UDC 576.895.121.56
DOI:10.54503/0514-7484-2024-64.1-142

Assessment of *Echinococcosis spp*. Surveillance System through SWOT Analysis in Armenia

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Keywords: human echinococcosis, cystic echinococcosis, alveolar echinococcosis, SWOT analysis, epidemiology, Armenia

Introduction

Human echinococcosis is a zoonotic parasitic disease caused by larval stages of cestodes belonging to the genus *Echinococcus* [9, 12]. The World Health Organization (WHO) listed echinococcosis as 1 of 20 neglected tropical diseases, and included *Echinococcus granulosus (E. granulosus)* and *Echinococcus multilocularis (E. multilocularis)* among food-borne parasites of global public health importance [1]. The two most common clinical types of echinococcosis, cystic echinococcosis (CE) and alveolar echinococcosis (AE), impose a considerable health and financial burden, particularly in low-income countries [1, 7, 9, 15, 16]. *E. granulosus* is well recognized as a parasite of concern in domestic animals, while *E. multilocularis* is a wildlife parasite. Domestic dogs are the most frequent definitive host for *E. granulosus,* with intermediate hosts including domesticated sheep, goats, camels, pigs, and equids. Wild or domestic carnivores such as foxes, domestic dogs, cats are definitive hosts in the lifecycle of *E. multilocularis*, while their prey, small mammals such as rodents, are intermediate hosts. Humans are accidental (aberrant) intermediate hosts and the dead-end of the life cycle [9, 16]. Except Antarctica continent, *E. granulosus* is distributed worldwide (especially in certain rural settings) [1, 2, 12, 16]. The causative agent of AE, *E. multilocularis*, is widely distributed in the northern hemisphere and central regions of Asia [2, 14, 16]. In endemic areas, the annual CE incidence ranges from 1 to 200 per 100 000 population, while the AE incidence ranges from 0.03 to 1.2 per 100 000 population [7, 15]. Human CE and AE are both chronic diseases. CE is a disabling disease with a low fatality rate, on the other hand, AE is often a life-threatening disease due to tumor-like progression [3].

Regarding data management there are two information flows: inter-sectoral and information flow within health system. For epidemiological

investigation the main responsible institution is National Centre for Disease Control and Prevention (NCDC Armenia). Surveillance data flows from lower to higher levels for the final policy making by Ministry of Health (fig. 1).

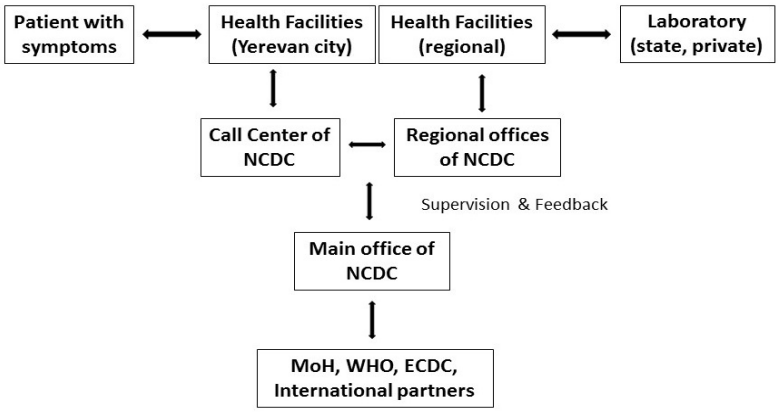

Fig. 1. Information flow chart of the echinococcosis spp. surveillance system

CE surgery cases from hospital discharge records are included in the NCDC Armenia database (passive surveillance system). CE surgical incidence increased between 2012 and 2019. AE incidence per 100 000 population varied between 0.032 in 2008 and 0.1 in 2017 and 2022, the year with the highest AE annual incidence (fig. 2).

