

Policy Brief:

## Policy Options for Reducing *Toxocara* spp. Contamination in Iran: One Health Approach

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### Abstract

**Background and Objective:** Environmental contamination with *Toxocara* spp. eggs represents an important yet neglected public health concern due to its role in the transmission of human toxocariasis. Children are particularly vulnerable because of frequent exposure to contaminated soil in public spaces. This policy brief was developed to provide evidence-informed policy recommendations for reducing *Toxocara* spp. soil contamination and human exposure in Iran through a One Health approach.

**Material and Methods:** This policy brief was developed based on evidence generated from a previously conducted systematic review and meta-analysis entitled “An Updated Systematic Review and Meta-analysis of the Prevalence of *Toxocara* spp. Eggs in the Soil of Public Areas in Iran,” approved by the Ethics Committee of Shahid Beheshti University of Medical Sciences. Epidemiological findings were synthesized and translated into policy recommendations using a One Health framework integrating human, animal, and environmental health perspectives.

**Results and Conclusion:** The pooled prevalence of *Toxocara* spp. soil contamination in Iran was estimated at 16% (95% CI: 12–21%), indicating persistent environmental exposure risk. No significant reduction in contamination was observed over the past two decades. Current evidence supports four complementary policy pillars: environmental surveillance, animal reservoir management, public education, and intersectoral One Health governance. Policymakers should prioritize the establishment of coordinated One Health programs, routine environmental monitoring, management of animal reservoirs, and community-based educational interventions to reduce environmental contamination and protect vulnerable populations.

**Keywords:** *Toxocara* spp.; Soil contamination; Toxocariasis; One Health; Public health policy; Environmental surveillance; Iran

## 1. Introduction and statement of the problem

Toxocariasis is one of the most common zoonotic helminth infections worldwide and remains an important yet frequently neglected public health concern, particularly in low- and middle-income countries [1, 2]. Human infection occurs primarily through accidental ingestion of embryonated eggs of *Toxocara canis* and *Toxocara cati* from contaminated environments. Public parks, playgrounds, schoolyards, and other recreational areas represent major sources of exposure, especially for children, who are more likely to come into direct contact with contaminated soil

through outdoor activities and hand-to-mouth behaviors. Clinical manifestations range from asymptomatic infection to visceral, ocular, and neurological larva migrans, with ocular toxocariasis potentially resulting in permanent visual impairment [1-4].

Environmental contamination of soil with *Toxocara* eggs is recognized as a key indicator of transmission risk within communities. Unlike many infectious diseases that can be monitored through clinical surveillance systems, human toxocariasis is frequently underdiagnosed due to its



nonspecific clinical presentation and limited routine diagnostic testing. Consequently, environmental surveillance provides an important proxy measure for assessing population exposure and identifying areas requiring preventive interventions [1, 2, 4].

Evidence from a recent systematic review and meta-analysis indicates that soil contamination with *Toxocara* spp. eggs remains widespread across Iran. The pooled prevalence of contamination in public areas was estimated at 16% (95% CI: 12–21%), indicating that approximately one in every six soil samples collected from public environments contains *Toxocara* eggs [1, 2]. Furthermore, temporal analyses demonstrated no statistically significant reduction in contamination levels over the past two decades, suggesting that existing preventive measures have been insufficient to achieve meaningful control. Geographic variation was also observed, with several central and arid provinces reporting higher contamination rates than southern regions.

The persistence of environmental contamination reflects a broader One Health challenge involving interactions among animal reservoirs, environmental conditions, and human exposure. Iran continues to face substantial populations of free-roaming dogs and cats, while coordinated national programs for routine deworming, population management, and environmental monitoring remain limited. In addition, public awareness regarding zoonotic soil-transmitted infections is generally low, further increasing the risk of exposure among vulnerable populations [3, 5].

Given the sustained burden of environmental contamination and the absence of coordinated control strategies, there is an urgent need for evidence-informed policies that integrate human, animal, and environmental health perspectives. This policy brief examines available policy options for reducing *Toxocara* spp. soil contamination in Iran and provides recommendations to support the implementation of a One Health approach aimed at minimizing environmental transmission and protecting public health.

## 2. Methods

This policy brief was developed based on evidence generated from a previously published systematic review and meta-analysis entitled “An Updated Systematic Review and Meta-analysis of the Prevalence of *Toxocara* spp. Eggs in the Soil of Public Areas in Iran” (Maleki et al., 2025). The parent study was conducted under the approval of the Ethics Committee of Shahid Beheshti University of Medical Sciences (Ethics Code: IR.SBMU.SRC.REF.1404.006). Evidence regarding the prevalence, temporal trends, and geographical distribution of *Toxocara* spp. soil contamin-

ation in Iran was synthesized and interpreted within a One Health framework. Based on the identified evidence and public health priorities, policy options and recommendations were formulated to support decision-making for reducing environmental contamination and human exposure in Iran.

