GEORGIAN MEDICAL NEWS

ISSN 1512-0112

NO 1 (358) Январь 2025

ТБИЛИСИ - NEW YORK

ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

Медицинские новости Грузии

საქართველოს სამედიცინო სიახლენი

GEORGIAN MEDICAL NEWS

Monthly Georgia-US joint scientific journal published both in electronic and paper formats of the Agency of Medical Information of the Georgian Association of Business Press. Published since 1994. Distributed in NIS, EU and USA.

GMN: Georgian Medical News is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

GMN: Медицинские новости Грузии - ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

GMN: Georgian Medical News – საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

WEBSITE

www.geomednews.com

К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

При нарушении указанных правил статьи не рассматриваются.

REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.

ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

GEORGIAN MEDICAL NEWS
No 1 (359) 2025

Содержание:

GEORGIAN MEDICAL NEWS
No 1 (358) 2025

HEALTH RISK-FACTORS ASSOCIATED WITH LEAD EXPOSURE IN THE KVEMO KARTLI REGION OF GEORGIA

Robizon Tsiklauri, Tamar Jankhoteli, Maiko Chokheli, Ani Khachidze, Lela Kazarashvili, Nino Chkhaberidze, Ketevan Kavtaradze, Emzari Chachua, Mariam Vardoshvili.

National Centre of Disease Control and Public Health, 99, Kakheti av., Tbilisi, Georgia.

Abstract.

Introduction: In 2018, the first national study on blood lead levels (BLL) in children aged 2–7 years was conducted as a part of the Multiple Indicator Cluster Survey (MICS). The results revealed that a significant proportion of children (41%) had BLLs exceeding 5 μg/dL. The aim of this study is to evaluate the health risks associated with the potential environmental impacts of technogenic chemical agents in the Bolnisi-Dmanisi region. Additionally, the research seeks to develop recommendations for mitigating these risks through appropriate preventative and corrective measures.

Methodology: A cross-sectional method was used for this survey and biomonitoring to assess sources of lead exposure. Three target groups (TGs) were selected for the study based on potential exposure levels, randomly interviewed about their health status, and subjects were randomly selected to undergo venous blood testing for lead. For the correlation defining the Statistical analysis of crossover interference using the chi-square model was used. The results obtained determine the relative risks of various nosologies among the TGs, the correlations with various risk factors, and their potential cause-and-effect relationships.

Results: Our results revealed a significant reduction in BLLs among residents of the study region when compared to the MICS results. In 2023, our findings indicated a decrease in BLLs among populations in potentially exposed areas of Kvemo Kartli. Specifically, the average BLL in the Kvemo Kartli region decreased by approximately 50%, from 4.2 μg/dL in 2018 to 1.8 μg/dL in 2023. Demographic risk factors did not exhibit significant variation across the TGs. Notably, statistically significant relative risks (RR) for diseases of the eye and adnexa were observed in the first and second TGs, while no such significant associations were found for other diseases.

Conclusion: Although the MICS study conducted in the country five years ago showed a significant reduction (by two times or more) in the high average biomonitoring results recorded in children, our study still revealed certain low, yet credible, health risks in populations living 'near production/mining' sites and 'potentially living on ore,' according to some nosological classes. The biomonitoring results also recorded isolated cases of relatively high BLLs, particularly in the exposed groups compared to the control group. Based on these findings, we conclude that the measures implemented over the past five years have yielded positive results, significantly reducing lead concentrations in humans. However, certain low but credible health risks persist in the presumably exposed areas. These results can serve as a baseline for future research, and periodic monitoring will help track the progress towards further improvement in the region.

Key words. Lead, disposal, contamination, soil, morbidity, health-risk, Georgia.

Introduction.

Lead exposure is a critical global public health issue, impacting millions, especially in low- and middle-income countries. Despite international efforts to mitigate lead exposure, it remains a significant threat due to its pervasive presence in the environment, including air, water, soil, and consumer products. Lead is a powerful neurotoxin, and even minimal exposure can lead to severe health issues, particularly for vulnerable groups like children and pregnant women [1-12].

Key sources of lead exposure include lead-based paints, contaminated drinking water, industrial emissions, and leaded gasoline. In urban areas, historical use of leaded products continues to pose exposure risks. Certain occupations, such as battery manufacturing, recycling, mining, and construction, also present increased exposure risks for workers [13-15].

The health effects of lead exposure are well-documented, including cognitive impairment, developmental delays, and behavioral issues in children. In adults, lead exposure is associated with hypertension, kidney dysfunction, and reproductive problems. The World Health Organization (WHO) and the Centers for Disease Control and Prevention (CDC) stress that no level of lead exposure is safe, highlighting the need for ongoing vigilance and intervention [8,16-26].

Georgia, located in the South Caucasus region, east of the Black Sea, had a population of 3,694,600 in 2024, covering an area of 69,700 square kilometers [24]. Kvemo Kartli, one of Georgia's twelve regions, has a population of 436,000 and spans 6,527 square kilometers [17]. Situated on the Trialeti Plateau, the region is historically rich in mineral resources. Since the 1950s, open-pit mining and extraction of gold-bearing copper-pyrite and polymetallic ores have been active in the Bolnisi district. The Madneuli gold-extraction plant, constructed in 1997, continues to process secondary quartzites containing gold and silver [2,3].

