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ORIGINAL ARTICLE

Physicians' Knowledge and Attitudes Toward Strongyloidiasis: A Preliminary Study at a Malaysian Tertiary Hospital

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ABSTRAK

Strongyloidiasis, merupakan penyakit tropika terabai yang menjadi sasaran dalam Peta Jalan Pertubuhan Kesihatan Sedunia (WHO) 2021-2030 bagi pencegahan dan kawalan, yang membawa risiko kesihatan yang ketara terutamanya kepada individu yang mengalami imunokompromi. Strongyloidiasis masih kurang dikenali dalam banyak sistem penjagaan kesihatan walaupun mempunyai kepentingan klinikal. Kesedaran dan pengetahuan dalam kalangan pengamal perubatan amat penting bagi memastikan diagnosis yang tepat pada masanya serta pengurusan yang berkesan. Kajian ini bertujuan untuk menilai tahap pengetahuan dalam kalangan pengamal perubatan mengenai strongyloidiasis serta mengenal pasti faktor-faktor utama yang mempengaruhi tahap kesedaran dan kesiapsiagaan klinikal mereka. Satu kajian keratan rentas yang melibatkan 70 orang pengamal perubatan di Hospital Canselor Tuanku Muhriz, Kuala Lumpur, Malaysia telah dijalankan menggunakan soal selidik yang telah disahkan untuk menilai latar belakang sosiodemografi, tahap pendedahan dan pengetahuan berkaitan jangkitan Strongyloides. Skor pengetahuan dikategorikan berdasarkan taksonomi Bloom dan dianalisis menggunakan 'Statistical Package for the Social Sciences'. Walaupun penyakit ini jarang berlaku, 41% daripada pengamal perubatan menunjukkan tahap pengetahuan yang mencukupi. Kebiasaan (50%), pengalaman merawat pesakit imunokompromi (45%), dan latihan berkaitan penyakit tropika (56%) menunjukkan korelasi dengan tahap pengetahuan yang lebih tinggi, namun tidak signifikan secara statistik ($p > 0.05$). Pengalaman klinikal (38%) mahupun kelayakan lanjutan (40%) tidak memberikan kelebihan yang ketara. Penemuan awal ini mencadangkan kemungkinan wujud jurang dalam pengetahuan dalam kalangan doktor, namun ketiadaan signifikan statistik dan saiz sampel yang kecil memerlukan tafsiran yang berhati-hati.
Kata kunci: *Imunokompromi; penilaian pengetahuan; pegawai perubatan; strongyloidiasis; Strongyloides stercoralis*

ABSTRACT

Strongyloidiasis, a neglected tropical disease targeted in the World Health Organisation (WHO) Roadmap 2021-2030 for prevention and control, poses significant health risks particularly to immunocompromised individuals. Despite its clinical significance, strongyloidiasis remains under-recognised in many healthcare settings. Physician awareness and knowledge are critical for timely diagnosis and effective

management. This study aimed to assess the level of knowledge among physicians regarding strongyloidiasis and to identify key factors influencing their awareness and clinical preparedness. A cross-sectional study involving 70 physicians at Hospital Canselor Tuanku Muhriz, Kuala Lumpur, Malaysia was conducted using a validated questionnaire to assess sociodemographics, familiarity and knowledge of *Strongyloides* infection. Knowledge scores were categorised using Bloom's taxonomy and analysed via Statistical Package for the Social Sciences. Despite its rarity, 41% of physicians exhibited adequate knowledge. Familiarity (50%), treating immunocompromised patients (45%) and tropical disease training (56%) correlated with higher knowledge, though not statistically significant ($p > 0.05$). Neither clinical experience (38%) nor advanced qualifications (40%) conferred a notable advantage. These preliminary findings suggest potential gaps in physician knowledge, though the lack of statistical significance and small sample size warrant cautious interpretation.

Keywords: Immunocompromised; knowledge assessment; physicians; strongyloidiasis; *Strongyloides stercoralis*

INTRODUCTION

Strongyloidiasis is a neglected tropical disease caused by the nematode *Strongyloides stercoralis*, with global infection rates estimated to exceed 600 million individuals (Uslu et al. 2025; WHO 2024). Malaysia is one of the Southeast Asian countries where this parasite is endemic, posing a significant public health challenge (Mohammad et al. 2024). Recognising its global burden, the World Health Organisation (WHO) has recently included *S. stercoralis* in its list of soil-transmitted helminths (STHs) targeted for intensified control efforts under the 2021-2030 strategic framework (WHO 2023).

