

REVIEW ARTICLE

Occupational Health in Mountainous Kyrgyzstan

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Abstract

BACKGROUND In the period of transition from a centralized economy to the market economy, occupational health services in Kyrgyzstan have survived through dramatic, detrimental changes. It is common for occupational health regulations to be ignored and for basic occupational health services across many industrial enterprises and farms to be neglected.

OBJECTIVE The aim of this study was to demonstrate the present situation and challenges facing occupational health services in Kyrgyzstan.

FINDINGS The transition from centralized to the market economy in Kyrgyzstan has led to increased layoffs of workers and unemployment. These threats are followed by increased workload, and the health and safety of workers becomes of little concern. Private employers ignore occupational health and safety; consequently, there is under-reporting of occupational diseases and accidents. The majority of enterprises, especially those of small or medium size, are unsanitary, and the health status of workers remains largely unknown. The low official rates of occupational diseases are the result of data being deliberately hidden; lack of coverage of working personnel by medical checkups; incompetent management; and the poor quality of staff, facilities, and equipment.

Because Kyrgyzstan is a mountainous country, the main environmental and occupational factor of enterprises is hypoxia. Occupational health specialists have greatly contributed to the development of occupational medicine in the mountains through science and practice.

CONCLUSIONS The enforcement of existing strong occupational health legislation and increased financing of occupational health services are needed. The maintenance of credible health monitoring and effective health services for workers, re-establishment of medical services and sanitary-hygienic laboratories in industrial enterprises, and support for scientific investigations on occupational risk assessment will increase the role of occupational health services in improving the health of the working population.

KEY WORDS high altitude, occupational disease, occupational health services, research, workplace environment

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INTRODUCTION

General Country Information. Kyrgyzstan is a landlocked mountainous country, and is one of the post-Soviet republics. The country population is estimated to be about 5.758 million, with a life expectancy at birth of 69 years (73 years for women and 66 for men) and an infant mortality rate of 21.6 per 1000 live births as of 2013.¹ The challenges facing Kyrgyz society include the migration of qualified specialist workforce to Russia, Kazakhstan, and other countries; and decreasing coverage of workers by occupational health services.^{2–4} The World Health Organization estimated expenditure on health was 6.7% of the country's gross domestic products, with 221 international dollars (PPP\$) per capita as of 2013.¹

The labor market. The economically active population of the country is 2.49 million people and 2.278 million people are employed, including 881,600 women.¹ In 2013, the labor market of the Kyrgyz Republic consisted of 572,400 operating business entities.¹ Of these business entities, 65% carry out their activities in agriculture and trade and provide a variety of services; 5.6% are in transport and communication (Table 1). Most of the large- and medium-sized businesses are concentrated in the cities of Bishkek and Osh.

About 98% of all active business entities have private ownership (560,000), 1.1% are state-owned enterprises (6500), and 0.9% are municipal (5800). Small businesses make up 19,400, medium-sized enterprises 3700, and large companies account for 1700 of active businesses. There are 279,800 agricultural farms and 261,300 individual entrepreneurs.

According to the Integrated Labor Force Survey, a relatively high level of economic activity characterized the labor market over the past 10 years. Almost 65% of the population aged 15 years and older is economically active (2496.8 thousand people), of which the urban population is 34.2% and the rural population is 65.8%. The labor market comprises 58.6% men and 41.4% women.

The level of economic activity among the urban population is 61.6%, including 65.6% of the rural population. It has been demonstrated that men are more economically active than women in the community (77.3% vs 51.8%, respectively).

REGULATIONS ON OCCUPATIONAL HEALTH

In Kyrgyzstan, all legislative acts were inherited from the Soviet period. The present acting regulations include laws designed to protect the health of the people (2005), labor protection (2003), Labor Code of the Kyrgyz Republic (2004), and the sanitary and epidemiological welfare of the population (2001). These laws establish and state the rights of citizens to health and a healthy environment, including healthy workplaces.

