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# Profile of Asthmatic Patients in South Kazakhstan Region: A Cross-Sectional Study.

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**ABSTRACT**

The GINA based algorithms and the international asthma control test is still not fully implemented in the official protocol diagnostic and treatment of asthma on governmental level. Many difficulties create lack of diagnostic equipment, qualified pulmonologists/allergologists and asthma control schools for patients. We aimed to determine the profile of asthma patients according to GINA classifications and barriers to asthma medications and equipment based on cross-sectional study. We conducted a cross-sectional study using a structured questionnaire of asthma patients. The obtained results showed that both sexes in working age, mostly from urbanized territory with high rate of unemployed and disabled individuals suffered from asthma in South Kazakhstan Region. At the same time SABA usage more than 5 times a day is spread in a half of asthma patients. The biggest part of registered patients is not available to use spirometry, peakflowmetry, bronchial reversibility test and ACT due to lack of recourses and barriers of access. Further study is needed to understand the best way of improvement of asthma management situation based on international recommendations of GINA and taking into account current health care system peculiarities in Kazakhstan.
**Keywords:** Asthma, GINA, asthma control, access, spirometry

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## INTRODUCTION

In according to the Global Initiative for Asthma (GINA) report "Global burden of asthma", about 300 million people of all ages, and all ethnic groups, suffer from asthma and the burden of this disease to governments, health care systems, families, and patients is increasing around all countries [1]. The asthma prevalence rate is high in urbanized countries and communities accepted western lifestyles. The projected prognosis for asthma worldwide rate estimated with an additional 100 million diagnosed persons by 2025 [1-3]. Access barriers to basic treatment and medical care of asthma together with economic growth and improving of access to the primary health care facilities in many countries indicates on necessity of search effective ways for elimination of this situation [4-6].

Kazakhstan is the largest of the former Soviet republics after the Russian Federation [6]. The population number counted of 18.1 million in 2015. Kazakhstan related to the fastest growing economies worldwide due to booming energy sector [7]. But the population health of the country has similar challenges to other central Asian countries, with low life expectancy, high infant and maternal mortality, and high rates of communicable and non-communicable diseases such as bronchial asthma and arterial hypertension. Despite free access for everyone to all levels of health care and almost all main medical recourses for asthma treatment according to the governmental order Kazakhstan has one of the highest rate of mortality caused by bronchial asthma in the world [1, 8]. Around fourteen administrative units called "oblast" (which is means region) and three cities – former capital city is Almaty, Bayqongyr, and the actual capital city Astana are different prevalence rate of asthma. That obviously connected with geographic and anthropogenic diversity territories of regions [9]. The South Kazakhstan region has the highest prevalence rate of asthma in the country. Moreover the GINA based algorithms and the international asthma control test (ACT) are still not fully implemented in the official protocol diagnostic and treatment of asthma on governmental level. One of the barriers to ACT adoption is absence of the validated version of the questionnaire in Kazakh language (native language of Kazakhstan citizens). Additional difficulties create lack of diagnostic equipment (availability of spirometers), qualified specialists (pulmonologists or allergologists) and asthma control schools for patients.

In this study, we aimed to determine the profile of asthma patients according to GINA classifications and barriers to asthma medications and equipment based on cross-sectional study at the Regional Clinical Hospital of the South Kazakhstan Region, Kazakhstan.

## MATERIALS AND METHODS

### Study Design

The cross-sectional study was carried out at the Regional Clinical Hospital of the South Kazakhstan Region, Kazakhstan, aimed at all patients currently registered with bronchial asthma diagnosis in the South Kazakhstan.

Research team used a specially prepared, structured questionnaire form with 30 questions in the Russian and Kazakh languages. Each item of questionnaire form was independently back-translated to insure the validity of translation.

These items covered the asthma patients' demographics, residency, smoking status, basic characteristics of asthma clinical features, indicators of lung function, results of ACT, medical history connected with asthma, control level by GINA, perception of asthma self control level and experience of education at asthma control schools for patients.