## 3. Results

Evidence synthesized from the available literature demonstrates that environmental contamination with *Toxocara* spp. eggs remains widespread and persistent across public areas in Iran. The pooled prevalence of soil contamination was estimated at 16%, indicating that a considerable proportion of parks, playgrounds, and recreational environments continue to function as reservoirs of zoonotic transmission. Despite increasing awareness of parasitic zoonoses, temporal analyses revealed no statistically significant reduction in contamination levels over the past two decades, suggesting that existing control measures have had limited impact on interrupting environmental transmission [1, 2].

The observed contamination pattern reflects the complex interaction between animal reservoirs, environmental conditions, and human exposure. Free-roaming dogs and cats represent the primary source of environmental egg dissemination, while favorable climatic conditions may facilitate egg survival and prolong infectivity in soil. Geographic heterogeneity identified across provinces further suggests that local ecological characteristics, urbanization patterns, and stray animal densities may influence contamination dynamics. These findings indicate that environmental contamination is not solely a veterinary issue but rather a multifactorial public health challenge requiring coordinated intervention.

Current evidence also highlights important deficiencies in surveillance and prevention systems. Environmental monitoring remains fragmented and geographically limited, while no standardized national framework exists for routine assessment of soil contamination. Furthermore, public awareness regarding zoonotic soil-transmitted infections appears insufficient, particularly among populations with frequent exposure to contaminated environments. Together, these factors contribute to the continued circulation of *Toxocara* eggs in public spaces and sustain the risk of human infection.

From a policy perspective, the findings support the adoption of an integrated One Health strategy that simultaneously targets animal reservoirs, environmental contamination, and human behavioral risk factors. Strengthening surveillance systems, expanding deworming programs, improving management of stray animal populations, and implementing educational interventions



may collectively reduce environmental contamination and human exposure. The persistence of contamination despite decades of documented evidence underscores the need to transition from isolated control activities toward coordinated, evidence-informed national policies..

## 4. Health Policy Framework

The persistence of *Toxocara* spp. contamination in public soils across Iran highlights the need for a coordinated and evidence-informed policy response. Reducing environmental transmission requires interventions that simultaneously address animal reservoirs, environmental contamination, human behavior, and intersectoral governance. Based on the available evidence, a comprehensive One Health strategy should be implemented through four complementary policy priorities.

### 4.1. National Environmental Surveillance and Monitoring

Effective control of environmental toxocarasis requires the establishment of a standardized national surveillance system for monitoring soil contamination. Routine environmental sampling of parks, playgrounds, schoolyards, and other public spaces should be integrated into existing public health monitoring programs. Geographic Information System (GIS)-based mapping of contamination hotspots would enable policymakers to identify high-risk areas, prioritize resource allocation, and evaluate the effectiveness of implemented interventions. Standardized surveillance protocols would also improve comparability of data across provinces and support evidence-based decision-making at both local and national levels.

### 4.2. Integrated Management of Animal Reservoirs

Dogs and cats represent the principal sources of environmental contamination through the shedding of *Toxocara* eggs. Therefore, national and municipal authorities should strengthen programs aimed at routine deworming of owned pets and humane management of free-roaming animal populations. Integrated approaches combining deworming, vaccination, registration of companion animals, and trap-neuter-return (TNR) strategies may substantially reduce environmental egg dissemination while maintaining animal welfare standards. Strengthening collaboration between veterinary services and municipalities is essential for the long-term sustainability of these interventions.

### 4.3. Public Education and Community Engagement

Behavioral interventions constitute a critical component of toxocarasis prevention. Policymakers should promote nationwide educational initiatives targeting parents, schoolchildren, pet owners, and municipal workers regarding transmission pathways and preventive practices.

Public awareness campaigns should emphasize hand hygiene, responsible pet ownership, safe disposal of animal feces, and the potential health risks associated with contaminated soils. Integrating zoonotic disease education into school health programs may provide a sustainable mechanism for reducing exposure among children, who represent the population at greatest risk.

### 4.4. One Health Governance and Intersectoral Coordination

The complex transmission cycle of *Toxocara* spp. requires coordinated action across the human health, veterinary, environmental, and municipal sectors. Policymakers should establish formal One Health coordination mechanisms at national and provincial levels to facilitate information sharing, joint planning, and integrated implementation of control measures. The development of national guidelines, interagency agreements, and shared monitoring indicators would strengthen accountability and ensure that interventions are implemented consistently across regions.

