

# Assembling a framework for intensified control of taeniasis and neurocysticercosis caused by *Taenia solium*

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*Report of an informal consultation*

*WHO Headquarters, Geneva, 17-18 July 2014*



In collaboration with



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Organization  
of the  
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This report is available in electronic format on <http://www.who.int/taeniasis/en/>

## Acronyms and abbreviations

Ag-ELISA	Antigen ELISA
CC/NCC	cysticercosis and neurocysticercosis
CSF	cerebrospinal fluid
CT	computerised tomography scan
DALY	disability-adjusted life year
ELISA	enzyme-linked immunosorbent assay
GSO	General Statistics Office of Viet Nam
FAO	Food and Agriculture Organization of the United Nations
IBE	International Bureau for Epilepsy
ILAE	International League against Epilepsy
ILRI	International Livestock Research Institute
ITM	Institute of Tropical Medicine, Belgium
LAMP	loop mediated isothermal amplification
LMIC	low- and middle-income countries
MDA	mass drug administration
mhGAP	Mental Health Gap Action Programme
MRI	magnetic resonance imaging
NCC	neurocysticercosis
NIMPE	National Institute of Malariology, Parasitology and Entomology (Viet Nam)
NTD	neglected tropical disease
OFZ	Oxfendazole
OIE	World Organisation for Animal Health
PCR	polymerase chain reaction
PCD	point of care diagnostics
RFLP	restriction fragment length polymorphism
SIVAC	Supporting National Independent Immunization and Vaccine Advisory Committees
SLMEN	Endemics and Neglected Diseases Service of the Ministry of Public Health
STAG-NTD	Strategic and Technical Advisory Group for Neglected Tropical Diseases
STH	soil-transmitted-helminthiasis
TDR	tropical disease research
TS/CC	taeniasis and cysticercosis
TS/NCC	taeniasis and neurocysticercosis
WHO	World Health Organization

## Executive summary

The World Health Organization (WHO), in close collaboration with the Food and Agriculture Organization, the World Organisation for Animal Health (OIE) and International Livestock Research Institute (ILRI), convened an informal consultation in Geneva, from 17-18 July 2014.

The aim of the consultation was to build a framework for the intensified control of *Taenia solium* taeniasis and cysticercosis (TS/CC) and management of neurocysticercosis (NCC) cases in resource-constrained endemic countries. Further the consultation sought to initiate the development of control strategies in selected countries and identify any barriers to implementation due to gaps in knowledge or availability of tools. The meeting was a first step in achieving the milestone defined by the WHO Neglected Tropical Disease Roadmap and endorsed by Member States at the 66<sup>th</sup> World Health Assembly in 2013 of having a “*validated strategy for control and elimination of T. solium taeniasis/cysticercosis available*”.

The two-day meeting was attended by delegates from countries with endemic *T. solium*, experts covering various disciplines and representatives of the pharmaceutical industry. Situation analyses presented by Brazil, China, Côte d’Ivoire, Madagascar and Viet Nam provided the foundation for discussions regarding the design and operationalization of strategies for control. Two detailed landscape reviews of the literature on 1) control options and 2) management of neurocysticercosis in low resource settings and an updated transmission dynamics model provided the available evidence for control. The group agreed that current tools, technologies and knowledge of the disease are sufficient to begin the implementation of control programmes in countries, starting on a small scale, and integrating, where appropriate, with other neglected tropical diseases (NTDs) and animal health interventions. Further research remains important to improve tools and permit easy application and standardisation of intervention measures to effect control of cysticercosis particularly in resource-poor regions.

Situation analyses of the different presenting countries demonstrated the disparity in levels of capacity to implement large-scale control activities for *T. solium*. Support to countries would include:

- 1) Collecting relevant base line as well as monitoring and evaluation data as interventions unfold
- 2) Integrating with other NTDs and animal health interventions or programmes
- 3) Provision of existing diagnostic tools
- 4) Providing access to drugs for treating humans and pigs, and vaccine for porcine use
- 5) Choosing the best algorithms for control
- 6) Implementing inter-sectoral control
- 7) Facilitating international advice and support for implementation of control

Based on the requests from the countries, the WHO accepted to constitute and manage in close collaboration with OIE and FAO an informal practical network aiming to provide support to countries in their efforts to control *T. solium* cysticercosis. More specifically the role of this network would be to create a centralised data repository to summarise country situations, provide an inventory of evidence-based control options including diagnostic and evaluation tools, provide guidance for training and educational material, facilitate leverage for funding and other support for country control programmes, and facilitate inter-sectoral collaboration. The network would include country representatives and as needed, researchers, human and animal health experts, international agencies, and other stakeholders. The WHO suggested hosting a second informal consultation in 2015, where the specific country control strategies for *T. solium* TS/CC designed over the course of the year will be presented, needs and progress assessed and a plan for implementation agreed upon.

