The Control of Neglected Zoonotic Diseases

From advocacy to action

Report of the fourth international meeting held
at WHO headquarters, Geneva, Switzerland
19-20 November 2014

World Health Organization

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World Health Organization

Food and Agriculture Organization of the United Nations

OIE WORLD ORGANISATION FOR ANIMAL HEALTH

in collaboration with **Advanz – Advocacy For Neglected Zoonotic Diseases, ICONZ – Integrated Control Of Neglected Zoonosis and European Commission - Research: The Seventh Framework Programme**

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Contents

04

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Lastly, we would like to thank everyone who attended, contributing their presentations, comments and materials, which led to an extremely informative, lively and productive meeting.

[1] UOE: University of Edinburgh, UCPH: University of Copenhagen, UOF: University of Florida, UOL: University of Liverpool, UKZN: University of Kwa-Zulu Natal, UOG: University of Glasgow.

Preface

This meeting was the fourth in a series of meetings on Neglected Zoonotic Diseases (NZDs). The first meeting was held in 2005, when the priority was on gathering evidence and gaining an understanding of NZDs. Now 10 years later, substantial momentum and significant volumes of evidence have been gathered by the NZD community. There are now proven pathways for control and even elimination of certain NZDs. Thus in 2014 the focus of our meeting moved 'From Advocacy to Action'.

The goal of this meeting was to showcase successful One Health programmes from across the world and identify ways to achieve the NZD control milestones as specified in the WHO roadmap[2].

As in previous meetings, One Health researchers and representatives from the animal and human health sectors worldwide came together to network and explore ways to extend current control interventions to new locations and to other NZDs. Health education and communication remain key tools for promoting awareness and advocacy around NZDs at all levels.

Now they have returned to their home countries, it is our hope that the invited policy makers, funders and other stakeholders who attended will act as high level advocates, persuading others into action.

Indeed it is our hope that this report will also motivate you to increase your own commitment towards actions to control NZDs.

It is time to move 'From Advocacy to Action' and remove the 'N' from Neglected Zoonotic Diseases for good.

The NZD4 organising committee

[2] WHO's 2012 Roadmap on accelerating work to overcome the global impact of neglected tropical diseases (NTDs) and Resolution WHA66.12 on NTDs adopted by the World Health Assembly in May 2013.

06

Executive Summary

The fourth International Meeting on the Control of Neglected Zoonotic Diseases (NZDs) was held on 19–20 November 2014. The meeting was financially supported by the European Union seventh framework programme through the ADVANZ (Advocacy for Neglected Zoonotic Diseases) and ICONZ (Integrated Control Of Neglected Zoonoses) projects. It was hosted by WHO at its headquarters in Geneva, Switzerland, and opened by the Assistant Director-General, Dr Nakatani.

NZDs are found in communities in low-resource settings across the world, where they impose a dual burden on people's health and that of the livestock they depend upon. National governments are increasingly seeking to mitigate the impact of NZDs on their citizens by implementing control programmes to address these burdens. These initiatives have been strongly endorsed by the Food and Agriculture Organization of the United Nations, the World Organisation for Animal Health and WHO tripartite and financially supported by members of the broader international community including the Bill & Melinda Gates Foundation, the UK Department for International Development, the European Union, the International Development Research Centre and the CGIAR. WHO's 2012 Roadmap on accelerating work to overcome the global impact of neglected tropical diseases (NTDs) and Resolution WHA66.12 on NTDs adopted by the World Health Assembly in May 2013 have enhanced the visibility of zoonotic NTDs' – notably rabies, cysticercosis, echinococcosis, human African trypanosomiasis, foodborne trematodiases and leishmaniasis. Although not specifically included in the WHO Roadmap, other diseases have been addressed by the NZD community such as anthrax, bovine tuberculosis, brucellosis and leptospirosis.

Much of the initial momentum for action against NZDs was catalysed by the inaugural meeting on NZD control in 2005. Whilst the priority at that time was a need for evidence, a decade later the focus is on better implementation of proven pathways for control and mobilizing central governments and donors within broader health and development agendas. The fourth international meeting on NZDs acknowledged the momentum generated by the NZD community over the past decade, urging the more than 100 participants – including representatives from national governments, international organizations, academia, foundations, the private sector and NGOs – to exert their influence and focus on operations, especially for the NZDs included in the WHO Roadmap.

Clear themes that emerged throughout this meeting were the need for political commitment, sustainable One Health collaborations and the identification of local champions to drive community participation in control. Examples of programmes making significant progress in the control of some NZDs, both at national and local levels from across three continents, were provided by many countries.

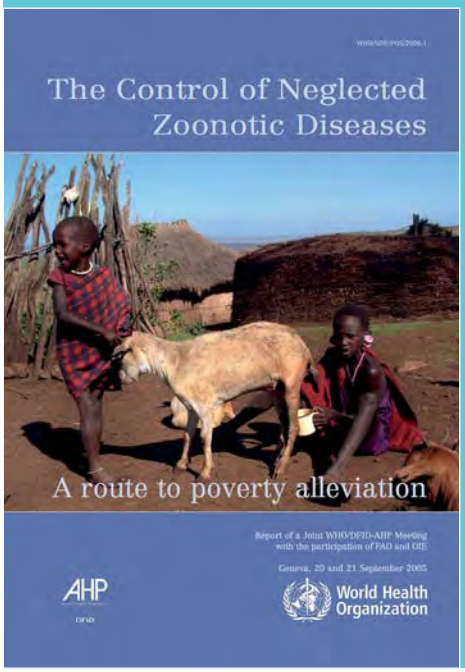
Dissemination of the knowledge gained through these programmes provides significant encouragement to country partners that the control of NZDs can indeed be achieved with currently available tools. There are opportunities for innovative funding mechanisms to support NZD control outside traditional donor models, including initiatives stemming from national bodies and from the private sector. Whilst challenges undoubtedly remain regarding refinement of control tools and their application in low-income settings, these should not prevent large-scale implementation of control programmes. There is now the opportunity to capitalize on the existing knowledge, experience and political will to move 'From Advocacy to Action. WHO will continue to report progress and follow-up on actions recommended during the meeting through its Strategic and Technical Advisory Group for Neglected Tropical Diseases (STAG-NTDs).

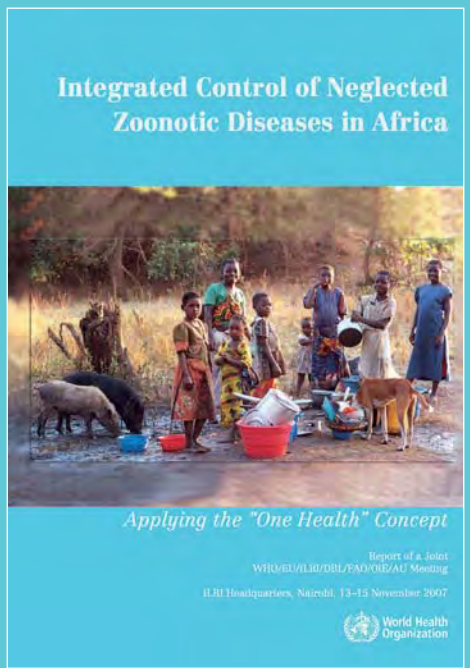
1 Welcome and scene-setting

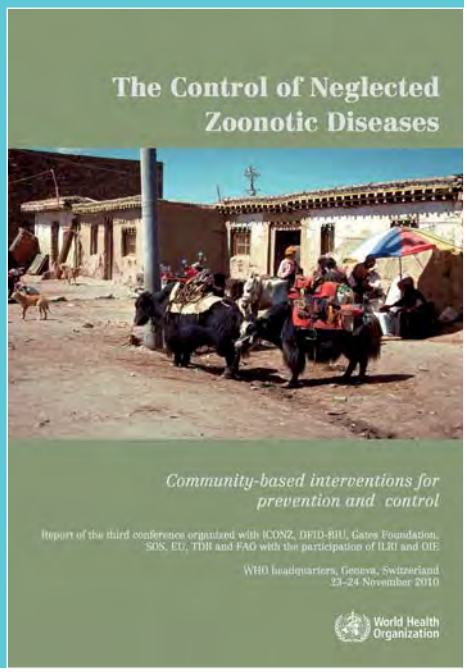
Attended by over 120 participants, the 4th International Meeting on the Control of Neglected Zoonotic Diseases (NZD4) was hosted by the World Health Organization (WHO) at its headquarters in Geneva, Switzerland, on 19–20 November 2014.

