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*Original article*

# Analysis of Hospital Admissions of Patients with Hyperthyroidism in Kazakhstan Based on Data from the Unified National Electronic Health System 2013-2022

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## Abstract

Hyperthyroidism is a common endocrine disorder associated with significant cardiovascular, ophthalmological, and systemic complications if inadequately treated. While extensive epidemiological data are available from high-income countries, population-level evidence from Central Asia remains scarce. In Kazakhstan, thyroid disorders continue to represent a public health concern, and comprehensive national data on hyperthyroidism are limited.

Objective: To describe the epidemiology, socio-demographic characteristics, clinical features, treatment patterns, complications, and mortality among patients diagnosed with hyperthyroidism in Kazakhstan.

Methods. A retrospective population-based study was conducted using data from the Unified National Electronic Health System of Kazakhstan. Patients hospitalized with hyperthyroidism (ICD-10 code E05) between 2013 and 2022 were included. Demographic variables, regional distribution, ICD-10 subtypes, surgical and interventional treatments, complications, and mortality outcomes were analyzed. Descriptive statistics were used to summarize findings.

Results. A total of 10,122 patients with hyperthyroidism were identified. Females predominated (72.2%), with the highest burden observed among individuals aged 18–70 years. Most patients were of Kazakh ethnicity (77.6%), and cases were nearly evenly distributed between urban and rural areas, with higher concentrations in Astana, Almaty, and East Kazakhstan regions. Graves' disease (E05.0) accounted for approximately 80% of diagnoses. Total and subtotal thyroidectomy were the most common definitive treatments, together representing over 17% of cases. Cardiovascular (11.7%) and ophthalmological (6.5%) complications were most frequently observed. Overall mortality during the study period was 6.8%, with no significant sex-based differences.

Conclusions. This study provides the first comprehensive national epidemiological assessment of hyperthyroidism in Kazakhstan. The findings highlight a substantial disease burden among women and working-age adults and underscore the importance of early diagnosis, optimized management strategies, and improved long-term follow-up to reduce complications and mortality.

**Keywords:** Hyperthyroidism, Epidemiology, Population Data, Kazakhstan, inpatient records.

## 1. Introduction

Hyperthyroidism is a condition characterized by excessive production and release of thyroid hormone due to exogenous or endogenous causes, whereas the term "thyrotoxicosis" refers to symptomatic presentation of the action of inappropriate thyroid hormone secretion [1]. Globally, the prevalence of overt hyperthyroidism ranges between 0.2% and 1.3%, depending on geographical, nutritional, and sociodemographic factors [2, 3]. The condition is significantly more common in women, with a female-to-male ratio of up to 10:1, and typically presents between the third and fifth decades of life [2] with the prevalence of 4-5% [4]. Graves' disease (70%) and toxic nodular goiter (16%) are the two main causes of hyperthyroidism worldwide [5].

The most frequent etiologies include Graves' disease, toxic multinodular goiter, and toxic adenoma, with autoimmune thyroid dysfunction being dominant in iodine-sufficient regions [6]. While many cases are successfully managed with antithyroid medications, radioactive iodine ablation, or thyroidectomy, hyperthyroidism remains a condition with potentially severe consequences if untreated or poorly controlled.

Action of excessive thyroid hormone mimics the adrenergic activation in the body. Thus, arrythmias are highly associated with hyperthyroidism and may lead to cardiovascular complications, e.g., atrial fibrillation and cardiac arrest [1]. Neuropsychiatric disturbances, including anxiety, insomnia, tremor, and cognitive dysfunction, are also frequently reported. One of the most severe and life-threatening manifestations is thyroid storm, a rare decompensated form of thyrotoxicosis, which carries a mortality rate of 10–30% despite intensive care management [7].

Long-term risks associated with hyperthyroidism also include increased all-cause and cardiovascular mortality, particularly in individuals with suppressed TSH levels or persistent biochemical thyrotoxicosis [8]. Additionally, Graves' ophthalmopathy —an inflammatory ocular complication—can lead to vision loss and functional impairment, especially if not promptly identified and treated [9].

Although extensive research on the epidemiology and management of hyperthyroidism exists in high-income countries, there is a marked lack of population-level data from low- and middle-income countries. In many such settings, delayed diagnosis, limited access to endocrine care, and variability in treatment approaches may contribute to worse clinical outcomes [10]. Moreover, health system factors such as weak primary care networks, inconsistent follow-up, and underutilization of electronic health data limit the ability to track disease burden and outcomes over time.

