Housing environment and external migration as factors influencing population health

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Abstract. This article investigates the impact of housing quality and type on the health of migrants in developing countries, emphasizing factors such as overcrowding, sanitation, and access to healthcare. It further explores how specific aspects of housing quality, including structural integrity, ventilation, insulation, and access to utilities, influence population health. A comprehensive review of relevant literature is conducted, presenting evidence on the relationship between housing conditions and the prevalence of respiratory diseases, cardiovascular diseases, and mental disorders. The study focuses on Kyrgyzstan, aiming to elucidate how various living conditions affect the health of its population. The analysis utilizes secondary data from sociological studies and scientific research from various countries, offering recommendations applicable to Kyrgyzstan. Numerous contributing factors are identified, including the economic and social damage associated with inadequate housing, housing construction, and improvements in living conditions; air quality; indoor temperature and warmth; infestation by parasites and pests; and sanitary and hygienic conditions. The article concludes with practical recommendations for policy and intervention.
Keywords: housing, living conditions, public health, diseases, migration, urbanization, population, entrepreneurship, correlation.

1. Introduction

Over the years of independence, the issue of the impact of the housing sector on the health of the population has not received adequate attention and remains a pressing concern for Kyrgyzstan. Despite governmental efforts to reform the healthcare system and formulate strategies to enhance public health, the overall health of the population continues to deteriorate.

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These reforms have been implemented through various government programs, funded by both budgetary allocations and grants.

Currently, the public health sector is executing the Government of the Kyrgyz Republic's program for protecting public health and developing the healthcare system for 2019-2030, titled "A Healthy Person is a Prosperous Country" [1]. This program is a continuation of the National Program for Reforming the Healthcare System of the Kyrgyz Republic, "Den Sooluk" (2012-2016) [2], the Manas Taalimi program (2006-2011) [3], and the Manas project (1996-2005) [4]. These reforms primarily targeted the healthcare system without adequately addressing the influence and interconnection of external factors, such as the living conditions of the population.

Among the various external factors, the level of development of the housing sector across different population groups plays a significant role. From a scientific perspective, there is considerable interest in whether investment in housing constitutes an effective strategy for improving the health of diverse population groups at the national level.

The primary objective of this study is to elucidate the changes in the health of the population of Kyrgyzstan as influenced by various living conditions. This will be achieved through secondary analysis of sociological research and scientific studies conducted by researchers from different countries, with subsequent recommendations tailored for application in Kyrgyzstan.

The study focuses on the healthcare system in the Kyrgyz Republic as its object, while the subject of the study is the array of housing factors influencing population health. Despite the progress made in healthcare reform, several strategic challenges persist. The health sector reforms have been largely sectoral, with insufficient consideration of intersectoral issues and approaches, particularly those related to housing conditions.

In 2009, the Law of the Kyrgyz Republic "On Public Health" [5] was enacted to regulate public health issues. However, regulatory legal acts have not been adequately developed to delineate the functions of responsible organizations and the flows of data collection, especially concerning services aimed at recovery from illnesses caused by poor housing conditions. Issues falling outside the health care system's direct competence, particularly those related to the risks associated with living in substandard housing, are not adequately reflected in the regulations.

The public health management system does not function optimally and fails to align with new development trends, characterized by fragmentation and uncoordinated efforts. Existing research is insufficient to conclusively determine whether investing in housing is an effective strategy for improving public health. Given these considerations, the topic is highly relevant and holds significant scientific potential for further investigation.

2. Literature Review

The concept of "living conditions" can be traced back to the first half of the 19th century in the works of K. Marx and F. Engels. In their political economy, they frequently addressed living conditions, albeit not as a fundamental category of their theory. Marx and Engels posited that "It is not consciousness that determines life, but life (life conditions) that determines consciousness" [6]. This suggests that the level of societal development is shaped by the conditions under which individuals live, influencing behavior and social structure.

Modern researchers have continued to explore this concept extensively. Long-term studies on housing development and living conditions have been conducted by Asaul A.N. (2021) [7], Grabovoi P.G. (2010) [8], Sternik G.M. (2018) [9], Kiyanenko K.V. (2002) [10], and Ovsyannikova T.Yu. (2004; 2005) [11; 12]. These studies consider living conditions through the lenses of quality of life, population migration, and human potential. Notable contributions in this domain include the research of A.B. Assylbayev (2016-2024) [13-19], K.N. Niyazalieva (2016-2024) [20-22] , and G.V. Kumskova (2017) [23].