The meeting was organized in collaboration with the Food and Agriculture Organization of the United Nations (FAO), the World Organisation for Animal Health (OIE) and the European Union's 7th Framework Programme for research and innovation through the ADVANZ (Advocacy for Neglected Zoonotic Diseases) and ICONZ (Integrated Control of Neglected Zoonoses) projects.

Chronology of international meetings on control of neglected zoonotic diseases







> *"The time is ripe to transform evidence into practical and feasible strategies scaled-up on the ground."*
>
> **Dr Dirk Engels,** Director
> WHO Department of Control of Neglected Tropical Diseases

Objectives of the meeting

- To showcase successfully implemented programmes and track their progress.
- To identify ways in which the milestones for control of NZDs as specified by the WHO roadmap can be achieved.
- To explore ways in which current control interventions can be extended to include other NZDs.
- To identify ways in which awareness of NZDs can be enhanced through health education and communication programmes.
- To launch the Pan-African platform for the prevention and control of NZDs.
- To influence leaders, in particular key policy-makers and donors, to increase commitment to action for the control of NZDs.

Photo ©Banchob Sripa

Working relationships between neglected zoonotic diseases and neglected tropical diseases

As a group of poverty-inducing diseases, NZDs negatively affect both livelihoods and human health with dramatic consequences. Built upon three previous meetings that highlighted the need to prioritize these zoonoses through research, integrated control and community-based approaches, NZD4 was convened under the theme of 'From advocacy to action'. The meeting focused on the 'key ingredients' needed to quickly expand and scale-up proven interventions. This introductory session set the tone for the remainder of the meeting, emphasizing the importance of intersectoral collaboration, context-specific interventions and strong political support. Presenters outlined crucial ways in which evidence can be effectively translated into appropriate policy frameworks in order to simultaneously save lives and secure livelihoods through the control of NZDs in Latin America, Asia, Africa and beyond.

Neglected zoonoses within the WHO roadmap on neglected tropical diseases

Of the 17 neglected tropical diseases (NTDs) included in the WHO roadmap for lowering the public-health burden of NTDs (1), four are prominently zoonotic: *Taenia solium* cysticercosis, echinococcosis, foodborne trematodiases and rabies. Other NTDs with zoonotic aspects include *Trypanosoma brucei rhodesiense* human African trypanosomiasis, leishmaniasis and zoonotic schistosomiasis. Moving from advocacy to action emphasizes the strategic expansion of NTD programmes in countries where government commitment is forthcoming. NZDs fall under the remit of the WHO Strategic and Technical Advisory Group for NTDs, or STAG-NTD, the principal advisory group for NTD control reporting directly to the WHO Director-General. It has the mandate of advising WHO on global policies and strategies, including monitoring programme delivery and forging linkages with health interventions in other sectors.

The WHO Assistant Director-General Dr Hiroki Nakatani opened the meeting, recalling how past NZD meetings (2005, 2007 and 2010) have served as a platform for cross-cutting and multisectoral reflection that must be expanded in the future. While past meetings have focused on disease burden, research priorities and public engagement, Dr Nakatani reminded participants that the overarching theme of NZD4 was for scaled-up action. This requires translating the bulk of existing knowledge into implementable plans and programmes, advancing research and translating recommendations into practical, tailored and adapted interventions for endemic country settings.

Dr Dirk Engels, Director of the WHO Department of Control Neglected Tropical Diseases, situated NZD control within the current NTD global health landscape. Reflecting on the currently available toolbox for NTDs, he stressed the need to expand vector control, veterinary public health and water, sanitation and hygiene (WASH) interventions. Recognizing the challenges of cross-sectoral collaboration, Dr Engels called for a 're-think' to address the difficulties of packaging these more complex interventions to policy-makers and donors. He outlined how building evidence and proof of concept for NZD

scale-up requires a dedicated 'step-wise' agenda. Focused investments that showcase successful scale-up for rabies, *T. solium* and echinococcosis will catalyse control of other NZDs, providing unique leverages for capacity and commitment.

Intersectoral collaboration and the WHO–FAO–OIE tripartite

Opening remarks were furthered by the WHO–FAO–OIE tripartite, represented by Dr Bernadette Abela-Ridder (WHO), Dr Katinka de Balogh (FAO) and Dr Alex Thiermann (OIE). These presentations highlighted the long history of cross-sectoral collaboration spearheaded by the Tripartite, promoting good governance and disease prevention and control systems at the human–animal–ecosystems interface. Dr de Balogh situated the role of the Tripartite in global leadership and technical expertise, where it acts as a 'convening power'. The Tripartite is directly involved in the implementation of international standards, guidelines and recommendations through the WHO's International Health Regulations, the OIE's Performance of Veterinary Services tool and the FAO/WHO Codex Alimentarius. Recognizing the 'reactive', donor-driven nature of past responses to disease threats, Dr de Balogh stressed that the Tripartite places great emphasis on strengthening existing health systems through coordination, infrastructure (for example, building surveillance and laboratory capacity) and human resources.

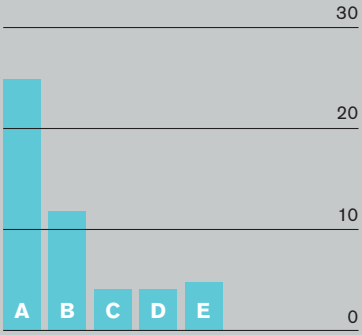
Moving the world closer to applying cross-sectoral approaches requires a combination of global leadership, national engagement and local impact. The opening remarks reiterated the Tripartite's recent focus surrounding zoonotic influenza, rabies and antimicrobial resistance; for example, the 2013 FAO–OIE–WHO World Rabies Day joint statement highlighting their commitment to rabies elimination. A high-level technical meeting to address health risks at the human–animal–ecosystems interface in Mexico in 2011 (2) focused on national-level actions and key elements for cross-sectoral approaches to foster working relationships and collaborative technical activities. The Tripartite has sought to 'lead by example', contributing to the global momentum of the One Health vision to inform effective action

Participant feedback

Clicker devices were distributed to all participants at the start of the meeting, in order to record their responses to a series of questions posed at the end of each session. Through utilizing the clicker methodology, it was possible to engage a broader audience in the discussions and to increase the organizing committee's understanding of participants' opinions on both the meeting administration and the topics discussed. The clicker responses were also useful in enabling the recognition of regional patterns and comparisons and in contributing to the identification of realistic goals and resources for moving 'beyond NZD4'.

The clicker questions for session one were basic identifier questions in order to gain a sense of participants' representative regions and sectors of employment. The results indicated that the majority of the participants represented the African and European regions, the bulk of whom were working in either the academic/research or the national government sectors.

Which sector does your main current occupation fall under?



A Academic/research/think-tank
B National government
C Private sector (for profit)
D Nongovernmental organization (NGO)/not for profit (NFP)
E Multilateral agency/donor

Which WHO region do you feel you exert the most policy influence?

A African Region
B Region of the Americas
C South-East Asia Region
D European Region
E Eastern Mediterranean Region
F Western Pacific Region
G Global

against NZDs through the use of strong governance structures, stakeholder trust, capacity strengthening, public communication and financial support.