The only available statistical data on Kazakhstani population describing the epidemiology of thyroid disorders is the annual reports from the National Research Center for Health Development (NRCHD). Based on the 2020 report, the incidence of endocrine disorders registered in medical and preventive organizations is 5191.50 per 100,000 population in 2020; 3706.64 per 100,000 population in 2021 and 3248.80 per 100,000 population in 2022 [11]. Although such report provides some information based on age categories, urban and rural populations as well as regional divisions, there is a lack of statistical analysis of separate specific thyroid conditions, survival rate, and associated complications of hyperthyroidism in Kazakhstani population. As the extensive epidemiological research studies regarding hyperthyroidism were done and are still going on in different parts of the world, the following research will be unique work providing the insight to the epidemiology of hyperthyroidism in Kazakhstan as well as in Central Asia.

The objective of this project is to conduct an epidemiological analysis of prevalence, incidence and mortality rate of patients registered with hyperthyroidism in hospital settings, based on the data collected between 2013 and 2021 from Unified National Electronic Health System (UNEHS) database of Kazakhstan.

## 2. Materials and Methods

*Study population*

According to the international classification of diseases 10th revision (ICD-10), thyrotoxicosis (hyperthyroidism) is encoded as E05 [12]. The study population includes those individuals, who are diagnosed with hyperthyroidism (ICD-10 code: E05) in UNEHS registry between 2013 and 2019 and were in in-patient settings. The initial data contained 15,694 observations, which included several hospitalizations for a person throughout the observation period. After removing duplicates (24 duplicates) and reshaping the data based on single person, the final number of observations reduced to 9,057 observations. As some patients were hospitalized more than once during the period of observations, the first recorded admission date was considered. The RpnID is a unique ID assigned for a single person. 1,219 observations had missing RpnIDs, thus they were identified based on same date of birth, sex, ethnicity, and living address. Some observations were treated as related to a single person if the ethnicity was any other else except Kazakh or had date of death.

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*Ethical approval*

This study was ethically approved by Nazarbayev University Institutional Review Ethics Committee (NU-IREC 203/29112019).

*Exposures and covariates*

Patients' date of birth and death, ethnicity, sex, ICD-10 diagnosis, date of admission, date of death (if any), living address, residency, complication (if any), type of hospitalization, surgery type (if any), and RpnID were analyzed. Age was calculated based on the date of admission and was categorized into five groups: under 18 y.o., between 18 and 34 y.o., between 35 and 50 y.o., between 51 and 70 y.o., and above 70 y.o. Ethnicity was categorized into Kazakhs, Russian, others (the list is provided in supplementary material section) and missing. The living address was categorized based the administrational divisions of the Republic of Kazakhstan, which were Astana city, Almaty city, Shymkent city, and others. The type of residency was divided into urban and rural. More extended information on E05 code, list of complications, administrational regional divisions of the country is provided in the supplementary materials sections. As there were several hospitalizations for a person between 2013-2019, the personal information from the first admission was analyzed.

*Statistical analysis*

All statistical analyses were performed using STATA 16 MP/IC Version software (STATA Corporation, College Station, TX). P values <0.05 will be considered statistically significant. Continuous variables is presented as mean±S.D., and categorical data is given in a form of a percentage (%).

## 3. Results

Table 1 below summarizes the demographic characteristics of 10,122 patients with hyperthyroidism treated between 2013 and 2022, stratified by sex. Overall, female patients predominated, accounting for 72.2% (n = 7,409) of the cohort, while males comprised 26.8% (n =2,713). The median age of the total population was 42 years (IQR: 27–56), with comparable median ages observed in females (42 years, IQR 27–57) and males (42 years, IQR 28–55). Across age categories, the largest proportion of patients fell within the 35–50 year group (36.2%), followed by those aged 18–34 years (28.4%) and 51–70 years (28.0%).

*Table 1 - Demographic characteristics of patients with hyperthyroidism between 2013 and 2022*