Internationally, similar studies are prevalent and their findings have been effectively utilized to inform strategies for housing sector reform, demographic planning, and healthcare system

improvements. Significant works in this area include those by Mulder, Clara H., and Thomas J. (2005) [24-26], and Petticrew M. (2006) [27]. These studies have identified links between various physical aspects of housing (such as humidity, temperature, insect presence, and air pollution) and the health outcomes of residents. Mulder's research (2006) is particularly noteworthy for establishing connections between housing and demographic indicators. Additionally, M. Braubach's work (2013) [28], has provided valuable insights into the relationship between housing conditions, the urban environment, and public health.

An analysis of domestic literature reveals that in the Kyrgyz Republic, issues related to housing and public health have not been prioritized as an independent field of scientific inquiry within economic science, nor have they been a focus of socio-economic policy. From the perspectives of social structure and processes, the impact of living conditions on health is discussed in the works of domestic scholars such as Isaeva K.I. (2002) [29], Borsokbaeva S.S. (2002) [29], Moldokeeva Zh. F. (2008) [30], and Salmorbekova R. (2010) [31].

In summary, while substantial research exists globally and to some extent domestically, the integration of housing conditions as a critical factor in public health strategies remains underexplored, particularly within the context of the Kyrgyz Republic. This gap highlights the need for more focused studies to understand and address the intricate relationship between housing and health, aiming to enhance both scientific knowledge and policy development in this area.

3. Methods and Methodology

The research methodology employs a multifaceted approach, integrating systematization of information, demographic analysis, and synthesis. This approach aims to identify patterns and trends in the dynamics of housing development and morbidity levels in the Kyrgyz Republic. Key methods include the classification and selection of statistical information, as well as secondary data analysis techniques, to examine empirical data associated with disease processes in specific housing settings.

Specifically, the methodology comprises:

Systematization of Information: This involves gathering and organizing data related to housing conditions and healthcare systems. By structuring this information, the study aims to facilitate a clear understanding of the current state and historical trends in these areas.

Demographic Analysis: This step involves analyzing population data in relation to residential density. Understanding how population distribution and density correlate with health outcomes is crucial for identifying vulnerable groups and areas.

Synthesis of Information: By integrating data from various sources, the study constructs a comprehensive picture of the relationship between housing conditions and health status. This synthesis involves both qualitative and quantitative data to ensure a robust analysis.

Intelligent Data Analysis: Advanced analytical techniques are applied to large datasets, including both quantitative and qualitative data. This analysis helps in identifying significant correlations and causal relationships between housing conditions and health outcomes.

The comprehensive analysis conducted using this methodology underscores the importance of coordinated efforts to mitigate the adverse health impacts associated with poor housing conditions. Through systematic and detailed examination, the study aims to provide actionable insights for policymakers and stakeholders to improve public health by addressing housing quality issues.

4. Results Obtained

The longstanding relationship between increased morbidity and mortality and poor housing conditions is well-documented, particularly among the socially vulnerable segments of the population in the Kyrgyz Republic. It is crucial to recognize that housing conditions encompass numerous factors, including the location, state, and timing of residence. External migration has

been identified as a contributor to increased residential density and the spread of viral diseases. Based on a secondary analysis of scientific literature, we present detailed and accessible indicators of living conditions.

4.1 Sanitary and Hygienic Conditions

According to a study conducted by a group of authors under the UNDP Peace and Development Program and the Assembly of the People of Kyrgyzstan [32], the most pressing issues in Kyrgyz settlements include:

- Poor condition of roads;
- Insufficient provision of housing and communal services;
- Inadequate access to clean drinking water;
- Lack of social institutions, such as medical centers, pharmacies, and sports clubs.

Sanitary and hygienic living conditions, particularly in urban and rural areas, are a significant concern due to a severe shortage of garbage disposal facilities. This shortage leads to the formation of spontaneous landfills, which increase the risk of infectious disease outbreaks [32]. From 2010 to 2018, waste disposal methods in Kyrgyz households varied: in urban areas, 68.4% of households used containers for waste disposal, while 18.2% used landfills. In rural areas, 42.9% of households burned garbage, and 20.6% buried it. The Batken region had the highest proportion of households burying garbage (39.8%), while the Talas region had the lowest (3.1%), followed by the Naryn (5.6%) and Jalal-Abad regions (8.7%) [33; 34].

Another critical indicator of infrastructural insufficiency is the unsatisfactory condition of sewerage systems. As of 2014, only 28.3% of the population had access to proper sewage facilities, with rural areas lagging significantly behind urban settlements. Only about 7% of rural residents had access to sewage systems, compared to 62.9% in urban areas. By 2023, the disparity remained substantial, with rural access still seven times lower than urban areas [35].