Examples of national commitment to zoonoses control

Translating science into effective policies and action on the ground requires ministerial support at the highest levels. Professor Be-Nazir Ahmed, from the Ministry of Health and Family Welfare in Bangladesh, outlined the importance of national steering committees. He showcased how ministerial support drove the rapid but successful scale-up of a nationwide rabies control programme in Bangladesh that was financially and logistically country-led. Despite resource limitations that often necessitate external support, drastic changes in NZD control at scale can be achieved through dedicated champions, financial support and coordination at the national level.

Dr Manoj Kumar Roy, Deputy Secretary of the Ministry of Health and Family Welfare in Bangladesh, reiterated the support of the Bangladeshi government in effective zoonoses control, which began more than a decade ago when pandemic influenza demanded emergency action. A long-term commitment to zoonoses control was generated by implementing a national strategy and action plan, which resulted in the training of thousands of health workers alongside the formation of a multisectoral taskforce that facilitated national coordination of activities using a multisectoral approach. The example from Bangladesh highlighted how pandemic preparedness has resulted in the transformation of government attention towards NZDs such as anthrax and rabies.

Ministerial support was also emphasized by the Honourable Dr Bright Rwamirama, the Minister of State for Agriculture, Animal Industry and Fisheries in Uganda. The Minister stressed that although scientific tools may exist for many NZDs, endemic countries too often find it difficult to mobilize the strong leadership and public investment needed to catalyse change. The Coordinating Office for Trypanosomiasis Control in Uganda (COCTU) is a unique example of the potential for endemic countries to develop collaborative institutions and coordination mechanisms within their national systems to effectively address NZDs. He pointed to the dramatic impacts of insecticide-treated cattle, tsetse traps and the involvement of affected communities in reducing the tsetse population in Uganda, as testimony to Ugandan-driven successes. Dr Rwamirama concluded by emphasizing the need to take stock of past success and move forwards to build new national and regional platforms.

Public-health strategies of the WHO roadmap on neglected tropical diseases

Of the 17 NTDs, 7 are known to be fully or partially zoonotic. The WHO roadmap on NTDs outlines five public-health strategies to overcome NTDs:

1. Large-scale preventive chemotherapy
2. Intensified disease management
3. Vector control
4. Veterinary public health
5. Water, sanitation and hygiene

WHO is committed to strengthening capacity and scale-up of those interventions central to NZD prevention and control: vector control, veterinary public health services and provision of safe water, sanitation and hygiene.

References

1. Accelerating work to overcome the global impact of neglected tropical diseases: a roadmap for implementation. Geneva: World Health Organization; 2012 (www.who.int/neglected_diseases/NTD_RoadMap_2012_Fullversion.pdf).
2. High-level technical meeting to address health risks at the human–animal–ecosystems interface. FAO/OIE/WHO; 2011 (www.fao.org/docrep/017/i3119e/i3119e.pdf).

> *“Our focus is not the disease, but the people that are neglected… we need to translate [research] results into the livelihoods of poor populations.”*

Dr Bernadette Abela-Ridder, Team Leader NZDs
WHO Department of Control of Neglected Tropical Diseases

Conclusion

The objectives of NZD4 reflect the need to move research results into country settings that can be specifically adapted to their local contexts and needs. Dr Bernadette Abela-Ridder, Team Leader for NZDs at the WHO Department of Control of NZDs, emphasized the need for innovative thinking about how existing platforms, tools and strategies for control of NZDs can be extended, strengthened and better coordinated.

In order to save lives and secure livelihoods through NZD control, the NZD community needs to move beyond peer-reviewed publications, placing at-risk populations at the centre of NZD activities.

2 *The value of intersectoral working – One Health*

The benefits of intersectoral collaboration as guided by One Health are fundamental to the control of NZDs. The successful integration of One Health approaches into existing – and future – NZD programmes lies in strategic planning and the identification of champions who can advocate control at ministerial and community levels.

Several examples of successful, sustainable One Health platforms for NZD control exist across Africa, Latin America and Asia, inspiring the continued uptake and promotion of similar intersectoral approaches to address these diseases at the human–animal–ecosystem interface.

Photo ©Nik Wood

> *"Building-up relationships within the One Health agenda is vital."*

Professor Peter Holmes, Chairman
Strategic and Technical Advisory Group for Neglected Tropical Diseases

Key messages from the session

- Whilst the application of One Health is not new, it brings a new momentum and new alliances to tackling zoonotic diseases.
- The international NZD community has made admirable advances over the past decade; whilst 2005 saw a requirement for evidence, in 2014 the focus is how to better package this evidence to attract central governments and donors.
- Politically endorsed national structures can help facilitate and promote cross-sectoral surveillance, interventions and partnerships and should be encouraged across all regions.
- Disease 'champions' drive buy-in and help facilitate communication between decision-makers and primary beneficiaries.

Photo ©Christine Amongi Acup

Examples of intersectoral collaboration initiatives for zoonotic control from Africa and Latin America

The WHO NZD website (http://www.who.int/neglected_diseases/zoonoses/en/) defines NZDs through the word 'neglect', highlighting their occurrence in poor and marginalized populations in low-resource settings. In order to break transmission, NZD control requires integrated, strategic approaches that draw consultation from a wide range of stakeholders; synergy is key. From its initial application to the emerging viral zoonoses with pandemic potential, One Health has evolved to apply to disease situations that are more endemic and 'neglected' in nature (1–3). One Health also goes beyond infectious disease control to incorporate the human–animal bond and, particularly in the developing country context, the societal value of animals that usually extends beyond their commercial worth. Whilst recognizing that the individual tools may differ according to the disease agent involved, One Health provides an overarching toolbox for the delivery of synergistic approaches to NZD control.

The practical delivery of One Health requires innovation in order to showcase its principal concepts and potential applications. For example, the successful eradication of rinderpest and smallpox, despite not being zoonotic diseases, demonstrates how international agencies can work together to drive political commitment and encourage local community involvement in disease control. Rabies is another example of a zoonotic disease where there is increasing interest and political will to coordinate efforts towards a specific target, with initiatives such as the Partners for Rabies Prevention (PRP) of the Global Alliance for Rabies Control (GARC) promoting partnerships among private sector actors, national governments, international agencies and donors to achieve a One Health approach for the control of this disease. One Health is not new, but it brings a new momentum to the control of zoonoses that should be harnessed by NZD advocates.

Launch of the Pan-African One Health platform on Neglected Zoonotic Diseases

The Pan-African One Health NZD platform was conceptualized through the ADVANZ project funded by the European Commission (http://www.advanz.org/). The platform arose from a recognized gap in the coordination of NZD activities across sub-Saharan Africa, where current activities are scattered, largely in the form of vertical approaches towards singular diseases such as anthrax or rabies. The platform therefore aims to identify and collaborate with these existing independent NZD networks, acting as an 'umbrella' forum to facilitate continuous dialogue with NZD stakeholders, including the affected communities who are very much part of the disease control process. Through harnessing the specific strengths of each disease-specific network via a centralized platform, it is anticipated that lessons learnt and future opportunities for intersectoral collaboration can be readily promoted, enabling African stakeholders to control NZDs in a locally appropriate way. The platform is also expected to advocate for NZD control in the region, persuading decision-makers to coordinate sustainable policy approaches for NZD

> *"In the United Republic of Tanzania, One Health approaches and activities are driven by the One Health Country Coordination Committee (CCC) in the Office of the Prime Minister."*
>
> **Dr Julius Keyyu,** Director of Research Development and Coordination
> Tanzania Wildlife Research Institute

control. A further vehicle for achieving cross-sectoral collaboration and knowledge is a website containing One Health advocacy information material developed by the ADVANZ EU-project (http://advocacy.advanz.org).