The patients received personal codes and then were asked to reply the questionnaires based on the explanations of the research assistants. A part of questionnaire form included lung function tests and evaluation of asthma control level by GINA was completed according to medical history of patient registered in the hospital database. Before the enrollment of patients in the survey, paper-based informed consent was taken from each participant beforehand. The study protocol was registered and approved by the Local Ethics Committee of International Kazakh Turkish University named after K.A.Yassavy, Shymkent, Kazakhstan. A total of 594 patients were included for registration in this study between May and July 2015.

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**Questionnaire outline**

The questionnaire included seven blocks of items, all of which represented the issues discussed in this article.
Detailed characteristics of variables are reflected in table 1.

**Table 1: Baseline characteristics of the questionnaire**

| Block | Item | Measure |
|---|---|---|
| Socio-demographic (5) | Age | Years |
| | Sex | Male/female |
| | Nationality | Kazakh/russian/other |
| | Residency | Urban/rural |
| | Employment status | Unemployed/employed |
| Smoking status (1) | Smoking | Yes/no |
| Medical history (9) | Duration of asthma | Years |
| | Co morbid diseases | Yes/no |
| | Usage of short-acting beta2-agonists (SABA) | The number of SABA usage for relieve the asthma symptoms a day |
| | Frequency of ambulance call | The number of ambulance calling due to require for emerging department visit in the past 12 months because of asthma |
| | Frequency of hospitalization | The number of hospitalization in the past 12 months because of asthma |
| | Frequency of emerging measures | The number of emerging measures which carried out at intensive care unit because of asthma |
| | Any activity limitation | Yes/no |
| | Exacerbation of asthma | The number of exacerbations during past 2 years |
| | Unplanned visits | Unplanned visit to a doctor because of asthma (yes/no) |
| Functional and laboratory tests (5) | Forced expiratory volume in 1 second (FEV1) | FEV1 is the volume of air that can forcibly be blown out in one second, after full inspiration, represented in % from normal indicator |
| | Forced vital capacity (FVC) | FVC is the volume of air that can forcibly be blown out after full inspiration, represented in % from normal indicator |
| | Peak expiratory flow (PEF) | PEF is the maximal flow (or speed) achieved during the maximally forced expiration initiated at full inspiration, measured in liters per minute or in liters per second, represented in % from normal indicator |
| | Bronchial reversibility test (BRT) | Any time BRT during asthma course (yes/no) |
| | Asthma genetic markers (AGM) | Any time AGM detection during asthma course (yes/no) |
| Control of asthma (4) | ACT | Any time pass the ACT for detection of the asthma control level (yes/no) |
| | Asthma control level by GINA | Controlled/partly controlled/uncontrolled |
| | Self perceived control | Controlled/uncontrolled |
| | Education at asthma school | Any number experience of education at asthma school for control of asthma (yes/no) |
| Access to diagnostic equipment and medications (6) | Frequency of pulmonologist or allergologist consultation | Once every 6 months/once a year/once every 2 years |
| | Frequency of spirometry | Once every 6 months/once a year/once every 2 years |
| | Frequency of peakflowmetry | Once every 6 months/once a year/once every 2 years |
| | Availability of personal peakflowmeter | Yes/no |
| | Usage of personal peakflowmeter | Yes/no |
| | Permanent and regular asthma medication provision | Yes/no |

**Statistical Analysis**

Procedure of statistical analysis was carried out using the SPSS statistical package, version 20.0 for Windows (IBM Ireland Product Distribution Limited, Ireland). The data from personal questionnaire forms

were coded according to planned variables types and entered to a SPSS database. First of all we have analyzed the distribution types of all variables (Shapiro-Wilk's W test). After that we describe categorical data with the use of percentage and 95% confidence intervals (95% CI). Quantitative data are represented as mean ± standard deviation, in cases of non-normal distribution as median and interquartile range. For search of differences between the quantitative data used T-test and for differences between groups for quantitative variables was used analysis of variance (ANOVA). The critical level of significance was set at $\alpha < 0.05$.