| Variables | Total (n=10,122) | Female (n=7,409 72.20%) | Male (n=2,713, 26.80%) | p-value |
|---|---|---|---|---|
| **Age, n(%)** | | | | |
| <18 | 529 | 423 | 106 | 0.157 |
| (%) | 5,23 | 79,96 | 20,04 | |
| 18-34 | 2 879 | 2 128 | 751 | 0.284 |
| (%) | 28,44 | 73,91 | 26,09 | |
| 35-50 | 3 662 | 2 588 | 1 074 | 0.250 |
| (%) | 36,18 | 70,67 | 29,33 | |
| 51-70 | 2 837 | 2 073 | 764 | 0.275 |
| (%) | 28,03 | 73,07 | 26,93 | |
| >70 | 215 | 197 | 18 | 0.442 |
| (%) | 2,12 | 91,63 | 8,37 | |
| Median age (IQR) | 42 (27-56) | 42 (27-57) | 42 (28-55) | |
| **Ethnicity, n(%)** | | | | |
| Kazakh | 7 853 | 5 686 | 2 167 | 0.268 |
| (%) | 77,58 | 72,41 | 27,59 | |
| Russian | 1 169 | 907 | 262 | 0.321 |
| (%) | 11,55 | 77,59 | 22,41 | |
| Others | 1 051 | 781 | 270 | 0.288 |
| (%) | 10,38 | 74,31 | 25,69 | |
| Missing | 49 | 35 | 14 | 0.258 |
| (%) | 0,48 | 71,43 | 28,57 | |
| **Residency, n(%)** | | | | |
| Urban | 5 825 | 4 358 | 1 467 | 0.293 |
| (%) | 57,55 | 74,82 | 25,18 | |
| Rural | 4 297 | 3 051 | 1 246 | 0.253 |
| (%) | 42,45 | 71,00 | 29,00 | |

Patients younger than 18 years (5.2%) and older than 70 years (2.1%) constituted smaller fractions of the cohort. No statistically significant differences in age distribution were observed between females and males across any age category (all p>0.05). Regarding ethnicity, the majority of patients were Kazakh (77.6%), followed by Russian (11.6%) and other ethnic groups (10.4%); ethnicity data were missing in less than 1% of cases. The sex distribution within each ethnic group did not differ significantly (p>0.05 for all comparisons). In terms of residency, 57.6% of patients resided in urban areas, while 42.4% were from rural regions. The proportion of females and males was similar across urban and rural settings, with no statistically significant differences detected (p>0.05). Overall, the cohort was characterized by a predominance of middle-aged female patients, with no significant sex-based differences observed in age group distribution, ethnicity, or residency.

*Table 2 - Regional distribution of patients with hyperthyroidism between 2013 and 2022*

| **Regional divisions, n(%)** | **Total** | **Female** | **Male** | **p-value** |
|---|---|---|---|---|
| Astana city | 1 006 | 772 | 234 | 0.313 |
| (%) | 9,94 | 76,74 | 23,26 | |
| Almaty city | 704 | 550 | 154 | 0.326 |
| (%) | 6,96 | 78,13 | 21,88 | |
| Shymkent city | 234 | 172 | 62 | 0.280 |
| (%) | 2,31 | 73,50 | 26,50 | |
| Akmola region | 430 | 294 | 136 | 0.224 |
| (%) | 4,25 | 68,37 | 31,63 | |
| Aktobe city | 477 | 357 | 120 | 0.294 |
| (%) | 4,71 | 74,84 | 25,16 | |
| Almaty region | 1 505 | 1 089 | 416 | 0.268 |
| (%) | 14,87 | 72,36 | 27,64 | |
| Atyrau region | 463 | 339 | 124 | 0.277 |
| (%) | 4,57 | 73,22 | 26,78 | |
| Eastern Kazakhstan region | 1 025 | 710 | 315 | 0.234 |
| (%) | 10,13 | 69,27 | 30,73 | |
| Karaganda region | 622 | 457 | 165 | 0.279 |
| (%) | 6,15 | 73,47 | 26,53 | |
| Kostanay region | 300 | 221 | 79 | 0.281 |
| (%) | 2,96 | 73,67 | 26,33 | |
| Kyzylorda region | 650 | 475 | 175 | 0.275 |
| (%) | 6,42 | 73,08 | 26,92 | |
| Mangystau region | 262 | 193 | 69 | 0.281 |
| (%) | 2,59 | 73,66 | 26,34 | |
| Northern Kazakhstan region | 245 | 178 | 67 | 0.271 |
| (%) | 2,42 | 72,65 | 27,35 | |
| Pavlodar region | 404 | 281 | 123 | 0.237 |
| (%) | 3,99 | 69,55 | 30,45 | |
| Turkistan region | 823 | 615 | 208 | 0.292 |
| (%) | 8,13 | 74,73 | 25,27 | |
| Western Kazakhstan region | 577 | 414 | 163 | 0.261 |
| (%) | 5,70 | 71,75 | 28,25 | |
| Zhambyl region | 395 | 292 | 103 | 0.284 |
| (%) | 3,90 | 73,92 | 26,08 | |

Table 2 presents the regional distribution of patients with hyperthyroidism registered between 2013 and 2022, stratified by sex. Patients were distributed across all major regions of Kazakhstan. The highest proportion of cases was observed in the Almaty region (14.9% of the total cohort), followed by the Eastern Kazakhstan region (10.1%) and Astana city (9.9%). Other regions each contributed between approximately 2% and 8% of the total patient population. Across all regions, female patients consistently predominated, accounting for approximately 69–78% of cases in each geographic area. The proportion of male patients ranged from 21% to 31%, with the highest relative male representation observed in the Akmola, Eastern Kazakhstan, and Pavlodar regions. However, no statistically significant differences in sex distribution

were identified across regions, as reflected by uniformly non-significant p-values (all p > 0.05). Overall, the regional analysis demonstrates a broad geographic distribution of hyperthyroidism cases throughout the country, with a stable female predominance that was consistent across all administrative regions and did not vary significantly by location.