The study areas in Kvemo Kartli are characterized by naturally high concentrations of heavy metals. The Kazretula and Mashavera Rivers, flowing through this territory, have been polluted for years by leachates from nearby factories. The river waters' pH often drops to 2-3, significantly increasing heavy metals' solubility in the acidic water. Consequently, these rivers are highly contaminated, with metal concentrations far exceeding maximum permissible concentrations (MPC) [1,3].

A 2017 report by the "Green Policy Scientific Research Platform" titled “Analysis of Mining and Extractive Industrial Pollution in Kvemo Kartli from a Green Policy Perspective” identified the Kazreti polymetallic mining enterprise, owned by RMG (Rich Metals Group), as a significant source of pollution. Studies show that soil, water, and air pollution in this region exceed regulatory norms. Local residents have expressed concerns about potential health impacts, prompting calls for government action to assess risks. In response, the RMG Environmental Policy Document was approved in 2018 and implemented by 2022. Measures included modernizing equipment, managing water systems, installing treatment plants, encapsulating the Kazretula River, integrating tailings pond water into a closed cycle, ongoing reclamation, dust control, using covered transport, washing roads, and systematic environmental monitoring [3,18].

The 2018 Multi-Indicator Cluster Survey (MICS) revealed that while blood lead levels (BLLs) in children aged 2-7 in Kvemo Kartli were lower than in other regions, they remained high overall. Nationwide, 41.1% of children had BLLs ≥5 μg/dL, with 15.6% exceeding ≥10 μg/dL. In Kvemo Kartli, these figures were 17.9% and 5.7%, respectively [22]. Given the visible sources of exposure in the region, such as mining and processing sites, and the local belief that disease prevalence was particularly high among those living near these facilities, a risk assessment was conducted for populations in potentially exposed settlements. This assessment involved a health survey and a one-time biomarker (venous blood) study.

The study aims to evaluate the health risks associated with the potential environmental impacts of technogenic chemical agents in the Bolnisi-Dmanisi region. Additionally, it seeks to develop recommendations for mitigating these risks through appropriate preventative and corrective measures.

Materials and Methods.

As part of this study, the first phase of the study involved an analysis of regional medical statistics and a comparison of the average data of the administrative units in the region over the past five years with regional and national averages, categorized by international classification of diseases (ICD-10th revision).

To test the research hypothesis and assess the exposure to environmental pollutants at potentially varying levels, the study was designed to include three TGs (TG):

1. **Settlements located near production and mining activities** – from the municipalities of Bolnisi and Dmanisi.
2. **Presumably, the settlements residing on the ore-rich regions** – Bolnisi municipality.
3. **Control settlements** – from the municipalities of Tetritskaro and Marneuli.

The first TG encompassed populations residing within 5 km of open-pit mining quarries and production facilities (including Kazreti village and surrounding settlements) as well as those located within 2 km of a newly opened, closed mining quarry (e.g., Bertakari village, Senebi). The second TG consisted of populations in settlements presumed to live above ore deposits, situated at relatively greater distances (ranging from 6 km to 10 km) from mining and production areas. The third TG (Control Group) included populations in settlements located 60-70 km away from mining and production activities, where neither mining nor mineral extraction occurs, and where there is no indication of the presence of surface minerals.

To calculate the representative sample size for the study, the following parameters were used in the sample size calculation formula: a 95% confidence level, a population size of 72,731 for the Bolnisi-Dmanisi study areas (based on the 2014 census), and a population proportion of 50%. Consequently, a minimum sample size of 383 respondents was determined for the study.

However, to improve the accuracy and reliability of the survey results, the researchers increased the sample size, selecting 600 households each from the presumably exposed groups I and II, as well as 600 households from the control group. The survey was conducted using random sampling approach; within each household, all family members who were available at the time of the survey and who agreed to participate were interviewed. In total, 3 524 respondents from all three TG were interviewed regarding their health status.

For the laboratory analysis of heavy metals, one child or adolescent aged 5-18 and one adult aged 35-44 were selected

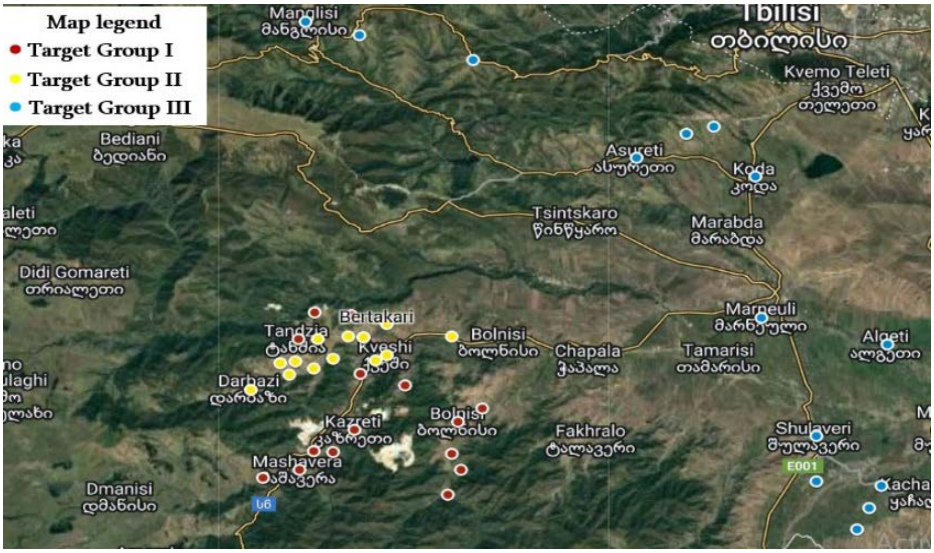

Figure 1. *TGs located in the Kvemo Kartli region - with indication of settlements.*