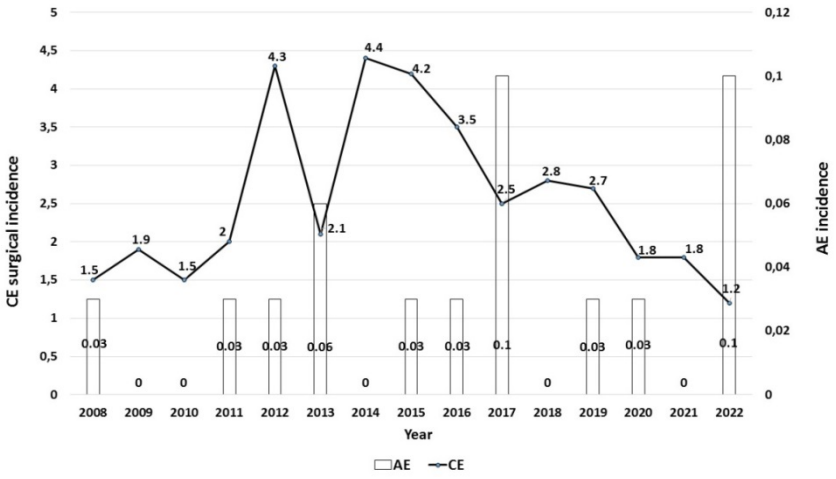

Fig. 2. CE surgical incidence and AE incidence in Armenia per 100 000 population, 2008-2022

The average annual mortality rate is 0.07 per 100 000 population, and the fatality rate was 1.29 per 100 patients. People aged 70 to 79 had the highest mortality. Mortality was also recorded in non-operated children [6]. CE is

common among ruminants. Almost the whole territory of Armenia is affected, however, the proportion of livestock species and infection rates vary by geographical areas. The most common mode for parasite's circulation is the feeding of shepherd dogs with infected offal [5]. The Molecular Parasitology research group of the Scientific Center for Zoology and Hydroecology NAS RA investigated the epidemiological status of *Echinococcus spp.* in free-ranging dogs and wild animals in target regions of Armenia. The following parasite species were identified based on the results of egg DNA sequencing: in dogs, *Echinococcus multilocularis*; in lynx, *Echinococcus canadensis* [8].

The objective of this study was to assess *Echinococcosis spp*. surveillance system through SWOT (Strengths (S), Weaknesses (W), Opportunities (O), Threats (T)) analysis method in order to gain a better understanding of the current situation in Armenia and to improve operational efficiency, as well as to plan the future strategy.

Material and Methods

A SWOT analysis is an essential component of situational analysis and can help in decision-making by identifying internal (strengths and weaknesses) and external (opportunities and threats) components that may have an effect (help or hinder) on the policy [13]. Healthcare professionals can utilize SWOT analysis technique as strategic planning tool in any area of health care. We assessed the structure of control operations, staff, legal formulation, capacities, and financial resources.

Results and Discussion

The analysis is divided into the four categories:

Strengths

- National electronic registry of CE surgery cases
- Capability of CE laboratory diagnostic at the national level
- Qualified parasitologists in NCDC Armenia
- Resolution N° 51-N of the Minister of Health of the Republic of Armenia dated 10 November 2017 on the approval of sanitary-epidemiological regulations and standards for the epidemiological control of helminthiasis
- Resolution of the RA Government N 426-N dated 31 March 2004 on Implementation of veterinary and sanitary examination prior to the sale meat and animal slaughter products.

Weaknesses

- Lack of reports from private laboratories and hospitals

- Absence of laboratory testing for echinococcosis in regions
- No diagnostic tests for AE
- Absence of control and eradication programs
- Lack of research projects
- Low level of public awareness
- No information about patients with conservative treatment
- Outdated healthcare facilities and technology in regions
- Cyst staging is not performed
- Insufficient inter-sectoral collaboration and information exchange between public health and animal sectors at the national level
- Absence of wildlife disease surveillance

Opportunities

- Awareness campaigns and hygiene education among people at high risk
- Develop a national strategic plan or program
- Echinococcosis-specific legal regulations
- Strengthen regional laboratory diagnostic system
- Collaboration with private laboratories and hospitals
- Information sharing and collaboration with veterinary service
- Joint trainings, regular meetings between all relevant stakeholders (human and animal sectors)
- Introduce affordable and accessible treatment
- Raise academic interest in the parasitic diseases
- Need for international cooperation and financial resources

Threats

- Lack of screening programs
- Low governmental support
- Unavailability of scientific studies
- Inadequate continuous control program over animals
- Exclusion of patients receiving conservative treatment and readmissions from the epidemiological surveillance system
- Lack of motivation among the young generation due to relatively low promotion
- Lack of a skill development programs
- Lack of information on wildlife
- Insufficient human, financial and material resources

Two forms of human echinococcosis, CE and AE, are endemic and neglected by health authorities in Armenia. It is critical to highlight the relevance of local political commitment and resource allocation in the establishment of an inter-ministerial control committee and national strategic program [11].