Table 1. Equipment of Housing: Sewerage Pipes (thsd.m²)

Year	Total	Urban areas	Rural ares
2010	16181	14721	1460
2011	13407	11921	1486
2012	13796	12286	1511
2013	13742	12130	1612
2014	14545	12316	2228
2015	14093	11860	2233
2016	14368	12108	2260
2017	14805	12488	2260
2018	14287	11992	2295
2019	15167	12844	2323
2020	15627	13251	2375
2021	16322	13916	2406
2022	17371	14785	2586
2023	18276	15607	2669

Source: Compiled by the author based on data from the NSC KR [36]

Hand hygiene is an essential practice for preventing disease transmission. Studies by Ensink (2008) [37], and Luby (2005) [38] indicate that handwashing with soap and water significantly reduces the risk of diarrhea, respiratory infections, and other diseases. In Kyrgyzstan, 87% of households with handwashing facilities had both water and soap, indicating satisfactory water

access. However, some households had only water, and 2% lacked both water and soap or other cleaning products [32; 34; 35]. This situation has improved notably since the Covid-19 pandemic.

4.2 Infestation by Parasites and Pests

The home environment can be a significant source of parasite and pest infestations, leading to various health problems. Common sources of infestation include lice, bedbugs, fleas, cockroaches, ticks, rats, and mice. These pests pose direct health hazards, such as bedbugs feeding on human blood and rats carrying diseases. Additionally, poor hygiene conditions can exacerbate these hazards; for example, cockroaches and house flies can transfer harmful microorganisms between food products, while house dust mite excrement can act as a potent allergen.

Effective prevention strategies are crucial to combat these health hazards. Key preventive measures include the careful storage of food and waste, maintaining good hygiene practices to reduce the home's attractiveness to vermin and pests, and, if necessary, employing chemical treatments to eradicate infestations.

Recent studies in Kyrgyzstan highlight the impact of inadequate sanitary and hygienic standards on the incidence of infectious diseases. The data indicates a growing proportion of patients infected due to poor compliance with these standards. This trend underscores the urgent need for improved hygiene practices and effective pest control measures to protect public health.

4.3 Air Quality, Indoor Temperature, and Heat

It has been well established that insufficient living space and inadequate cubic capacity of premises, combined with a lack of rational ventilation, contribute significantly to the spread of many infectious diseases and helminthic infestations. This is due to the increased possibility of infection transmission through direct contact with patients and bacteria carriers, as well as through the air and contaminated furnishings. Overcrowded spaces hinder proper cleaning, leading to untidiness and the proliferation of insects. Consequently, the air quality in such premises often deteriorates, predisposing residents to a variety of diseases due to decreased resistance.

In the group of airborne infections, a comparison of incidence rates per 100,000 population from 2010 to 2014 reveals alarming trends: the incidence of influenza increased by 2.6 times, mumps by 2.1 times, meningococcal infection by 1.7 times, whooping cough by 9.5%, and acute respiratory infections by 8.4%. A significant spike in measles cases was observed in 2014, with 265 cases reported, compared to just one case in 2013 [34].

Indoor air quality is compromised by multiple factors, with over half of indoor particles originating from outdoor sources. Common indoor sources include tobacco smoke, house dust mites, cooking activities, certain heating appliances, and various human activities. The primary biological indoor air pollutants—house dust mites, cockroaches, and pets such as cats and dogs—contribute significantly to allergenic conditions Holmes (2000) [39].

A 2023 survey in Kyrgyzstan highlighted a stark contrast in heating infrastructure: 29.8% of urban households had access to a centralized heating system, compared to only 0.5% of rural households. This disparity underscores the urban-centric provision of centralized heat supply services. Additionally, 29.9% of households in the republic had access to the gas pipeline network, with urban households (46.8%) being far better served than rural households (5.3%) (NSC KR) [36].

The World Health Organization (WHO) has identified indoor air pollution from solid fuel use as a significant contributor to increased morbidity and mortality (WHO, 2006) [35].. In the Kyrgyz Republic, cooking practices vary widely: urban areas see 45.4% of non-poor households using gas stoves connected to a central gas pipeline, while 41.6% of poor

households and 57.7% of very poor households use electric stoves. In rural areas, solid fuel is predominantly used by 46.6% of very poor and 47.0% of poor households. Notably, urban households in Jalal-Abad (24.7%), Bishkek (73.3%), and Osh (43.4%) heavily rely on gas stoves for cooking [35].