## RESULTS

### Demographics

Basic demographic characteristics of the study participants are presented in Table 2. Total number of respondents was 594, out of which 43.4% (95% CI: 39.5–47.5%) were men and 56.6% (95% CI: 52.6–60.5%) were women. There were 56.2% (95% CI: 52.2–60.2%) Kazakh, 34.2% (95% CI: 30.5–38.1%) were Russian, and other 9.6% (95% CI: 7.5–1.2%) represented by different minor nationalities. A large majority of participants were urban citizens 82.0% (95% CI: 78.7–84.9%) and 18.0% (95% CI: 15.1–21.3%) were registered as rural natives. Patients with disability status constituted 30.1% (95% CI: 26.6–33.9%) of the studied population. The biggest part of the study participants were registered as unemployed individuals 81.6% (95% CI: 78.3–84.6%). Current smoking status was marked in 16.8% cases (95% CI: 14.0–20.0%).

**Table 2: Baseline characteristics of the study participants (n=594)**

| Variable | % (95% CI: %) |
|---|---|
| Age (mean±SD) | 47.32±14.1 |
| Sex | |
| Male | 43.4% (39.5–47.5) |
| Female | 56.6% (52.6–60.5) |
| Nationality | |
| Kazakh | 56.2% (52.2–60.2) |
| Russian | 34.2% (30.5–38.1) |
| Other | 9.6% (7.5–1.2) |
| Residency | |
| Urban | 82.0% (78.7–84.9) |
| Rural | 18.0% (15.1–21.3) |
| Disability status | |
| Yes | 30.1% (26.6–33.9) |
| No | 69.9% (66.1–73.4) |
| Employment status | |
| Unemployed | 81.6% (78.3–84.6) |
| Employed | 18.4% (15.4–21.7) |
| Smoking | |
| Yes | 16.8% (14.0–20.0) |
| No | 83.2% (79.9–85.97) |

### Medical history

The median duration of disease in all participants was 12 years with interquartile (IQ) range 49 years, minimum course of asthma 1 year and maximum duration 50 years. The patient with 50 years duration of asthma was aged 86 years. More than seventy-eight percents of individuals (95% CI: 75.1–81.7%) had co morbid conditions. The SABA usage was reported from 1–4 times a day by 42.3% (95% CI: 38.4–46.3%), from 5 to 8 times a day by 54.7% (95% CI: 50.7–58.7%). It should be noted that there was a group which used SABA more than 9 times a day – 2.8% (95% CI: 1.8–4.6%). The number of ambulance calling due to require for emerging department visit from 1 to 4 times in the past 12 months because of asthma was registered in 93.3% (95% CI: 90.9–95.0%) of the subjects. Related to the mentioned before indicator of hospitalization frequency and frequency of emerging measures also were extremely high – 98.5% (95% CI: 97.1–99.3%) and 99.7% (95% CI: 98.7–99.9%) respectively. The events of activity limitation were reported by 23.2% (95% CI: 20.0–26.8%) of the patients. The number of exacerbations from 1 to 4 times during past 2 years was marked in 94.9% (95% CI: 92.9–96.5%) of cases. The frequency of unplanned visits to a doctor because of asthma in all individuals was 89.1% (95% CI: 86.3–91.3%).

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**Table 3: Medical history data of participants (n=594)**

| Variable | Number (%) |
|---|---|
| Duration of asthma (Median, IQ range ) | 12, 49 (min=1, max=50) |
| Co morbid diseases | |
| Yes | 78.6% (75.1–81.7) |
| No | 21.4% (18.3–24.9) |
| Usage of SABA | |
| 0 | 0.2% (<0.01–0.1) |
| 1 – 4 | 42.3% (38.4–46.3) |
| 5 – 8 | 54.7% (50.7–58.7) |
| 9 and > | 2.8% (1.8–4.6) |
| Frequency of ambulance call | |
| 0 | 4.4% (2.98–6.4) |
| 1 – 4 | 93.3% (90.9–95.0) |
| 5 – 8 | 2.4% (1.4–3.95) |
| Frequency of hospitalization | |
| 0 | 1.3% (0.6–2.7) |
| 1 – 4 | 98.5% (97.1–99.3) |
| 5 and > | 0.2% (<0.01–0.1) |
| Frequency of emerging measures | |
| Yes | 99.7% (98.7–99.9) |
| No | 0.3% (<0.01–0.1) |
| Any activity limitation | |
| Yes | 23.2% (20.0–26.8) |
| No | 76.8% (73.2–79.99) |
| Exacerbation of asthma | |
| 0 | 1.5% (0.7–2.9) |
| 1 – 4 | 94.9% (92.9–96.5) |
| 5 and > | 3.5% (2.3–5.4) |
| Unplanned visit | |
| Yes | 89.1% (86.3–91.3) |
| No | 10.9% (8.7–13.7) |