Unlike other helminth parasites, *S. stercoralis* has a unique ability to autoinfect, enabling it to cause persistent and prolonged infections (Alam et al. 2024). The life cycle of *S. stercoralis* is unique among helminths, involving both free-living and parasitic cycles. Infection begins when filariform larvae penetrate the skin, typically from contact with contaminated soil. They migrate via the bloodstream to the lungs, ascend the respiratory tract, are swallowed and mature into adult females in the small intestine. These females reproduce through parthenogenesis, releasing eggs that hatch into rhabditiform larvae which are excreted or develop into filariform larvae within the host, leading to autoinfection. This autoinfection cycle enables chronic infection and can cause hyperinfection or disseminated disease in immunocompromised individuals (Centers for Disease Control and Prevention, n.d.; Gordon et al. 2024; Page et al. 2018). Despite recommendations for screening *Strongyloides stercoralis* in high-risk groups, actual practice often falls short. De l'Étoile-Morel et al. (2022) highlighted awareness gaps among physicians, while Australian sources similarly report low adherence to screening guidelines for migrants and immunosuppressed patients (Muhi et al. 2022; Page & Speare 2016). Agbata et al. (2018) further reinforces the need for systematic screening approaches in migrant health protocols.

The combination of nonspecific symptoms and the diagnostic challenges posed by the intermittent excretion of *Strongyloides* larvae significantly complicated its detection. However, an equally critical factor contributing to the underdiagnosis of strongyloidiasis in immunocompromised patients is the limited awareness among physicians regarding its clinical relevance, especially outside endemic settings. Studies have shown that despite the existence of screening recommendations in some countries, implementation is inconsistent due to knowledge gaps and competing clinical demands (Muhi et al. 2022). This knowledge gap often led to missed opportunities for early detection, particularly in high-risk groups requiring immunosuppressive therapy. Notably, a study from Canada further highlighted this issue by

demonstrating that limited physician knowledge of *Strongyloides* was directly associated with low rates of screening in high-risk populations (Del 'Étoile-Morel et al. 2022). In Malaysia, the absence of standardised national guidelines or screening protocols for *Strongyloides* infection further contributes to diagnostic challenges, leaving many immunocompromised patients undiagnosed and untreated (Zainol et al. 2024). This is especially concerning as those undergoing immunosuppressive therapy are at high risk of severe and potentially life-threatening complications. To date, the increasing recognition of strongyloidiasis cases worldwide, especially in Asia, underscores the importance of conducting studies to assess and improve physicians' awareness and understanding of this re-emerging infection (Chan et al. 2023). Given these challenges, the study aimed to assess the level of knowledge on *Strongyloides* and its influencing factors, with a particular focus on physicians' training, clinical practice and exposure to relevant updated guidelines.

MATERIALS AND METHODS

Study Design and Population

This research utilised a cross-sectional study design to evaluate physicians' knowledge of strongyloidiasis management. This design was selected to provide a snapshot of the current understanding among doctors, specifically focusing on their clinical practice knowledge and awareness of screening and treatment approaches for this parasitic infection. The study population comprised 70 physicians from the Medical Department, Hospital Canselor Tuanku Muhriz (HCTM), Kuala Lumpur, Malaysia, who were actively involved in the management of chronic and immunocompromised patients. HCTM was chosen as the study site given a recent report of *Strongyloides stercoralis* seroprevalence of 10.5% among its immunocompromised patients, underscoring the hospital's relevance for assessing physician awareness in a high-risk setting (Osman et al. 2022). These physicians were deemed a critical group for evaluating awareness and strategies related to strongyloidiasis, given their direct role in patient care. By targeting this population, the study aimed to gain valuable insights into the level of understanding and preparedness in managing a tropical parasitic infection like strongyloidiasis, which posed significant risks to vulnerable patients. The findings contributed to identifying gaps in knowledge and guiding future interventions to improve clinical management and patient outcomes.

Sampling Method

A multistage universal sampling technique was employed in this study to ensure comprehensive coverage of the target population. All eligible physicians who met the inclusion criteria were invited to participate. The sample unit for this study comprised physicians who met four specific inclusion criteria. First, the study targeted physicians from the Internal Medicine Department, as they were more likely to encounter and manage strongyloidiasis cases. The study included both house officers and senior physicians, capturing a diverse range of experience levels. This approach was critical to identifying potential variations in knowledge and exposure to strongyloidiasis across different career stages. Lastly, only respondents who fully completed the survey were included in the analysis.