4.4 Indoor Smoking and Secondhand Smoke Exposure

A 2012 study in Kyrgyzstan aimed to estimate the percentage of households exposed to secondhand smoke, underscoring the health risks for children and adults who do not smoke [35]. This investigation aligns with findings from similar studies conducted in the USA, which elaborate on the detrimental effects of smoking on public health. For instance, research indicates that children exposed to secondhand smoke are at a heightened risk of developing respiratory and ear diseases, as well as experiencing impaired lung development (Thomas E. Novotny, 2006) [40].

The study in Kyrgyzstan revealed that respondents in one-third of households reported indoor smoking, with 31% indicating daily indoor smoking and 3% smoking indoors weekly. The prevalence of indoor smoking was notably higher in rural areas (41%) compared to urban areas (25%) [35]. This significant disparity highlights the need for targeted public health interventions to address secondhand smoke exposure, particularly in rural communities.

The data emphasize the critical public health issue posed by secondhand smoke and the urgent need for comprehensive smoking cessation programs and policies to mitigate this risk, especially in vulnerable populations such as children and non-smoking adults.

4.5 Housing Construction and Improvement of Living Conditions

The relationship between apartment living, particularly in high-rise buildings, and various adverse outcomes such as increased stress, social isolation, crime, intrusion into privacy, and reduced safe play opportunities for children is well-documented. Recent epidemiological surveys have demonstrated a clear link between poor mental health and residence in high-rise buildings and apartment complexes. This evidence suggests that the architectural and environmental characteristics of housing can significantly impact mental well-being.

Additionally, specially designed housing is critical for individuals with limited physical mobility. In some countries, residents with special healthcare needs are relocated when their mobility constraints prevent them from fully utilizing their accommodation. These "relocations for medical reasons" have been associated with improvements in self-assessed physical and mental health, indicating that appropriate housing can facilitate better health outcomes for individuals with mobility issues.

In Kyrgyzstan, more than 166,000 families require new housing or improvements to their current living conditions. Over 17,000 families reside in dormitories, and housing for more than 16,000 families is located in areas at high risk of natural disasters and other emergencies, necessitating relocation to safer areas. The overall comfort and provision of necessary amenities in Kyrgyz housing, including water supply, sewerage, and heating, fall significantly behind international standards. Notably, 65% of families have a living area of less than 5 square meters per person.

Furthermore, approximately 3.75 million people in Kyrgyzstan live in zones susceptible to 9-magnitude earthquakes. According to a comprehensive plan of urgent measures to prepare the governing bodies, forces, and resources of the state civil protection system and the population for potential earthquakes, 74 out of 193 settlements in Kyrgyzstan are located in areas where earthquakes with intensities greater than 9 points are possible. Preliminary estimates suggest that about 3.3 million people, or 66% of the population, live in houses that are extremely vulnerable to expected strong earthquakes. This highlights the urgent need for seismic risk mitigation strategies, including the reinforcement of existing structures and the construction of new, earthquake-resistant buildings to ensure the safety and resilience of the population [36].

4.6 Relationship Between Migration Gain or Outflow and Total Area Per Person

To elucidate the relationship between migration trends and housing availability in Kyrgyzstan, we examined the correlation between migration growth or outflow and the housing supply coefficient. The analysis included constructing a dynamic behavior diagram of these two factors over the period from 2011 to 2021 (Figure 1).

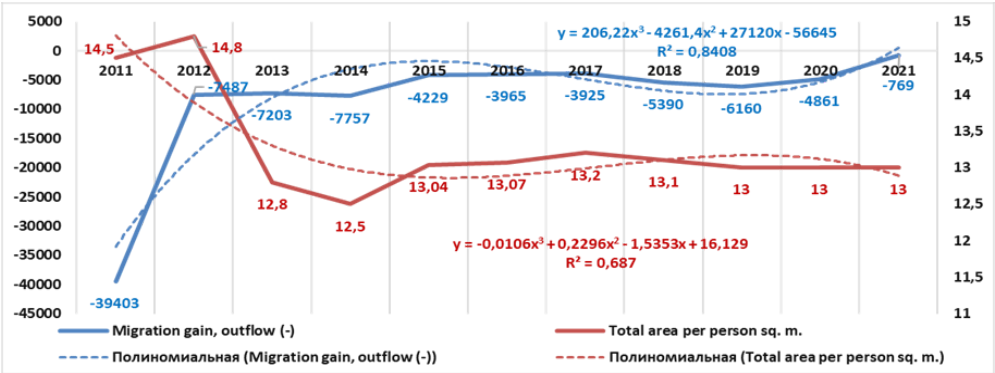

Figure 1 Migration Gain or Outflow and Total Area Per Person for the Period from 2011 to 2021
Полиномиальная – Polynomial
Source: prepared by the author according to the NSC KR data [36]