**Asthma control characteristics**

The basic problem of asthma management in the South Kazakhstan region was represented by absence of ACT using and education at asthma school in routine practice. Nobody from officially registered patients had ACT results. According to the asthma control level classified by GINA recommendations the greatest part consisted by partly controlled and uncontrolled levels – 61.3% (95% CI: 57.3–65.1%) and 29.3% (95% CI: 25.8–33.1%) respectively. Interestingly, that number of asthma patients who think that they are controlling own condition was 86.5% (95% CI: 83.5–89.1%).

**Table 4: Objective and subjective indicators of asthma control in the study group (n=594)**

| Indicator of asthma control | n, (95% CI: %) |
|---|---|
| ACT | |
| Yes | – |
| No | 594 (n/a) |
| Asthma control level by GINA | |
| Controlled | 9.4% (7.3–12.1) |
| Partly controlled | 61.3% (57.3–65.1) |
| Uncontrolled | 29.3% (25.8–33.1) |
| Self perceived control | |
| Controlled | 86.5% (83.5–89.1) |
| Uncontrolled | 13.5% (10.95–16.5) |
| Education at asthma school | |
| Yes | – |
| No | 594 (n/a) |

The inter group comparisons for various control level of asthma according to GINA classification were find statistically significant differences in functional and laboratory tests results. The mean indicator of FEV1was the worst in patients with partly controlled and uncontrolled level (37.10% and 28.45% respectively). The same picture was observed relatively to FVC. There were 38.35% in partly controlled level patients and

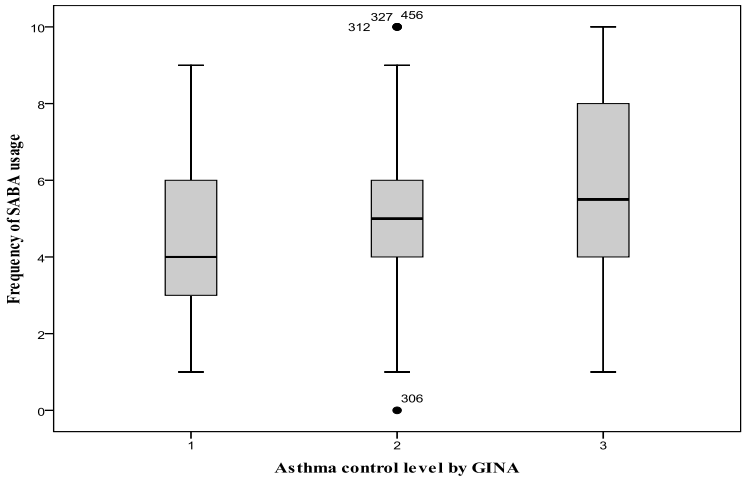
partly controlled 31.74% in uncontrolled level patients. Very important characteristics of all study population were absence of peakflowmetry, bronchial reversibility test and asthma genetic markers examinations.

Asthma control level also was assessed with characteristics of the frequency of SABA usage. There were found statistically significant differences in the frequency number between groups divided according to the asthma control level by GINA ($p < 0.005$). Frequently of all were used SABA patients with uncontrolled level (mean=5.38, 95% CI: 5.04–5.72).