To realize these regulations, the government passed a number of resolutions, including the following:

1. Approval of rules of compensation for harm caused to workers by injury, occupational disease, or other health impairment related to the performance of their duties (№175, 23.04.1993);
2. The list of heavy work and work in hazardous working conditions, in which the employment of women is prohibited (№ 158 from 24.03.2000);
3. Passport of sanitary state of enterprises (1999), the state program on improvement of safety and working conditions, the protection of life and health of workers for 2002–2005 (№ 807 from 24.12.2001), and orders of the Health Ministry;
4. The order of mandatory preliminary and periodic medical examinations of workers (№ 70, 20.03.2000);
5. The processing of information, investigation, recording, and reporting of occupational diseases (№ 385, 13.09.2002);
6. The appointment and payment of pensions on preferential terms and the amount of compensation under an employment injury to employees (№ 827, 28.12.2001).⁵

All hygienic standards for the working environment are reviewed and brought into accordance with international standards. This work is

Table 1. Employed Population Distribution by Sector^{*,†}

| Economic sector | N (thousands) | Total Number of Employees (%) |
|------------------------------|---------------|-------------------------------|
| Homemaking | 8.7 | 0.4 |
| Financial activities | 23.1 | 1 |
| Energetics | 34.3 | 1.5 |
| Utilities | 37.6 | 1.6 |
| Rent and service | 43.8 | 1.9 |
| Hotels and restaurants | 84.3 | 3.4 |
| Health | 84.1 | 3.7 |
| Public administration | 109.3 | 4.8 |
| Transport and communications | 164.5 | 7.2 |
| Education | 180.4 | 7.9 |
| Industry | 186.6 | 8.2 |
| Construction | 259.0 | 11.3 |
| Trade | 346.3 | 15.1 |
| Agriculture | 688.0 | 30.1 |

* Includes foreign markets.
 † Adapted from National Statistical Committee of the Kyrgyz Republic.¹

continued since, in July 2015, Kyrgyzstan joined to the new Eurasian economic union.

OCCUPATIONAL HEALTH IN KYRGYZSTAN: CURRENT SITUATION AND CHALLENGES

The occupational health surveillance system in Kyrgyzstan is mainly based on the extensive system of Sanitary Epidemiological Services (SESs) inherited from the Soviet period.^{3,6} SESs are provided by the government to protect the health of the population. The current system of SES consists of the Department for State Sanitary and Epidemiological Surveillance, including regional and 2 city centers for SES. Each center had a Division of Occupational Hygiene with the main goal of preventing general and occupational diseases and industrial trauma and poisoning in workplaces. These divisions also controlled the standards and requirements of industrial hygiene, the content of toxic substances, and the physical parameters of work zones. They also organized preliminary and periodic medical examinations of the workers. In 2010, these divisions were removed and their functions are now handled by the Divisions of Sanitary Inspection.

In 1986, the system of obligatory registration of occupational diseases was introduced in Kyrgyzstan as in all Soviet republics. The SES center collects primary materials for registration of occupational diseases. Workers with an initial diagnosis of an occupational disease are sent to the Department of Pathology of the National Hospital after a periodic medical examination at the enterprise or by family doctor for an in-depth examination, treatment, and further medical checkup. The doctors will inform the SES center about the case of suspected occupational disease. The SES specialist provides a focused examination of the individual's working conditions and fills out the unified sanitary-hygienic characteristic of workplace in case of assumption of occupational disease (poisoning) form, taking into account the preliminary diagnosis of occupational disease, characteristics of all harmful factors of the occupational environment, and labor process and modes of work, that could lead to occupational disease (poisoning). This is the main document for confirming or denying the occupational character of disease. On the basis of this document and on medical examination, the occupational health physician registers the final clinical diagnosis.

Judging by health statistics, it appears that during the Soviet period, SES services ran efficiently: Occupational morbidity, accidents, and mortality were continuously decreasing. However, since the breakup of the Soviet Union, these services have been stopped having a positive effect, and health outcomes have worsened drastically.^{2,6}

The breakup of the Soviet Union brought many changes: The majority of industries shut down; a large number of small and medium-sized enterprises specializing in production, transportation of goods, and auto-repair were established; big enterprises closed their medical and industrial hygiene facilities; big collective farms (kolkhoz and sovkhoz) were replaced by many individual and family farms.

Managers of recently opened small- and medium-sized enterprises, private businesses, and agricultural farms ignored the laws on occupational safety, sanitation, and the epidemiologic well-being of the population of the Kyrgyz Republic. Recruiting for work was done without preliminary health examinations. Medical examination of workers engaged in hazardous industries was not performed in a timely manner, leading to the deterioration of employee health monitoring at such enterprises.