A universal sampling method was employed, and the estimated sample size was informed by a 4% unawareness rate reported in a recent cross-sectional survey on *Strongyloides* awareness among Canadian physicians (De l'Étoile-Morel et al., 2022). However, the present study involved only Malaysian physicians working at HCTM, Kuala Lumpur, Malaysia. Since the outcome of interest was categorical (i.e., adequate vs. inadequate knowledge), the sample size was estimated using the Arifin WN Sample Size Calculator (Arifin n.d.). Given the exploratory nature of this study and the constraints of a single-center physician population, formal

power calculations with defined effect sizes and thresholds were not employed. Ethical approval for the study was obtained from the Ethics Committee of Universiti Kebangsaan Malaysia, ensuring adherence to ethical standards and the protection of participants' rights.

Survey Design

An online survey was conducted using a structured questionnaire hosted on Google Forms. The questionnaire was validated in two steps: content validity and face validity. For content validity, three parasitology experts pretested the questionnaire, resulting in a content validity index (CVI) of 1, indicating strong agreement. For face validity, five medical doctors evaluated the questionnaire's clarity and structure, with three doctors showing perfect agreement (Fleiss Kappa Index = 1.00), confirming its relevance and alignment with the intended topics. The questionnaire began with a participant information sheet, followed by a consent agreement for participation. It consisted of three sections, demographic data, factors influencing knowledge scores and knowledge of *Strongyloides*, including aspects of the disease, diagnosis and treatment. The demographic section collected information such as age, job category, job grade, professional qualifications and duration of practice. The knowledge section contained 15 questions designed to evaluate the physician's knowledge of *Strongyloides*, specifically in relation to symptoms, diagnosis and treatment. Responses were recorded as "Yes", "No", or "Not Sure", with correct answers scored as 1 point, and incorrect answers or "Not Sure" responses scored as 0. The total knowledge score, ranging from 0 to 15, was calculated by summing the points for each correct answer. Based on Bloom's cutoff points, total knowledge scores were categorised into two levels: adequate knowledge level (score ≥ 9) and inadequate knowledge level (score < 9) (Table 1). Previous studies had applied Bloom's taxonomy as a standard method for categorising and assessing physicians' knowledge, particularly in medical fields such as parasitology, which supported the use of this scoring approach in our study (Wang et al. 2022; Wahidiyat et al. 2021). This approach ensured a systematic assessment of physicians' knowledge and provided valuable data for addressing gaps in awareness.

Independent Variables

We considered the following variables as independent: gender (male, female); age; undergraduate university (public, private); years since graduation from medical school; medical position (general practitioner, resident or specialist); postgraduate degree (doctorate, master's or none); and experience in taking care of immunocompromised patients.

Dependent Variable: Knowledge of Strongyloidiasis

Based on the knowledge questions, the minimum score was 0 and the maximum was 15 points; the higher the score, the greater the knowledge. To evaluate the factors associated with higher knowledge, we dichotomised the variable according to whether the score was above the 60th percentile (adequate knowledge) or below or equal to the 60th percentile (inadequate knowledge).

Ethical Aspects

The present study was approved by the institutional Ethics Committee of the Universiti Kebangsaan Malaysia (Approval code: JEP-2024-073). At the beginning of the survey, informed consent was requested from each participant, the survey was anonymous, and the data obtained were confidential.

Statistical Analysis

Statistical Package for the Social Sciences (SPSS) (Version 27.0, IBM Corp. Armonk, NY, USA) was used for statistical analysis. Descriptive analysis was conducted where appropriate. The study

TABLE 1: Characteristic of the participants (n = 70)

Characteristic	n = 70
Age, mean (SD)	34.5 (5.2)
Duration of Practice, mean (SD)	8.4 (4.9)
Medical Position	
Consultant	8 (11%)
Specialist	10 (14%)
Registrar	6 (9%)
Medical Officer	45 (64%)
House Officer	1 (1%)
Undergraduate University	
Public Local University	29 (41%)
Private Local University	15 (21%)
Overseas University	26 (37%)
Level of Academic achievement	
PhD/post-doc/subspeciality	1 (1%)
Master's	24 (34%)
MBBS/MD	45 (64%)
Factor 1: Familiarity with strongyloidiasis	
No	40 (57%)
Yes	30 (43%)
Factor 2: Experience treating individuals with Strongyloides infection	
No	62 (89%)
Yes	8 (11%)
Factor 3: Experience treating immunocompromised patients	
No	15 (21%)
Yes	55 (79%)
Factor 4: Undergone training related to tropical/parasitic disease	
No	52 (74%)
Yes	18 (26%)
Knowledge assessment	
Knowledge score, mean (SD)	8.0 (2.7)
Knowledge level	
< 9	41 (59%)
≥ 9	29 (41%)