**Access to diagnostic equipment and medications**

The main characteristics of access problems to diagnostic equipment and medications for asthma patients illustrated at the figure 2. Big proportions of individuals had problems of access to pulmonologist or allergologist consultation 97% (95% CI: 95.2–98.1), free access in clinic or hospital to spirometry and peakflowmetry – 96.3% (95% CI: 94.4–97.6%) and 99.8% (95% CI: 98.9–>99.9%) respectively. Absence of personal peakflowmeter and skills of work with it also was frequent characteristics of the studied population – 100% in both variables. At the same time, only 12.99% (95% CI: 10.3–15.7%) of subjects had no permanent and regular asthma medication provision.

**Figure 1: Usage of SABA according to control level by GINA (n=594)**




* – Asthma control level by GINA 1 – controlled, 2 – partly controlled, 3 – uncontrolled

**Figure 2: The characteristics of access to diagnostic equipment and medications for asthma patients (n=594)**

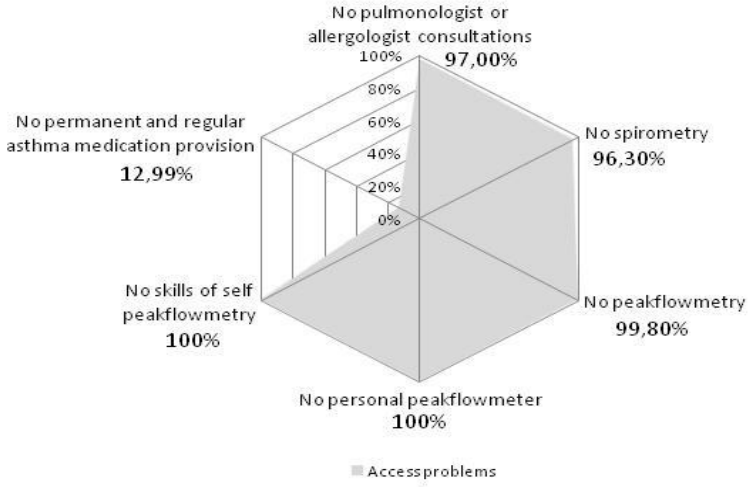


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**Table 5: Functional and laboratory tests according to asthma control level by GINA (n=594)**

| Functional and laboratory tests | Control level by GINA | N | Mean | 95% Confidence Interval for mean | | F | p-value. |
|---|---|---|---|---|---|---|---|
| | | | | Lower CI | Upper CI | | |
| FEV1 | Controlled | 56 | 58.11 | 50.31 | 65.90 | 21.683 | 0.0001 |
| | Partly controlled | 364 | 39.73 | 37.10 | 42.36 | | |
| | Uncontrolled | 174 | 32.19 | 28.45 | 35.93 | | |
| | Total | 594 | 39.25 | 37.11 | 41.40 | | |
| FVC | Controlled | 56 | 55.61 | 48.08 | 63.13 | 20.28 | 0.0001 |
| | Partly controlled | 364 | 38.35 | 35.87 | 40.84 | | |
| | Uncontrolled | 174 | 31.74 | 28.17 | 35.30 | | |
| | Total | 594 | 38.04 | 36.01 | 40.07 | | |
| PFM | Controlled | 56 | .00 | .00 | .00 | n/a | n/a |
| | Partly controlled | 364 | .00 | .00 | .00 | | |
| | Uncontrolled | 174 | .00 | .00 | .00 | | |
| | Total | 594 | .00 | .00 | .00 | | |
| Bronchial reversibility test (BRT) | Controlled | 56 | .00 | .00 | .00 | n/a | n/a |
| | Partly controlled | 364 | .00 | .00 | .00 | | |
| | Uncontrolled | 174 | .00 | .00 | .00 | | |
| | Total | 594 | .00 | .00 | .00 | | |
| Asthma genetic markers (AGM) | Controlled | 56 | .00 | .00 | .00 | n/a | n/a |
| | Partly controlled | 364 | .00 | .00 | .00 | | |
| | Uncontrolled | 174 | .00 | .00 | .00 | | |
| | Total | 594 | .00 | .00 | .00 | | |