Table 3 summarizes the distribution of ICD-10 diagnostic codes (E05 category) among patients with hyperthyroidism treated between 2013 and 2022, stratified by sex. The most frequent diagnosis was E05.0, accounting for 79.6% (n = 8,059) of all cases. Within this group, females comprised 71.9% and males 28.1%, with no statistically significant difference in sex distribution (p = 0.362). Other ICD-10 subcategories were substantially less common. E05.5 represented 7.5% (n = 761) of cases, followed by E05.2 (6.1%, n = 614) and E05.1 (4.3%, n = 437). Rare diagnoses included E05.8 (2.1%), E05.3 (0.25%), E05.9 (0.11%), and E05.4 (0.01%). Across all ICD-10 subtypes, female patients predominated, generally accounting for approximately 72–84% of cases, except for E05.0 and E05.5, where female representation was slightly lower but still predominant. Importantly, no statistically significant sex-based differences were observed for any ICD-10 category, as indicated by non-significant p-values across all comparisons (p > 0.05). Overall, the diagnostic structure of hyperthyroidism in this cohort was dominated by E05.0, with a consistent pattern of female predominance across all ICD-10 subtypes and no evidence of differential sex distribution by diagnostic category.

*Table 3 - ICD10 codes of patients with hyperthyroidism between 2013 and 2022*

| ICD10 E05, n(%) | Total | Female | Male | p-value |
|---|---|---|---|---|
| E05.0 | 8 059 | 5 795 | 2 264 | 0.362 |
| (%) | 79,62 | 71,91 | 28,09 | |
| E05.1 | 437 | 358 | 79 | 0.378 |
| (%) | 4,32 | 81,92 | 18,08 | |
| E05.2 | 614 | 514 | 100 | 0.380 |
| (%) | 6,07 | 83,71 | 16,29 | |
| E05.3 | 25 | 21 | 4 | 0.500 |
| (%) | 0,25 | 84,00 | 16,00 | |
| E05.4 | 1 | 1 | 0 | 0.271 |
| (%) | 0,01 | 100,00 | 0,00 | |
| E05.5 | 761 | 553 | 208 | 0.278 |
| (%) | 7,52 | 72,67 | 27,33 | |
| E05.8 | 214 | 157 | 57 | 0.437 |
| (%) | 2,11 | 73,36 | 26,64 | |
| E05.9 | 11 | 10 | 1 | 0.156 |
| (%) | 0,11 | 90,91 | 9,09 | |

Table 4 presents the distribution of surgical and interventional treatment modalities performed among patients with hyperthyroidism between 2013 and 2022, stratified by sex. The most commonly performed procedure was total thyroidectomy, accounting for 11.6% (n=1,175) of all patients, followed by subtotal thyroidectomy (5.6%, n=562). Less frequently performed procedures included hemithyroidectomy (1.8%, n=179), partial thyroidectomy (1.4%, n=143), and radioiodine ablation (0.8%, n=82). Other thyroid-related operations constituted 1.9% (n=192) of cases, while non-thyroid operations were rare (0.5%, n = 49). Across all surgical categories, female patients predominated, representing approximately 70-90% of procedures. The highest female proportion was observed for hemithyroidectomy (90.5%), whereas radioiodine ablation showed a comparatively higher proportion of male patients (30.5%) relative to other procedures. However, no statistically significant differences in sex distribution were detected across any surgical or interventional category, with all p-values exceeding 0.05.

Overall, the data indicate that thyroidectomy, particularly total thyroidectomy, was the predominant intervention among patients with hyperthyroidism, with a consistent pattern of female predominance and no evidence of sex-specific differences in the choice of surgical or ablative treatment.