Since the mid-1980s, several preventative and control programs have been conducted in Spain to reduce *E. granulosus* infection. It has been shown that control campaigns centered on health education, active mass screening for human echinococcosis, a change in risk behaviors, parasite biomass reduction in the definitive hosts: surveillance for canine echinococcosis and echinococcosis in livestock, are an essential components of precise echinococcosis control and to reduce the number of human cases [2, 4, 7, 9, 10]. Human behavior is strongly linked to human cultural and economic origins [9]. According to the Ministry of Economy of the Republic of Armenia, animal breeding is one of the leading branches of the agricultural sector. Animal breeding has contributed over 40% of the country's agricultural gross product in recent years. In highly endemic areas, it is recommended to implement ultrasound, population-based surveys for the active search [2, 3]. An in-depth investigation of the epidemiology of echinococcosis in humans and animals can be useful in developing a cost-effective control program [2]. "One Health" approach in the national strategic program is crucial for disease prevention and control measures.

Health education can play a vital role in reducing the echinococcosis transmission. Raising awareness among healthcare workers (HCWs) to include AE in the differential diagnosis of liver lesions, since a majority of them were convinced there is no AE in Armenia. In addition, confirmation of AE cases in Armenia points out the need for an AE surveillance system. Adoption of CE and AE case definition, development of national guidelines for the compulsory notification and prospective registry with reliable information should be a priority [8, 10]. For CE diagnosis, the use of the WHO's international ultrasonography classification of stage-specific cystic images and genotype features is advised [2].

Unfortunately, there is no information about the prevalence rate among the definitive host (dog) in Armenia. Dog deworming can be done three or four times a year at private veterinary clinics, depending on the recommendation of the veterinarian or the animal owners' requests.

Accepted 05.12.23

Оценка системы надзора по эхинококкозу с помощью SWOT-анализа в Армении

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Всемирная организация здравоохранения включила эхинококкоз человека в число забытых тропических болезней. Два наиболее распространенных клинических типа эхинококкоза – кистозный эхинококкоз и альвеолярный эхинококкоз, являются тяжелым бременем на здоровье и финансовом положении, особенно в странах с низким уровнем дохода. Целью данного исследования была оценка системы наблюдения по эхинококкозу с помощью SWOT-анализа (сильные стороны – S, слабые стороны – W, возможности – O, угрозы – T), чтобы лучше

понять текущую ситуацию в Армении и повысить эффективность работы, а также спланировать будущую стратегию. Внедрение концепции «Единое здоровье» в национальную программу имеет решающее значение для мер по профилактике и борьбе с болезнями. Приоритет следует отдать информированию общественности и образовательным инициативам среди медработников и уязвимых групп населения.

Հայաստանում SWOT վերլուծության միջոցով էխինակոկոզային հիվանդության համաճարակաբանական համակարգի գնահատում

Ա. Հ. Մանուկյան

Առողջապահության համաշխարհային կազմակերպությունը մարդու էխինակոկոզը դասել է անտեսված արևադարձային հիվանդությունների շարքում: Էխինակոկոզի երկու ամենատարածված կլինիկական տեսակները՝ բշտային էխինակոկոզը և ալվեոլյար էխինակոկոզը, ստեղծում են զգալի առողջապահական և ֆինանսական բեռ, հատկապես ցածր եկամուտ ունեցող երկրներում: Այս հետազոտության նպատակն է՝ SWOT (ուժեղ կողմեր՝ S, թույլ կողմեր՝ W, հնարավորություններ՝ O, սպառնալիքներ՝ T) վերլուծության միջոցով գնահատել էխինակոկոզային հիվանդության համաճարակաբանական համակարգը՝ Հայաստանում ներկա իրավիճակն ավելի լավ պատկերացնելու, ինչպես նաև ապագա ռազմավարությունը ծրագրելու համար: «Մեկ առողջություն» մոտեցումը կարևոր նշանակություն ունի ազգային ծրագրում՝ հիվանդության կանխարգելման և վերահսկման միջոցառումների համար: Առաջնահերթությունը պետք է տրվի բուժաշխատողների և խոցելի խմբերի շրջանում հանրային իրազեկման և կրթական նախաձեռնություններին:

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