## DISCUSSION

The aim of our study was to determine the profile of asthma patients according to GINA classifications and barriers to asthma medications and equipment at the Regional Clinical Hospital of the South Kazakhstan Region, Kazakhstan. The Regional Clinical Hospital is the central medical body (tertiary level) which is collected the data of all officially registered patients with asthma in the South Kazakhstan Region, Kazakhstan. Both sexes in the study had almost equal share in total number of asthmatic patients. Almost all subjects were in working age, but about one-third of them had disability status and more than eighty percents were unemployed. The biggest part was from urban area (82%). That could be connected as well with access problems to a proper diagnostics in rural regions as with ecological unfavorable situation in the urban part of in the South Kazakhstan Region. The similar picture was reflected in relative studies [10, 11].

A lot of individuals had long asthma duration with a broad range from 1 to 50 years. More than half patients used SABA in uncontrolled way; approximately 54% used it from 5 to 8 times a day. It means that almost all individuals do not have clear instructions from responsible specialists (allergologist, pulmonologist or general practitioner) about right using of SABA.

We think that the most commonly reason of the frequent ambulance calling (from 1 to 4 times in the past 12 months – about 93%), high number of hospitalizations (from 1 to 4 times in the past 12 months – about 98%) and frequent emerging measures (in the past 12 months – about 99%) is due to the poor asthma control of a patient route between primary and tertiary level medical organizations. The same situation is develops in different countries [12-14]. Typically a patient is not consulted with the same specialist all time because of asthma symptoms. Sometimes it can happen at primary level in general practitioner, sometimes in private clinic or in case of severe exacerbation already at the hospital emergency care unit.

Twenty-three percents of individuals which indicated some activity limitations show an adverse picture compare to [11]. This result may indicate on a subjective non-perception of severity asthma symptoms. Even a patient has to use SABA more than 5 – 8 times a day he continuous thinks that it is not activity limitation. Very high number of asthma exacerbations in contrast with other studies [15, 16] is signalized about urgent situation on asthma management in the South Kazakhstan region. The same urgent sign we can observe relatively to one of serious part of asthma patients' examination with PFM, bronchial reversibility test, asthma genetic markers, ACT. Absence of these investigations in all officially registered patients tells about serious deficiency of recourses and correct approaches to asthma diagnostics [17, 18]. The low rate of controlled level asthma in total patients' population (9.4%) was lower than reported by other authors [19, 20]. At the same time many patients inadequately assessed own asthma control rate ("controlled level": "by GINA"

— 9.4% vs. “Self perceived control” – 86.5%). It can be connected to the lack of asthma schools and experience of education at asthma school for control of asthma.

Our findings is different with other studies if concern to results of SABA usage according to asthma control level by GINA [10, 11]. Even in “controlled level” patients we still find the subjects who used SABA more than eight times a day. This event could be sign of misclassification the asthma control level by doctors according to GINA recommendations.

Finally, we defined a lot of access barriers to diagnostic equipment and medications for asthma patients. Only 3.0% of individuals had pulmonologist or allergologist consultation at least once every two years. More than 96% – 99% did not have possibility to pass spirometry or peakflowmetry tests at hospital or specialized department of clinic due to lack of equipment as well as did not have personal peakflowmetr or skills to work with it. Although, in Kazakhstan the provision with free medications for asthma at primary health care organizations about 13% asthma patients have barriers. That is most unacceptable for health care system with free access to primary health care recourses including medications from the guaranteed volume of free health care.

In the context of this study, several limitations should be noted: the study results are representative only to the Kazakhstan situation on asthma management. A part of data was collected using the self-report method. The self-report method collection of information cannot to be concern as fully true information, which therefore limits generalizability.

In conclusion, the profile of asthma patients according to GINA classifications includes:

– Both sexes in working age, mostly from urbanized territory with high rate of unemployed and disabled individuals;
– SABA usage more than five times a day is spread in a half of asthma patients, as well as high frequency of ambulance call, hospitalization, emerging measures and exacerbation of asthma;
– A lot of officially registered patients are not available to use spirometry, peakflowmetry, bronchial reversibility test and ACT due to lack of recourses and barriers of access;
– The high rate of SABA using in all levels of asthma control is signalized about lack of education on asthma management not only in patients, but in medical specialists (pulmonologists, general practitioners) at the same time.