*Table 4 - Performed surgery types among patients with hyperthyroidism between 2013 and 2022*

| Surgery types, n (%) | Total | Female | Male | p-value |
|---|---|---|---|---|
| Non-thyroid operations | 49 | 39 | 10 | 0.340 |
| (%) | 0,48 | 79,59 | 20,41 | |
| Total thyroidectomy | 1 175 | 939 | 236 | 0.343 |
| (%) | 11,61 | 79,91 | 20,09 | |
| Subtotal thyroidectomy | 562 | 449 | 113 | 0.343 |
| (%) | 5,55 | 79,89 | 20,11 | |
| Hemithyroidectomy | 179 | 162 | 17 | 0.433 |
| (%) | 1,77 | 90,50 | 9,50 | |
| Partial thyroidectomy | 143 | 114 | 29 | 0.341 |
| (%) | 1,41 | 79,72 | 20,28 | |
| Radioiodine ablation | 82 | 57 | 25 | 0.237 |
| (%) | 0,81 | 69,51 | 30,49 | |
| Other operations of thyroid | 192 | 135 | 57 | 0.246 |
| (%) | 1,90 | 70,31 | 29,69 | |

Table 5 summarizes the spectrum of registered complications among patients with hyperthyroidism between 2013 and 2022, stratified by sex. Overall, cardiovascular complications were the most frequently recorded, affecting 11.7% (n=1,181) of patients. Other complications were observed in 9.6% (n = 970) of cases, while ophthalmological complications occurred in 6.5% (n = 662). Rare but clinically significant events included thyroid crisis (0.25%, n=25) and nervous system complications (0.23%, n=23). Female patients predominated in most complication categories, particularly for thyroid crisis (88.0% female) and ophthalmological complications (67.4% female). In contrast, nervous system complications showed a higher proportion of male patients (56.5%), although the absolute number of cases was very small. Importantly, no statistically significant sex-based differences were identified for any complication category, with all p-values exceeding 0.05. In summary, complications associated with hyperthyroidism in this cohort were most commonly cardiovascular and ophthalmological, with rare occurrences of thyroid crisis and neurological involvement. The distribution of complications did not differ significantly by sex.

*Table 5 - Registered complications among patients with hyperthyroidism between 2013 and 2022*

| Disease complications, n(%) | Total | Female | Male | p-value |
|---|---|---|---|---|
| Thyroid crisis | 25 | 22 | 3 | 0.414 |
| (%) | 0,25 | 88,00 | 12,00 | |
| Ophthalmological complications | 662 | 446 | 216 | 0.213 |
| (%) | 6,54 | 67,37 | 32,63 | |
| Cardiovascular complications | 1181 | 786 | 395 | 0.204 |
| (%) | 11,67 | 66,55 | 33,45 | |
| Nervous system complications | 23 | 10 | 13 | 0.083 |
| (%) | 0,23 | 43,48 | 56,52 | |
| Other complications | 970 | 659 | 311 | 0.219 |
| (%) | 9,58 | 67,94 | 32,06 | |

Table 6 presents the mortality outcomes among patients with hyperthyroidism treated between 2013 and 2022, stratified by sex. During the study period, the majority of patients were alive at follow-up, comprising 93.2% (n = 9,437) of the cohort. Deaths were recorded in 6.8% (n = 685) of patients. Among survivors, females accounted for 73.6%, while males represented 26.4%, reflecting the overall sex distribution of the study population. Similarly, among deceased patients, females comprised 67.9% and males 32.1%. No statistically significant difference in mortality by sex was observed, as indicated by non-significant p-values for both survival status comparisons (p = 0.499 for alive; p = 0.066 for deceased). Although a relatively higher proportion of males was noted among deceased patients compared with survivors, this difference did not reach statistical significance. Overall, the findings indicate a low mortality rate in this large hyperthyroidism cohort, with no evidence of sex-specific differences in mortality over the study period.

*Table 6 - Mortality rate among patients with hyperthyroidism between 2013 and 2022*

| Mortality, n(%) | Total | Female | Male | p-value |
|---|---|---|---|---|
| Alive | 9 437 | 6 944 | 2 493 | 0.499 |
| (%) | 93,23 | 73,58 | 26,42 | |
| Dead | 685 | 465 | 220 | 0.066 |
| (%) | 6,77 | 67,88 | 32,12 | |

## 4. Discussion

This study provides a comprehensive overview of the socio-demographic and clinical characteristics of patients diagnosed with hyperthyroidism in Kazakhstan over a ten-year period (2013–2022). The findings demonstrate a clear predominance of hyperthyroidism among females, with women accounting for more than twice the number of cases compared with men. This pronounced sex disparity is consistent with existing international evidence, which attributes the higher prevalence of hyperthyroidism in women to hormonal, genetic, and autoimmune mechanisms. The concentration of cases among women aged 18–70 years further highlights the substantial burden of disease within the economically and socially active population. Similarly, recent review article concluded that globally hyperthyroidism cases were predominant among women, with the ratio of 4:1 [13]. Interestingly, review also highlighted that thyroid diseases affect only 0.2% to 1.4% of people globally.