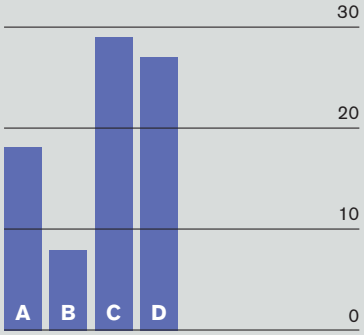
The Zoonotic Disease Unit of the Government of Kenya (http://www.zdukenya.org/)

A series of key steps have moved the Kenyan government towards the realization of One Health, stemming from the multisectoral national influenza taskforce formed in response to the threat of H5N1 avian influenza in 2005. Kenya's 2006–2007 Rift Valley fever (RVF) outbreak saw this taskforce evolve into the RVF taskforce; it was permanently renamed in 2008 as the Zoonoses Technical Working Group (ZTWG) and has met quarterly ever since. The requirement to form a One Health office in Kenya was recognized in 2011, resulting in a Memorandum of Understanding between the Ministries of Health and Agriculture, Livestock and Fisheries to form the Kenyan Zoonotic Disease Unit (ZDU), which is the Secretariat to the ZTWG. The platform is chaired on a rotational basis by the Director of Veterinary Services and the Director of Medical Services, with the mandate to provide technical advice regarding prevention and control of zoonoses in the country. The ZTWG is well-represented by national and international human and animal health sectors, including experts from the two line ministries, WHO, FAO, AU-IBAR, KEMRI, ILRI, CDC and KWS among others. A list of priority zoonoses has been prepared for Kenya, aligning with the revised Integrated Disease Surveillance and Response (IDSR) guidelines to incorporate diseases such as anthrax, rabies and RVF. To date, One Health has prompted collaboration between the human and animal health sectors for several prevention and control strategies, for example the rabies elimination strategy, a RVF contingency plan and risk mapping to identify national zoonoses hotspots. Challenges remain, however, including the implementation of One Health at the sub-national level and the low levels of awareness of the country's zoonoses burdens by policy-makers, resulting in inadequate financial and technical resources.

Participant feedback

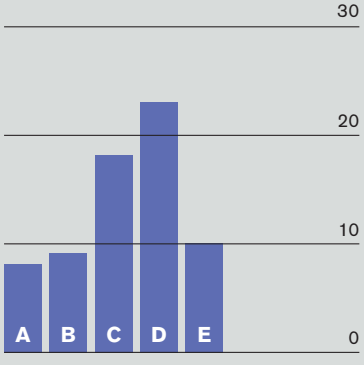
Participants considered it to be equally important to focus on cross-sectoral collaboration at both the community and central government levels in order to achieve a One Health approach for NZD control. It was encouraging that the majority of respondents considered themselves to be either moderately or very active in current One Health platforms in their region.

Which 'building block' do you feel is the most important for the promotion of cross-sectoral collaboration in your region?



- **A** Proof of financial advantages of a collaborative approach
- **B** Documenting and promoting One Health success stories
- **C** Cross-sectoral collaboration at the local community level
- **D** Cross-sectoral collaboration between central government departments and donors at the planning level

What level of interaction do you currently have with existing One Health initiatives (related to NZDs) in your region?



- **A** One Health initiatives exist in my region, but I have no involvement
- **B** Passive interaction only
- **C** Moderate interaction
- **D** Very active
- **E** I would like to be involved, but I am not aware of One Health initiatives in my region

The Coordinating Office for Trypanosomiasis Control in Uganda

In Uganda, a multi-stakeholder institution established over 20 years ago still operates as a One Health model to this day. Uganda has a long history of trypanosomiasis and tsetse challenges, which reached dangerous levels in the 1970s and 1980s. In 1986, the Uganda Trypanosomiasis Control Council (UTCC) was formed to help avert the threat of zoonotic *T.b. rhodesiense* to the human population at that time, with the Coordinating Office for the Control of Trypanosomiasis in Uganda (COCTU) as its secretariat. In 1992, a parliamentary act was established to permanently insert UTCC and COCTU into the National Constitution; COCTU is therefore a good example of a One Health institutional platform embedded in government law, which ensures its sustainability (4).
A major role of COCTU is to advocate for community empowerment, bringing One Health coordination closer to affected communities; the first such centre was opened in northern Uganda on 14 October 2014, with an aim to establish centres in all major HAT affected regions over the next 3 years. Through promoting the development of infrastructure to control and prevent human African trypanosomiasis at the centres themselves, for example community-level technologies such as mobile livestock spraying and the building of tsetse traps, the benefits to livelihood from simultaneous control of both tsetse and trypanosomiasis can in turn contribute to the betterment of the broader society.

Addressing canine rabies and other neglected zoonoses in Latin America

The Pan American Health Organisation (PAHO) contribution to the control of dog-transmitted human rabies across Latin America and the Caribbean (LAC) is an example of how political will can drive regional coordination for the effective control of transnational NZDs. However, despite the very significant achievements by the countries, the few remaining hotspots in the region are now the priority for canine rabies elimination. The LAC rabies scenario demonstrates the 'last mile' challenges of any disease elimination programme, when interest tends to wane once the disease no longer constitutes a public health concern and other priorities arise. Several lessons can be taken from LAC experiences in regional rabies elimination, such as the need for early recognition of the large regional heterogeneities in order to tailor approaches and help garner support between LAC countries. This is the current situation where rabies-free countries are contributing capacity building in the remaining rabies hotspots.

Other NZDs such as visceral leishmaniasis are also of concern in the region, with regional activities targeting standardisation of risk indicators to populate a recently established epidemiological data management system for the region. Hydatidosis is also endemic in a number of Latin American countries, with regional initiatives including a five-country network that targets capacity building via training, advocacy via communications, and evaluation of processes to allow identification of best practices. In order to strengthen integrated control actions against taeniasis/cysticercosis in endemic countries, PAHO has planned the first steps to gather information from endemic countries on national capacity on prevention and control of cysticercosis/neurocysticercosis in the region with the objective to develop a network in the Americas. The cysticercosis network in the Americas will be a platform for communication and south-south and north-south cooperation.

Mission of the WHO Department of Control of Neglected Tropical Diseases on neglected zoonoses

"To reduce the burden of neglected zoonotic diseases on poor and marginalized populations in low-resource settings by advocating for and strengthening their prevention and control through effective collaboration with strategic partners and relevant sectors".

References

1. Bechir M, Schelling E, Wyss K, Daugla DM, Daoud S, Tanner M et al. An innovative approach combining human and animal vaccination campaigns in nomadic settings of Chad: experiences and costs [article in French]. Med Trop. 2004;64:497–502. PMID:15771021.
2. Okello AL, Gibbs EPJ, Vandersmissen A, Welburn SC. One Health and the neglected zoonoses: turning rhetoric into reality. Vet Rec. 2013;169:281–5. doi:10.1136/vr.d5378.
3. Zinsstag J, Schelling E, Roth F, Bonfoh B, de Savigny D, Tanner M. Human benefits of animal interventions for zoonosis control. Emerg Infect Dis. 2007. 13:527–31. PMID:17553265.
4. Okello AL, Bardosh K, Smith J, Welburn SC. One health: past successes and future challenges in three African contexts. PloS Negl Trop Dis. 2014;8(5):e2884. doi:10.1371/journal.pntd.0002884.

Conclusion

Whilst exciting examples exist to date of intersectoral collaboration for NZD control, participants acknowledged the work yet to be done, particularly at the sub-national levels. Another challenge is how to maintain momentum during the 'last mile' of disease control once interventions have demonstrated success.