With the introduction of the 2000 Presidential Decree on measures for reduction of a number of unreasonable inspections of entrepreneurial undertakings, the relations between the SES and private companies significantly changed. Whereas the SES used to control all nonregulated business corporations, the number of visits has recently decreased considerably (more than 5 times). Small- and medium-sized business regulation should give more flexibility to SES for control.

In agriculture, farmers use children to work with sick animals in the lambing time. Serious violations of the law are taking place when children, pregnant women, and nursing mothers are involved in cultivating and harvesting tobacco. According to the Department of Sanitary Inspection, in 2013, more than 30% of workers (120,000), including 37% of women, worked in unfavorable hygienic conditions (Fig. 1).

The causes of deterioration of the working environment include a break in the system of state control over enterprises; a lack of legal and economic mechanisms to encourage employers to take effective measures to ensure healthy and safe working conditions; and low financing for public health services, including SES. In 2010, the average per-capita spending on public health services was KS 13.41 (US\$0.28) per year.⁷

Under these conditions, there has been a trend of reduced rates of occupational diseases in the enterprises in the country: The number of newly registered occupational diseases dropped from 35 in 1998 to 11 per 100,000 workers in 2013 (Fig. 2). However, this reduction was not due to improved working conditions and health promotion, but to an under-reporting of occupational diseases, the inability to control medical examination of employees in private enterprises, and the absence of motivation on the part of employers to provide favorable working conditions for employees.

As many workplaces opened in small- and medium-sized enterprises in the service and sale sectors of the economy, which are not under SES control, the National Department of State Sanitary Surveillance conducted a survey of workers of different sectors.⁸ According to this report, more than 35% of men and 30% of women were working more than 8 hours a day. Among sales workers, 73% of men and 71% of women reported longer working days. Survey results showed that 29% of men and 27% of women had highly insecure jobs (Fig. 3). More than 40% of men and 31% of women reported having poor health (Fig. 4).

However, taking into account new challenges and international requirements for the public and the legislature, there is a need to significantly change the perception of occupational health and safety, occupational diseases, and the status of occupational medicine in the following ways: review and change national legislation; revise and bring hygienic standards into accordance with the recommendations of the European Union and Commonwealth countries; implement compulsory social insurance against occupational accidents and diseases; improve the quality of education and training of occupational health doctors and occupational medicine specialists; create a center of and an information network for occupational health and safety in the country.

Along with this, during the economic transition period in the country, the introduction of various forms of ownership in certain industries and enterprises dictates the need to address certain priorities. These priorities include the certification of new workplaces and industries and the development of regulations, sanitary guidelines, and recommendations for various sectors and industries, especially those sectors that may lack guidelines or may be using obsolete documents that are irrelevant to the current situation.



Figure 1. Share of individuals working in inadequate conditions.

OCCUPATIONAL HEALTH RESEARCH IN HIGH ALTITUDE

In Kyrgyzstan, there is no specific scientific institution for research in occupational health. Researchers at the Hygiene Department of the Kyrgyz State Medical Academy, in collaboration with the occupational health laboratory of the Scientific Institute for Preventive Medicine and Scientific Institute for Mountain Physiology, are conducting all scientific investigations.

Mountains occupy more than 94% of the country's territory. The life and human activities in the specific climatic conditions of mountains poses specific occupational health issues, such as assessment of the functional status of the body, selection of workers, and ensuring working conditions and health.

Kyrgyz researchers achieved some successes in solving these occupational medical problems: They gave mountain systems a biomedical classification and studied and described the natural and social media components affecting the formation of physiological and sanitary conditions of human life, including labor life, in mountainous areas.⁹⁻¹² Mechanisms of acclimatization and adaptation to bioclimatic characteristics and the extent of climatic contrasts in mountain areas of the country are thus clarified.¹³⁻¹⁵ Methods for forecasting and assessing criteria of workability in the mountains have been developed.¹⁶⁻¹⁸

The cross-adaptation mechanisms of mountaineers to mountainous climate factors and a number of different industrial labor factors of differing intensity (in particular, the oxygen provision system of a