From an ethnic perspective, the majority of patients were of Kazakh ethnicity, comprising nearly four-fifths of the study population, followed by Russians and other ethnic groups. While this distribution likely reflects the underlying demographic structure of Kazakhstan, it may also suggest potential ethnic differences in disease detection, healthcare utilization, or genetic susceptibility. These observations warrant further investigation to disentangle population structure effects from true epidemiological differences.

Geographically, hyperthyroidism cases were almost evenly distributed between urban and rural settings, with a slight predominance in metropolitan areas. This pattern may reflect better access to specialized healthcare services and diagnostic facilities in large cities rather than a true difference in disease occurrence. The administrative-regional analysis supports this interpretation, as the highest number of cases was observed in Astana, Almaty, and the East Kazakhstan region – areas characterized by higher population density and more advanced healthcare infrastructure. Interestingly, East Kazakhstan region was also known for high numbers in thyroid cancers in Kazakhstan partly because of Semipalatinsk Nuclear test site [14]. Authors have noted that the incidence of thyroid cancers has increased over the past decade.

In terms of diagnostic classification, hyperthyroidism in Kazakhstan is predominantly coded under ICD-10 code E05.0, corresponding to thyrotoxicosis with diffuse goiter (Graves' disease). The dominance of this diagnostic category suggests that Graves' disease remains the leading etiological form of hyperthyroidism in the country, in line with global epidemiological patterns.

Surgical management was commonly employed, with total and subtotal thyroidectomy representing the most frequent operative approaches. Together, these procedures accounted for more than 17% of all surgical interventions, indicating a substantial reliance on definitive surgical treatment. This may reflect disease severity at presentation, limited long-term adherence to antithyroid medications, recurrence after conservative therapy, or established clinical preferences within the national healthcare system. If medication and radio-active iodine methods are proven to be helpless for treating patients with Graves' disease, surgical intervention is an unavoidable next step [15]. It is worth to mention that that the radio-iodine ablation of thyroid gland was not available in Kazakhstan until 2023. Surgical ablation of thyroid is a proven method for successful treatment with low chances complications and quick recovery [15].

The analysis of complications revealed that cardiovascular, ophthalmological, and other systemic complications were the most prevalent among patients with hyperthyroidism. The prominence of cardiovascular complications underscores the well-recognized systemic impact of prolonged thyrotoxicosis and highlights the importance of early diagnosis and effective disease control. Ophthalmological complications further emphasize the burden of Graves' disease–related extrathyroidal manifestations. Study by Ertek and Cicero highlighted that cardiovascular complications during hyper- or hypothyroidism are a commonplace [16]. It was also stated that conditions linked with thyroid have negative impact on the cardiovascular system, and that the current treatment methods of hyper- or hypothyroidism focus on preventing arrythmias [16].

Mortality data indicate that by the end of the observation period, 6.8% of patients with hyperthyroidism had died, with females accounting for approximately two-thirds of deaths. Although this mirrors the higher prevalence of hyperthyroidism among women, it also raises important questions regarding long-term disease outcomes, comorbidity burden, and potential sex-specific differences in disease progression or management.

Overall, these findings provide valuable national-level evidence on hyperthyroidism in Kazakhstan and highlight key demographic, regional, and clinical patterns. Future research should focus on longitudinal outcomes, treatment effectiveness, and potential disparities in access to care to inform targeted prevention and management strategies.

## 5. Conclusion

Hyperthyroidism represents a clinically important endocrine disorder in Kazakhstan. This study provides the first comprehensive national epidemiological assessment of hyperthyroidism in Kazakhstan. Thyroid malfunction predominantly affects women and individuals of working age, thereby carrying significant public health and socioeconomic implications. Graves' disease emerged as the leading etiological form, consistent with global patterns. Today thyroid dysfunctions remain an unresolved public health issue. The substantial burden of cardiovascular and ophthalmological complications highlights the systemic consequences of prolonged or inadequately controlled thyrotoxicosis and underscores the importance of early diagnosis and effective management. Although overall mortality was relatively low, recorded deaths emphasize the need for improved long-term monitoring and comorbidity management.

**Conflict of interest**. Authors declare no conflict of interest.

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**Author contribution.** Conceptualization, A.G.; methodology, Z.I. and A.G.; validation, T.M. and A.G.; formal analysis, Z.I.; investigation, T.M. and A.G.; resources, T. M.; data curation, T.A.; writing – original draft preparation, T.M., Z.I. and A.G.; writing – review and editing, A.O. and K.A.; visualization, T.M.; supervision, A.G.; project administration, A.O. and A.G.; funding acquisition, A.O. and A.G. All authors have read and agreed to the published version of the manuscript.