Table 1. *Disease Incidence: Country, Kvemo Kartli Region, and Individual Districts (Average Indicators for 2015–2019).*

International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)	Georgia	Kvemo kartli	Rustavi	**Bolnisi**	**Dmanisi**	Gardabani	Tetritskaro	Marneuli	Tsalka
Neoplasms	1569.0	399.9	515.6	**760.1**	**184.5**	540.5	262.2	430.6	105.6
Malignant neoplasms	539.4	193.8	207.5	**401.8**	**132.0**	125.1	186.5	227.1	76.9
Diseases of the blood and blood-forming organs and certain disorders involving the immune mechanism	880.9	809.4	594.3	**325.2**	**163.1**	918.7	952.3	1282.8	1429.7
Endocrine, nutritional and metabolic diseases	7173.6	4876.1	12406.2	**4440.3**	**2841.7**	2641.5	3933.3	5005.0	2864.6
Mental and behavioural disorders	2762.4	1086.9	5173.7	**260.4**	**85.4**	375.6	357.7	1035.6	320.0
Diseases of the nervous system	4166.5	2399.4	4636.5	**2538.5**	**598.1**	2510.4	1600.0	3348.9	1563.1
Diseases of the eye and adnexa	5911.2	2589.4	5264.3	**2831.7**	**568.9**	2048.0	1989.2	4008.2	1415.4
Diseases of the circulatory system	15563.3	9393.0	9326.0	**14518.7**	**5581.6**	10626.9	12134.2	6695.9	6867.7
Diseases of the respiratory system	19521.8	11906.0	18613.8	**8864.4**	**4659.2**	15025.9	16111.7	6731.5	13335.4
Diseases of the digestive system	16007.1	4364.1	5816.3	**2799.6**	**2668.9**	5804.0	3864.0	5696.3	3899.5
Diseases of the musculoskeletal system and connective tissue	4543.3	2818.1	5195.3	**1772.7**	**1015.5**	2082.6	3362.2	2674.6	3623.6

Table 2. *Prevalence of Chronic Diseases or Surgeries by TGs (%).*

	TG			
	I TG	**II TG**	**III TG**	Total
Has a chronic illness or has undergone surgery	55.9%	62.1%	50.6%	56.0%
Confirmed by a doctor	93.1%	93.1%	84%	90.5%
Is undergoing appropriate treatment	60.9%	73.7%	91.0%	67.9%
Has not consulted a doctor but experiences various complaints	50.0%	57.7%	48.2%	51.8%
Has spots on the skin	4.6%	1.9%	2.5%	3.0%
Believes their illness is related to environmental pollution	12.4%	12.8%	6.2%	10.6%

Table 3. *Respondents' Demographic Characteristics by TGs.*

Demographic characteristics	**TG**			
	TG I	**TG II**	**Control Group**	
	%	**%**	**%**	***Total***
Sex				
man	33.8%	36.8%	41.4%	37.3 %
women	66.2%	63.2%	58.6%	62.7 %
Age				
< 18 old	23.8%	13.9%	17.7%	18.6%
18 - 39 old	20.6%	20.4%	25.4%	22.2%
40 - 64 old	32.7%	34.5%	34.1%	33.7%
65 + old	23.0%	31.1%	22.8%	25.5%

from each household. Children and adolescents were chosen because they are particularly vulnerable to the effects of heavy metal exposure, the adults were included as this age group had not previously been included in the study in Georgia before. 750 respondents agreed to participate in laboratory testing, and 255 individuals were able to attend medical facilities for blood sampling.

Laboratory Research.

Quantitative analysis of lead in venous blood, samples were conducted at the Chemical Risk Factors Research Laboratory using high-precision inductively coupled plasma mass spectrometry (ICP-MS). For the analysis of lead in biological materials, an Agilent ICP-QQQMS 8900 series instrument (Agilent Technologies) was utilized.

Sampling Procedures.

Venous Blood Sampling Procedure:

Venous blood samples were collected following the OTH-GDO-012 sample collection protocol. The samples were drawn into EDTA K2 tubes, which are specifically designed for trace metal analysis, in strict adherence to biosafety regulations. The blood samples were then stored at -20°C until analysis.

Results.