The data reveals a consistent trend of net migration outflow in Kyrgyzstan throughout the analysis period. The peak migration outflow occurred in 2011, with 39,430 individuals departing, while the lowest outflow was recorded in 2021, with 769 individuals. The trend line of the migration outflow, described by a cubic function $y=206.22x^3-4261.4x^2+27120x-56645$, had an approximation value $R^2=0.8408$, indicating an 84% confidence level.

Simultaneously, the total area per person also exhibited a polynomial trend. Studies have consistently shown that overcrowded living conditions are associated with higher mortality rates, ranging from 1.5 to 2 times greater compared to those living in more spacious accommodations. Tuberculosis, in particular, is prevalent in overcrowded housing. Additionally, homelessness is on the rise, especially in larger cities. [7]

Housing supply per capita in Kyrgyzstan decreased from 15.7 square meters per person in 2010 to 12.7 square meters in 2014. However, this figure increased again to 14 square meters per person by 2023. [17] A similar pattern was observed in both urban and rural areas. The largest residential area per person was in Issyk-Kul (16.7 square meters) and Chui (14.9 square meters) regions, while the smallest was in Jalal-Abad, Osh, and Bishkek, ranging from 10.2 to 12.6 square meters.

Expenditures on housing and communal services increased significantly. In 2015, housing and communal services accounted for 27.1% of total service expenses, up from 19.9% in 2011. This increase highlights the growing financial burden on households for maintaining adequate living conditions over the analyzed period.

These findings underscore the complex interplay between migration, housing availability, and public health in Kyrgyzstan, suggesting that improving housing conditions could mitigate some of the adverse effects associated with high-density living and migration outflows.

4.7 Economic and Social Damage Associated with Inadequate Housing Conditions

Davidson et al. (2010) [41] developed a methodology to quantify the annual cost to the health sector due to inadequate housing, contrasting it with the cost of one-time improvements. In England alone, this cost is estimated to be at least £600 million (approximately €717 million) per year. The economic burden on the health sector constitutes about 40% of the total societal

damage, excluding the losses related to decreased educational attainment and lost work hours due to health-related absenteeism [42].

In Kyrgyzstan, healthcare expenditures have comprised an average of 10-12% of the state budget over the past five years. Per capita healthcare spending has risen significantly, with the allocation reaching 2,259 soms per resident in 2014, which is 1.5 times higher than in 2010. Total healthcare expenditures in 2014 doubled compared to 2009, amounting to 12,920.9 million soms, although the percentage of GDP spent on healthcare remained relatively stable at 3.2% [43; 44].

A secondary study conducted in Kyrgyzstan highlighted several factors that respondents believe impact their health. According to the findings, 55.6% of respondents indicated that their living conditions affect their health, 62% pointed to lifestyle factors, and 47.5% identified constant stress as a significant health determinant. Stress is particularly problematic, causing depression in 70.1% of respondents. Over more than a decade, these issues persist, with many people losing faith in government intervention and control.

According to research by the UNDP Peace and Development Program and the Assembly of the People of Kyrgyzstan, when faced with problems, 88% of respondents turn to God, 46.2% to family members, 27.1% to relatives, 20.9% resolve issues independently, 19% seek help from friends and acquaintances, and only 17% appeal to relevant government bodies [30; 31;32].

These findings underscore the profound economic and social impacts of inadequate housing conditions in Kyrgyzstan. The data suggests that substantial investments in improving housing conditions could reduce the health sector's financial burden and enhance overall societal well-being.

5. Discussion

The findings of this study underscore the significant impact of housing conditions on health, particularly mental health. Through secondary analysis of sociological research and scientific studies from various countries, this research elucidates the specific ways in which the health of the population in Kyrgyzstan is affected by diverse housing-related factors.

The evidence suggests that improving living conditions has the potential to substantially enhance health outcomes, especially among individuals in poor health, older adults, and younger generations. However, there remains a paucity of data on which specific types of housing improvements yield the most significant health benefits and which interventions offer the best health outcomes relative to their cost. The health impact of housing conditions is further mediated by the socioeconomic status of residents and the characteristics of the surrounding neighborhoods, which can evolve as housing improvement programs are implemented.