## 6. Supplemental materials

*Other ethnicities*: Adjaria, Azerbaijani, Armenian, Balkarian, Bashkir, Belorus, Bulgarian, Chechen, Chinese, Chuvash, Dungane, Georgian, German, Greek, Ingush, Iranian, Kalmyk, Karakalpak, Korean, Koryak, Kumyk, Kurd, Kyrgyz, Lezgin, Lithuanian, Marites, Moldovan, Mongol, Mordva, , Polish, Tajik, Tatar, Turkish, Turkmen, Udmurt, Ukrainian, Uygur, Uzbek.

*Administrational divisions of the Republic of Kazakhstan*: Astana city, Almaty city, Shymkent city, Akmola region, Aktobe region, Atyrau region, Eastern Kazakhstan region, Karaganda region, Kostanay region, Kyzylorda region, Mangystau region, Northern Kazakhstan region, Pavlodar region, Turkistan region, Western Kazakhstan region, and Zhambyl region.

*ICD-10 code for E05*:

- E05.0: Thyrotoxicosis with diffused goiter (Graves disease, toxic diffused goiter));
- E05.1: Thyrotoxicosis with toxic single thyroid nodule;
- E05.2: Thyrotoxicosis with toxic multinodular goiter;
- E05.3: Thyrotoxicosis from ectopic thyroid tissue;
- E05.4: Thyrotoxicosis factitia (exogenous thyrotoxicosis e.g., ingestion of drug);
- E05.5: Thyroid storm or crisis;
- E05.8: Other thyrotoxicosis (Overproduction of thyroid-stimulating hormone, use additional external cause code (Chapter XX), if desired, to identify cause);
- E05.9: Thyrotoxicosis unspecified (Hyperthyroidism NOS).

*Cardiovascular complications*:

- I15.2: Hypertension secondary to endocrine disorders;

- I43.1: Cardiomyopathy in metabolic diseases;
- I43.8: Cardiomyopathy in other diseases classified elsewhere (thyrotoxic heart disease);
- I48: Atrial fibrillation and flutter;
- I49.0: Ventricular fibrillation and flutter;
- I50.0: Congestive heart failure.

*Endocrinological complication*:

- E05.5: Thyroid storm or crisis.

*Ophthalmologic complications*:

- H05.2: Exophthalmic conditions (displacement of globe, hemorrhage and edema of orbit);
- H06.2: Dysthyroid (endocrine) exophthalmos;
- H58.8: Visual disturbances in diseases classified elsewhere (thyroid (thyrotoxic) eye disease).

*Neurologic complications*:

- G63.3: Polyneuropathy in other endocrine and metabolic diseases;
- G73.0: Myasthenic syndrome in endocrine diseases;
- G73.5: Myopathy in endocrine diseases;
- G98: Other disorders of nervous system, not elsewhere classified.

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# Бірыңғай ұлттық электрондық денсаулық сақтау жүйесінің деректері негізінде Қазақстандағы гипертиреозбен ауыратын науқастарды 2013-2022 жылдар аралығындағы ауруханаға жатқызу көрсеткіштерін талдау

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## Түйіндеме

Гипертиреоз дұрыс емделмеген кезде жүрек-қан тамырлары, офтальмологиялық және жүйелік асқынуларға алып келетін кең таралған эндокриндік ауру болып табылады. Табысы жоғары елдерде кең эпидемиологиялық деректер қолжетімді болғанымен, Орталық Азияда халық деңгейіндегі аталмыш деректер әлі де жеткіліксіз. Қазақстанда қалқанша безінің ауруы қоғамдық денсаулық сақтау мәселесі болып қала береді, ал гипертиреоз туралы кешенді ұлттық деректер шектеулі.

Зерттеудің мақсаты: Қазақстанда гипертиреоз диагнозы қойылған науқастардың эпидемиологиясын, әлеуметтік-демографиялық сипаттамаларын, клиникалық белгілерін, емдеу режимдерін, асқынуларын және өлім-жітімді сипаттау.

Әдістері. Қазақстанның Бірыңғай ұлттық электронды денсаулық сақтау жүйесінің деректерін пайдалана отырып, ретроспективті популяциялық зерттеу жүргізілді. Зерттеуге 2013 және 2022 жылдар аралығында гипертиреозбен ауруханаға жатқызылған науқастар деректері (ICD-10 коды E05) қолданылды. Демографиялық айнымалылар, аймақтық таралу, ICD-10 кіші түрлері, хирургиялық және интервенциялық емдеу, асқынулар және өлім-жітім көрсеткіштері талданды. Нәтижелерді қорытындылау үшін сипаттамалық статистика қолданылды.