Convincing politicians and communities to support the necessary policy changes that evolve with this progression – for example, switching from mass vaccination of animal reservoirs towards risk-based assessments for action – will be a tough political decision. Intersectoral and multi-disciplinary approaches, such as the inclusion of health economics to justify policy decisions, will be integral to garner support from policy-makers and communities alike.

3 *Interventions for dog-borne zoonoses*

Elimination of canine-mediated rabies is a priority of the FAO–OIE–WHO tripartite. Recent rabies success stories motivate the possibility of global freedom from dog-mediated human rabies by 2030, with several recent interventions demonstrating effective and efficient scaled-up control over wide geographical areas.

Common themes underpinning these successes include political commitment and the promotion of community ownership and awareness. Echinococcosis advocates meanwhile have focused on building the global evidence base for this disease, standardizing the clinical approach to human case management in an effort to effectively highlight the scale of the problem in endemic countries.

Photo ©KZN Project: Daniel Stewart

> *"We [the KwaZulu-Natal project] started small, proved our point and grew bigger."*

Mr Daniel Stewart, Primary Animal Health Coordinator
Pietermaritzburg, KwaZulu-Natal (KZN), South Africa

Action points for control of canine-mediated rabies

- Achieve a canine-mediated rabies free world by 2030.
- Support PAHO (Pan American Health Organization) and REDIPRA (Reuniones de Directores de los Programas Nacionales de Control de Rabia en América Latina) in the final phases of dog rabies elimination in Latin America.
- Implement the Stepwise Approach to Rabies Elimination (SARE) and the rabies blueprint in endemic countries of Africa and Asia.
- Channel rabies control interventions through improved coordination of global rabies actors.
- Develop programmes around vaccine bank initiatives and promote rabies control networks in Africa and Asia.
- Campaign for financial support from both external donors and governments of relevant countries, realizing that success hinges on political commitment and support.

Photo ©Franck Boué

Current initiatives to control dog-borne zoonoses

Global partnerships for rabies control

More than 98% of human rabies cases are canine-mediated, with about 85% of the global burden borne by countries in Asia and Africa (1). Children aged under 15 years are proportionally at higher risk of the disease, where a dog that is owned or known constitutes the most common route of exposure. Africa has the highest number of human rabies cases per inhabitant, mainly due to the lack of available and accessible human post-exposure prophylaxis (PEP) and the low rate of canine vaccination. In Asia, despite the large amount of PEP distributed each year, this region also accounts for unacceptably high numbers of human rabies cases, with bite sufferers either not seeking PEP or not completing the course of treatment. The Asian situation is further complicated by the various perceptions of dog 'ownership' and the resulting large numbers of community dogs.

The GARC together with the FAO has developed a Stepwise Approach towards Rabies Elimination (SARE), which links closely to the blueprint for rabies control (2). These outputs are intended to assist decision-makers and programme managers with developing and implementing practical, measurable and meaningful rabies prevention and control programmes. SARE has been developed as a tool to assist countries in the development of a national programme and strategy for sustainable rabies prevention, control, and eventually elimination (Fig. 3.1). Another initiative of the GARC has been World Rabies Day, a recognized United Nations International Day that has improved the visibility of rabies, placing control on the agenda of many countries and organizations where it was previously not present. Another GARC initiative is the Partners for Rabies Prevention, or PRP, which promotes a diverse membership for rabies control from both the public and private sectors, including international organizations and donors, WHO rabies collaborating centres, research scientists and representatives from industry.

Successful control of canine-mediated rabies in Bangladesh and South Africa

Paradigm shifts in rabies control in Bangladesh and the South African Province of KwaZulu-Natal (KZN) has

> *"GARC [the Global Alliance for Rabies Control] must be congratulated for initiating World Rabies Day. It has made a huge change, putting rabies on the agenda of many countries and organizations where it was not present before."*

Dr Katinka de Balogh, Senior Officer Veterinary Public Health, Food and Agriculture Organization, Italy

led to impressive results, with both strategies generating subsequent natural momentum. Prior to 2010, Bangladesh had no strategy for rabies elimination, no dog bite management centres and more than 80% of the estimated canine population of 1.2 million was unvaccinated, giving rise to the loss of more than 2000 lives annually through 300 000–400 000 dog bites. The Bangladesh programme, anchored around a four-point plan (Box 3.1) saw a consistent reduction of rabies cases from 2100 human cases in 2010 to 1400 cases in 2013 and human rabies-free status in one municipality.

The incursion in 1976 of rabies into KZN resulted in an ongoing rabies problem in one of South Africa's most heavily populated provinces, with nearly 500 canine cases recorded in 2007, and under-reporting in humans remaining high. In 2009, the KZN project started to address rabies in KZN province, supported by funding from the Bill & Melinda Gates Foundation (BMGF). By 2014, canine rabies cases in the province had decreased to 37, with no human cases reported at this time, demonstrating the feasibility of human rabies elimination (Fig. 3.2). The KZN rabies project developed an adaptable working model by a process of evaluation, research and innovation for the elimination of human rabies through the control – and eventual elimination – of canine rabies. Standard operating procedures (SOPs) developed as part of the programme are published in the rabies blueprint.(2)

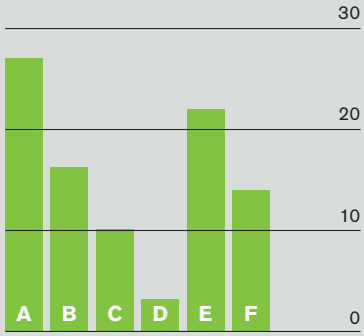
One of the challenges of large-scale disease control programmes is dependence on a single stream of funding, either from donors or from a single Ministry, as was the case in KZN and Bangladesh respectively. Both case studies emphasized that evidence of the impact of control enhanced the political momentum to commit further budgetary allocations. In Bangladesh, the Ministry of Health financially contributed to the mass vaccination of dogs, despite this being originally perceived as the remit of the Ministry of Agriculture. For KZN, the involvement of key global health actors such as BMGF and WHO added legitimacy to, and raised the profile of, the programme; however, it was the success of the project itself that stimulated additional contributions by the government to promote self-sustainability.

A dedicated platform from which to coordinate activities was also deemed important. Since 2010, Bangladesh has demonstrated this necessary paradigm shift in rabies control and elimination activities through the formation of national committees to oversee dog bite management (DBM) centres and mass dog vaccination (MDV) programmes. During 3 years of scale up, these activities have resulted in the coverage of more than 100 000 dogs across all district municipalities, accompanied by the capacity development of an impressive number of local health-care providers and MDV personnel across the country. The creation of a rabies office in KZN provided a centralized operation point. The role of effective champions who take the cause seriously and engage with other organizations such as animal welfare groups was recognized as an important component of the KZN project. DBM was highlighted as a key component of both the Bangladesh and South African strategies, as experience proved it was difficult to convince people to take on a large-scale dog vaccination programme without first addressing dog bites (3). Finally, the Bangladesh and South Africa examples emphasized the notion of a parallel top down-bottom up or 'top-bottom' approach, whereby communication of

Fig. 3.1
Reduction in number of human deaths and animal cases due to rabies since inception of KZN project, 2007–2014. The 2012 'spike' in cases was caused by a concurrent FMD outbreak that interrupted canine mass vaccination.

Participant feedback

Why do you think dogs are not being vaccinated to prevent rabies in your region?



A Lack of public awareness that dog vaccination can prevent rabies
B Affordability/availability of an efficacious dog vaccine
C Lack of/differing perceptions of dog 'ownership'
D People would rather go to hospital for PEP after a bite than rely on dog vaccine
E Lack of official commitment by public-health authorities or veterinary services
F Rabies is not an issue in my region

information should feed from the decision-makers to the community and back up, simultaneously targeting ministerial actors and local communities.

