Summary of the Thirty-Eighth Meeting of the International Task Force for Disease Eradication (ITFDE)
November 5–6, 2024

The 38th Meeting of the International Task Force for Disease Eradication (ITFDE)[1] was convened in a hybrid (in-person and virtual) format at The Carter Center in Atlanta, GA, USA, on November 5–6, 2024, to discuss "the status of *Taenia solium* taeniasis/cysticercosis control & elimination". This 38th meeting of the ITFDE highlighted the progress made towards combatting *T. solium* taeniasis/cysticercosis (TSTC) globally and discussed emerging recommendations for elimination.

Overview and History

TSTC are parasitic neglected tropical diseases (NTDs) of poverty endemic in subsisting and disadvantaged communities in Africa, Asia, and Latin America, where open human defecation and free-ranging pigs coexist.[2] When roaming pigs ingest something contaminated with feces that have *T. solium* eggs, the eggs can develop into cysts that can live for years in the pig, leading to a condition called porcine cysticercosis (PCC). If a human eats undercooked pork that contains these cysts, the cysts can develop into adult tapeworms that can live for years in humans, leading to a condition called taeniasis.[3] Humans also risk developing cysticercosis if they consume something contaminated with feces that contain these eggs; when cysts develop in the brain, it is called neurocysticercosis (NCC). NCC is the leading cause of preventable epilepsy globally, responsible for 30–70% of cases in endemic areas. An estimated 2.56–8.30 million people are affected, with epilepsy often accompanied by social stigma and lack of access to diagnosis and treatment.[4, 5] TSTC is endemic in 51 countries, suspected in 14 others, and focal in nature.[6]

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[1] The ITFDE members are Dr Kashef Ijaz, The Carter Center (Chair), USA; Dr Fatima Barry, World Bank, USA; Mr Simon Bland, Global Institute for Disease Elimination, United Arab Emirates; Dr Ibrahima Soce Fall, WHO, Switzerland; Dr Peter Figueroa, University of the West Indies, Jamaica; Dr Donald Hopkins, The Carter Center, USA; Dr Patrick Lammie, Task Force for Global Health, USA; Dr Ephrem T. Lemango, UNICEF, USA; Dr Kim Lindblade, PATH, USA; Dr David Molyneux, Liverpool School of Tropical Medicine, United Kingdom; Dr Ana Morice, independent consultant, Costa Rica; Dr William Schluter, Centers for Disease Control and Prevention, USA; Dr Faisal Sultan, Shaukat Khanum Memorial Cancer Hospital and Research Center, Pakistan; Dr Jordan Tappero, Bill & Melinda Gates Foundation, USA; and Dr Dyann Wirth, Harvard TH Chan School of Public Health, USA.

[2] World Health Organization. (2022). *Weekly epidemiological record, 2022, vol. 97, 17 [Full issue]*. *Weekly Epidemiological Record*, 97(17), 169–172. https://iris.who.int/handle/10665/353611

[3] World Health Organization. (2022, January 11). *Taeniasis/cysticercosis*. World Health Organization (WHO). https://www.who.int/news-room/fact-sheets/detail/taeniasis-cysticercosis

[4] Winkler, A. S., Willingham, A. L., 3rd, Sikasunge, C. S., & Schmutzhard, E. (2009). Epilepsy and neurocysticercosis in sub-Saharan Africa. *Wiener klinische Wochenschrift*, *121 Suppl 3*, 3–12. https://doi.org/10.1007/s00508-009-1242-3

[5] Ndimubanzi, P. C., Carabin, H., Budke, C. M., Nguyen, H., Qian, Y. J., Rainwater, E., Dickey, M., Reynolds, S., & Stoner, J. A. (2010). A systematic review of the frequency of neurocyticercosis with a focus on people with epilepsy. *PLoS neglected tropical diseases*, *4*(11), e870. https://doi.org/10.1371/journal.pntd.0000870

[6] World Health Organization. (2022). *Weekly epidemiological record, 2022, vol. 97, 17 [Full issue]*. *Weekly Epidemiological Record*, 97(17), 169–172. https://iris.who.int/handle/10665/353611

In 1992, the ITFDE identified TSTC as potentially eradicable, citing the ability to surveille pigs for PCC to identify foci of transmission and to intervene in these foci to effectively treat human taeniasis with praziquantel and niclosamide during mass drug administration (MDA) campaigns.[7, 8] Recommendations to develop simpler diagnostics for humans and more sensitive diagnostics for pigs were made, with actual eradicability dependent on demonstration of elimination in a sizeable geographical scale.