Нәтижелері. Гипертиреозбен ауыратын барлығы 10 122 науқас анықталды. Әйелдер саны басым болды (72,2%), ең жоғары таралуы 18-70 жас аралығындағы адамдарда байқалды. Науқастардың көпшілігінің ұлты қазақ болды (77,6%), ал аурулар саны қалалық және ауылдық тұрғындар арасында біркелкі бөлінді. Әсіресе Астана, Алматы және Шығыс Қазақстан облыстарында таралуының жоғары тығыздығы байқалды. Грейвс ауруы (E05.0) диагноздардың шамамен 80%-ын құрады. Ең көп таралған емдеу әдістері жалпы және субтотальды тиреоидэктомия болса, олар бірігіп 17%-дан астам аурушаңдықты құрады. Ең көп таралған асқынулар жүрек-қан тамыр жүйесі бойынша (11,7%) және офтальмологиялық (6,5%) асқынулар болды. Зерттеу кезеңіндегі жалпы өлім-жітім 6,8% құрады, жынысы бойынша айтарлықтай айырмашылық анықталған жоқ.

Қорытынды. Бұл зерттеу Қазақстандағы гипертиреоздың алғашқы кешенді ұлттық эпидемиологиялық бағалауын сипаттайды. Зерттеу нәтижелері аталмыш аурудың әйелдер мен еңбекке қабілетті жастағы тұрғындар арасындағы жүктемесінің айтарлықтай екенін көрсетеді. Асқынулар мен өлім-жітім көрсеткіштерін төмендету үшін ерте диагностикалаудың, емдеу стратегияларын оңтайландырудың және ұзақ мерзімді бақылауды жақсартудың маңыздылығын көрсетеді.

**Түйін сөздер**: гипертиреоз, эпидемиология, тұрғындар туралы деректер, Қазақстан, ауруханалық жазбалар.

# Анализ госпитализаций пациентов с гипертиреозом в Казахстане на основе данных Единой национальной электронной системы здравоохранения за 2013-2022 годы

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## Резюме

Гипертиреоз является распространенным эндокринным заболеванием, связанным со значительными сердечно-сосудистыми, офтальмологическими и системными осложнениями при неадекватном лечении. Хотя обширные эпидемиологические данные доступны из стран с высоким уровнем дохода, данные на уровне населения Центральной Азии остаются скудными. В Казахстане заболевания щитовидной железы продолжают представлять собой проблему общественного здравоохранения, а всеобъемлющие национальные данные по гипертиреозу ограничены.

Цель исследования: описать эпидемиологию, социально-демографические характеристики, клинические особенности, схемы лечения, осложнения и смертность среди пациентов с диагнозом гипертиреоз в Казахстане.

Методы. Было проведено ретроспективное популяционное исследование с использованием данных Единой национальной электронной системы здравоохранения Казахстана. В исследование были включены пациенты, госпитализированные с гипертиреозом (код МКБ-10 E05) в период с 2013 по 2022 год. Были проанализированы демографические переменные, региональное распределение, подтипы МКБ-10, хирургическое и интервенционное лечение, осложнения и показатели смертности. Для обобщения результатов использовалась описательная статистика.

Результаты. В общей сложности было выявлено 10 122 пациента с гипертиреозом. Преобладали женщины (72,2%), при этом наибольшая распространенность наблюдалась среди лиц в возрасте 18-70 лет. Большинство пациентов были казахского происхождения (77,6%), и случаи были почти равномерно распределены между городским и сельским населением, с более высокой концентрацией в Астане, Алматы и Восточно-Казахстанской областях. На Болезнь Грейвса (E05.0) приходилось приблизительно 80% диагнозов. Наиболее распространенными методами окончательного лечения были тотальная и субтотальная тиреоидэктомия, на которые в совокупности приходилось более 17% случаев. Наиболее часто наблюдались сердечно-сосудистые (11,7%) и офтальмологические (6,5%) осложнения. Общая смертность за период исследования составила 6,8%, без существенных различий по полу.

Выводы. Данное исследование представляет собой первую всестороннюю национальную эпидемиологическую оценку гипертиреоза в Казахстане. Полученные результаты указывают на значительное бремя заболевания среди женщин и трудоспособного населения и подчеркивают важность ранней диагностики, оптимизированных стратегий лечения и улучшенного долгосрочного наблюдения для снижения осложнений и смертности.

**Ключевые слова:** гипертиреоз, эпидемиология, данные о населении, Казахстан, стационарные записи.

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