The analysis of the statistical data showed that for only two ICD-10 categories, the Bolnisi district (the district assumed to have probable exposure) had higher rates compared to the regional average, although still lower than the national average. These categories were: diseases of the circulatory system and

Table 4. *Frequency Distribution of Risk Factors by TGs.*

	TGs (%)			
	TG I	**TG II**	**TG III**	**Total**
	%	**%**		
Tobacco use				
Smokers regularly	10.4%	9.8%	14.0%	11.4%
Smokers occasionally	0.9%	0.9%	0.5%	0.7%
Does not smoke anymore	4.9%	5.8%	5.9%	5.5%
Has never smoked	80.0%	80.8%	77.7%	79.4%
No answer	3.9%	2.8%	2.0%	2.9%
Alcohol use				
Drinks daily	0.6%	0.3%	0.5%	0.5%
Drinks occasionally	17.8%	14.2%	19.4%	17.2%
Does not drink anymore	3.6%	4.4%	2.7%	3.6%
Has never drunk	73.6%	78.0%	74.9%	75.5%
Refused to answer	0.1%	0.0%	0.1%	0.1%
No answer	4.3%	3.0%	2.3%	3.2%
Drug use				
Has never used	95.0%	96.1%	96.5%	95.9%
Refused to answer	0.0%	0.0%	0.1%	0.0%
No answer	5.0%	3.9%	3.4%	4.1%
Total	100.0%	100.0%	100.0%	100.0%

Table 5. *BLLs by TGs, 2023.*

			Lead in the blood		**Total**
			≥5 µg/dL	**<5 µg/dL**	
TGs	I **TG**	N	**3**	104	107
		% within **TG**	**2.8%**	97.2%	100.0%
	II **TG**	N	**3**	74	77
		% within **TG**	**3.9%**	96.1%	100.0%
	III **TG**	N	**1**	70	71
		% within **TG**	**1.4%**	98.6%	100.0%
Total		N	**7**	248	255
		% within **TG**	**2.7%**	97.3%	100.0%

Table 6. *BLLs ≥5 µg/dL by TGs, gender, and age.*

Ages	**TG I**		**TG II**		**TG III**		Total		
	women	man	women	man	women	man	women	man	Total
5-10 old	-	1	-	1	-	-	-	2	2
11-14 old	1	-	-	1	-	-	1	1	2
35-44 old	1	-	1	-	1	-	3	-	3
Total	2	1	1	2	1	-	4	3	7

Table 7. *BLLs (≥1) by TGs.*

			Presence/absence of lead		**Total**
			<1 µg/dL	**≥1 µg/dL**	
TGs	**I TG**	N	24	83	107
		% within **TG**	22.4%	77.6%	100.0%
	II TG	N	31	46	77
		% within **TG**	40.3%	59.7%	100.0%
	III Group	N	20	51	71
		% within **TG**	28.2%	71.8%	100.0%
Total		N	75	180	255
		% within **TG**	29.4%	70.6%	100.0%

Table 8. *RRs in TG I by Nosology Classes.*

Classes of diseases	**TG I**		**TG III**		RR (95% CI)	p value
	N	%	N	%		
Diseases of the circulatory system	371	51.7%	346	48.3%	1.075 (0.950 - 1.216)	0.252
Diseases of the musculoskeletal system	203	56.1%	159	43.9%	1.280 (1.056 - 1.551)	**0.011**
Diseases of the digestive system	119	57.2%	89	42.8%	1.340 (1.030 - 1.744)	**0.029**
Diseases of the nervous system	58	53.2%	51	46.8%	1.140 (0.789 - 1.647)	0.485
Diseases of the eye and its adnexa	44	65.7%	23	34.3%	1.918 (1.165 - 3.156)	**0.01**
Cancers	64	54.2%	54	45.8%	1.188 (0.834 - 1.692)	0.339
Diseases of the endocrine system	99	47.4%	110	52.6%	0.902 (0.696 - 1.170)	0.437
Diseases of the genitourinary system	67	48.2%	72	51.8%	0.933 (0.678 - 1.289)	0.673
Diseases of the blood and hematopoietic organs	32	46.4%	37	53.6%	0.867 (0.544 - 1.382)	0.548
Diseases of the respiratory system	39	58.2%	28	41.8%	1.396 (0.865 - 2.254)	0.17
Diseases of the ear	8	57.1%	6	42.9%	1.337 (0.465 - 3.841)	0.589
Hypertension	271	50.7%	263	49.3%	1.033 (0.889 - 1.200)	0.673

Table 9. *RRs by Nosology in TG II.*

Classes of diseases	**TG II**		**TG III**		RR (95% CI)	p value
	count	%	count	%		
Diseases of the circulatory system	448	56.4%	346	43.6%	1.400 (1.248 - 1.570)	**<0.001**
Diseases of the musculoskeletal system	246	60.6%	159	39.4%	1.667 (1.388 - 2.000)	**<0.001**
Diseases of the digestive system	104	53.9%	89	46.1%	1.263 (0.963 - 1.652)	0.09
Diseases of the nervous system	77	60.2%	51	39.8%	1.632 (1.156 - 2.304)	**0.005**
Diseases of the eye and its adnexa	45	66.2%	23	33.8%	2.115 (1.288 - 3.473)	**0.002**
Cancers	58	51.8%	54	48.2%	1.161 (0.809 - 1.667)	0.418
Diseases of the endocrine system	123	52.8%	110	47.2%	1.209 (0.947 - 1.543)	0.128
Diseases of the genitourinary system	69	48.9%	72	51.1%	1.036 (0.752 - 1.427)	0.828
Diseases of the blood and blood-forming organs	26	41.3%	37	58.7%	0.760 (0.463 - 1.240)	0.275
Diseases of the respiratory system	42	60.0%	28	40.0%	1.622 (1.012 - 2.598)	**0.04**
Diseases of the ear	7	53.8%	6	46.2%	1.261 (0.428 - 3.742)	0.675
Hypertension	372	58.6%	263	41.4%	1.529 (1.335 - 1.752)	**<0.001**

oncological diseases. Environmental pollution with heavy metals is considered one of the significant risk factors for these two classes of diseases.