Improving awareness of the impact of cystic echinococcosis in Morocco and Mongolia

WHO is working towards the validation of effective cystic echinococcosis control strategies by 2020. The case studies from Mongolia and Morocco presented at NZD4 highlighted the complexity of control and the challenges to the 2020 target posed by low resource allocation for this disease. A WHO-supported clinical management study of human cystic echinococcosis in an area of high endemicity was presented from Morocco, where the requirement for effective stakeholder collaboration for interdisciplinary surveillance and control of cystic echinococcosis involving community based approaches has been recognized. The objectives of the study included training local health professionals in the diagnosis and management of abdominal cysts, and evaluating the effectiveness of selected treatment. It was acknowledged that more work is required to bring this disease to the attention of policy-makers in Morocco in order to promote the importance of this disease along several points of the food value chain, including at meat inspection.

In Mongolia, preliminary results from a WHO-commissioned situational analysis have highlighted that neither a national policy nor national guidelines for surveillance, prevention and case management of echinococcosis currently exist in the country, despite a high rate of underreporting in certain provinces. The future plan is to establish the burden and societal cost of cystic echinococcosis and to develop national SOPs on clinical approaches to diagnoses and patient management.

The studies on cystic echinococcosis described at NZD4 were both in the early stages of gathering evidence in order to provide advocacy and make recommendations for control, rather than implementing interventions. Whereas for rabies the extent of the problem is understood and clear strategies and action plans exist, burden estimates and proven control approaches are still lacking for *Echinococcus*. Health education, control at-source and the improvement of clinical procedures are currently the main priorities as identified by the two studies presented at the meeting. Building control of cystic echinococcosis onto other operational disease control programmes, such as that for brucellosis in Mongolia, was proposed as a strategy to promote its control and reduce surveillance costs. Whilst the development of parallel rabies and echinococcosis control programmes is appealing, consideration is required regarding the different timescales for interventions of these two diseases given that rabies requires an annual booster, whereas praziquantel administration for control of cystic echinococcosis is every 3 months.

Four-point plan for rabies control in Bangladesh

1. Advocacy, communication and social mobilization,
2. Dog bite management,
3. Mass dog vaccination,
4. Dog population management with the goal to achieving elimination of rabies and certification of rabies-free status.

References

1. WHO global health estimates 2014 summary tables; http://www.who.int/entity/healthinfo/global_burden_disease/GHE_DthWHOReg6_2000_2012.xls?ua=1 (accessed 9 February 2015).
2. Blueprint for Rabies Prevention and Control. Partners for Rabies Prevention; 2010. http://www.rabiesblueprint.com/(accessed 30 January 2015).
3. Shwiff SA, Hatch B, Anderson A, Nel LH, Leroux K, Stewart D et al. 2014. Towards canine rabies elimination in KwaZulu-Natal, South Africa: assessment of health economic data. Transbound Emerg Dis. 2014. doi:10.1111/tbed.12283.

> *"Without high-level political commitment, a country cannot achieve control or elimination of any disease."*

Professor Be-Nazir Ahmed, Ministry of Health and Family Welfare, Bangladesh

Conclusion

Several recent rabies success stories exemplify the potential impact of strong global advocacy on NZD control. The addition of practical tools such as SARE and the rabies blueprint helps countries to identify where they lie on the continuum of rabies elimination, providing operational guidance on all rabies control aspects.

Achieving a canine-mediated human rabies free world by 2030 is an aspirational, but nevertheless possible, target. Conversely, the control of canine zoonoses such as Echinococcus has been hindered by a low political profile, suspected high underreporting and a general recognition that control of this disease is complex, factors which may hinder the achievement of the WHO 2020 target.

4 *Control of neglected parasitic zoonoses*

The 2012 WHO roadmap on NTDs commits that by 2020, interventions for *Taenia solium* control will be scaled up in selected countries and that morbidity due to food-borne trematodiases will be controlled in all endemic countries.

Examples of successful control programmes, utilizing currently available tools, were given for fish-borne trematodiases in Thailand and *T. solium* cysticercosis in Peru. It is now imperative to adapt and scale up possible control strategies in endemic geographical areas.

Photo ©B. Sripa

> *"Effective control of T.solium will require a one health approach with multiple interventions implemented simultaneously across sectors."*

Professor Maria Vang Johansen, Professor in Parasitic Zoonoses, University of Copenhagen

Case study – the Lawa project: an eco–health approach to fish-borne trematode control

- The human liver fluke *Opisthorchis viverrini* is a major cause of bile duct cancer in South-East Asia, driven by culturally determined behaviours such as consumption of raw-fish.
- Lack of continuity in government policy and control activities has contributed to previous control failures.
- A prevalence of 67% was found in Lawa village in north-eastern Thailand.
- Lawa village was provided with targeted praziquantel treatment and intensive community education with a parallel 'liver fluke-free school' programme of treatment and education.
- Ecological monitoring is a central aspect of this integrated programme.
- Community prevalence declined to 16% and all 9 schools were declared 'liver fluke-free' in 2012.
- The prevalence in fish declined from 70% to 1% over 10 years.
- The Thai government has based a national programme on this approach.

> *"There will never be one solution that fits all, but interventions can always be selected and adapted. We must not let longstanding habits or short term money savings stand in the way of progress against these diseases."*

Dr Sarah Gabrïel,
Institute of Tropical Medicine, Belgium

Photo ©L Thomas

Promoting scale-up of pilot programmes

Recent examples of successful interventions for the control of fish-borne trematodes in Thailand and *Taenia solium* cysticercosis in Peru

Fish-borne trematodes such as *Opisthorchis viverrini* are a significant cause of cholangiocarcinoma, one of the primary liver cancers of the bile duct in Asia, with Thailand having the highest incidence of this condition in the world. Culturally determined risk-factors such as raw fish consumption are deeply embedded in the indigenous rice–fish culture of the region. These parasites have co-evolved with humans for hundreds of years, multiplying quickly to infect other reservoir or intermediate hosts, including cats and dogs, and are highly effective at adapting to changes in the environment. These factors make control a difficult challenge, with the lack of continuity in government policy and control activities constant barriers to sustainable, widespread control.

The 'Lawa project' (1) is working with a transdisciplinary team in the north-eastern Lawa Lake region of Thailand, a fish-borne trematodiasis hotspot with a community prevalence of 67% before the initiation of control activities. A control strategy was devised in this area based upon the eco–health approach, integrating targeted chemotherapy in high prevalence areas with intensive community education, environmental monitoring and extensive community participation.

A door-to-door intensive community education programme utilized Thailand's system of health volunteers, each of whom is responsible for 10–15 households. School-based education was also implemented alongside targeted chemotherapy using praziquantel. During the period 2008–2014, the liver fluke infection rate in the programme villages has declined to less than one-third from the baseline and all nine schools were classified as 'liver fluke-free'. In 2012, the prevalence in *Cyprinoid* fish species, which are the second intermediate host, was found to be less than 1% compared with a maximum of 70% during the baseline survey. The success of the Lawa project convinced the Thai government to launch a liver fluke campaign in 2012 based upon the eco–health approach and it is believed that this model can be applied to other food-borne parasites.