In 2003 and 2013, the ITFDE reviewed key achievements since the preceding meeting, made additional recommendations, and reaffirmed eradication feasibility. Additional tools included advanced diagnostics with improved clinical imaging of brain lesions, antibody and antigen tests for larval stages of the parasite, and antibody and coproantigen tests for intestinal adult stages of the parasite. Effective anthelminthic treatments suitable for single-dose use in humans (praziquantel, albendazole) and pigs (oxfendazole) were available, and a vaccine to prevent PCC was developed. Notably, several pilot studies on the effectiveness of combinations of interventions to reduce taeniasis were conducted in several countries. Recommendations to improve surveillance, sanitation, and community education; to develop rapid point-of-care (POC) diagnostics; and to show effective control or elimination on a national scale using multiple interventions were made alongside a need to better document the prevalence and economic impact of the disease.[9, 10] A recommendation was also made to evaluate the impact of schistosomiasis control (using praziquantel) and lymphatic filariasis elimination (using albendazole) programs on TSTC in co-endemic settings.

In the WHO *Ending the neglect to attain the Sustainable Development Goals: A road map for neglected tropical diseases 2021−2030* (WHO NTD Road Map 2021–2030), the main disease-specific target for TSTC is to achieve "intensified control in hyperendemic areas", especially through focused interventions and high throughput testing for control program evaluation.[11]

Diagnostics, Treatment, and Prevention

There are two points where interventions can be implemented to break the TSTC transmission cycle, one in humans and one in pigs. To detect taeniasis, a promising new serological POC test

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[7] Recommendations of the International Task Force for Disease Eradication. (1993). *MMWR. Recommendations and reports : Morbidity and mortality weekly report. Recommendations and reports*, *42*(RR-16), 1–38.
[8] Centers for Disease Control and Prevention. *Recommendations of the International Task Force for Disease Eradication*. MMWR 1993;42(No. RR-16): 12
[9] International Task Force for Disease Eradication, 2003. Summary of the Fourth Meeting of the ITFDE(II) April 16, 2003. Available at: https://www.cartercenter.org/ documents/1367.pdf
[10] International Task Force for Disease Eradication, 2013. Summary of the Twenty-First Meeting of the ITFDE(II) July 10, 2013. Available at: https://www.cartercenter.org/resources/pdfs/news/health_publications/itfde/ITFDE-summary-071013.pdf
[11] World Health Organization. (2021). *Ending the neglect to attain the Sustainable Development Goals: A road map for neglected tropical diseases 2021–2030*. World Health Organization. https://doi.org/10.25560/9789240010352https://doi.org/10.25560/9789240010352https://doi.org/10.25560/9789240010352

for antibody detection was developed yet demonstrated low sensitivity in field applications.[12, 13] POC NCC antibody and antigen detection platforms have been developed with studies underway to enhance sensitivity and specificity. Emerging molecular tools, like circulating cell-free parasite DNA, offer potential for more sensitive NCC diagnostics.[14] Potential future innovations include developing distinct diagnostic tools for field applications, such as POC coproantigen or urinary antigen tests using monoclonal antibodies to detect taeniasis. Effective taeniasis treatments exist and are used in PC where a single dose of praziquantel (10 mg/kg), single dose of niclosamide (2g), or triple dose of albendazole (400 mg for 3 consecutive days) are recommended.[15, 16] In 2020, a donation program by Bayer was established to cover praziquantel and niclosamide for programmatic preventive chemotherapy (PC) needs.

