

## Research Article

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## Primary Assessment of the Correlation between Pesticides and Cancer Incidence in Children

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### Introduction

In 2022, the number of newly diagnosed children with cancer aged 0 to 18 years was 881 (2021 - 873). The incidence rate of cancer in children was 7.5 (2021 - 7.4) per 100,000 child population. In the structure of oncological diseases, the leading positions were held by: leukemias and lymphomas (29.5%), brain and spinal cord tumors (21.8%), bone and joint neoplasms (7.8%), connective and soft tissue neoplasms (7.2%), kidney neoplasms (6.2%), retroperitoneal space neoplasms (4.7%), and eye neoplasms (4.2%), which together accounted for 81.4% of all newly diagnosed cancer in children. The distribution of tumor process stages in 2022 was as follows: stage I-II 49.7% (2021 - 38.4%), stage III - 19.3% (2021 - 18.9%), stage IV - 4.9% (2021 - 3.2%). In 2022, 4,907 children were under dispensary observation in oncological institutions. The prevalence rate of cancer in the pediatric population in 2022 was 41.8 per 100,000 child population. The mortality rate from cancer per 100,000 child population in 2022 was 2.8 (2021 - 2.9). The main causes of deaths among children were: brain and spinal cord neoplasms (22.7%), hemoblastoses (10.6%), bone and joint neoplasms (10.3%), kidney neoplasms (8.2%), lymphomas (8.2%), liver neoplasms (7.3%), and connective and other soft tissue neoplasms (7.3%), which together accounted for nearly 74.5% of all deaths from cancer among children [1].

The spread of malignant diseases is a significant concern in Uzbekistan. Recent data suggest a possible link between pesticide exposure and the increased frequency of cancer. Due to the lack of a population cancer registry, it is challenging to establish a true correlation. However, a relative correlation can be formed through retrospective and prospective surveys of families affected by cancer in Uzbekistan. Primary endpoint for this project was to assess the possible correlation between pesticide exposure and cancer incidence in children. Secondary endpoint was to receive feedback on pediatric cancer control programs in Uzbekistan.

Pesticides are used in the cultivation of a wide range of agricultural crops, both cotton and cereals (the most common crops) and vegetables, fruits, berries, flowers, tobacco, fruit and ornamental trees and shrubs, as well as forest plantations. A total of 249 different preparations of plant protection substances are permitted in Uzbekistan. They include various active ingredients, 59 of which are recognized as highly hazardous pesticides (HHPs) and are listed in the Pesticide Action Network (PAN) list of HHPs of 2019. Furthermore, 34 of them are banned in other countries, according to PAN's consolidated list of HHPs. Uzbekistan has established a database of laws and regulations governing the production, use, injury and liability of individuals and legal entities and the sound management of chemicals including the registration, licensing and prevention of stockpiling of hazardous chemicals (primarily pesticides) in the country [2].

Meta analysis which was published in 2018 dedicated to the household exposure to pesticides and risk of leukemia in children and adolescents have shown a positive association between domestic pesticide exposure and childhood leukemia is confirmed [3].

Another ongoing study AGRICAN implies the risk of sarcomas was increased in several pesticide related farming activities with differences according to histological subtype.

Statistically, rural population has less cancer morbidity than the city population due to healthier environment and less risk factors. Learning the geographical contribution of the cancer cases in Uzbekistan allow us to estimate the correlation between the pesticide exposure and childhood cancer.

The study aims to identify significant correlations between pesticide exposure and cancer incidence. Results will inform new pesticide use recommendations and contribute to reducing cancer risk in Uzbekistan.

Establishing positive correlation would allow to justify further investigations on determining pesticide levels in breastmilk of population.

