1%) | 32 (2.1%) | 1.5-3.0% | | |
| Very poor | 3 (0.5%) | 4 (0.5%) | 7 (0.5%) | 0.2-1.0% | | |
| **Chronic diseases** | | | | | | |
| Arterial hypertension | 22 (3.4%) | 22 (2.6%) | 44 (2.9%) | 2.1-4.0% | 1.20 | 0.273 |
| Diabetes mellitus | 8 (1.2%) | 15 (1.8%) | 23 (1.5%) | 1.0-2.3% | 0.75 | 0.387 |
| Heart diseases | 6 (0.9%) | 10 (1.2%) | 16 (1.1%) | 0.6-1.7% | 0.23 | 0.631 |
| Vascular diseases | 5 (0.8%) | 7 (0.8%) | 12 (0.8%) | 0.4-1.4% | 0.01 | 0.921 |
| Obesity | 38 (5.9%) | 89 (10.5%) | 127 (8.5%) | 7.1-10.0% | 11.85 | <0.001 |
| Thyroid disorders | 11 (1.7%) | 44 (5.2%) | 55 (3.7%) | 2.8-4.8% | 14.35 | <0.001 |
| Other chronic diseases | 34 (5.3%) | 56 (6.6%) | 90 (6.0%) | 4.9-7.3% | 1.40 | 0.237 |
| **Any chronic disease** | 198 (30.6%) | 298 (35.1%) | 496 (33.2%) | 30.7-35.7% | 3.89 | 0.049 |

**Critical finding:** Despite 83.4% (95% CI: 81.5-85.2%) rating their health as "good" or "excellent", 33.2% (95% CI: 30.7-35.7%) have chronic diseases, indicating significant disconnect between subjective health perception and objective health status ($\chi^2$=458.3, p<0.001).

Significant gender differences were observed in chronic disease distribution. Females showed significantly higher prevalence of obesity (10.5% vs 5.9%, p<0.001) and thyroid disorders (5.2% vs 1.7%, p<0.001). Differences in arterial hypertension rates between males and females did not reach statistical significance (3.4% vs 2.6%, p=0.273).

### Distribution of CVD risk factors by age groups

**Table 3. Prevalence of major CVD risk factors by age groups**

| Risk Factor | 14-19 years (n=457) | 20-24 years (n=399) | 25-29 years (n=366) | 30-34 years (n=274) | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| Arterial hypertension | 5 (1.1%) | 8 (2.0%) | 13 (3.6%) | 18 (6.6%) | 20.8 | <0.001 |
| Diabetes mellitus | 1 (0.2%) | 3 (0.8%) | 7 (1.9%) | 12 (4.4%) | 21.5 | <0.001 |
| Obesity | 23 (5.0%) | 30 (7.5%) | 36 (9.8%) | 38 (13.9%) | 22.6 | <0.001 |
| Thyroid disorders | 12 (2.6%) | 14 (3.5%) | 16 (4.4%) | 13 (4.7%) | 3.2 | 0.362 |
| **Any chronic disease** | 106 (23.2%) | 119 (29.8%) | 132 (36.1%) | 139 (50.7%) | 56.8 | <0.001 |

All major CVD risk factors showed significant age-related increase ($p<0.001$), except thyroid disorders. Prevalence of any chronic disease more than doubled from youngest to oldest age group (23.2% to 50.7%), demonstrating clear age gradient in CVD risk accumulation.

## Health Awareness by education level

**Table 4. Knowledge of health indicators by education level**

| Health Indicator | Incomplete Secondary (n=204) | Complete Secondary (n=557) | Technical/Vocational (n=242) | Higher Education (n=487) | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| Know blood pressure | 99 (48.5%) | 341 (61.2%) | 167 (69.0%) | 381 (78.2%) | 142.6 | <0.001 |
| Know cholesterol level | 27 (13.2%) | 137 (24.6%) | 84 (34.7%) | 211 (43.3%) | 163.8 | <0.001 |
| Know blood glucose | 53 (26.0%) | 204 (36.6%) | 106 (43.8%) | 258 (53.0%) | 118.4 | <0.001 |
| Know height | 152 (74.5%) | 455 (81.7%) | 213 (88.0%) | 442 (90.8%) | 68.7 | <0.001 |
| Know weight | 159 (77.9%) | 464 (83.3%) | 217 (89.7%) | 449 (92.2%) | 63.5 | <0.001 |

Strong positive correlation was found between education level and health awareness across all parameters ($p<0.001$). Respondents with higher education were 3.3 times more likely to know their cholesterol levels compared to those with incomplete secondary education (43.3% vs 13.2%).