While the overall trend indicates that better housing conditions lead to better health outcomes, it is crucial to consider potential adverse effects. Notably, improvements in housing can result in increased housing costs, which may exacerbate financial strain. This, in turn, can negatively impact health by reducing disposable income for essential needs such as heating, food, and other necessities.

Despite the clear relationship between housing conditions and health, there is a notable gap in quantifiable evidence regarding many housing-related factors that may pose risks to healthy individuals. This lack of robust data makes it challenging to fully understand and address the multifaceted health implications of housing.

Further research is needed to enhance and expand the existing evidence base, moving beyond the traditional focus on infrastructure, engineering, and financial aspects of housing. There is a particularly significant gap in understanding the potential health and economic benefits of interventions in housing construction and maintenance. Comprehensive studies in this area would provide valuable insights into how targeted housing improvements can contribute to better health outcomes and economic stability for residents.

In conclusion, while the link between housing conditions and health is well established, the complexities and nuances of this relationship warrant deeper investigation. Enhanced understanding and evidence-based policies are essential for designing effective housing improvement programs that maximize health benefits and minimize potential adverse effects.

6. Conclusion

This study provides compelling evidence that inadequate housing conditions pose significant threats to human health. By systematically addressing and mitigating factors that negatively impact health and safety, and by fostering a favorable living environment, improvements in housing conditions can yield substantial benefits for both residents and society at large. Consequently, reducing the health system's burden of caring for those impacted by poor housing should be prioritized as both a public health initiative and an economic strategy.

The findings of this report underscore the necessity of integrating health considerations into housing policy. Creating healthy, affordable, and environmentally sustainable housing must be a top priority for policymakers and officials engaged in housing and health sectors. Recognizing the critical role of adequate housing in promoting a healthy lifestyle is essential for comprehensive public health strategies.

In conclusion, the imperative to enhance housing conditions extends beyond individual well-being to encompass broader societal and economic benefits. Policymakers must embrace this holistic approach, ensuring that housing policies are designed and implemented with health at their core. By doing so, we can promote healthier communities, reduce healthcare costs, and improve overall quality of life.

References

1 Program of the Government of the Kyrgyz Republic for the protection of public health and development of the healthcare system for 2019-2030 “A healthy person is a prosperous country”. Retrieved from link https://cbd.minjust.gov.kg/12976/edition/929710/ru

2 National program for reforming the healthcare system of the Kyrgyz Republic “Den Sooluk” for 2012-2016. Retrieved from https://cbd.minjust.gov.kg/7-15528/edition/929498/ru

3 National program for reforming the healthcare system of the Kyrgyz Republic. project “Manas Taalimi” (2006-2011). Retrieved from https://cbd.minjust.gov.kg/7-15528/edition/929498/ru

4 National program for reforming the healthcare system of the Kyrgyz Republic. “Manas” (1996-2005). Retrieved from https://cbd.minjust.gov.kg/7-15528/edition/929498/ru

5 Law of the Kyrgyz Republic “On Public Health” dated July 24, 2009 No. 248. Retrieved from https://cbd.minjust.gov.kg/202630/edition/1278706/ru

6 Marx K., Engels F. Soch., 2nd ed., T.3, p.25.

7 Asaul, A. N., Asylbaev, A. B., Niyazalieva, K. N., & Asaul, M. A. (2021). Dynamics of development of the housing stock in conditions of projected demographic growth in the member states of the EAEU. Housing Strategies, 8(4), 343-362. DOI: 10.18334/zhs.8.4.113688

8 Grabovyi P.G. Surveying and professional real estate development: aspects of economics, organization and management in construction: monograph / edited by. ed. prof. P.G. Grabovoi, prof. S.A. Baronina. Penza, 2010. P. 249.

9 Sternik, S.G. Methodology for predicting the volume of commissioning in the local market for construction and housing sales / S. G. Sternik, G. M. Sternik // Housing Strategies. - 2018. - T. 5. - № 2. - P. 137-152. DOI: 10.18334/zhs.5.2.39142

10 Kiyanenko, K.V. Introduction to the problems of modern market housing [Text]: textbook. allowance / K. V. Kiyanenko. – Vologda: VoGTU, 2002. – 154 p.

11 Ovsyannikova, T. Yu. Investments in housing [Text]: monograph. / T. Yu. Ovsyannikova. – Tomsk: Publishing house Tom. state architectural-builds. Univ., 2005. – 379 p.

12 Ovsyannikova, T. Yu. Economics of the construction complex: Economic justification and implementation of investment projects [Text]: textbook. allowance / T. Yu. Ovsyannikova. – Tomsk: Publishing house Tomsk. state architectural-builds. University, 2004. – 239 p.