MBBS: Bachelor of Medicine, Bachelor of Surgery; MD: Doctor of Medicine; SD: Standard deviation; PhD: Doctor of Philosophy

also employed the Chi-square test to assess the association between factors and knowledge levels. The crude prevalence ration (cPR) and 95% confidence intervals (CI) were calculated. The cPR represented the ratio of the prevalence of adequate knowledge (score ≥ 9) among exposed groups compared to unexposed groups. Statistical significance was set at a p-value of less than 0.05.

RESULT

Table 1 summarised the demographic and professional characteristics of the participating physicians, including their familiarity with strongyloidiasis, clinical experience and knowledge assessment. The majority were medical officers, while the remaining participants comprised specialists, consultants, registrars and house officers. The cohort represented a diverse educational background, with degrees obtained

from both local and international institutions. Bachelor of Medicine, Bachelor of Surgery (MBBS) or Doctor of Medicine (MD), while a smaller proportion possessed postgraduate qualifications, including master's and doctoral degrees. The mean knowledge score was 8.0 (SD: 2.7). Based on the predefined threshold, 59% of physicians demonstrated inadequate knowledge (score < 9), whereas 41% exhibited adequate knowledge (score ≥ 9).

To further explore the factors influencing these knowledge levels, Table 2 compared the characteristics of physicians with adequate knowledge (score ≥ 9) to those with inadequate knowledge (score < 9). While no statistically significant differences were observed, several trends emerged. For instance, physicians with familiarity in strongyloidiasis were more likely to demonstrate adequate knowledge (50% vs. 35%), which suggested that prior exposure may facilitate an enhanced understanding of the condition. However, the lack of statistical significance (p = 0.207) indicated that familiarity alone did not serve as a robust predictor of knowledge. Similarly, experience in managing immunocompromised patients exhibited a positive trend towards better knowledge (45% vs. 27%, p = 0.19), a finding consistent with the understanding that individuals in this demographic were at a heightened risk for strongyloidiasis. Nevertheless, experience with treating *Strongyloides* infection itself did not show a significant association with knowledge levels (38% vs. 42%, p = 0.811), potentially due to the small sample size (n = 8) of physicians with such experience. Training in tropical and parasitic diseases also revealed a favourable trend, with trained physicians more likely to exhibit adequate knowledge (56% vs. 37%, p = 0.158), although this did not achieve statistical significance. Surprisingly, academic qualifications had little to no influence on the knowledge levels regarding *Strongyloides* infection (40% vs. 42%, p = 0.856), suggesting that advanced academic achievement did not necessarily correlate with enhanced clinical knowledge in this specific area.

Table 3 highlighted significant gaps in

TABLE 2: Comparison of characteristic between those physicians with adequate knowledge (≥ 9) and those with inadequate knowledge (< 9) of Strongyloides infection

Characteristic	< 9, n = 41 n (%)	≥ 9, n = 29 n (%)	cPR [95% CI] *	p-value
Factor 1: Familiarity with strongyloidiasis				
No	26 (65%)	14 (35%)	Ref	0.207
Yes	15 (50%)	15 (50%)	1.86 [0.70 to 4.88]	
Factor 2: Experience treating individuals with Strongyloides infection				
No	36 (58%)	26 (42%)	Ref.	0.811
Yes	5 (63%)	3 (38%)	0.83 [0.18 to 3.79]	
Factor 3: Experience treating immunocompromised patients				
No	11 (73%)	4 (27%)	Ref.	0.19
Yes	30 (55%)	25 (45%)	2.29 [0.65 to 8.09]	
Factor 4: Undergone training related to tropical/parasitic disease				
No	33 (63%)	19 (37%)	Ref.	0.158
Yes	8 (44%)	10 (56%)	2.17 [0.73 to 6.44]	
Factor 5: Level of Academic achievement				
High	15 (60%)	10 (40%)	Ref.	0.856
Low	26 (45%)	19 (42%)	1.10 [0.40 to 2.97]	