At the porcine level, controlling PCC is critical to interrupt the *T. solium* transmission cycle. Current pig diagnostics, like tongue inspection, have limited sensitivity, especially for animals with low parasite burdens. Necropsy remains the gold standard but is laborious and limited to post-mortem use. Improved meat inspection and serological tests may be considered, taking into account the limitations they present. Treating pigs with a single dose of 30 mg/kg oxfendazole kills muscle cysts, and a three-week withdrawal period is required before treated meat is safe to consume.[17,18] Oxfendazole treatment alone has exhibited large reductions in PCC prevalence, as observed in Tanzania, where viable porcine cysticerci decreased from 25.5% at baseline to 2.8% at endline following this intervention.[19] The combination of a single dose of oxfendazole to eliminate infections with a full course (two doses) of the TSOL18 Cysvax vaccine to protect pigs from future infection is a valuable porcine prophylactic method. Field trials in seven highly endemic countries showed no viable *T. solium* infections in treated and vaccinated pigs,

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[12] Mubanga, C., Trevisan, C., Van Damme, I., Schmidt, V., Phiri, I. K., Zulu, G., Noh, J., Handali, S., Mambo, R., Chembensofu, M., Masuku, M., Reynders, D., Jansen, F., Bottieau, E., Magnussen, P., Winkler, A. S., Dorny, P., Mwape, K. E., & Gabriel, S. (2021). Challenges Encountered When Evaluating an Antibody-Detecting Point-of-Care Test for Taeniosis in an Endemic Community in Zambia: A Prospective Diagnostic Accuracy Study. *Diagnostics (Basel, Switzerland)*, *11*(11), 2039. https://doi.org/10.3390/diagnostics11112039

[13] Van Damme I, Trevisan C, Mwape KE, Schmidt V, Magnussen P, Zulu G, et al. Trial Design for a Diagnostic Accuracy Study of a Point-of-Care Test for the Detection of *Taenia solium* Taeniosis and (Neuro)Cysticercosis in Community Settings of Highly Endemic, Resource-Poor Areas in Zambia: Challenges and Rationale. Diagnostics (Basel). 2021;11(7). Epub 2021/07/03. doi: 10.3390/diagnostics11071138. PubMed PMID: 34206654; PubMed Central PMCID: PMCPMC8306489

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[19] Kabululu, M. L., Ngowi, H. A., Mlangwa, J. E. D., Mkupasi, E. M., Braae, U. C., Colston, A., Cordel, C., Poole, E. J., Stuke, K., & Johansen, M. V. (2020). TSOL18 vaccine and oxfendazole for control of *Taenia solium* cysticercosis in pigs: A field trial in endemic areas of Tanzania. *PLoS neglected tropical diseases*, *14*(10), e0008785. https://doi.org/10.1371/journal.pntd.0008785

underscoring the feasibility of integrating vaccination and treatment strategies to interrupt transmission.[20, 21]

Modeling Strategies

Modeling techniques for *T. solium* integrate spatial statistics, risk factor analysis, and transmission dynamics to understand disease patterns and optimize intervention strategies. Tools such as spatial risk mapping, deterministic models, and agent-based models (ABMs) provide insights for controlling transmission by simulating interventions like MDA, pig vaccination, and oxfendazole treatment and predicting their impact.[22, 23, 24] The utility of the models lies in demonstrating their credibility through validation, as they may inform policies and use limited resources to tackle NTDs like TSTC that disproportionately affect marginalized populations.[25]

In Uganda, spatial risk mapping integrated risk factors such as poor sanitation, pig density, and poverty to identify high-risk areas.[26] These maps examined spatial and temporal variations from 2001 to 2016, using spatial statistics that aggregated risk factors by cluster, assessed spatial autocorrelation, and mapped high-risk areas. This approach has been replicated in other countries, such as Laos, expanding the methodology to include hospital data on NCC and slaughterhouses records.[27]