In order to achieve endpoint results the research team has put following research objectives

### Determine the Level of Pesticide Exposure among Survey Participants

The first objective of this study is to ascertain the extent of pesticide exposure among the children who participate in the survey. This involves gathering comprehensive data on various factors that contribute to pesticide exposure. Specifically, we aim to collect detailed information on:

- **Residential Proximity to Agricultural Areas:** This includes whether participants live near cotton fields, wheat fields, or other agricultural areas where pesticides are commonly used. The distance of their residence from such fields will be noted to assess potential exposure.
- **Parental Occupational Exposure:** Information on whether parents or guardians work in occupations that involve handling or being around pesticides will be collected. This includes agricultural work, pest control services, and other related fields.
- **Use of Pesticides in Home Gardens:** The study will document the use of pesticides in participants' home gardens and the frequency and type of pesticides used.
- **Environmental and Household Factors:** Additional data on the presence of pesticides in and around the home environment will be recorded, including the use of pest control products within the household.
- **Involvement in the Process of Working in Fields:** As it is known, all of the fields are exposed to pesticides in Uzbekistan. Since the field workers are not given any special outwear which defends from pesticides, that could have

By analyzing these factors, we aim to establish profile of pesticide exposure among the participants. This will help in understanding the potential risk factors and exposure routes that might contribute to the incidence of cancer among children.

### Evaluate the Correlation between Pesticide Exposure Levels and Cancer Incidence Rates

The second objective is to evaluate the correlation between the levels of pesticide exposure and the incidence rates of cancer, particularly lymphomas, among the participants. This involves:

- **Statistical Analysis:** Utilizing statistical methods such as logistic regression and correlation analysis to assess the relationship between pesticide exposure levels and cancer incidence rates. This will help in determining whether there is a statistically significant association between the two.
- **Adjusting for Confounding Variables:** To ensure the accuracy of the results, the analysis will adjust for potential confounding variables such as age, gender, family history of cancer, socioeconomic status, and other environmental factors.
- **Comparative Analysis:** Comparing the incidence rates of cancer in participants with high levels of pesticide exposure to those with low or no exposure. This comparative approach will help in highlighting any significant differences or trends.
- **Longitudinal Study:** For a more robust understanding, a longitudinal study design may be implemented, where participants are followed over a period of time to observe the onset of cancer in relation to their exposure levels.

By conducting this comprehensive analysis, the study aims to uncover any significant correlations between pesticide exposure and cancer incidence. This information will be crucial for developing targeted public health interventions, regulatory policies on pesticide use, and further research into cancer prevention strategies.

### Methodology

#### Research Design

- **Study Type:** Cross-sectional study using retrospective and prospective questionnaires to collect data on pesticide exposure and cancer incidence.

#### Sampling

- **Population:** Children diagnosed with cancer at the National Children's Medical Center and Taskin Hospice.
- **Sample Size:** Minimum of 100 participants to ensure statistical significance.

#### Inclusion Criteria

- o Age below 18 years.
- o Histologically confirmed cancer (Hodgkin and non-Hodgkin lymphomas, sarcomas).
- o Consent to participate in the study.

#### Exclusion Criteria

- o History of other malignant diseases.
- o Inability to complete the questionnaire independently or with guardian assistance.

#### Data Collection

- **Questionnaire**
  - o Demographic information (age, gender, residence).
  - o Pesticide exposure history (living near cotton, agricultural, and wheat fields where pesticides are used, professional activities, use in home gardens, etc.).
  - o Medical history including lymphoma diagnoses in relatives.

#### Data Collection Method

- o Questionnaires will be administered via phone calls. Participants can respond independently or with trained personnel assistance.

#### Informed Consent

- o Informed consent will be obtained before the survey via phone. The conversation will be recorded for further statistical processing.

#### Data Analysis

- **Description**
  - o Demographic characteristics and pesticide use data will be presented as frequency distributions and averages.

#### Statistical Analysis

- o Conducted using SPSS and MS Excel.
- o Logistic regression to assess the link between pesticide exposure and lymphoma incidence.
- o Correlation analysis to evaluate the strength and direction of the relationship.
- o Adjustments for potential confounding variables (e.g., age, gender, family medical history).

#### Project Implementation Timeline

- **Project Duration:** One month post approval (Expected start: July 1, 2024, End: July 31, 2024).
- **Deliverables:** Detailed project report, presentations, and a