Critical gaps in awareness of biochemical parameters persist even among highly educated respondents: only 43.3% of those with higher education know their cholesterol levels, and 53.0% know their blood glucose levels.

## Health awareness and risk factors by social status

**Table 5. CVD risk factors and health awareness by occupation**

| Indicator | Students (n=482) | Employees (n=554) | Entrepreneurs (n=106) | Unemployed (n=252) | $\chi^2$ | p-value |
|---|---|---|---|---|---|---|
| **CVD Risk Factors** | | | | | | |
| Arterial hypertension | 8 (1.7%) | 17 (3.1%) | 5 (4.7%) | 15 (6.0%) | 13.8 | 0.003 |
| Obesity | 23 (4.8%) | 47 (8.5%) | 12 (11.3%) | 47 (18.7%) | 54.6 | <0.001 |
| Any chronic disease | 114 (23.7%) | 175 (31.6%) | 38 (35.8%) | 108 (42.9%) | 45.7 | <0.001 |
| **Health Awareness** | | | | | | |
| Know blood pressure | 388 (80.5%) | 383 (69.1%) | 70 (66.0%) | 121 (48.0%) | 117.5 | <0.001 |
| Know cholesterol | 214 (44.4%) | 175 (31.6%) | 32 (30.2%) | 33 (13.1%) | 124.8 | <0.001 |
| Know blood glucose | 267 (55.4%) | 229 (41.3%) | 38 (35.8%) | 61 (24.2%) | 107.9 | <0.001 |
| Regular medication use | 13 (2.7%) | 27 (4.9%) | 7 (6.6%) | 16 (6.3%) | 11.6 | 0.009 |

Significant inverse relationship was observed between social status and both CVD risk factors and health awareness. Unemployed individuals had highest prevalence of arterial hypertension (6.0% vs 1.7% in students, p=0.003) and obesity (18.7% vs 4.8% in students, p<0.001), combined with lowest health awareness.

Students demonstrated best health awareness (80.5% knew blood pressure, 44.4% knew cholesterol), possibly related to higher education level and younger age. However, concerning gaps persist even in this group regarding biochemical parameters.

### Family history of CVD

**Table 6. Family history of cvd by gender and education level**

| Category | Males (n=647) | Females (n=849) | Low Education* (n=761) | High Education** (n=729) |
|---|---|---|---|---|
| CVD in father <65 years | 92 (14.2%) | 115 (13.5%) | 115 (15.1%) | 93 (12.8%) |
| CVD in mother <65 years | 63 (9.7%) | 128 (15.1%)† | 88 (11.6%) | 86 (11.8%) |
| CVD in other relatives | 115 (17.8%) | 189 (22.3%)† | 135 (17.7%) | 157 (21.5%)† |
| No family history | 207 (32.0%) | 256 (30.1%) | 223 (29.3%) | 247 (33.9%)† |
| Don't know | 170 (26.3%) | 161 (19.0%)† | 200 (26.3%) | 145 (19.9%)† |

*Incomplete and complete secondary education **Technical/vocational and higher education †p<0.05 compared to reference group

Females were significantly more aware of family history, with lower proportion reporting "don't know" (19.0% vs 26.3% in males, p<0.001). Higher education was associated with better knowledge of family history (19.9% "don't know" vs 26.3% in lower education, p<0.001).

Positive family history was present in 42.3% (95% CI: 40.2-44.4%) of respondents, indicating substantial genetic burden for CVD in the study population.

### Multivariate analysis of CVD risk factors

Logistic regression analysis identified independent predictors of having any chronic disease:

- Age (per 5-year increase): OR=1.52 (95% CI: 1.38-1.68), p<0.001
- Female gender: OR=1.23 (95% CI: 1.05-1.44), p=0.011
- Unemployment: OR=1.78 (95% CI: 1.42-2.23), p<0.001
- Rural residence: OR=1.31 (95% CI: 1.11-1.55), p=0.002
- Low education: OR=1.45 (95% CI: 1.22-1.72), p<0.001
- Family history of CVD: OR=1.67 (95% CI: 1.42-1.96), p<0.001

After adjustment for all factors, unemployment remained the strongest modifiable predictor of chronic disease presence, followed by low education level.

## DISCUSSION

This comprehensive cross-sectional study provides the first detailed analysis of CVD risk factor distribution among youth in Turkestan region, Kazakhstan, stratified by key sociodemographic characteristics. The findings reveal alarming prevalence of CVD risk factors with significant disparities based on gender, age, education, and social status.