TABLE 3: Proportion of correct answers by question, n = 70

Questions: Correct Answer	n	%
Transmission of Strongyloides stercoralis is via respiratory droplets: False	74%	52
Strongyloidiasis is a chronic infection that can remain asymptomatic for decades: True	71%	50
Strongyloides stercoralis infection often leads to 'autoinfection' : True	49%	34
Strongyloides stercoralis has the tendency to cause 'hyperinfection' : True	61%	43
Patients on corticosteroids have a higher risk of developing severe strongyloidiasis: True	81%	57
Acute infection is generally characterized by gastrointestinal and pulmonary symptoms: True	84%	59
Severe strongyloidiasis (e.g. chronic intestinal disease, disseminated disease) may have an abrupt onset of symptoms: True	76%	53
Migration of the Strongyloides larvae through the lungs causes pneumonitis that resembles Loeffler's syndrome: True	74%	52
Larva currens (racing larvae) is the pathognomonic sign of Strongyloides stercoralis infection: True	44%	31
Eggs/ova of Strongyloides can be found in the sputum sample of a severely infected patient: True	4%	3
Albendazole is commonly used in patients with Strongyloides stercoralis infection: True	73%	51
Ivermectin has been shown to be more effective than Albendazole for the treatment of strongyloidiasis: True	51%	36
Thiabendazole is an alternative therapeutic option for strongyloidiasis: True	37%	26
For patients who are unable to tolerate or absorb oral treatment for strongyloidiasis, rectal or subcutaneous administration may provide an effective alternative: False	1%	1
In patients with severe Strongyloides infection, a combination of more than one anti-parasitic drug can be used for effective treatment: False	1%	1

knowledge that require urgent attention. While participants demonstrated a solid understanding of some clinical aspects, concerning deficiencies were noted in more specialised areas, particularly in pathophysiology, diagnosis and treatment strategies. Despite a reasonable understanding of acute infection symptoms and risk factors, crucial elements such as autoinfection (49%) and hyperinfection (61%) were less recognised, which were vital for understanding the chronic and severe nature of the disease. Alarmingly, only 44% identified larva currens as a key diagnostic sign and a mere 4% knew that *Strongyloides* eggs could be found in the sputum of severely infected patients, the key features for accurate diagnosis that were often overlooked. In terms of treatment, while most participants correctly identified albendazole, knowledge of ivermectin's superior efficacy (51%) and alternative treatments like thiabendazole (37%) was lacking. Only 1% were familiar with alternative administration routes, such as rectal or subcutaneous options for patients who cannot tolerate oral treatment, and similarly low numbers understood the role of combination therapy in severe cases.

DISCUSSION

Neglected tropical diseases (NTDs), including strongyloidiasis, are underrepresented in medical education and clinical training globally (Venturini et al. 2021). This gap is especially concerning for physicians managing immunocompromised patients, who are at greater risk of developing severe complications. In this study, only 41% of participants demonstrated adequate knowledge of strongyloidiasis, and while 56% had undergone some training in tropical diseases, a significant proportion still lacked disease-specific knowledge. Interestingly, 37% of those with good knowledge had not received formal training, suggesting that clinical exposure or self-directed learning may contribute significantly to knowledge acquisition. Prior awareness of *Strongyloides stercoralis* was also associated with better performance with 50% of knowledgeable participants reported such familiarity. However, 35% had no prior exposure, indicating that indirect clinical experience might influence recognition and awareness. This finding suggests that formal training and case-based exposure may be important contributors to diagnostic confidence, particularly for neglected tropical infections. For instance, in Nigeria, Lar et al. (2023) reported that a mixed-methods, participatory training package for community and primary-level health workers improved knowledge and supported the identification, referral and clinical diagnosis of suspected skin NTD cases reference. Similarly, in the United States, Mankbadi et al. (2016) reported that a moulage-based simulation improved participants' medical knowledge and diagnostic abilities. Both studies highlight that interactive, case-based training enhances preparedness to recognise and manage neglected tropical infections.