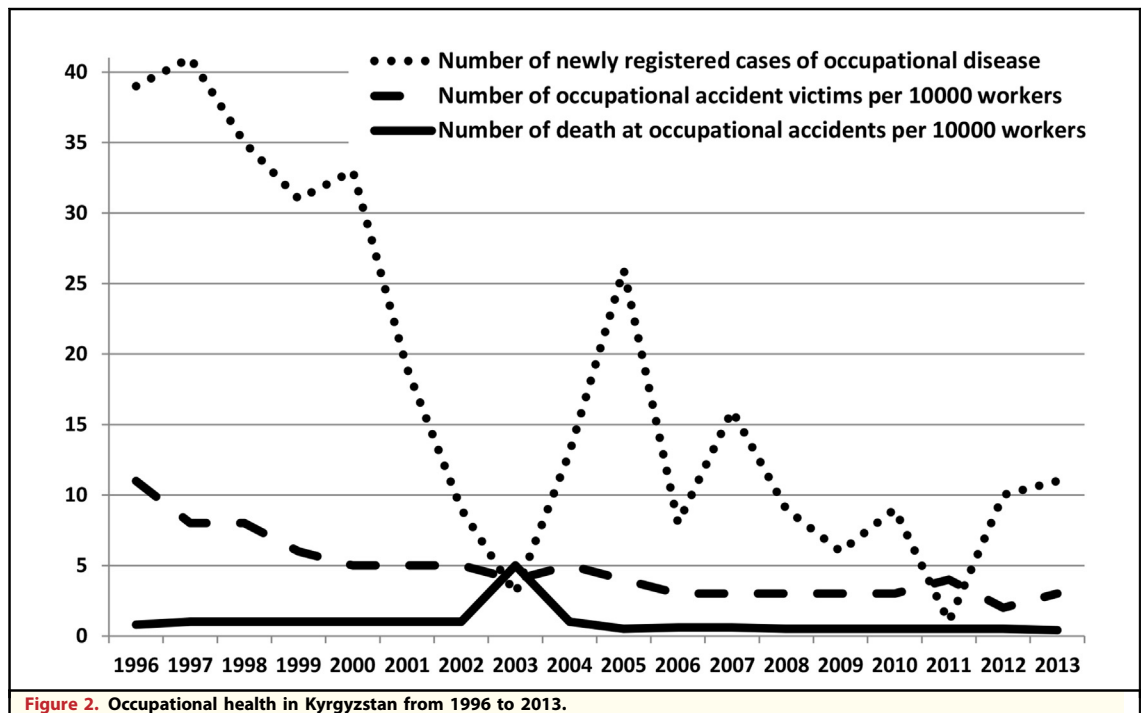


Figure 2. Occupational health in Kyrgyzstan from 1996 to 2013.

body during exercise) have been generalized.¹⁹⁻²¹ High altitude increases the overall cost of body oxygen provision during labor operations and energy expenditures. Individuals who are not trained for industrial labor spend significantly greater amounts of energy to perform work in high-altitude conditions than those who are adapted to labor of medium or severe intensities.

Studies have found that the physiological cost of labor increases with the altitude of the enterprise; work in the highlands can be seen as significant or

of high severity, whereas identical work in the plains area is considered easy or of moderate severity.^{19,20} The energy intensity of industrial operations of medium or severe physical stress and average energy expenditures increase with altitude, exceeding 250 kcal per hour and falling into category III of severity of labor. The time required for recovery of autonomic functions—breathing and circulation—at altitudes higher than 2500 m is longer than that in lower altitudes.

On the basis of data on the oxygen cost of labor operations, energy expenditures are estimated and patterns of vegetative reactions of workers during the most important manufacturing operations are identified. Recommendations for establishing suitable labor conditions for workers employed in industrial enterprises located in the medium and high mountains have been developed.

Currently, the country is increasingly introducing the shift mode of labor organization in the mountains. Miners practice expeditions of different duration and complexity (from 1 day to 1 year). Despite the presence of physiological substantiation of stay periods at different altitudes, economic interests determine the timing of expeditions for varying altitude.