For other nosological categories, the statistical data for Bolnisi were lower than both the regional and national averages.

The response rate for the survey, based on the 1,800 households initially planned in the survey protocol, was 98.9%. A total of 1,780 households participated in the survey, with 590 households surveyed in TG 1, 599 in TG 2, and 591 in TG 3. The chi-square test did not show difference by the risk factors between the presumably exposed and control group, except of the few variables. Furthermore, factors such as noise, deforestation, air pollution, allergies to house dust, and proximity to high-exposure sources were reported to affect TG 1 compared to the Control Group. For instance, 56% of the surveyed population in TG1 reported the presence of noise near their homes, compared to 15% in the control group. Additionally, 82% of individuals in TG1 mentioned deforestation, while only 5% in the control group did. Similar patterns were observed for air pollution and allergies to house dust: 56% in TG1 versus 16% in the control group, and 42% versus 35%, respectively.

After examining the demographic data from the households, each family member was surveyed regarding their health status. The survey included 3,624 respondents from 1,780 households, data on their activities, health status, and harmful habits were collected. Health-related complaints were more prevalent among participants in the first and second TG, who were presumably more exposed to environmental pollution. Specifically, 12-13% of respondents in the first and second TG reported that their health issues might be associated with environmental pollution, whereas only 6.2% of individuals in the control group expressed similar concerns. However, in the control group (third group), the reported health complaints were somewhat lower compared to the populations in the first and second TGs, which were presumed to be exposed to environmental pollution. Among the presumably exposed TGs, 12-13% of respondents indicated that their health complaints might be related to environmental pollution, whereas only 6.2% of individuals in the control group reported similar concerns.

When comparing the health status of the female population across the TGs, no significant or reliable differences were observed.

In terms of the rates of cesarean sections, spontaneous abortions, and stillbirths, women living in the first TG had a lower share compared to those in the control group.

Biomonitoring.

For biomonitoring, 255 venous blood samples were collected: 129 from children and adolescents aged 5-18 years, and 126 from adults aged 35-44 years, typically considered the healthiest and most active age group. According to WHO guidelines, a blood lead level (BLL) of ≥5 μg/dL requires medical attention, with

actions needed to identify and reduce lead exposure sources [27,28]. The CDC recommends a lower threshold of ≥3.5 μg/dL for children, using t,28his as a reference to identify elevated BLLs [8]. Georgia should align with WHO recommendations, providing medical assistance to children and pregnant women with elevated BLLs.

The study's biomonitoring results showed significant improvements in lead levels compared to previous data. In 2018, the MICS reported an average BLL of 4.2 μg/dL among children aged 2-7 years in the Kvemo Kartli region [22]. Our 2023 study found a lower average of 1.8 μg/dL for both children (aged 5-7 years) and adults (aged 35-44 years). Specifically, the average lead concentration was 2.1 μg/dL in children aged 5-7 years, 1.7 μg/dL in children aged 5-14 years, and 1.96 μg/dL in adults. This suggests minimal differences in lead concentrations across age groups. The findings also indicated that elevated lead levels were evenly distributed across the first and second target groups.

Since the recommended BLL was only observed in 7 cases (4 children and 3 adults), this difference is not statistically significant the focus of the analysis was shifted. Rather than examining instances of high lead concentrations, the general presence of lead in the blood (i.e., concentrations ≥1 μg/dL) was investigated. This approach was adopted because the WHO does not define a safe threshold for lead in the body, and there is existing literature suggesting that even low concentrations of lead can have detrimental effects on human health. According to Akinleye, Oremade, and Xu (2023), "findings showed that low blood levels of cadmium (Cd) and lead (Pb) were associated with higher odds of chronic kidney disease (CKD)“ [1]. Strieker et al. (2024) state that "Even very low BLLs may harm. For example, around four points lower intelligence test results were found in children with BLLs between 24 and 100 μg/l" [2].

In light of this, the study focused on BLLs above 1 μg/dL. The analysis revealed that the first TG exhibited a significantly higher percentage of individuals with detectable lead levels in their blood compared to both the second and third TGs.

As observed from the table, the presence of lead in the first TG is notably high, while the control group falls between the first and second TGs in terms of lead concentration. The results of the current study are insufficient to fully explain this finding, indicating that further research is needed. This observation may be related to the general presence of lead within the region’s population; however, additional studies are required to investigate this hypothesis more thoroughly.

Statistical Analysis.

Study showed that TG 1 had significantly higher relative risks (RR) for three ICD10 classes compared to control group.

The RR for "Diseases of the eye and adnexa" was found to be the highest – data shows that TG 1 has 92% increased risk of this ICD10 class compared to control group, suggesting a stronger association between this condition and proximity to mining and production activities (X^2=6.19, P=0.012). Given that open-pit mining has been ongoing for several decades, during which both ore and waste rock have been exposed, it is plausible that the mucous membranes of the eye have been significantly affected by environmental exposure.

In both presumably exposed groups (I and II), high RRs were observed for the association between eye diseases and place of residence, also musculoskeletal system morbidity and place of residence. The strength and reliability of the association between the residents of the ore and eye diseases were greater than in the first TG (X^2=8.48, P=0.003).

As for the strength and reliability of the associations with musculoskeletal diseases, they were found to be high in both groups, particularly in the second TG—where the corrected chi-squared value (X^2= 17.0798) and the p-value (P = 0.000036) were highly significant.