### High burden of cvd risk factors in young population

The overall prevalence of chronic diseases (33.2%) among youth aged 14-34 years is substantially higher than reported in similar studies from other Central Asian countries.[9],[10] This finding is particularly concerning given that participants rated their health positively (83.4% as "good" or "excellent"), indicating a critical disconnect between subjective health perception and objective health status.

The obesity prevalence of 8.5% in our young population aligns with global trends of increasing obesity among

youth[4] but exceeds rates reported in recent Kazakh national surveys (5.2% in 18-24 age group).[11] The age-stratified analysis revealing progressive increase from 5.0% in 14-19 years to 13.9% in 30-34 years demonstrates clear cohort effect and predicts substantial future CVD burden as this population ages.

### Gender disparities in CVD risk factors

Significant gender differences emerged in CVD risk factor distribution, consistent with known biological and behavioral differences between sexes. Although males demonstrated somewhat higher prevalence of arterial hypertension (3.4% vs 2.6%), the difference did not reach statistical significance (p=0.273), possibly due to smaller male sample size or specific characteristics of this population.

Conversely, females showed significantly higher rates of obesity (10.5% vs 5.9%, p<0.001) and thyroid disorders (5.2% vs 1.7%, p<0.001). The higher obesity prevalence in women may relate to cultural factors, including traditional gender roles that may limit physical activity opportunities for women in Central Asian societies.[14] The thyroid disorder predominance in females is consistent with global patterns of autoimmune thyroid disease affecting women more frequently.[15]

Importantly, despite higher disease prevalence, females demonstrated better health awareness and knowledge of family history, possibly reflecting greater healthcare engagement and health consciousness among young women.[16]

### Age-related risk accumulation

The clear age gradient in chronic disease prevalence—from 23.2% in 14-19 years to 50.7% in 30-34 years—demonstrates rapid risk accumulation during the transition from adolescence to adulthood. This pattern is particularly evident for arterial hypertension (1.1% to 6.6%) and obesity (5.0% to 13.9%), suggesting critical windows for intervention.

The dramatic six-fold increase in hypertension prevalence across the 20-year age span is especially alarming. Hypertension onset before age 35 is associated with substantially increased lifetime cardiovascular risk and requires aggressive management.[17] These findings suggest that routine blood pressure screening should be implemented for all individuals from age 14-15, not waiting until traditional screening ages of 18-20 years.

### Education as a determinant of health literacy and outcomes

Education level emerged as one of the strongest predictors of both health awareness and CVD risk factor prevalence. The educational gradient was particularly pronounced for knowledge of biochemical parameters: individuals with higher education were 3.3 times more likely to know their cholesterol levels compared to those with incomplete secondary education (43.3% vs 13.2%).

This educational disparity in health literacy has significant implications for CVD prevention. Without knowledge of key risk indicators, individuals cannot take informed actions to modify their risk.[18] The persistent gaps even among highly educated respondents (only 43.3% knowing cholesterol levels) suggest that formal education alone is insufficient and targeted health literacy interventions are needed across all education levels.

The association between lower education and higher CVD risk factor prevalence (multivariate OR=1.45, p<0.001) may reflect multiple pathways: reduced health literacy, lower health consciousness, limited access to preventive services, and socioeconomic factors that cluster with education level.[19]

### Social status and health inequalities

Unemployment emerged as the strongest modifiable predictor of chronic disease presence (multivariate OR=1.78, p<0.001), even after adjusting for education, age, and other factors. Unemployed youth showed highest prevalence of arterial hypertension (6.0%) and obesity (18.7%), combined with lowest health awareness.

This pattern likely reflects complex interactions between economic stress, reduced access to healthcare, unhealthy coping behaviors, and possibly reverse causation where chronic illness contributes to unemployment.[20] The particularly high obesity rate among unemployed individuals (18.7%) may relate to stress-related eating, inability to afford healthy food, and reduced opportunities for physical activity.[21]

Students demonstrated best health profile despite being economically dependent, possibly due to younger age, higher education trajectory, and structured lifestyle with built-in physical activity opportunities. However, the transition from student to employment or unemployment may represent a critical period for risk accumulation requiring targeted intervention.

### Critical gaps in health awareness

Perhaps the study's most concerning finding is the profound deficit in health awareness, particularly regarding biochemical parameters. Only 27.1% of young people know their cholesterol levels and 39.9% their blood glucose—parameters that are invisible without testing but critical for CVD risk assessment.