## 1 Introduction

### 1.1 Background and rationale for the meeting

In 2011, the WHO's Strategic and Technical Advisory Group for Neglected Tropical Diseases (STAG-NTD) and partners adopted a roadmap for control of 17 neglected tropical diseases, including infection with the zoonotic parasite *T. solium*. The roadmap was published in 2012 (1) and set targets for a validated strategy for control of *T. solium* by 2015, with interventions scaled up in selected countries by 2020. The roadmap was endorsed by Member States at the 66<sup>th</sup> World Health Assembly in 2013 (WHA66.12) (2). Options for control of *T. solium* were discussed in 2009 during the WHO expert consultation on foodborne trematodiasis and taeniasis/cysticercosis held in Vientiane, Lao People's Democratic Republic. The meeting issued guidance that single interventions are insufficient to control TS/CC and that successful control strategies must be built on interdisciplinary and integrated approaches that target both taeniasis and cysticercosis and include large-scale preventive chemotherapy in humans, and treatment and vaccination of pigs (3). The meeting further acknowledged that community-led total sanitation, that is, the provision of adequate water and sanitation organized by the community itself, had the potential to significantly reduce infection with *T. solium* with minimal investment (3). Since 2009, advances in tools, technologies and knowledge have set the scene for reconsidering building a framework for intensified control of TS/CC while working closely with countries to meet their needs in the context of operationalizing a strategy for control.

In order to meet the targets of the 2012 NTD roadmap, and in recognition of the importance of interdisciplinary control strategies for the control of *T. solium*, the WHO, in collaboration with FAO, OIE and ILRI, convened the 2014 informal consultation for intensified control of taeniasis and neurocysticercosis caused by *T. solium*. This informal consultation brought together representatives from endemic countries, public health and agricultural experts, researchers and other key stakeholders. Presenting countries at the meeting included Brazil, China, Côte d'Ivoire, Madagascar and Viet Nam.

### 1.2 Objectives and expected outcomes

The objectives of the 2014 Informal Consultation were:

- To build a framework for intensified control of taeniasis and management of NCC caused by *T. solium* in resource-constrained endemic countries
- To initiate the development of control strategies for identified countries
- To identify gaps and future steps to be taken

### 1.3 Declarations of interest

Country representatives and advisors invited to the WHO informal consultation completed the WHO standard form for declaration of interests prior to the meeting. At the start of the meeting, the secretariat reported that no conflicts of interest were identified.

#### 1.4 Landscape analysis for prevention/control of *T. solium*

A WHO landscape analysis on control strategies for *T. solium* was prepared in advance of the consultation, in order to guide discussion and to provide guidance for countries in the selection of control strategies. The landscape analysis constituted a detailed review of all the current evidence for *T. solium* control identified in the literature published in English (see Annex 3). Eight key intervention components were identified, namely:

- Preventative chemotherapy (PCT) through Mass Drug Administration (MDA), focus-orientated chemotherapy or identification and treatment of taeniasis cases
- Health education
- Improved pig husbandry
- Anthelmintic treatment of pigs
- Vaccination of pigs
- Improved meat inspection
- Processing of meat products
- Improved sanitation

Empirical data were available only for preventative chemotherapy, health education, anthelmintic treatment of pigs and vaccination of pigs and some combinations thereof.

Valid comparison between control strategies were difficult due to variable durations of follow-up and differing methods of monitoring between studies. Over the short term, however, there is an indication that disruption of transmission has been achieved through administration of niclosamide or praziquantel to humans in combination with either health education or anthelmintic treatment/vaccination of pigs. Some reduction in transmission has been reported through the use of health education although it has been difficult to attribute this directly to the interventions used. Oxfendazole administration and vaccination of pigs have both shown efficacy in the treatment and prevention of porcine cysticercosis, although the impact of these strategies on the prevalence of human TS/CC infections has yet to be quantified.

Due to the paucity of data available it is difficult to make evidence based recommendations on control strategies to be used for this parasite. Extrapolation from the evidence available along with modelled projections and the various recommendations by experts that are available in the literature, however indicates that a combined approach utilising the treatment of human taeniasis cases (through MDA or selective chemotherapy) combined with the vaccination (TSOL18) and treatment of the porcine host (oxfendazole 30mg/kg) would be the 'best-bet' for rapid reduction of infection pressure. This is the strategy currently being undertaken in Peru (see page 7) and the results of this trial are eagerly awaited. It is strongly suggested that this core approach be supplemented by supporting measures such as health education and followed by those measures requiring fundamental social changes including improved meat inspection, improved husbandry and improved sanitation. Any control programme

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