It has been found that adaptive changes made by miners in a stationary mode of labor organization results in increasing physiological “cost.” The

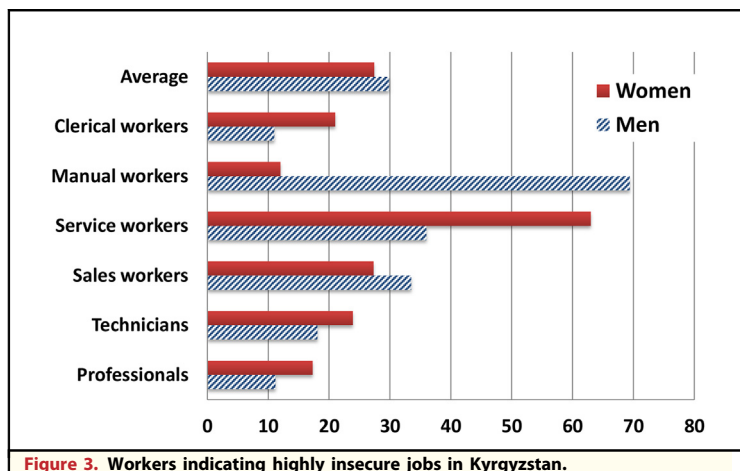


Figure 3. Workers indicating highly insecure jobs in Kyrgyzstan.

physical reactions of people climbing in alpine shift mode 15 × 15 days is different from that of individuals who gradually adapt only once to the production and climatic conditions of high altitude; the latter individuals have lower blood oxygen capacity, slower reactivity, and have a less efficient gas transmission system.^{20,22}

Studies have showed that the working conditions of shift workers increase energetic “cost” and functional “value” in the coming period of recovery and rest. On high-altitude shifts, even workers with 3 to 6 years of experience do not show stabilization and coordination in reactions of elements in the body gas transportation system.²² A long period of intermittent shift work in the mountains does not lead to a sustainable, balanced status in the functional systems of the body if workloads are excessive. Shift work in high altitudes changes the body’s reactivity, creating a pattern that reduces productivity, impairs performance, enhances response to industrial and environmental stimuli, and has significant effects on the health of workers in these circumstances. Therefore, the incidence of health problems among shift workers in mining is 1.5 to 2 times higher compared with miners of the stationary work. Morbidity depends on the length of workers’ alpine working experience. The proportion of days of disability for workers of mining enterprises located more than 3000 m above sea level increases to 54%, which indicates the severity of the disease in the highlands. Occupational factors of the underground environment cause the development of dust-related disease in miners who have worked for 16 to 18.5 years, vibration-related disease in those who have worked 15 to 20 years in mines located at 3000 m above sea level, and both diseases in miners with 10 to 15 years of service at heights of more than 3500 m above sea level.

Thus, the periodic increases in the highlands of the scheme 15 × 15 days—12 × 12 hours are physiologically unfounded and unjustified by sanitary criteria. The physical, functional systems of shift workers—natives of middle alpine topography—are least affected and more quickly acclimated than those of workers from other regions.

The shift method of organization of mining production at high altitudes is a factor that has increased the hazard classification of the occupational environment and the severity and intensity of miners’ labor by 1 degree relative to that established in stationary work.^{23,24}

A system of medical selection of workers in enterprises in high altitude has been developed. Researchers identified the optimal age range and

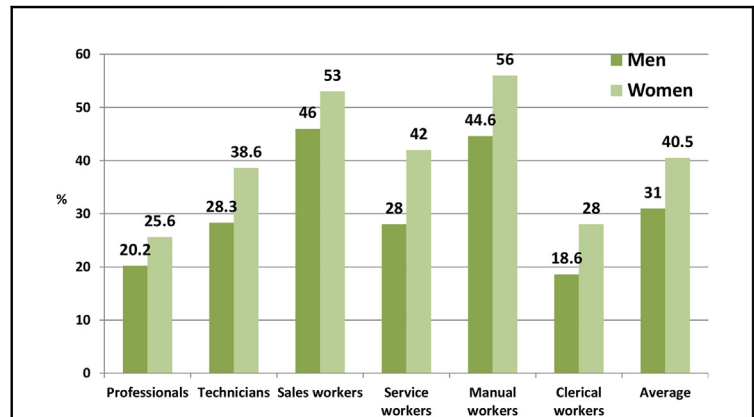


Figure 4. Self-reported poor health by workers of Kyrgyzstan, 2010.