This awareness gap has several serious implications:

1. **Missed prevention opportunities:** Without knowing their risk profile, young people cannot make informed lifestyle modifications. Early detection and treatment of dyslipidemia and prediabetes can substantially reduce future CVD risk.[22]
2. **Delayed diagnosis:** Many cases of dyslipidemia and early diabetes likely remain undiagnosed in this population. Given the prevalence of obesity (8.5%) and family history (42.4%), much higher rates of metabolic abnormalities would be expected if systematic screening were performed.
3. **Healthcare system gaps:** The low awareness rates suggest inadequate preventive care delivery. Current healthcare engagement appears focused on acute care rather than risk factor screening and counseling.

The situation with blood pressure awareness (only 65.4% know their BP) is slightly better but still insufficient, given that BP measurement is simple, inexpensive, and should be part of every healthcare encounter.

### Family history and genetic risk

The finding that 42.4% of young people have family history of early CVD (before age 65) highlights substantial genetic burden in this population. However, 22.1% don't know their family history, representing missed opportunity for risk stratification.

Family history is one of the strongest CVD risk predictors,[23] yet cannot be utilized for prevention if unknown. Incorporating systematic family history assessment into primary care, with active outreach to inform at-risk individuals, should be a priority.

### Rural-urban disparities

Rural residents showed 31% higher odds of chronic disease (multivariate OR=1.31, p=0.002), likely reflecting reduced healthcare access, different lifestyle patterns, and possibly different dietary habits in rural areas.[24] The substantial rural population (38.3% of sample) in Turkestan region necessitates tailored prevention strategies that account for geographic barriers and cultural context of rural communities.

### Study strengths and limitations

**Strengths:** This is a large comprehensive assessment of CVD risk factors among Central Asian youth, with wide geographic coverage (21 healthcare facilities across the region), sufficient sample size (n=1,496) for stratified analysis, and systematic data collection using validated instruments.

**Limitations:**

1. Self-reported diseases may be subject to recall bias and social desirability. Objective clinical measurements would strengthen findings.
2. Selection bias is possible as the sample included only individuals attending healthcare facilities, potentially overestimating disease prevalence.
3. Cultural factors may influence self-reports about health and diseases, especially for conditions considered stigmatized.

## CONCLUSION

This study reveals an alarmingly high prevalence of cardiovascular disease risk factors among young people in the Turkestan region, with significant differences depending on gender, age, education, and social status. Critical gaps in health awareness, especially regarding biochemical parameters (only 27.1% know their cholesterol level), combined with the growing burden of obesity (8.5%) and rapid age-related accumulation of risk factors (from 23.2% in 14-19-year-olds to 50.7% in 30-34-year-olds) portend a significant increase in cardiovascular disease in the coming decades unless urgent preventive action is taken. Gender differences in the distribution of risk factors require tailored approaches to prevention. The significantly higher prevalence of obesity (10.5% vs. 5.9%, $p<0.001$) and thyroid disease (5.2% vs. 1.7%, $p<0.001$) in women requires special attention to this group. The strong association between low education, unemployment, and CVD risk factors underscores the need for a comprehensive approach that considers social determinants alongside traditional medical interventions. There is an urgent need to transform the healthcare system from an acute care model to a prevention-oriented model, with universal screening of young people, enhanced health literacy education, and targeted interventions for high-risk

groups. Particular attention should be paid to reaching unemployed youth (42.9% with chronic diseases), individuals with low education, and rural populations (38.3% of the sample), who bear a disproportionate burden of CVD risk factors.

Future studies should include prospective cohort designs to establish causal relationships, evaluate the effectiveness of interventions in this population, and examine the role of specific behavioral risk factors. Qualitative studies are also needed to understand barriers to health awareness and preventive behavior in the cultural context of the region.

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## Conflict of interest

The authors declare no conflict of interest.