13 Assylbayev, A., Niiazalieva, K., Kryzhanova, L., Ploskikh, E., & Kumskov, G. (2024). Interdependence of the rural housing stock and the rural population: A scientific perspective. BIO Web of Conferences, 83, 07007. https://doi.org/10.1051/bioconf/20248307007

14 Assylbayev, A. B., Safronchuk, M. V., Niiazalieva, K. N., & Brovko, N. A. (2023). Green transformation and the concept of energy efficiency in the housing sector. In Lazareva, E. I., Murzin, A. D., Rivza, B. A., & Ostrovskaya, V. N. (Eds.), Innovative trends in international business and sustainable management (pp. 567–577). Singapore: Springer. DOI: 10.1007/978-981-19-4005-7_61

15 Assylbayev, A., Niiazalieva, K., Brovko, N., & Borbugulov, M. (2021). Problems of residential migration in the framework of the formation of "smart agglomeration". E3S Web of Conferences, 311, 07002. DOI: 10.1051/e3sconf/202131107002

16 Assylbayev, K. B., Assylbayev, A. B., & Niiazalieva, K. N. (2016). Diagnostics of unbalanced development of the regions of Kazakhstan and analysis of their convergence using convergence. Journal of Actual Problems of Economics, 180(6), 231-245.

17 Assylbayev, A., Niiazalieva, K., Bekjanov, D., Ollanazarov, B., & Ibrayimova, D. (2023). Analyzing the future of housing provision in a high-demographic growth region. E3S Web of Conferences, 449, 03001. DOI: 10.1051/e3sconf/202344903001

18 Asylbaev, A. B., & Niiazalieva, K. N. (2021). Development of residential areas in the conditions of the influx of internal migrants into the cities of Kyrgyzstan. Today and Tomorrow of the Russian Economy, 105-106, 27-37. DOI: 10.26653/1993-4947-2021-105-106-03

19 Assylbayev, A. B., Asaul, A. N., Niiazalieva, K. N., et al. (2021). Organization of a Unified State Housing and Demographic Policy as a Condition for Sustainable Development of Cities and Settlements. In Silin, Y. (Ed.), Proceedings of the Second Conference on Sustainable Development: Industrial Future of Territories (IFT 2021), Ekaterinburg, September 24, 2021 (pp. 283-290). Ekaterinburg: Atlantis Press. DOI: 10.2991/aebmr.k.211118.051

20 Niiazalieva, K., Assylbayev, A., Bekjanov, D., Saidov, D., & Matjonov, B. (2024). Analyzing the Relationship between Healthcare Facility and Housing Stock Volume: A Statistical Study of the International Association of the EAEU. BIO Web of Conferences, 82, 06001. DOI: 10.1051/bioconf/20248206001

21 Niiazalieva, K. N., Assylbayev, A. B., Alymkulova, A. S., Ploskikh, V. V., & Assylbayev, K. B. (2023). Urbanization of the population within the context of urban agglomeration development: a scientific perspective. E3S Web of Conferences, 403, 01005. DOI: 10.1051/e3sconf/202340301005

22 Niiazalieva, K. N., Kydykbaeva, A. K., Nazarbekova, E. U., Assylbayev, A. B., & Yessimova, Sh. A. (2023). Dynamics of development of urban housing stock and urban population. E3S Web of Conferences, 403, 01001. DOI: 10.1051/e3sconf/202340301001

23 Kumskov, G.V., Asylbaev, A.B., & Niyazalieva, K.N. (2017). Statistical method for assessing the influence of the housing sector on the reproductive behavior of the population. Bulletin of the Tajik National University. Socio-Economic and Social Sciences Series, (No. 2/3), 3-8. EDN ZAXXJT.

24 Mulder, C.H., & Cooke, T.J. (2009). Family ties and residential locations. Population, Space and Place, 15(4: Special Issue: Family Ties and Residential Locations), 299–304. doi:10.1002/psp.556

25 Mulder, C.H. (2006). Population and housing. Demographic Research, 15, 401–412. DOI: 10.4054/DemRes.2006.15.13

26 Mulder, C.H. (2006). Home-ownership and family formation. Journal of Housing and the Built Environment, 21(3), 281–298. DOI: 10.1007/s10901-006-9050-9 EDN: OBXYDA

27 Petticrew, M., & Roberts, H. (2006). Systematic reviews in the social sciences: A practical guide. Blackwell Publishing. https://doi.org/10.1002/9780470754887