medical and physiological criteria for individuals working high-altitude shifts, thereby creating an integrated method of forecasting possibilities of employment in the mountains. This system organically combines the advantages of many previously tested test techniques and is appropriate for mass selection of people suitable for life in extreme mountain conditions.^{23–25}

Occupational health specialists developed hygienic classifications of mining sites in Kyrgyzstan based on geological, technical, high-altitude permafrost characteristics and location of ore deposits above sea level. This, to a certain extent, allows for prediction of the working conditions of miners and more precise targeting and development of preventive measures in the organization of production in high altitude environment conditions of mining.^{22,26}

Studies of occupational environments in mercury-antimony, tin-tungsten, and gold ore production have allowed the development of scientific and practical methodologies for monitoring ecological and hygienic situations in occupational environments, changing conditions and mitigating their effects on the health of workers and the population.^{27–32} Integrated ecological and hygienic assessments of the effect of chemical factors on staff in mercury-antimony biogeochemical provinces and in other regions at the population, system, organ, tissue, and molecular levels was performed.^{31,32}

Studies of the hygienic, physiologic, and psychologic characteristics of the labor of heavy-vehicle drivers, those migrating at different heights of highlands, and operators in the mountains were conducted.^{33–36} However, these types of work are poorly understood in terms of the effect of high-

altitude climatic conditions on psychological functions and intensity of operator labor. Research in this area is still highly relevant.

In Kyrgyzstan, transhumance developed historically. A number of studies have been devoted to physiologic and hygienic evaluation of sheep breeders working in high-altitude pastures. As a result, the methods and means to optimize production activity, nutrition, and the welfare of farmers and their families aimed at maintaining their health and performance are justified. Physiologic and climatic zoning of mountain pastures of Kyrgyzstan and their classification has therefore been performed.^{37,38}

The occupational health of farmers and their families during seasonal migration and implementation of new forms of farming, adjustment to new psychosocial factors, and encounters with new and emerging biological risks remain unexplored.

CONCLUSION

This review presented official statistical data on occupational disease and summarized peer-reviewed scientific literature on occupational health care in Kyrgyzstan published in Russian between 1950 and 2012.

If Kyrgyzstani official statistics are to be trusted, the country has low rates of occupational diseases. This positive picture is not in accordance with poor compliance with occupational health regulations and the breakdown in occupational health monitoring and workers' health protection programs in the economic transition period.

Inadequate government attention and financing is given to the very poor state of occupational health and health care. Legislation is needed to hold employers accountable for adherence to safety regulations and truthful reporting of occupational diseases and injuries. Well-equipped and well-staffed hygienic laboratories and regular health screening of workers by qualified personnel in both state and private enterprises require adequate financial and

administrative support. The implementation of sound principles and policies is needed.

To address the occupational health and safety of the working population, the establishment and development of a national center of occupational health and safety is appropriate in Kyrgyzstan. This center would coordinate and resolve issues of professional selection and career counseling; provide preliminary and periodic medical examinations and early diagnosis and prevention of occupational diseases and intoxications; provide validation and certification of workplaces, production methods, and enterprises; provide state supervision of health measures in the workplace; monitor hygienic working conditions (including those women, children, and people of older age groups); offer vocational rehabilitation of sick and disabled people; and conduct scientific and practical research on topical issues of occupational medicine and industrial ecology.

In accordance with the immediate priorities of the national economy, there is a need to develop the following promising areas of occupational health in Kyrgyzstan:

- Farmers' occupational health, including assessment of new and emerging biological risks and the health of farmers and their families in high altitudes, taking into account their biological rhythms and seasonal migration;
- Occupational health of service workers;
- Occupational health of drivers of heavy vehicles migrating from or to different altitudes;
- Revising and bringing hygienic standards into line with international recommendations;
- Establishing a national center of occupational medicine.

However, the depth of the problem of workers' health is so great that its solution can be effective only if direct participation of all branches of government, public authorities at various levels, public and private employers, and professional and community organizations help in resolving this national problem.