Although 45% of participants had managed immunocompromised patients, only 38% had treated strongyloidiasis cases. This suggests that experience with high-risk groups may raise general clinical vigilance but does not necessarily translate to disease-specific expertise. A similar gap was found by Buonfrate et al. (2020), who reported persistent deficiencies in physicians' knowledge of parasitic diseases despite general familiarity with tropical medicine. Only 49% of participants understood the autoinfection cycle, which is a critical feature that allows lifelong infection and poses serious risks in immunocompromised individuals. Even more concerning, only 4% recognised the presence of larvae in sputum as indicative of hyperinfection syndrome. Treatment knowledge was also inconsistent: while 73% correctly identified albendazole, only 51% knew that ivermectin is the preferred first-line agent. These findings are consistent with observations by Buonfrate et al. (2020), who highlighted widespread under-recognition and diagnostic challenges associated with strongyloidiasis, even among physicians familiar with tropical medicine. Boulware et al. (2007) further highlighted that physicians with limited experience in immigrant or tropical health were at markedly higher risk of diagnostic and treatment errors. In their large case series and survey, only 9% of U.S. residents recognised the need to screen at-risk patients for *Strongyloides*, while an alarming 23% recommended empiric corticosteroid use without prior screening. Notably, five patients in their cohort developed hyperinfection following steroid therapy, resulting in two fatalities, underscoring the grave consequences of failing to recognise the parasite's capacity for autoinfection and dissemination. Corticosteroid use has repeatedly been implicated in triggering hyperinfection, with reported mortality exceeding 60% in disseminated disease (Keiser & Nutman 2004; Roxby et al. 2009). Collectively, these findings underscore how knowledge gaps in recognition and screening contribute to delayed diagnosis and serious iatrogenic complications.

Of the 1,050 responses to knowledge questions, 52% were correct, 19% incorrect and 29% marked as "not sure." The high number of uncertain responses likely reflects awareness of limitations, while incorrect answers may indicate overconfidence, a known contributor to diagnostic errors (Kunitomo et al. 2022). Notably, there was little difference in knowledge between participants with higher (42%) and lower (40%)

academic qualifications, reinforcing the idea that academic rank does not necessarily equate to clinical competence. As Htay et al. (2024) pointed out, practical training and real-world exposure are often more impactful than formal instruction.

While our study hints at possible knowledge gaps among a specific physician subgroup, the limited sample and unadjusted analysis mean that these trends should be interpreted as exploratory rather than conclusive. Despite being limited to a single center and a relatively small cohort at Hospital Canselor Tuanku Muhriz, the findings provide valuable insights that may inform future educational strategies and training reforms. Integrating NTD-related content into undergraduate curricula and continuing medical education programs could enhance diagnostic accuracy and improve patient outcomes (Zarei et al. 2022). Future priorities should include development of targeted training modules, implementation of screening protocols for high-risk groups and incorporation of strongyloidiasis into national public health strategies. To our knowledge, this is the first study in Malaysia to evaluate physician knowledge of this parasitic infection, with findings that have the potential to guide both policy and practice (Justiz-Vaillant et al. 2025; Telchik et al. 2025; Uslu et al. 2025).

Although our sample size was limited to 70 participants, this reflects the total accessible physician population within the Internal Medicine Department at HCTM during the study period. A universal sampling strategy was adopted to capture all eligible individuals, ensuring that the findings represent this specific clinical setting. However, the single-center design inherently limits the generalisability of the results to broader physician populations in Malaysia. Future multi-center studies involving larger and more diverse cohorts or incorporating qualitative methodologies, may help uncover deeper insights and support wider applicability of the findings. Additionally, the limited number of respondents may have constrained the ability to detect statistically significant relationships between knowledge levels and influencing factors. Although trends were observed, such as higher knowledge among those with prior training or familiarity with strongyloidiasis, these did not achieve statistical significance, potentially due to type II error. The wide confidence intervals seen in several comparisons further suggest uncertainty in the effect estimates, reinforcing the need to interpret these exploratory findings with caution. Therefore, the results should be viewed as indicative rather than definitive, serving primarily as a basis for hypothesis generation in future research.

This study did not include multivariable logistic regression analysis to adjust for potential confounders such as age, clinical experience or postgraduate qualifications. Given the relatively small number of participants classified as having "adequate knowledge," incorporating multiple predictors in an adjusted model would have risked statistical overfitting and reduced the validity of the results. As such, only univariate analyses were performed to explore preliminary associations. Future studies with larger sample sizes will be essential to conduct robust multivariable analyses and more accurately determine the independent factors associated with physician knowledge.

CONCLUSION

This study highlights the progress and ongoing challenges in addressing knowledge gaps about NTDs, like strongyloidiasis, among healthcare professionals. While many participants demonstrated good knowledge, the need for more comprehensive training in tropical diseases remains evident. Strengthening NTD education and providing more hands-on opportunities will be essential to improving diagnostic skills and patient care, especially for immunocompromised individuals.

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