In the second TG, relatively high and significant RR were also identified for circulatory diseases, including hypertension, as well as for diseases of the nervous and digestive systems. This indicates that, in the second group, a greater number of disease classes showed reliable associations with residential territory and exposure levels compared to the first TG.

Discussion.

The study conducted in the Kvemo Kartli region provided a comprehensive assessment of the health risks and environmental pollution faced by the population living close to mining and ore processing activities.

The findings revealed that, in 2018, the average lead concentration in the Kvemo Kartli region, as reported by the MICS study, was 4.2 μg/dl [22]. Our study in 2023, showed a significant reduction, with the average concentration falling to 1.8 μg/dl. However, MICS study was not designed to identify prevalence of elevated BLL on regional level, so the numbers are not directly comparable, but the decrease is obvious. The decline in BLL in other region of Georgia has been studied recently and our results are in line with it [19].

This reduction in lead levels over the past five years can likely be attributed to several key factors:

1. **Public Awareness Initiatives:** Since 2018, intensive efforts have been made to raise awareness of lead prevention measures, targeting both medical professionals and the general population. These efforts included television broadcasts, social media campaigns, and the organization of annual lead prevention weeks nationwide [23].

2. **State Program for Lead Surveillance in Children:** Launched in 2019, this program facilitated the testing of children with suspicious symptoms for lead exposure, followed by additional diagnostic studies and treatment. The program also included an investigation into the potential source of lead in the home environment [21].

3. **Environmental Protection Measures by Ore Mining and Processing Enterprise:** Between 2019 and 2022, the enterprise underwent a complete overhaul of its equipment and production processes, introducing significant measures to protect the environment, including water, soil, and air. These improvements are reflected in the positive changes observed in ecological research outcomes.

An analysis of medical statistics for the past five years indicated that disease rates in Bolnisi Municipality were generally lower than the national average, with the exception of diseases related to the circulatory system and oncology (class 2 diseases). Furthermore, demographic risk factors in households

did not show significant differences across the TGs, and there was little variation between the exposed and control groups. For instance, the local population of individuals aged over 50 years was lowest in TG 1. This is likely due to migration patterns following the commencement of production activities in the region. Additionally, the consumption of local fish was notably higher in TG 1, which can be attributed to the proximity of the settlements to local rivers. The living conditions in the exposed areas appear to be comparable, with certain risk factors impacting the population in similar ways. In both the first and second exposed groups, elevated RRs were found for associations between eye diseases and musculoskeletal system disorders and residential proximity to mining/production sites. The reliability of these associations was notably higher in the second exposed group, particularly for eye diseases compared to the first TG. In terms of musculoskeletal system disorders, the association was strong in both groups, with particularly high reliability in the second TG, as indicated by p-value < 0.05. Furthermore, in the second TG, relatively high and statistically significant RRs were observed for circulatory diseases, including hypertension, as well as for diseases affecting the nervous and respiratory systems. These findings suggest that, in the second group, the correlation between disease outcomes and residential location, as well as exposure levels, is more pronounced and reliable than in the first TG.

The living conditions in the exposed areas appear to be comparable, with certain risk factors impacting the population in similar ways. In both the first and second exposed groups, elevated RRs were found for associations between eye diseases and musculoskeletal system disorders and residential proximity to mining/production sites. The reliability of these associations was notably higher in the second exposed group, particularly for eye diseases compared to the first TG. In terms of musculoskeletal system disorders, the association was strong in both groups, with particularly high reliability in the second TG, as indicated by p-value < 0.05. Furthermore, in the second TG, relatively high and statistically significant RRs were observed for circulatory diseases, including hypertension, as well as for diseases affecting the nervous and respiratory systems. These findings suggest that, in the second group, the correlation between disease outcomes and residential location, as well as exposure levels, is more pronounced and reliable than in the first TG.

The biomonitoring results indicate a relatively low prevalence of lead concentrations above 5 μg/dl (2.74%), with only 7 cases out of 255 showing such elevated levels. Further analysis of BLLs between 1 and 5 μg/dl revealed that 70.6% of respondents exhibited these concentrations, with a higher percentage of children (75%) showing low lead concentrations. This was particularly prevalent in the first TG (72%), followed by the second (50%) and third (54.5%) groups.

Higher RRs for more disease classes in the second group compared to the first, can be explained by the fact that 55% of respondents in the second group were over 50 years old, compared to 45% in the first and third groups. Therefore, this higher proportion of older individuals in the second group would contribute to a higher prevalence of chronic diseases, as compared to the relatively younger populations in the first and third groups.

For further research in this region, it would be appropriate to combine the first and second groups into a single exposure TG, while doubling the size of the control group. This would enhance the ability to detect more accurate differences between the groups.

The search for RRs across different TGs, as well as the comparison between biomonitoring results and identified ICD10 classes, did not identify any potential risks. The differences in biomonitoring results between the presumably exposed groups and the control group were not statistically significant enough to establish any substantial risk.

Study limitations.

The study had some limitations: a) while associations are observed, causality cannot be definitively established. b) Environmental study was very limited due to the existing budget. c) Part of the target areas (Kushchi, Kasumlo) was likely polluted by industries located in a neighboring state (Armenia), which we did not have the opportunity to research within the framework of this project.

Conclusion.