Further study is needed to understand the best way of improvement of asthma management situation based on international recommendations of GINA and taking into account current health care system peculiarities in Kazakhstan.

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## REFERENCES

[1] Masoli, M., et al., The global burden of asthma: executive summary of the GINA Dissemination Committee report. Allergy, 2004. 59(5): p. 469-478.
[2] Braman, S.S., The global burden of asthma. Chest Journal, 2006. 130(1_suppl): p. 4S-12S.
[3] To, T., et al., Global asthma prevalence in adults: findings from the cross-sectional world health survey. BMC public health, 2012. 12(1): p. 204.
[4] Williams, M.V., et al., Inadequate literacy is a barrier to asthma knowledge and self-care. Chest Journal, 1998. 114(4): p. 1008-1015.
[5] Mansour, M.E., B.P. Lanphear, and T.G. DeWitt, Barriers to asthma care in urban children: parent perspectives. Pediatrics, 2000. 106(3): p. 512-519.
[6] Yegeubaeva, S.A., et al., Challenges for injury prevention among the elderly in Kazakhstan. Asia Pac J Public Health, 2011. 23(2): p. 237-45.

[7] Simon, G., On the customs union of Belarus, Kazakhstan and Russia. Economic annals, 2010. 5(184).
[8] Kozina, A., et al., Study of the system of free drugs supply in Kazakhstan. International Student J of Medicine, 2013. 1: p. 32.
[9] Nurpeissov, T., et al., Asthma spreading and primary diagnostics problems in rural regions of Kazakhstan. Clinical and Translational Allergy, 2015. 5(Suppl 2): p. P22-P22.
[10] Zemedkun, K., K. Woldemichael, and G. Tefera, Assessing Control of Asthma in Jush, Jimma, South West Ethiopia. Ethiopian journal of health sciences, 2014. 24(1): p. 49-58.
[11] Brożek, G.M., et al., Profile of adults suffering from asthma in Poland—results of PulmoScreen study. Polish Pneumonology and Allergology, 2012. 80(5): p. 402-411.
[12] Hamdan, A., et al., Improper inhaler technique is associated with poor asthma control and frequent emergency department visits. Allergy Asthma Clin. Immunol, 2013. 9(1): p. 8.
[13] Kulm, K., K. Uba, and R. Jogi, Risk Factors For Poor Asthma Control In Estonia. Am J Respir Crit Care Med, 2015. 191: p. A4168.
[14] Slejko, J.F., et al., Asthma control in the United States, 2008-2010: Indicators of poor asthma control. Journal of Allergy and Clinical Immunology, 2014. 133(6): p. 1579-1587.
[15] Rabe, K.F., et al., Worldwide severity and control of asthma in children and adults: the global asthma insights and reality surveys. Journal of Allergy and Clinical Immunology, 2004. 114(1): p. 40-47.
[16] Osborne, M.L., et al., Assessing future need for acute care in adult asthmatics*: The profile of asthma risk study: a prospective health maintenance organization-based study. Chest, 2007. 132(4): p. 1151-1161.
[17] Reddel, H.K., et al., An Official American Thoracic Society/European Respiratory Society Statement: Asthma Control and Exacerbations. American Journal of Respiratory and Critical Care Medicine, 2009. 180(1): p. 59-99.
[18] Reddel, H.K., S.S. Hurd, and J.M. FitzGerald, World Asthma Day. GINA 2014: a global asthma strategy for a global problem. The International Journal of Tuberculosis and Lung Disease, 2014. 18(5): p. 505-506.
[19] Demoly, P., et al., Repeated cross-sectional survey of patient-reported asthma control in Europe in the past 5 years. European Respiratory Review, 2012. 21(123): p. 66-74.
[20] Allegra, L., et al., Real-life prospective study on asthma control in Italy: cross-sectional phase results. Respiratory medicine, 2012. 106(2): p. 205-214.