OPTIMIZING ONCOLOGY DATA MANAGEMENT: THE ROLE OF A NATIONAL CANCER REGISTRY IN PUBLIC HEALTH

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Abstract: In the context of the growing cancer burden, both nationally and internationally, optimizing the management of oncological data is a strategic priority for public health in the Republic of Moldova. The National Cancer Registry plays a key role in collecting, standardizing, and analyzing epidemiological data on cancer patients. By centralizing this information, the registry enables the monitoring of trends in incidence and mortality, the evaluation of the effectiveness of therapeutic interventions, and the development of evidence-based prevention and treatment policies. A well-structured cancer registry supports public health decision-makers in making informed, evidence-based decisions. Furthermore, the integration of digital technologies and international standards into data collection ensures global comparability and facilitates participation in multicenter studies. In conclusion, a well-organized National Cancer Registry represents a fundamental pillar of modern cancer management and public health strengthening. It contributes to a coherent and effective approach to cancer control programs.

Keywords: Cancer Registry, public health, cancer control programs.

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1. Introduction

Relevance and Importance of the Addressed Issue - an integrated and automated population-based cancer registry (information system) has the capacity to record all cancer cases within a defined population – most commonly a specific geographical area, such as a country or a significant region.

It places a strong emphasis on the use of epidemiological data, which are frequently employed in global studies assessing health outcomes and the cancer burden among populations, playing a critical role in shaping public health policies.

The registry is designed to identify the distribution of cancer cases by sex, race/ethnicity, age, and other demographic factors, as well as to determine the types of cancer most prevalent among various population groups. It also monitors cancer trends over time, supports the planning and evaluation of cancer control efforts, and helps prioritize the allocation of health resources.

Moreover, such registry advances research and supports clinical, epidemiological, and health services studies at the national level. The importance of this issue is further underscored by the current context, in which the growing volume of information demands several essential characteristics: data comparability, validity and accuracy of records, timeliness – frequently required by population-based cancer registries - as well as data completeness. All of these requirements can be met through a complex, well-organized information system, developed in strict accordance with customized (internal) needs while remaining aligned with international standards and requirements.

2. Literature Review

In recent decades, the exponential rise in cancer incidence has generated a growing need for high-quality epidemiological data to support public health decision-making. This necessity has fostered the emergence of *cancer informatics* - an interdisciplinary domain at the intersection of information science, computer science, oncology, and health systems research. The National Cancer Registrars Association (2023) defines it as the integration of all tools and processes required to optimize data acquisition, storage, processing, and utilization in oncology surveillance [1].

Global studies emphasize that early-onset cancer is becoming increasingly prevalent, especially among populations under 50 years old. Zhao et al. (2023) forecast a 31% increase in incidence and a 21% rise in mortality for early-onset cancers by 2030 [2]. Such projections underline the urgent need for real-time, standardized cancer registries that can track population-level dynamics and guide timely interventions.

Comprehensive, population-based cancer registries are recognized as essential instruments for monitoring incidence, prevalence, and survival rates. According to Merriman et al. (2021), registries not only support epidemiological surveillance but also enable cost-efficient screening strategies and outcome-based clinical benchmarking [3]. However, the effectiveness of these registries depends heavily on their *interoperability, completeness, and data standardization* - three elements often underdeveloped in low- and middle-income countries.

In Moldova, as in other developing health systems, oncological data often originates from multiple fragmented sources: imaging systems, laboratory platforms, handwritten records, and isolated clinical databases. Without structured integration, this diversity impairs the capacity to generate accurate, timely, and actionable insights. Wormeli et al. (2021) advocate for the adoption of centralized, digital registry models aligned with international standards to overcome such challenges [4].

Recent advances in natural language processing (NLP) and artificial intelligence also show promise in enhancing oncology data management. Savova et al. (2019) demonstrate how machine learning tools can mine electronic health records to produce structured cancer phenotypes, improving registry accuracy and enabling predictive analytics [5].

According to the *World Health Organization* (2023), Moldova still faces significant disparities in cancer surveillance infrastructure, particularly in rural areas. These challenges underscore the need for robust registry systems to ensure equitable health outcomes nationwide [6]. In parallel, platforms such as the *Global Cancer Observatory* from the International Agency for Research on Cancer (IARC) highlight the importance of harmonized cancer data collection to track global trends and enable policy-relevant cross-country comparisons [7].

In summary, the literature strongly supports the development of integrated, interoperable, and digitally enhanced cancer registries as a cornerstone of resilient oncology systems. Moldova's evolving National Cancer Registry is well-positioned within this global shift toward data-driven health governance and offers a valuable model for systems-level transformation.

3. Methodology

This study employs a descriptive research design with a practice-oriented approach, aiming to assess and optimize oncology data management within the National Cancer

Registry of the Republic of Moldova. The research was conducted over a four-year period (2016–2020) and involved both qualitative and quantitative components.

Data collection was based on a structured questionnaire adapted from the survey model recommended by the American Institute for Cancer Research (AICR). The tool was customized to reflect the local institutional context, targeting oncologists and healthcare professionals working at the IMSP Institute of Oncology and the Consultative Diagnostic Center.

The questionnaire included two main sections:

- ▪ *Section I:* socio-professional data (age, specialization, years of experience, department);
- ▪ *Section II:* items assessing practices, challenges, and perceptions related to oncological data reporting, interoperability, and registry integration.

Respondents were selected using purposive sampling to ensure relevant expertise. In total, 58 oncology specialists participated, covering various departments (surgery, radiotherapy, diagnostics, epidemiology).