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[20] Assana, E., Kyngdon, C. T., Gauci, C. G., Geerts, S., Dorny, P., De Deken, R., Anderson, G. A., Zoli, A. P., & Lightowlers, M. W. (2010). Elimination of *Taenia solium* transmission to pigs in a field trial of the TSOL18 vaccine in Cameroon. *International journal for parasitology*, *40*(5), 515–519. https://doi.org/10.1016/j.ijpara.2010.01.006

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[27] Larkins, A., Bruce, M., Phetsouvanh, R., & Ash, A. (2023). Risk mapping for *Taenia solium*: Applying multicriteria decision analysis in Lao PDR. *Tropical Medicine & International Health, 28*(9), 736-741. https://doi.org/10.1111/tmi.13917

While deterministic transmission models like EPICYST use compartmental frameworks to simulate interventions,[28] ABMs may offer more detailed information. CystiAgent, a spatially explicit ABM, simulates *T. solium* transmission at the village level by incorporating factors like focal transmission, host behaviors, population dynamics, and pig immunity.[29] Developed to provide cost-effective and flexible evaluations of control interventions, CystiAgent has successfully reproduced real-world outcomes from intervention trials in northern Peru.[30] Its iterative development has demonstrated regional transferability by validating predictions against intervention data without recalibration and has incorporated human NCC modeling through the integrated CystiHuman module.

The CystiSim predictive model supports the feasibility of eliminating *T. solium* through combined human and pig interventions, assessed through an economic modeling perspective.[31] A study in Madagascar suggested the potential to eliminate cysticercosis through human MDA with praziquantel, along with combined TSOL18 Cysvax pig vaccination and oxfendazole treatment.[32] Based on CystiSim model prediction estimates, the cost of a nationwide intervention would scale to US$31.6 million and suggest a benefit of US$460 million over the course of 25 years, making it highly cost-effective.[33] Cost-benefit analyses employed in economic models for TSTC elimination should factor in the impact of increased income for households that raise uninfected pigs, lowered healthcare costs for treating these diseases, and overall heightened economic productivity associated with healthier populations.[34]

Global Initiatives

Cognizant of restricted resources, core rapid impact interventions that have been identified through pilot projects and programmatic interventions are: (1) deworming humans (i.e., treating taeniasis) and (2) deworming and vaccinating pigs (i.e., treating and preventing PCC). Other

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[33] Ibid.

[34] Gabriël, S., Mwape, K. E., Phiri, I. K., Devleesschauwer, B., & Dorny, P. (2018). *Taenia solium* control in Zambia: The potholed road to success. *Parasite epidemiology and control*, *4*, e00082. https://doi.org/10.1016/j.parepi.2018.e00082

supporting measures include One Health approaches with community engagement that includes health education and improved sanitation, which could incorporate aspects of Community-Led Total Sanitation (CLTS) methods that have been employed by UNICEF in multiple countries.[35] Longer term measures requiring fundamental societal changes may include improved pig husbandry and enhanced meat inspection, especially through the control and handling of pork.

The following case studies demonstrate interventions conducted in: Burkina Faso, Peru, China and Madagascar.

Burkina Faso: A study in Burkina Faso evaluated a health education intervention to reduce TSTC in humans and pigs, emphasizing community involvement and behavior change.[36] The program was developed using the Predisposing, Reinforcing, and Enabling Constructs in Educational Diagnosis and Evaluation (PRECEDE) model, which identified key factors like self-efficacy, knowledge about *T. solium*, and the perceived financial benefits of controlling PCC. A 52-minute educational film was created and discussed in intervention villages to improve understanding of the parasite's life cycle. The program also adapted the Participatory Hygiene and Sanitation Transformation (PHAST) model, originally designed for improving hygiene, to focus on reducing exposure to *T. solium* eggs in the environment through better sanitation practices.[37] PHAST empowered communities to take ownership of sanitation efforts, such as building latrines. The intervention halved the incidence and prevalence of human cysticercosis in two of three provinces and significantly increased the construction of latrines across all regions. Data from this trial were used to build a compartmental transmission dynamics model that showed interrupting transmission was feasible by reducing human exposure to *T. solium* eggs through sanitation programs, which is more effective in interrupting transmission than improving pork cooking methods alone.[38] These findings emphasize a role for sanitation, community engagement, and structured educational approaches in controlling and potentially eliminating TSTC.