REFERENCES

1. National Statistical Committee of the Kyrgyz Republic. Kyrgyzstan: Brief Statistical Handbook. 2011-2013. Bishkek, Kyrgyzstan: National Statistical Committee of the Kyrgyz Republic; 2014:31.
2. Maier CB, Martin-Moreno JM. Quo vadis SANEPID? A cross-country analysis of public health reforms in

- 10 post-Soviet states. *Health Policy* 2011;102:18–25.
3. McKee M, Zatonski W. Public health in Eastern Europe and the former Soviet Union. In: Beaglehole R, ed. *Global Public Health*. Oxford, UK: Oxford University Press; 2003: 87–104.
4. Meimanaliev AS, Ibraimova A, Elebesov B, Rechel B. Kyrgyzstan. In: Rechel Bernd, McKee Martin, eds. *Health Systems in Transition*. Copenhagen: European Observatory on Health Systems and Policies; 2005.
5. Occupational Safety and Health in the Kyrgyz Republic. National profile. Moscow, Russian Federation: ILO; 2008:60.
6. Glass RI. The Sanepid Service in the U.S.S.R. *Public Health Rep* 1976;91: 154–8.
7. Gotsadze G, Chikovani I, Gogvadze K, Balabanova D, McKee M. Reforming sanitary-epidemiological service in central and Eastern Europe and the former Soviet Union: an exploratory study. *BMC Public Health* 2010;10:440.
8. Ministry of Health. Occupational Health and Safety in Small and Medium-sized Enterprises. Report of the National Department of State Sanitary and Epidemiological Surveillance. Bishkek, Kyrgyzstan: Ministry of Health; 2010:128.
9. Aidaraliev AA, Maksimov AJ. Determining the level of human physical performance at high altitudes. Guidelines. Frunze, Kyrgyzstan: Ilim; 1980:10.
10. Aidaraliev AA. Physiology of labor in the mountains: problems and prospects. *Hum Physiol* 1984;10:11–5.
11. Shanazarov AS, Chernook TB, Glushkov MU, Bogolyubov NA. Bioclimatic zoning map of the Kyrgyz Republic. Bishkek, Kyrgyzstan: *Kyrgyzgeodeziya*; 1996.
12. Shanazarov AS, Chernook TB, Glushkov MU. Social, ecological and physiological characteristics of employment in the highlands. In: Aidaraliev AA, ed. *The Mountains of Kyrgyzstan*. Bishkek, Kyrgyzstan: Technology; 2001:225–37.
13. Goldberg PN. The nature and parameters of extreme mountainous conditions. In: Mirrakhimov Mirsaid M, ed. *Highland Adaptation and Maladjustment*. Frunze, Kyrgyzstan: Ilim; 1984:117–23.
14. Dzhusupov KO. Modern presentations of thermoregulation of a body adapting to high altitude. In: Shevchenko YL, ed. *Hypoxia: Adaptation, Pathogenesis, Clinic*. Sankt-Petersburg, Russian Federation: ELBI-Petersburg; 2000:122–40.
15. Mirrakhimov MM, Sarybayev AS. Medical aspects of human adaptation to the mountains. In: Aidaraliev AA, ed. *The Mountains of Kyrgyzstan*. Bishkek: Technology; 2001:199–225.
16. Aidaraliev AA, Yakovlev VM. Prediction capacity of human activities in the mountains. In: Aidaraliev AA, ed. *Mountains of Kyrgyzstan*. Bishkek, Kyrgyzstan: Technology; 2001:239–45.
17. Mirrakhimov MM, Aidaraliev AA. Predicting Human Performance at High Altitudes. Guidelines. Moscow: USSR; 1980:14.
18. Mirrakhimov MM, Aidaraliev AA, Maksimov AL. Prognostic Aspects of Work at High Altitudes. Frunze, Kyrgyzstan: Ilim; 1983:161.
19. Dzhusupov KO. Oxygen provision of body of Tyan-Shan aborigines in lowlands. *Central Asia Med J* 2009;15: 38–42.
20. Kasymov OT, Dzhorbaeva AA, Dzhusupov KO, Erbaev A. Optimizing the functional status of the human body in the mountains. In: Shevchenko YL, ed. *Hypoxia: Adaptation, Pathogenesis, Clinic*. Sankt-Petersburg: ELBI-Petersburg; 2000: 95–122.