28 Braubach, M., Jacobs, D.E., & Ormandy, D. (2011). Environmental burden of disease associated with inadequate housing. Methods for quantifying health impacts of selected housing risks in the WHO European Region. Edited by: Braubach M., Jacobs D.E., Ormandy D. The WHO European Center for Environment and Health, Bonn Office, WHO Regional Office for Europe coordinated the development of this report. Retrieved from http://www.euro.who.int/data/assets/pdf_file/0003/142077/e95004.pdf

29 Isaev, K.I., & Borsokbaeva, S. (2002). Population: Quality of life and health. Bishkek: [b.i.].

30 Moldokeeva, Zh.F. (2008). Living conditions as a factor in the health of the population of modern Kyrgyzstan. (Doctoral dissertation, cand. sociol. Sciences: 22.00.04). Bishkek.

31 Salmorbekova, R.B., & Israilova, N.A. (2010). Social tension in modern Kyrgyzstan: sociological analysis of emerging urban residential areas. Bishkek: [b.i.].

32 National Statistical Committee of the Kyrgyz Republic. (2013). Demographic and Health Survey of the Kyrgyz Republic 2012. Bishkek, Kyrgyz Republic and Calverton, Maryland, USA: National Statistics Committee, Ministry of Health and ICF International.

33 National Statistical Committee of the Kyrgyz Republic. (2015). Social trends of the Kyrgyz Republic 2014-2018. Bishkek: NSK KR.

34 National Statistical Committee of the Kyrgyz Republic. (2015). Social trends of the Kyrgyz Republic, 2010-2014. Bishkek: NSK KR.

35 National Statistical Committee of the Kyrgyz Republic. (n.d.). Construction [Electronic resource]. Equipment of housing by type and location. Retrieved from https://stat.kg/ru/statistics/zhilishnyj-fond/

36 National Statistical Committee of the Kyrgyz Republic. (n.d.). Construction [Electronic resource]. Retrieved from https://stat.kg/ru/statistics/zhilishnyj-fond/

37 Ensink, J.H., Blumenthal, U.J., & Brooker, S. (2008). Wastewater quality and the risk of intestinal nematode infection in sewage farming families in Hyderabad, India. American Journal of Tropical Medicine and Hygiene, 79(4), 561-567. PMID: 18840745; PMCID: PMC2665018.

38 Luby, S.P., Agboatwalla, M., Feikin, D.R., Painter, J., Billhimer, W., Altaf, A., & Hoekstra, R.M. (2005). Effect of handwashing on child health: a randomized controlled trial. Lancet, 366(9481), 225-233. doi: 10.1016/S0140-6736(05)66912-7. PMID: 16023513.

39 Book Reviews: P. Holmes, C. Tuckett Airborne Particles: Exposure in the Home and Health Effects MRC Institute for Environment and Health, Leicester 2000 105 pp. – Access mode: https://journals.sagepub.com/doi/10.1177/1420326X0000900511?icid=int.sj-abstract.similar-articles.1

40 Thomas, E. (2006). US Department of Health and Human Services: A Need for Global Health Leadership in Preparedness and Health Diplomacy. American Journal of Public Health, 96(1), 11–13. doi: 10.2105/AJPH.2005.076885

41 The real cost of poor housing: footing the bill. / Davidson, M.; Roys, M.; Nicol, S. et al. Watford, UK: Building Research Establishment (BRE). 2010.

42 Watford, UK: Building Research Establishment (BRE). (2010). The real cost of poor housing: footing the bill.

43 Asylbaev, A.B. (2015). Problems and conditions for providing affordable and safe housing to the population of the Kyrgyz Republic. Bulletin of the KRSU, 15(8), 3-7.

44 Niiazalieva, K., Derbisheva, E., Haijun, Z., Assylbayev, A., & Suranaev, T. (2024). Unveiling the links between housing conditions and outward migration dynamics: A case study. E3S Web of Conferences, 533, 04010. https://doi.org/10.1051/e3sconf/202453304010

45 Assylbayev, A., Derbisheva, E., Niiazalieva, K., Suranaev, T., & Husainova, E. (2024). Sustainable housing construction and population growth in the EAEU: A comparative approach. E3S Web of Conferences, 535, 02004. https://doi.org/10.1051/e3sconf/202453502004

46 Niiazalieva, K., Kulova, E., Galushkina, E., Derbisheva, E., & Assylbayev, A. (2024). Assessing the consistency between social facility commissioning and new housing in the EAEU: A housing demography perspective. E3S Web of Conferences, 535, 02005. https://doi.org/10.1051/e3sconf/202453502005