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Peru: The Cysticercosis Working Group in Peru, an investigative consortium of specialists that has been operating since 1987,[39] has conducted multiple interventions to combat *T. solium* transmission. A study conducted from 2004 to 2010 involved a multi-phase approach to systematically evaluate TSTC elimination strategies.[40] It began with six different interventions in its first phase, including combined mass treatment of humans and pigs, continuous treatment of 3-month-old pigs, education on health behaviors, and pig culling and replacement across 42 villages that covered 11,000 humans and 17,000 pigs. The second phase evaluated an intensified approach with mass treatments of humans and pigs, with or without pig vaccinations, across 17 villages, achieving significant reductions in PCC. One year after the intervention, necroscopy results showed only 6 of 658 pigs with PCC; two years after intervention, necropsy results showed 7 of 310 pigs with PCC.[41] In the third phase, a more intensive strategy (mass oxfendazole in pigs x 5 rounds, mass niclosamide in humans x 3 rounds, pig vaccine applied twice) was implemented in 107 villages (>80,000 humans, >50,000 pigs), where necropsy results showed 3 of 342 pigs with PCC. These results demonstrate the feasibility of elimination of TSTC, yet the interventions were resource-intensive.

China: TSTC has been a long-standing public health issue in China. Nationwide surveys conducted in the 1990s revealed an estimated 1.3 million *Taenia* spp. infections across 27 provinces.[42] Control efforts began in the 1970s with a focus on treatment, feces management, and case management, evolving in the following decades to include broader interventions such as improving sanitation, health education, and food safety regulations. These efforts led to a significant reduction in *T. solium* prevalence, particularly in eastern and central provinces, with some regions meeting elimination criteria. However, high prevalence remains in remote and less developed southwestern areas with limited healthcare access and poor sanitation.[43] To address these persistent challenges, China has implemented a comprehensive, multi-sectoral elimination program using a One Health approach. This includes integrated surveillance systems, the development of antigen-based diagnostic tools to improve detection sensitivity, and enhanced community engagement through health education and sanitation initiatives.[44] The program also emphasizes food safety, particularly improving pork consumption practices, and bolsters case management through collaboration between government agencies, healthcare professionals, and

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[39] Garcia, H. H., Gonzalez, A. E., Rodriguez, S., Gonzalvez, G., Llanos-Zavalaga, F., Tsang, V. C., Gilman, R. H., & Grupo de Trabajo en Cisticercosis en Perú (2010). Epidemiología y control de la cisticercosis en el Perú [Epidemiology and control of cysticercosis in Peru]. *Revista peruana de medicina experimental y salud publica*, *27*(4), 592–597. https://doi.org/10.1590/s1726-46342010000400016

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local communities. Continued international partnerships support these efforts, sharing knowledge and best practices. While significant progress has been made, sustained and targeted interventions remain essential for the complete elimination of TSTC, especially in the most endemic southwestern regions.[45]