The collected data were analyzed using descriptive statistics (frequency distributions, percentages) and thematic content analysis for open-ended responses. The study did not involve patient-level clinical data and was exempt from formal ethical review, as it focused on institutional practices and system-level evaluations.

This methodological design allows the findings to offer both practical recommendations and policy-relevant insights for enhancing cancer data infrastructure.

4. Results and Discussion

We have identified the following issues related to the optimization of data management within the National Cancer Registry (NCR) - although medical institutions involved in the diagnosis or treatment of cancer patients are legally required to report a minimum set of relevant data to the NCR, many of these institutions face challenges in meeting reporting deadlines and complying with standardized requirements.

As a result, the risk of errors increases significantly, and failure to adhere to standards may compromise the accuracy of oncological data. This can have serious consequences, hindering the ability of public health authorities to respond effectively, as the actual situation may differ substantially from the data reported to the NCR.

One of the key areas for optimization with the integration of the NCR Information System (NCR-IS) is the reduction of oncological data fragmentation, which currently exists across multiple platforms (including information systems such as SIA AMP, SIA AMS, etc.).

These systems are not interconnected, often contain unstructured free-text entries (lacking standardized classifiers), or, even more problematically, the information is recorded manually. Although this data is valuable, its current form hinders the ability to rapidly identify and implement real-time interventions.

The lack of integration and structured formatting makes it difficult and time-consuming to develop and apply effective public health policies. In the Republic of Moldova, since 2016, a National Cancer Registry Information System (NCR-IS) has been implemented.

It was developed from the ground up by a multidisciplinary team, including graduates of the Academy of Economic Studies of Moldova (ASEM) specialized in cybernetics and economic informatics, working in collaboration with oncologists from the IMSP Institute of Oncology. The system was designed to optimize the management of oncological data. It includes integration with existing information systems, the implementation of both national and international classification standards for data

standardization, and the generation of reports aligned with internationally comparable indicators. The oncological indicators generated by the NCR are illustrated in Figure 1.
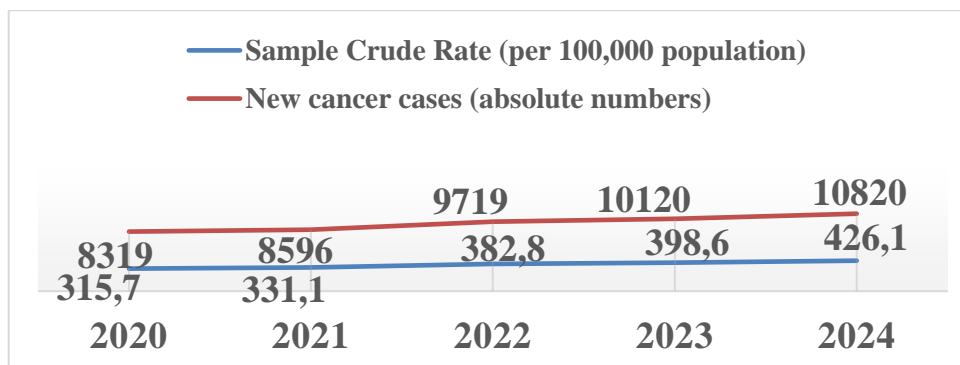

Figure 1. The dynamics of cancer incidence in the Republic of Moldova over the last 5 years
Source: National Cancer Registry

The National Cancer Registry Information System (SI RNC) ensures the accuracy of data management through the implementation of strict validation and verification protocols. Each entry undergoes rigorous control to eliminate errors and ensure interoperability between different data sources. The RNC uses advanced technologies, including machine learning tools, to detect anomalies and optimize workflows.

Significant progress has been made in reducing the challenges encountered in integrating data from multiple sources - such as inconsistencies in data formats and reporting gaps - through engineering solutions like the standardization of reporting formats and the development of user-friendly interfaces [5].

5. Conclusions

The findings of this study underscore the pivotal role of the National Cancer Registry in strengthening oncology data infrastructure and informing public health strategies in the Republic of Moldova. Through a practice-oriented approach, the research has identified both systemic gaps and recent technological advancements that contribute to optimizing cancer-related data management at the national level.

To optimize oncological data management, we have strengthened the use of information technologies within the National Cancer Registry, aiming for their full integration and focusing on the development of intuitive, accessible, and user-friendly interfaces for specialists.

In the long term, this approach not only contributes to cost reduction and ensures compliance with quality requirements and standards but also helps to reduce reliance on paper documentation, simplifying the medical documentation process and easing the administrative burden on physicians.

In public health policy, the National Cancer Registry ensures a continuous data validation process to eliminate errors and enhance the quality of processed and reported information. It also promotes interdisciplinary collaboration by involving experts in oncology, economics, informatics, engineering, and other fields to develop more advanced and efficient solutions that play a crucial role in reducing the cancer burden.

Finally, it is worth highlighting that the implementation of an integrated National Cancer Registry Information System underlines the importance of continuing efforts to improve the healthcare system in the field of oncology and adapt it to the specific needs of the medical community in the Republic of Moldova.

At the same time, the essential impact of the registry significantly contributes to strengthening the evidence base in cancer research, diagnosis, and treatment, as well as supporting the decision-making process in the development of public health policies.

Looking ahead, continued investment in digital infrastructure, workforce training, and international data alignment will be essential to ensure the sustainability and resilience of Moldova's cancer control system. The model presented can also serve as a reference for other countries seeking to modernize their cancer registries and enhance data-driven governance in public health.

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