The study revealed a significant reduction in mean blood lead levels (BLL) in the Kvemo Kartli region, dropping from 4.2 μg/dL in 2018 to 1.8 μg/dL in 2023. This improvement is linked to public awareness efforts, a state lead surveillance program for children, and environmental measures by the mining enterprise. Despite the decrease, low but credible health risks remain for populations near mining sites, with isolated cases of higher BLLs observed. These findings underscore the need for ongoing monitoring and research.

Funding.

Research funded by the Shota Rustaveli national scientific foundation of Georgia (FR-19-6906).

REFERENCES

1. ავქოფაშვილი გ. მონოგრაფია - ნიადაგების ფიტორემედიაცია (გვ. 198). გამომცემლობა შ.პ.ს. დი-ენდ-ჯი. 2016.
2. მწვანე ალტერნატივა. მწვანე პოლიტიკა და გარემოს დაცვა (გვ. 33). 2013.
3. წიქარიძე ნ, ავქოფაშვილი გ. ქვემო ქართლის სამთომოპოვებითი სამრეწველო დაბინძურების ანალიზი მწვანე პოლიტიკის პერსპექტივიდან. მწვანე პოლიტიკის საზოგადოების პლატფორმა. 2017:4-5.
4. Akinleye A, Oremade O, Xu X. Exposure to low levels of heavy metals and chronic kidney disease in the US population: A cross-sectional study. Environmental Health Perspectives. 2023;131:2.
5. American Academy of Pediatrics. Bright futures: Guidelines for health supervision of infants, children, and adolescents (4th ed.). American Academy of Pediatrics. 2017.
6. Cantor A, Hendrickson R, Blazina I, et al. Screening for elevated blood lead levels in children: A systematic review for the U.S. Preventive Services Task Force. Agency for Healthcare Research and Quality. 2019:18-05245-EF-1.

7. Cantor AG, McDonagh MS, Blazina I, et al. Screening for elevated blood lead levels in pregnant women: A systematic review for the U.S. Preventive Services Task Force: Evidence Synthesis No. 175. Agency for Healthcare Research and Quality. 2019:18-05245-EF-2.
8. Centers for Disease Control and Prevention. Blood lead surveillance data. Centers for Disease Control and Prevention. 2025.
9. Dang P, Tang M, Fan H, et al. Chronic lead exposure and burden of cardiovascular disease during 1990–2019: A systematic analysis of the global burden of disease study. Frontiers in Cardiovascular Medicine. 2024;11:1367681.
10. International Agency for Research on Cancer (IARC). IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Some Metals and Metal Compounds. 2020:118.
11. Institute for Health Metrics and Evaluation. Lead exposure-level 3 risk. University of Washington. 2024.
12. Kordas K, Ravenscroft J, Cao Y, et al. Lead exposure in low and middle-income countries: Perspectives and lessons on patterns, injustices, economics, and politics. International Journal of Environmental Research and Public Health. 2018;15:2351.
13. Kordas K, Ardoino G, Coffman D, et al. Patterns of exposure to multiple metals and associations with neurodevelopment of preschool children from Montevideo, Uruguay. Environmental Health Perspectives. 2015;123:301-307.
14. Lanphear B, Rauch S, Auinger P, et al. Low-level lead exposure and mortality in US adults: A population-based cohort study. Lancet Public Health. Lancet Public Health. 2018;3:e177-e184.
15. Levin R, Zilli Vieira C. L, Rosenbaum M. H, et al. The urban lead (Pb) burden in humans, animals, and the natural environment. Environmental Research. 2021;193:110377.
16. Mayans L. Lead poisoning in children. American Family Physician. 2019:24-30.
17. National Statistics Office of Georgia (GEOSTAT). Georgian Statistical Yearbook 2024. Tbilisi: GEOSTAT. 2024.
18. Rich Metals Group (RMG). Mitigation measures. 2025. https://richmetalsgroup.com/en/mitigation-measures/
19. Rylander C, Ephadze N, Manjavidze T, et al. Time-trends of BLLs from 2020 to 2023 in pregnant and breastfeeding women from Adjara, Georgia—A birth registry-based study. International Journal of Hygiene and Environmental Health. 2025;263:114482.
20. Strieker S, Radon K, Forster F, et al. Biomonitoring of lead in blood of children living in a former mining area in Lower Saxony, Germany. Environmental Science and Pollution Research International. 2024;31:29971-29978.
21. The Government of Georgia. Approval of state health programs in 2025 (Resolution 474). 2024.
22. UNICEF. Georgia 2018: Key findings. United Nations Children's Fund. 2018. https://www.unicef.org/georgia/media/3501/file/Georgia_MICS_2018_en.pdf
23. United Nations. Ending childhood lead poisoning in Georgia: Progress and lessons learned between 2017 and 2023. United Nations Georgia. 2023.
24. World Bank. Georgia - Country Overview. 2025. https://www.worldbank.org/en/country/georgia
25. World Health Organization (WHO). International lead poisoning prevention week of action: Our children's future – A call to end childhood lead poisoning. 2023.
26. World Health Organization (WHO). Lead poisoning and health. 2021. https://www.who.int/news-room/fact-sheets/detail/lead-poisoning-and-health
27. World Health Organization (WHO). Guideline for Clinical Management of Exposure to Lead: Executive Summary. 2021:7.
28. World Health Organization (WHO). WHO guidance to reduce illness due to lead exposure. 2021.