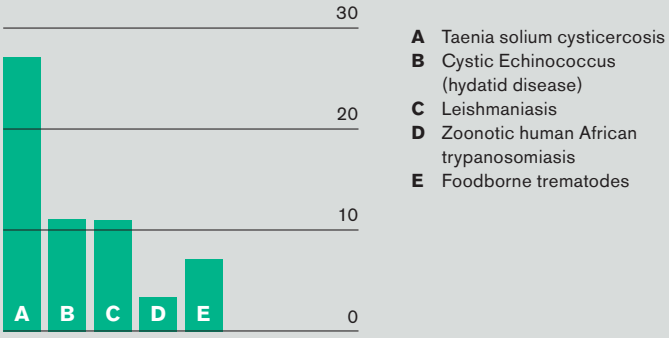
> *“It is important that these [WASH and NTD] sectors work together to reach the 2.5 billion people who don’t have access to improved sanitation, to stop open defecation and ensure that when wastewater is used it is done safely.”*
>
> **Ms Kate Medlicott,** WHO WASH

An example of successful control of *T. solium* was provided by Dr Armando Gonzalez of the National University of San Marcos in Peru. Financed by BMGF, the main objective of the Peruvian *T. solium* programme was to provide evidence that cysticercosis could be eliminated from the study area. A mass drug administration (MDA) campaign consisting of 2 g niclosamide at months 1, 5 and 9 was combined with anthelminthic treatment of pigs (30 mg/kg oxfendazole at months 0, 2, 4, 6 and 8) and porcine vaccination with TSOL18 at months 4 and 8. One year later, 310 pigs were culled and finely dissected for the presence of cysts. Within the vaccinated areas, only two pigs had a living cyst and these were living within a cluster of non-complainant families where the pastor prevented any treatment being provided to pigs. The use of the TSOL18 vaccine was highlighted as an important tool to enable elimination to be sustained. The success of this project was attributed to the dual health and production benefits of anthelminthic treatment in pigs, where farmers noticed weight gains of up to 5 kg in treated pigs at slaughter, thereby incentifying local communities to work with the project and improving compliance.

Participant feedback

Participants overwhelmingly identified *T. solium* as an important parasitic zoonosis in their region.

In your opinion, which of the following parasitic zoonoses is most under-reported in your area?



Outcomes of a WHO informal consultation on cysticercosis, 17–18 July 2014

Determining the optimum strategy for *T. solium* control and establishing a framework for the management of neurocysticercosis in resource-constrained countries were the objectives of an informal consultation on cysticercosis held at WHO headquarters in Geneva on 17–18 July 2014 (2). As well as representation from the FAO–OIE–WHO Tripartite, research and public-health stakeholders from countries committed to undertake pilot projects for control of *T. solium*, including Brazil, China, Côte d’Ivoire, Madagascar and Viet Nam, attended the meeting.

Extrapolation of the available data supports the current recommendations of a combined approach to *T. solium* control consistent with the Peruvian approach, comprising human MDA, porcine anthelminthic treatment and vaccination. Supportive measures such as health education were also highly recommended, although further validation of such strategies is needed. It was agreed that the current tools, technologies and understanding of the disease are sufficient to begin the implementation of small-scale control programmes in several countries. A commitment to develop detailed country-specific programmes including assessments of data availability, needs forecasts and the availability of new tools would occur over the next 12 months. This activity is currently being driven by a group of committed countries where there is political will to act.

Meeting participants also requested the establishment of a network open to willing country partners to support efforts to control cysticercosis. This network, representing Member countries, the research community, human and animal health sectors, international agencies and stakeholders from the NTD community, is now constituted and managed by WHO in collaboration with FAO and OIE. Its objective is to decrease disease transmission by addressing all aspects involved in the disease cycle and improve access to health services and disease management for people with taeniasis and neurocysticercosis (3).

Importance of collaborating with social research, hygiene and sanitation sectors to address neglected parasitic zoonoses

The parasitic zoonoses discussed at NZD4 exemplify how supporting strategies such as improved sanitation may have an impact on disease burden. The collaboration of NTD and water, sanitation and hygiene (WASH) sectors is an example of One Health operationalization whereby NZD control can be integrated into wider programmes. Collaboration between the WHO NTD and WASH departments is being legitimized through a new organizational strategy to be released in 2015, arising from a recognized need for the two departments to 'learn each other's language' in order to contribute to the control of these diseases. Whereas the NTD community talks of disease prevention, WASH talks of functionality, accessibility and affordability, with programmatic implementation often undertaken by private sector actors.

The integration of *T. solium* control within other NTD control activities was also discussed, with an acknowledgement that there are infrastructural areas where this integration may take place, for instance the potential for sharing staff and vehicles across control programmes. Integration of NZD control into existing animal health platforms (for example, combining TSOL18 with classical swine fever vaccine) was also raised as an example, but it was clear that integration may mean different things in different countries. A strong call was made to provide broad ranging extension services to communities that tackle many diseases simultaneously, rather than proposing vertical disease strategies or separate infrastructure for NZD control.

Health education is a key component of control strategies for the parasitic zoonoses, although empirical data on its efficacy are scarce. Moreover, many control programmes have not made full use of the latest advancements in social science and hence many educational tools are dated and somewhat inadequate. To tackle this issue for *T. solium* control, a new web-based health education tool has been developed under the EC-funded ADVANZ project (4), where initial data from the United Republic of Tanzania look promising. This platform will provide uniform training options and enable the teaching tools to be continuously improved. Although validation of educational tools is needed, experience from WASH indicates that there are many interventions that do not work without an educational message, whilst education alone will not work without the infrastructure.

References

1. Sripa B, Tangkawattana S, Laha T, Kaewkes S, Mallory FF, Smith JF et al. Toward integrated opisthorchiasis control in northeast Thailand: the Lawa project. Acta Trop. 2015;141(B): 361–7. doi:10.1016/j.actatropica.2014.07.017.
2. Maurice J. Of pigs and people: WHO prepares to battle cysticercosis. Lancet. 2014; 384:571–2. http://www.thelancet.com/journals/lancet/article/PIIS0140-6736%2814%2961353-2/fulltext?rss=yes (accessed 30 January 2015).
3. WHO cysticercosis network http://www.who.int/neglected_diseases/global_network_tackle_tapeworm/en/ (accessed 30 January 2015).
4. The vicious worm: a cysticercosis advocacy information tool http://www.theviciousworm.org/ (accessed 24 February 2015).

> ***"There are countries with huge burdens of neurocysticercosis that have strategies for control written but not implemented. We need to assist countries at a programmatic level and demonstrate success."***
>
> **Dr Bernadette Abela-Ridder,** Team Leader
> WHO NZD

Conclusion

Concurring with a June 2014 WHO informal consultation on the control of *T. solium*, participants agreed that the NZD community is sufficiently 'tool ready' to commence control of the parasitic zoonoses discussed at NZD4.

Despite impressive examples from isolated projects, integrated, sustainable and cost-effective programmes still require validation in most regions. This validation is urgently required so that we may adhere to the NTD roadmap targets on these important parasitic zoonoses.

5 *Forgotten bacteria: from silent suffering to recurrent epidemics*

The bacterial neglected zoonoses are not included in resolution WHA66.12 on neglected tropical diseases and have been described as the 'forgotten neglected zoonoses'. The reason for this neglect is multifaceted; for example, in the African Region, human disease priorities are defined by the Integrated Disease Surveillance and Response (IDSR) framework, where anthrax is the only bacterial zoonosis featured.

On the animal side, anthrax, bovine tuberculosis and brucellosis are listed as OIE notifiable diseases, but the veterinary and food safety sectors fail to control these diseases at source. Despite their low level of political attention in endemic regions, successful evidence of One Health approaches towards their control does exist; for example in Mongolia, where the strong evidence bases generated by brucellosis research have resulted in national-level policy dialogue.

Photo ©Felix Roth

> *"We are lagging behind in terms of [recognition/prioritization] for anthrax, BTB and brucellosis."*

Dr Rudovick Kazwala, Faculty of Veterinary Medicine and Public Health Sokoine University of Agriculture

Reasons for neglect of the bacterial zoonoses

- The current potential control options are not supported by an enabling policy framework in many endemic countries. For example, test and slaughter is the only at-source control option for bovine tuberculosis; however, this is not practical where compensation cannot be paid.
- There are major gaps in the understanding and training of medical and veterinary professionals with regard to the diagnosis and control of bacterial zoonoses.
- These diseases are not being prioritized at a national level by the health or veterinary sectors, and hence no resources are being allocated for national programmes.
- Difficulties in achieving cost-sharing of control across sectors leads to difficulties in quantifying the extent of these diseases and the true levels of under-reporting.