21. Likhnietskaya II, Mambetaliev BS, Shkulov VL. The health of miners at highlands of Central Asia. Frunze, Kyrgyzstan: Ilim; 1977:164.
22. Kasymov OT, Burabaeva AA, Dzhusupov KO, Erbaev AT. Optimization of Labor of Workers in Various Industries in the Extreme Conditions of High Mountains of Kyrgyzstan. Guidelines. Bishkek, Kyrgyzstan: Kyrgyz State Medical Academy; 2000:12.
23. Dzhusupov KO, Aidaraliev AA, Mambetaliev BS. Work-norm Settings of Workers in the Mountains of Kyrgyzstan. *New Armen Med J* 2012;6:75–80.
24. Mambetaliev BS, Kasymov OT. Organization of Medical Services of Miners at Altitude of 3000–4500 m above Sea Level. The toolkit. Frunze, Kyrgyzstan: Kyrgyz State Medical Institute; 1990:44.
25. Mambetaliev BS, Kasymov OT, Golderg PN. Guidelines for Provision of Medical and Social Wellbeing of Miners in Mountainous Shift. Bishkek, Kyrgyzstan: Kyrgyz State Medical Institute; 1990:32.
26. Shanazarov AS, Chernook TB, Glushkov MU, Bogolyubov NA. Problems of Labor in the Mountains. Bishkek, Kyrgyzstan: *KyrgNIINTI*; 1994:76.
27. Grischenko RG. Occupational health in the production of metallic mercury. *Iss Epidemiol Hyg* 1969;9:9–12.
28. Gudzovsky GA. Occupational hygiene in antimony production. PhD thesis. Frunze, Kyrgyzstan: Kyrgyz State Medical Institute; 1966:445.
29. Dzhusupov KO. Hygienic assessment of particles at the mining enterprises in Kyrgyzstan. *Bull Kyrgyz-Russian Slavic Univ* 2009;9:163–167.
30. Subbotin VV, Saipbaev BS. Human Ecology in Antimony Biogeochemical Region. Frunze, Kyrgyzstan: Kyrgyz Insitute for Hygiene and Sanitary; 1991:160.
31. Sharshenova AA. The ecology of man in the mercury-and-antimony biochemical region of the Kyrgyz Republic. In: Proceedings of the International Conference “Human Health and the Environment. Policies and Programs in the New Millennium.” May 14–16, 2001. Bishkek–Cholpon-Ata, Kyrgyzstan; 2001:126–129.
32. Sharshenova AA, Omurzakov KS, Saipbaev BS, et al. Aspects of environmental monitoring of mercury-antimony biogeochemical region. Bishkek, Kyrgyzstan: Institute for Preventive Medicine; 2000:226.
33. Aidaraliev AA, Galimov DF, Imankulov DI, Kuziyta EI. The operator work in the mountains. Frunze, Kyrgyzstan: Ilim; 1982:188.
34. Glushkov MY, Chernook TB, Shanazarov A. Evaluating the effectiveness of the operator’s activity in the highlands. In: Akylbekov IK, Ashirbaev AA, Tukhvatshin RR, eds. *Problems, Strategies and Prospects for the Development of Occupational Medicine in the Mountainous Regions*. Bishkek, Kyrgyzstan: Kyrgyz State Medical Academy; 2002:65–71.
35. Mambetaliev BS, Dzhaylobaev AD, Botombekova AB, et al. Physiological and hygienic evaluation of labor of operators serving a hydropower station in Kyrgyzstan. *J Health Kyrgyzstan* 1982;5:7–11.
36. Mambetaliev BS, Solomko PA, Petrov V. Improvement of Labor and Efficiency of Drivers of Heavy Vehicles in the High Mountains of Kyrgyzstan. Bishkek, Kyrgyzstan: Kyrgyz State Medical Institute; 1991:50.
37. Akynbekov KU, Shpirt MB, Dzhusupov KO. Topical Issues of Hygiene and Physiology of Shepherds in Mountains. Bishkek, Kyrgyzstan: Kyrgyz Agrarian University; 1996: 360.
38. Dzhusupov KO. Physiological and Hygienic Characteristics of the Working Conditions of Shepherds in Pastures of Kyrgyzstan. PhD thesis. Bishkek, Kyrgyzstan: Kyrgyz State Medical Academy; 1996:110.