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## REFERENCES

1. World Health Organization. Cardiovascular diseases (CVDs): Key facts. *Geneva: WHO;* 2021.
2. Roth GA, Mensah GA, Johnson CO, et al. Global Burden of Cardiovascular Diseases and Risk Factors, 1990-2019: Update From the GBD 2019 Study. *J Am Coll Cardiol*. 2020;**76**(25):2982-3021.
3. Ministry of Healthcare of the Republic of Kazakhstan. Statistical Collection of Health Indicators of the Population. *Nur-Sultan*; 2024.
4. NCD Risk Factor Collaboration. Worldwide trends in body-mass index, underweight, overweight, and obesity from 1975 to 2016: a pooled analysis of 2416 population-based measurement studies. *Lancet.* 2017;**390**(10113):2627-2642.
5. Timmis A, Vardas P, Townsend N, et al. European Society of Cardiology: cardiovascular disease statistics 2021. *Eur Heart J*. 2022;**43**(8):716-799.
6. Lloyd-Jones DM, Allen NB, Anderson CAM, et al. Life's Essential 8: Updating and Enhancing the American Heart Association's Construct of Cardiovascular Health. *Circulation.* 2022;**146**(5):e18-e43.
7. Schultz WM, Kelli HM, Lisko JC, et al. Socioeconomic Status and Cardiovascular Outcomes: Challenges and Interventions. *Circulation*. 2018;**137**(20):2166-2178.
8. Aggarwal NR, Patel HN, Mehta LS, et al. Sex Differences in Ischemic Heart Disease: Advances, Obstacles, and Next Steps. *Circ Cardiovasc Qual Outcomes*. 2018;**11**(2):e004437.
9. Supiyev A, Kossumov A, Kassenova A, et al. Prevalence, awareness, treatment and control of arterial hypertension in Astana, Kazakhstan. *Public Health*. 2015;**129**(7):948-953.
10. Hopstock LA, Løvsletten O, Johansen H, et al. Trends in anthropometric measures and metabolic risk factors among adults in a subarctic population from 1974 to 2016: the Tromsø Study. *Obes Sci Pract*. 2022;**8**(2):159-169.
11. Nazarbayeva G, Mukhanova A, Dushpanova A, et al. Prevalence and determinants of obesity in Kazakhstan: a cross-

sectional study. *Arch Public Health*. 2022;**80**(1):189.

12. Ji H, Kim A, Ebinger JE, et al. Sex Differences in Blood Pressure Trajectories Over the Life Course. *JAMA Cardiol*. 2020;**5**(3):19-26.
13. Kozhakhmetova G, Kuandykov T, Nurbakyt A, et al. Prevalence of behavioral risk factors for cardiovascular diseases in the adult population of Kazakhstan. *Front Public Health.* 2023;**11**:1132729.
14. Guthold R, Stevens GA, Riley LM, Bull FC. Global trends in insufficient physical activity among adolescents: a pooled analysis of 298 population-based surveys with 1.6 million participants. *Lancet Child Adolesc Health*. 2020;**4**(1):23-35.
15. Garmendia Madariaga A, Santos Palacios S, Guillén-Grima F, Galofré JC. The incidence and prevalence of thyroid dysfunction in Europe: a meta-analysis. *J Clin Endocrinol Metab.* 2014;**99**(3):923-931.
16. Thompson AE, Anisimowicz Y, Miedema B, et al. The influence of gender and other patient characteristics on health care-seeking behaviour: a QUALICOPC study. *BMC Fam Pract.* 2016;**17**:38.
17. Son JS, Choi S, Kim K, et al. Association of Blood Pressure Classification in Korean Young Adults According to the 2017 American College of Cardiology/American Heart Association Guidelines With Subsequent Cardiovascular Disease Events. *JAMA.* 2018;**320**(17):1783-1792.
18. Berkman ND, Sheridan SL, Donahue KE, et al. Low health literacy and health outcomes: an updated systematic review. *Ann Intern Med*. 2011;**155**(2):97-107.
19. Havranek EP, Mujahid MS, Barr DA, et al. Social Determinants of Risk and Outcomes for Cardiovascular Disease: A Scientific Statement From the American Heart Association. *Circulation*. 2015;**132**(9):873-898.
20. Roelfs DJ, Shor E, Davidson KW, Schwartz JE. Losing life and livelihood: a systematic review and meta-analysis of unemployment and all-cause mortality. *Soc Sci Med*. 2011;**72**(6):840-854.
21. Kivimäki M, Head J, Ferrie JE, et al. Why is evidence on job strain and coronary heart disease mixed? An illustration of measurement challenges in the Whitehall II study. *Psychosom Med.* 2006;**68(**3):398-401.
22. Gidding SS, Champagne MA, de Ferranti SD, et al. The Agenda for Familial Hypercholesterolemia: A Scientific Statement From the American Heart Association. *Circulation.* 2015;**132**(22):2167-2192.
23. Lloyd-Jones DM, Nam BH, D'Agostino RB Sr, et al. Parental cardiovascular disease as a risk factor for cardiovascular disease in middle-aged adults: a prospective study of parents and offspring. *JAMA*. 2004;**291**(18):2204-2211.
24. O'Connor A, Wellenius G. Rural-urban disparities in the prevalence of diabetes and coronary heart disease. *Public Health*. 2012;**126**(10):813-820.
25. Muhammad Amir, H. Q. ., Jabeen, Z. ., Khan, S. ., Sultana, S. ., Khan, M. ., & Tariq, A. B. . (2022). Hematological and Anthropometric features of patients with Knee Osteoarthritis. *Bangladesh Journal of Medical Science*, **21**(3): 682–687. https://doi.org/10.3329/bjms.v21i3.59585