Madagascar: A large and highly successful *T. solium* control program was recently completed in Madagascar, involving the Malagasy Ministry of Livestock Services and Ministry of Health, with support from WHO, Indian Ocean Commission, University of Melbourne, and funding from the IDRC Livestock Vaccine Innovation Fund.[46] The program, which lasted 22 months, focused on initially treating and vaccinating the entire pig population with oxfendazole and TSOL18 Cysvax, followed by treating and vaccinating only piglets born after the initial intervention, as well as administering a single treatment of taeniacide to the human population once pigs no longer posed a risk. Baseline assessments showed 30.8% of slaughter-age pigs were infected with viable *T. solium* cysticercosis and 1.25% of humans had taeniasis. The program vaccinated and treated 96,735 pigs and treated 117,216 people with praziquantel or niclosamide, achieving 62.5% coverage of eligible human participants. An extension of the program, including a second round of MDA, raised coverage to over 80%.[47] Final evaluations showed a statistically significant reduction in viable pig infections to 7.7%, all in untreated and unvaccinated pigs, along with human taeniasis prevalence at 0.6% (no statistically significant difference from baseline). Next steps involve consolidating the progress and potentially integrating TSTC control activities with other programs, such as the Malagasy Ministry of Public Health's annual schistosomiasis control program, to fully eliminate the parasite from Madagascar.

Integrated Programming

Opportunities exist to align *T. solium* control or elimination activities with other NTD programs, such as schistosomiasis control (praziquantel) or lymphatic filariasis elimination (albendazole). The praziquantel dosage used as a taeniacide in MDA is less (10 mg/kg) as compared to schistosomiasis (40 mg/kg). While rare, there is a potential for severe adverse events (SAEs) during MDA using praziquantel or albendazole as their ability to cross the blood-brain barrier can trigger inflammatory responses in people who may have latent NCC. [48] [49] Additionally, individuals suffering from NCC who present epilepsy as a SAE could be at a heightened risk of depression, which may stem from the stigma associated with seizures or the neurological effects of NCC itself. While SAEs are rare, robust planning and monitoring are essential to ensure safety.

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[45] Ibid.

[46] Andria-Mananjara, D.E., Raliniaina, M., Rakotoarinoro, M., Nely, J.A., Razafindraibe, N., Ramiandrasoa, S.N., Ramahefasoa, B., Rakotoarison, V.C., Torgerson, P.R., Cardinale, E. and Rasamoelina, H.A. (2024). Evaluation of a One Health public health program based on minimum inputs to control *Taenia solium* in Madagascar. *medRxiv*, 2024-08

[47] Ibid.

[48] Centers for Disease Control and Prevention. (n.d.). *Clinical care of cysticercosis*. https://www.cdc.gov/cysticercosis/hcp/clinical-care/index.html#:~:text=Medication%20options,of%20neurocysticercosis%2C%20albendazole%20and%20praziquantel.

[49] Pan American Health Organization. (2021). *Guideline for Preventive Chemotherapy for the Control of* Taenia solium *Taeniasis [Internet].* National Library of Medicine, National Center for Biotechnology Information. https://www.ncbi.nlm.nih.gov/books/NBK587135/

Surveillance for TSTC can also be enhanced by leveraging existing diagnostic tools and contextually applying them to collect samples (e.g., stool, blood, and urine) from high-risk groups (e.g., food handlers, pregnant women in antenatal clinics, HIV patients). Integrated serosurveillance using multiplex bead assays also pose an opportunity to detect exposure to human taeniasis and NCC for mapping or baseline studies.[50] For PCC, methods like tongue palpation and meat inspection can complement veterinary practices. Environmental sampling has received little attention, though it shows promising results and potential for integration.

Integrated approaches will ideally combine essential components such as water, sanitation, and hygiene (WASH) improvements and health education. To break transmission when pigs ingest human fecal matter, WASH interventions should consider the construction of high-quality latrines and appropriate methods to separate wastewater from potable water.[51] Health education should focus on expanding comfortability with using latrines and teaching proper hand hygiene to reduce exposure to PCC.

Another factor to consider for integrated programming is specific cultural taboos surrounding mental health and divisions of labor. Much stigma surrounds TSTC and epilepsy in endemic locations. For example, in a rural area in Zambia, seizures due to NCC are frequently accredited to witchcraft.[52] Latrine use is also associated with taboos, with male heads of households reporting feelings of shame and embarrassment about sharing latrines with other family members.[53] Women and children often play a central role in rearing pigs, as they are most often at home as compared to men in these communities.[54] Since this activity serves as a significant source of income for their households, the presence of TSTC directly affects livestock health and productivity, thereby reducing women's income and economic stability. In addition to economic challenges, women in these areas are frequently the primary caregivers for family members suffering from neurological conditions attributed to NCC. Morbidity and mortality from

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[50] Pan American Health Organization. (2022). *Toolkit for Integrated Serosurveillance of Communicable Diseases in the Americas.* Washington, D.C.: Pan American Health Organization. License: CC BY-NC-SA 3.0 IGO. https://doi.org/10.37774/9789275125656.