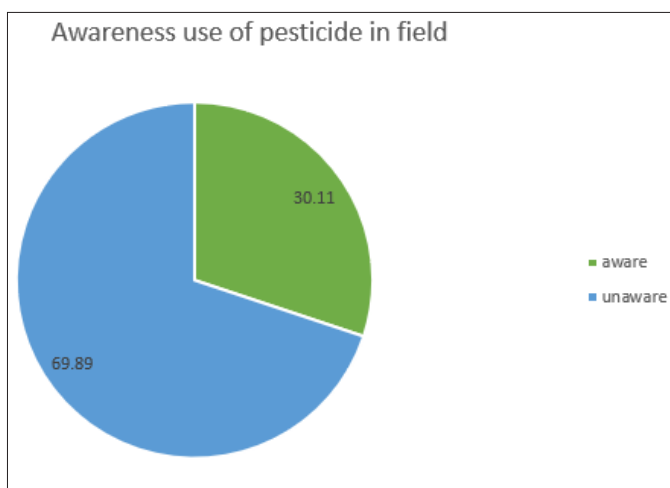


Figure 5: Geographical Distribution of the Respondents

Geographical distribution of the respondents showed that majority of them 72 (77.42%) were from rural area, while as 19 (20.43%) were from urban. 2 respondents denied their answers to be included to the survey.

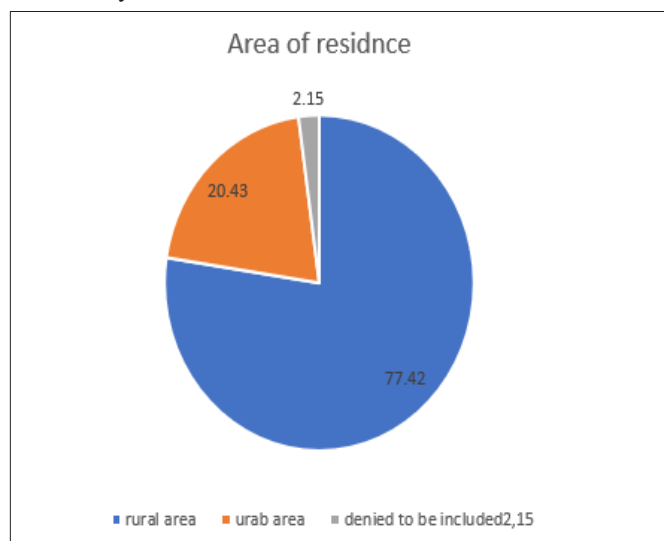


Figure 6: Awareness of Pesticide Exposure in the Field

### Discussion

Study included patients from 56 regions of Uzbekistan for 2.5 years. This data allows to make conclusions which are representative for the whole country, allows to exclude short-term reluctancies.

The study shows that a significant number of respondents (63 out of 93) live near fields, indicating a potential environmental exposure risk to field-related factors. Taking into consideration the fact that pesticides, including 34 banned, are widely used in the fields, strong linear correlation can be found between cancer morbidity and pesticide exposure ( $p=0.035$ ).

Although the data shows that childhood cancer prevalence is more in urban areas than rural, the research indicates that the vast majority of the respondents were from rural areas (77.42% and 20.43% respectively; two refused to answer the question). This is another linear correlation between morbidity and pesticide exposure.

Approximately 30% of respondents (28 out of 93) reported the use of pesticides in nearby fields. This could be a significant environmental factor impacting health outcomes.

Patients had 28 different diagnoses, with Leukemia and sarcomas as leading disease. Since meta-analysis and ongoing cohort studies indicate that pesticides cause leukemia and sarcoma, correlation between pesticide use, diagnosis and geographic localization indicates the correlation to be true for Uzbekistan.

### Conclusions

The primary assessment of the correlation between pesticides and cancer incidence in children in Uzbekistan highlights a significant potential link between environmental pesticide exposure and childhood cancer. The study involved 93 respondents, predominantly from rural areas, where agricultural practices, including the use of various pesticides, are prevalent. The data indicates that 67.75% of respondents lived near agricultural fields, and 26.89% had family members working in these fields. The widespread use of pesticides, including those banned in other countries, raises concerns about their potential role in increasing cancer risk among children.

The results of the survey show that leukemia and brain cancer are the most frequently diagnosed cancers among the respondents, aligning with previous meta-analyses that have established a link between pesticide exposure and these types of cancer. The geographical distribution of the respondents, with a majority residing in rural areas, further supports the hypothesis that environmental factors, such as pesticide use, may contribute to higher cancer morbidity in these regions. The study's findings suggest a strong correlation between pesticide exposure and childhood cancer incidence, underscoring the need for stricter regulations on pesticide use and more comprehensive clinic-epidemiological studies to confirm these findings and develop effective cancer prevention strategies in Uzbekistan [4].

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