Collectively, these policy recommendations provide a practical roadmap for reducing environmental contamination and minimizing the public health burden of toxocarasis in Iran. Successful implementation will require sustained political commitment, intersectoral collaboration, and continued investment in evidence-based prevention strategies within a comprehensive One Health framework. Particular attention should be directed toward high-risk public spaces, vulnerable populations, and provinces with elevated levels of environmental contamination. Through coordinated national action, Iran can substantially reduce human exposure to *Toxocara* spp. and strengthen the prevention of zoonotic soil-transmitted infections.

## 5. Declarations

### 5.1. Acknowledgement

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### 5.2. Conflict of Interest

All authors declare no conflict of interest.

### 5.3. Using chatbots

No chatbot or generative AI tool was used in the preparation of this manuscript.

### 5.4. Authors' Contributions

Bahman maleki, and Nahid Haghshenas: Conceptualisation, Methodology, Original Draft Writing, and Preparation.

Mostafa Rezaei-Tavirani: Data Curation, Reviewing, and Editing.



Bahman Maleki, Mostafa Rezaei-Tavirani, Negin Rezaei-Savadkouhi<sup>4</sup>, and Nahid Zerafati-Shoae: Reviewing, and Editing

Bahman Maleki: Supervision, Funding Acquisition, Validation, Project Administration, and Data Curation.

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خلاصه سیاستی:

## گزینه‌های سیاستگذاری برای کاهش آلودگی به *Toxocara spp.* در ایران: رویکرد سلامت واحد

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### چکیده

**سابقه و هدف:** آلودگی محیط به کیست‌های جنس توکسوکارا یکی از مشکلات مهم اما کمتر مورد توجه سلامت عمومی است که نقش مهمی در انتقال توکسوکاریازیس انسانی دارد. کودکان به دلیل تماس مکرر با خاک در فضاهای عمومی، در معرض خطر بیشتری قرار دارند. این خلاصه سیاستی با هدف ارائه پیشنهادهای سیاستی مبتنی بر شواهد برای کاهش آلودگی خاک به جنس توکسوکارا و کاهش مواجهه انسانی در ایران با استفاده از رویکرد «سلامت واحد» تدوین شد.

**مواد و روش‌ها:** این خلاصه سیاستی بر پایه شواهد حاصل از یک مطالعه مرور نظام‌مند و متاآنالیز با عنوان «مرور نظام‌مند و متاآنالیز به‌روز شده شیوع کیست‌های جنس توکسوکارا در خاک اماکن عمومی ایران» تهیه شد که به تأیید کمیته اخلاق دانشگاه علوم پزشکی شهید بهشتی رسیده است. یافته‌های اپیدمیولوژیک استخراج و با بهره‌گیری از چارچوب سلامت واحد شامل ابعاد سلامت انسان، سلامت حیوانات و سلامت محیط زیست، به توصیه‌های سیاستی تبدیل شدند.

**یافته‌ها و نتیجه‌گیری:** شیوع تجمعی آلودگی خاک به جنس توکسوکارا در ایران ۱۶ درصد (محدوده اطمینان ۹۵ درصد: ۱۲ تا ۲۱ درصد) برآورد شد که نشان‌دهنده تداوم خطر مواجهه محیطی است. همچنین طی دو دهه گذشته کاهش معنی‌داری در میزان آلودگی مشاهده نشد. شواهد موجود از چهار رکن مکمل سیاستی شامل پایش محیطی، مدیریت مخازن حیوانی، آموزش عمومی و حکمرانی بین‌بخشی مبتنی بر رویکرد سلامت واحد حمایت می‌کنند. سیاستگذاران باید ایجاد برنامه‌های هماهنگ مبتنی بر رویکرد سلامت واحد، استقرار نظام پایش منظم آلودگی‌های محیطی، مدیریت مخازن حیوانی و اجرای مداخلات آموزشی جامعه‌محور را در اولویت قرار دهند تا آلودگی محیطی و مواجهه انسانی کاهش یابد. اجرای راهبردهای ملی هماهنگ در این حوزه‌ها می‌تواند به طور قابل توجهی آلودگی محیطی و خطر مواجهه انسانی را کاهش دهد. این اقدامات نقش مهمی در تقویت برنامه‌های پیشگیری و حفاظت از گروه‌های آسیب‌پذیر، به‌ویژه کودکان، خواهد داشت.

**واژگان کلیدی:** توکسوکارا؛ آلودگی خاک؛ توکسوکاریازیس؛ سلامت واحد؛ سیاستگذاری سلامت؛ پایش محیطی؛ ایران