[51] Okello, A. L., & Thomas, L. F. (2017). Human taeniasis: current insights into prevention and management strategies in endemic countries. *Risk management and healthcare policy*, *10*, 107–116. https://doi.org/10.2147/RMHP.S116545

[52] Thys, S., Mwape, K. E., Lefèvre, P., Dorny, P., Phiri, A. M., Marcotty, T., Phiri, I. K., & Gabriël, S. (2016). Why pigs are free-roaming: Communities' perceptions, knowledge and practices regarding pig management and taeniosis/cysticercosis in a *Taenia solium* endemic rural area in Eastern Zambia. *Veterinary parasitology*, *225*, 33–42. https://doi.org/10.1016/j.vetpar.2016.05.029

[53] Thys, S., Mwape, K. E., Lefèvre, P., Dorny, P., Marcotty, T., Phiri, A. M., Phiri, I. K., & Gabriël, S. (2015). Why latrines are not used: communities' perceptions and practices regarding latrines in a *Taenia solium* endemic rural area in Eastern Zambia. *PLoS neglected tropical diseases*, *9*(3), e0003570. https://doi.org/10.1371/journal.pntd.0003570

[54] Thys, S., Mwape, K. E., Lefèvre, P., Dorny, P., Phiri, A. M., Marcotty, T., Phiri, I. K., & Gabriël, S. (2016). Why pigs are free-roaming: Communities' perceptions, knowledge and practices regarding pig management and taeniosis/cysticercosis in a *Taenia solium* endemic rural area in Eastern Zambia. *Veterinary parasitology*, *225*, 33–42. https://doi.org/10.1016/j.vetpar.2016.05.029

epilepsy-associated NCC should take into account the impact of poor mental health outcomes from these taboos, as they may affect the true burden of NCC.[55]

Tailoring integrated approaches to local contexts through implementation research is critical. BBy integrating surveillance, treatment, and prevention strategies, *T. solium* transmission can be significantly reduced. These efforts, supported by a One Health approach, not only address TSTC but also contribute to broader health system strengthening and resilience against future public health threats.

Conclusions and Recommendations

A notable achievement since the 2013 ITFDE meeting is the establishment of a new donation program by Bayer to cover praziquantel and niclosamide to support programmatic PC needs. Additional advancements include efforts to develop a POC test for taeniasis antibody detection and more sensitive and specific NCC diagnostics; implementing minimum input public health programs that incorporate community engagement and health education, expanding PCC vaccination and treatment, MDA for taeniasis, and training of health workers to manage NCC; and applying modeling techniques to guide and validate program design and to estimate costs to reduce parasite transmission between communities.[56] Countries such as Burkina Faso, China, Madagascar, Peru, and Uganda have demonstrated strong political will and have taken promising steps to reduce transmission, reinforcing the feasibility of eradication. While existing strategies are used in TSTC control and elimination efforts, opportunities to refine diagnostics, treatment strategies, modeling techniques, and integrated approaches inclusive of One Health initiatives remain.

1. Endemic countries should implement mapping exercises to identify foci of transmission to target interventions. This will strengthen a country's success toward achieving the target of "intensified control in hyperendemic areas" outlined in the WHO NTD Road Map 2021–2030.[57]

2. Tools exist to treat and prevent PCC through the administration of oxfendazole and TSOL18 Cysvax vaccine. Global health organizations and funders should advocate for the widespread rollout of these interventions while keeping costs low. The establishment of a PCC vaccine and oxfendazole treatment bank should be considered to ensure their continued availability.