აბსტრაქტი

შესავალი: ქვეყანაში 2018 წელს პირველად ჩატარდა (MICS-ის კვლევის ფარგლებში) ბავშვებთა სისხლში ტყვიის კონცენტრაციის კვლევა, რომელმაც აჩვენა სისხლში ტყვიის კონცენტრაციის მაღალი მაჩვენებლები (5 მკგ/დლ-ზე მეტი - გამოკვლეულთა 41%-ში); ქვემო ქართლის რეგიონში სხვადასხვა კვლევებმა გამოავლინა აგრეთვე გარემოს მნიშვნელოვანი დაბინძურებები მძიმე მერტალებით; ამიტომ ჩატარებული კვლევის მიზანი იყო ბოლნისი-დმანისის რეგიონში, ტექნოგენური ქიმიური აგენტებით გარემოზე შესაძლო ზემოქმედებასთან ასოცირებული ჯანმრთელობის რისკების შეფასება და მათი მინიმიზაციის ღონისძიებათა რეკომენდაციების შემუშავება.

მეთოდოლოგია: ჩვენს მიერ ჩატარდა მოსახლეობის ჯანმრთელობის მდგომარეობის შესწავლა - კვლევის ჯვარედინ-სექციური მეთოდის გამოყენებით და ბიომონიტორინგი ტყვიით ექსპოზიციაზე. კვლევისთვის შეირჩა სამი სამიზნე ჯგუფი შესაძლო ექსპოზირების დონის მიხედვით, რომელიც რანდომულად გამოიკითხა ჯანმრთელობის მდგომარეობაზე და ასევე რანდომული შერჩევით ჩაუტარდათ ვენური სისხლის კვლევა ტყვიაზე. მიღებული შედეგებით განისაზღვრება სამიზნე ჯგუფებს შორის სხვადასხვა ნოზოლოგიების ფარდობითი რისკები, კორელაციები (ხი-კვადრატის საშუალებით) სხვადასხვა რისკ-ფაქტორებთან და მათი მიზეზ-შედეგობრივი კავშირები.

შედეგები: ჩვენმა შედეგებმა გამოავლინა სისხლში ტყვიის კონცენტრაციის მნიშვნელოვანი შემცირება საკვლევი რეგიონის მაცხოვრებლებს შორის MICS -ის შედეგებთან შედარებით. 2023 წელს ჩვენი კვლევის შედეგებმა ქვემო ქართლის სავარაუდოდ ექსპოზირებულ ტერიტორიებზე მცხოვრებთა შორის, სისხლში ტყვიის კონცენტრაციების შემდგომი შემცირებას. კერძოდ, საშუალო ტყვიის კონცენტრაცია სისხლში ქვემო ქართლის რეგიონში შემცირდა დაახლოებით 50%-ით, 2018 წლის 4.2 მკგ/დლ-დან 2023 წლის 1.8 მკგ/დლ-მდე. შინამეურნეობებში დემოგრაფიული ხასიათის რისკ-ფაქტორები, სამიზნე ჯგუფების მიხედვით, ერთმანეთისგან დიდად არ განსხვავდებიან. სარწმუნო ფარდობითი რისკები მიღებულია თვალის და მისი დანამატების ავადობის შემთხვევებში პირველ და მეორე სამიზნე ჯგუფებში, ხოლო სხვა დაავადებებთან ასეთი მნიშვნელოვანი ასოციაციები არ იქნა ნაპოვნი.

დასკვნა: მართალია, 5 წლის წინ, ქვეყანაში ჩატარებული მიქსის კვლევის დროს, ბავშვებში

დაფიქსირებული ბიომონიტორინგის შედეგების მაღალი საშუალო მაჩვენებლები შემცირებულია 2-ჯერ და მეტად, მაგრამ ამ ფონზე, ჩვენი კვლევით, „წარმოება/მოპოვების მიმდებარედ“ და „სავარაუდოდ მადანზე მცხოვრებ“ მოსახლეობაში, ზოგიერთი ნოზოლოგიების კლასების მიხედვით, მაინც გამოიკვეთა გარკვეული დაბალი, მაგრამ სარწმუნო ჯანმრთელობის რისკები; ბიომონიტორინგის შედეგებმაც დაადასტურა სისხლში ტყვიის შედარებით მაღალი კონცენტრაციის ერთეული შემთხვევები, მაგრამ ექსპოზირებულ ჯგუფებში მეტი, ვიდრე საკონტროლო ჯგუფში. გამომდინარე ყოველივე აქედან, მივიჩნევთ, რომ ქვეყანაში ბოლო 5 წლის განმავლობაში გატარებულმა ზომებმა შედეგი გამოიღო და მნიშვნელოვნად შემცირდა ტყვიის კონცენტრაცია ადამიანებში, მაგრამ მიუხედავად ამისა, ჯანმრთელობის გარკვეული დაბალი, მაგრამ სარწმუნო რისკები - სავარაუდოდ ექსპოზირებულ ტერიტორიებზე, მაინც გამოვლინდა. რაც სამომავლო კვლევებისთვის ფონურ მაჩვენებლებად შეიძლება ჩაითვალოს და პერიოდული მონიტორინგებით განისაზღვროს რეგიონში სიტუაციის მეტი გაჯანსაღებისკენ სვლის ტემპები.