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[55] Molyneux D. H. (2023). Mental health and neglected tropical diseases - the neglected dimension of burden: identifying the challenges and understanding the burden. *International health*, *15*(Supplement_3), iii3–iii6. https://doi.org/10.1093/inthealth/ihad065

[56] de Coster, T., Van Damme, I., Baauw, J., & Gabriël, S. (2018). Recent advancements in the control of *Taenia solium*: A systematic review. *Food and waterborne parasitology*, *13*, e00030. https://doi.org/10.1016/j.fawpar.2018.e00030

[57] World Health Organization. (2021). *Ending the neglect to attain the Sustainable Development Goals: A road map for neglected tropical diseases 2021–2030*. World Health Organization. https://doi.org/10.25560/9789240010352

3. Using existing TSTC diagnostic tools for different control and elimination objectives should continue, while efforts to enhance sensitivity and specificity of existing diagnostics and to develop new POC tests to detect active taeniasis and NCC are ongoing.

4. One Health approaches that establish within-country multi-sectoral collaboration among human, animal, and environmental health sectors are encouraged to align resources, strengthen partnerships, and ensure sustained commitment to shared TSTC control and elimination goals.

5. Formalizing and strengthening between-country networks among One Health actors is encouraged to facilitate integrated TSTC surveillance data sharing and resources (e.g., access to diagnostic testing for humans and pigs). These platforms could include organizations such as the World Health Organization, Food and Agriculture Organization of the United Nations (FAO), and the World Organization for Animal Health (WOAH).

6. Elimination strategies should be tailored to local contexts, ideally integrating behavioral, infrastructural, and livestock management solutions. Modeling techniques and diagnostic tools should be adapted to available resources to address unique challenges (i.e. geographic, economic, cultural). In contexts where active surveillance is not feasible or poses safety risks, careful precautions must be implemented. This is especially critical for NCC patients with symptomatic epilepsy, as reporting symptoms may expose them to significant community stigma.

7. Models for TSTC elimination should incorporate parasite movement informed by robust data collection methods, as migration of parasites in both human (taeniasis) and pig (cysticercosis) hosts are important drivers of sustained transmission and potential for re-introduction. Including this in transmission models will help create greater precision in simulations of disease spread and intervention effectiveness, which is necessary when communicating to policymakers the recommended areas to intervene.

8. Models for TSTC elimination should incorporate the effectiveness and limitations of WASH interventions. Open defecation and lack of latrines significantly contribute to *T. solium* transmission by exposing humans and pigs to *T. solium* eggs. While models can simulate the impact of improved sanitation, they cannot guarantee lasting behavioral changes. Sustained health behavior education should accompany infrastructure improvements to maximize impact. Sanitation interventions may need to be paired with strict regulations on pig population movement and roaming, which is harder to replicate in areas where farming is key for livelihoods.

9. Further investigation on serious adverse events (SAEs) that may be attributable to MDA for taeniasis with praziquantel are warranted, particularly for co-infection with NCC and schistosomiasis treated with praziquantel.

10. Improved surveillance and diagnostic methods are critical to evaluating the burden of NCC and its association with the burden of epilepsy and mental health conditions. Modeling NCC prevalence should be bolstered by considering limitations to data collection. Due to the

stigma and depressive symptoms associated with epilepsy, women and children often do not seek care in endemic regions. Additionally, health center data on epilepsy may underestimate the true burden of disease in cases where mortality rates related to NCC and epilepsy have not been fully studied. Addressing these challenges requires improved awareness, better data collection, and culturally sensitive approaches to reduce stigma to improve access to care.

11. The ITFDE reaffirms the potential eradicability of TSTC and encourages a review of the existing WHO NTD Road Map 2021–2030 to extend the stated control targets to elimination. Political will to control or eliminate TSTC has strengthened. Establishing and focusing on incremental elimination benchmarks will prioritize the goal for countries who have yet to establish programs and may attract donor funding for elimination efforts.