Photo © Felix Roth

Current state of bacterial zoonoses control in Africa and Asia

> *"The money [spent on bacterial zoonoses research] is not invested according to long-term public health needs, with current funding being mostly directed to research on zoonotic agents that can be used as biological weapons, such as anthrax."*

Dr François Meslin, WHO NZD

Forgotten but funded

Despite their lower level of attention and lack of prioritization in endemic regions, work undertaken by ICONZ has shown that these diseases are nevertheless benefitting from significant investments in research (Fig. 5.1). For example, bovine tuberculosis and brucellosis are getting more funding than rabies, echinococcosis and cysticercosis combined, with more than €168 million being spent on anthrax research. Despite these figures, the type of research, and the intended beneficiaries, should be considered as it is often not those in endemic regions. For example, the research interest in brucellosis and anthrax is largely fuelled by their potential use as bioterrorist agents, rather than their impact on resource-poor economies.

Intersectoral collaboration for control: the case of brucellosis in Mongolia

The large-scale brucellosis intervention programme in Mongolia has demonstrated that synergies between the Ministry of Health and the Ministry of Agriculture are essential to success. Logistical cooperation in the form of joint transport, training, diagnostic analyses and data-sharing all contributed to synergizing control of brucellosis in Mongolia.

Aside from the logistical challenges, the operationalization of One Health is also difficult in terms of budgetary and financial constraints, particularly in resource-poor countries where ministries are often reluctant or unable to share their budgets with others. The Mongolian case demonstrated that where the economic evidence regarding the benefits and savings for disease control exists, government resources are more likely to be secured, particularly in the Ministry of Agriculture due to the livestock losses suffered from the disease (1, 2) (Fig. 5.2). On the human side, however, brucellosis remains neglected, with the Ministry of Health still seeking funding solutions for the payment of brucellosis treatment for human patients.

A second common challenge for zoonoses control – particularly for the bacterial zoonoses where at-source control in livestock reservoirs is the most effective in breaking transmission – is that the livestock sector is simply a sub-sector of a much larger Ministry of Agriculture

Fig 5.1
Value of funding (€) identified for the eight neglected zoonoses, for the 10 year period 2006–2015 (More info at: www.zoonosis.ac.uk/iconz)

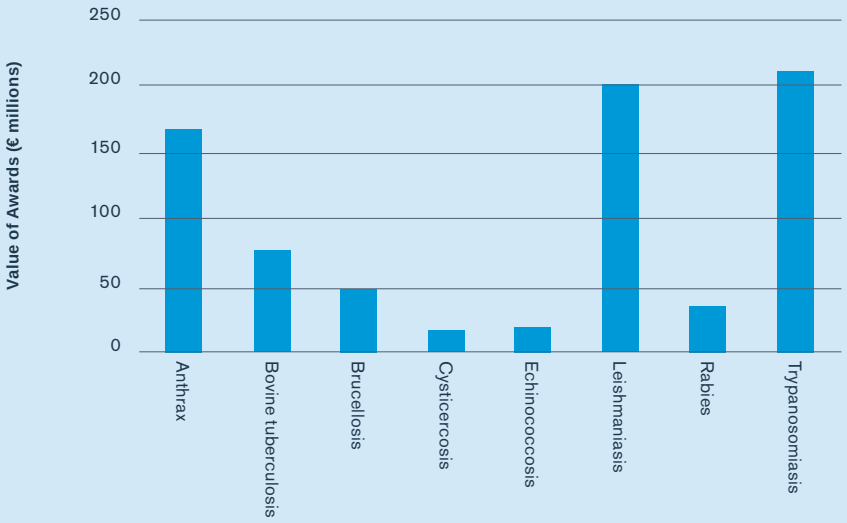
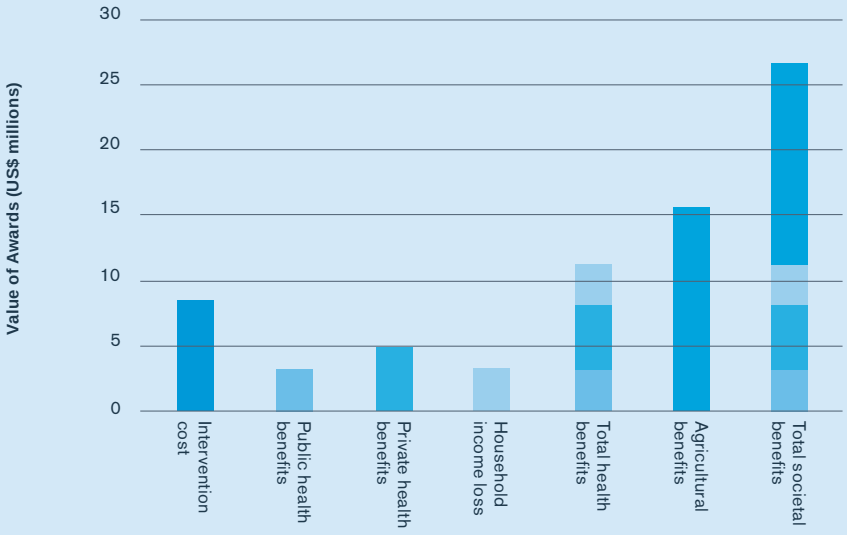


Fig 5.2
Distribution of the monetary benefits and costs of brucellosis control in Mongolia



with many competing funding priorities. There is a further need to improve the visibility of the livestock sector within national agricultural programmes and – particularly for countries whose agricultural sectors rely on significant external funding – among donor agencies (3, 4). In Mongolia, the Ministry of Agriculture was motivated to control brucellosis because of the potential for opening up livestock export markets; a reminder of the importance of the bacterial zoonoses in international trade sanctions. Despite advocacy in Mongolia, however, brucellosis is still not a priority for the Ministry of Health, although attempts have been made to include the disease in health insurance schemes. Declaring brucellosis as an occupational disease may open up new funding mechanisms to cover drug costs for the treatment of human brucellosis.

Sustainability of control and risk of re-emergence

In the 1960s, huge Soviet-led test and slaughter campaigns in Mongolia reduced the prevalence of brucellosis; however, it became obvious that this practice was not feasible in the nomadic setting. With the support of WHO, the authorities shifted to mass vaccination in small ruminants. Immunization levels were high enough to bring down prevalence but insufficient to interrupt transmission; as soon as vaccination stopped, the small ruminant prevalence – and consequentially the human prevalence – resurged. Government authorities launched a new 10-year mass vaccination campaign in 2001, but again failed to interrupt transmission. A third vaccination campaign was implemented in 2010, with four million ruminants vaccinated since then with Rev1 and S19, ensuring that coverage was high enough to stop transmission. The veterinary sector is currently monitoring the impact of vaccination, but finances are limited as remaining funds are being concentrated on foot-and-mouth disease (5). Similar experiences of initial success interrupted by budget cuts have been described in other countries.

Discontinuation of control programmes is not the only driver for recurrent epidemics, with the Syrian war situation illustrating how conflict is an important driver for brucellosis emergence (6). In 2007, the

Fig 5.3
Location of Human Brucellosis seroprevalence/incidence studies that meet quality criteria for analysis of disease incidence (7)

Syrian Arab Republic was reported to have the highest global prevalence of human brucellosis, hypothesized to have remained high despite the dearth of data since the onset of war. The objective of the current study presented during this session is to characterize the brucellosis situation post-war and to track how the disease has moved with the movement of displaced people, who have taken their cattle with them to the bordering countries of Jordan and Lebanon.

Global burden of brucellosis

A systematic review of publications on human brucellosis, commissioned by the Foodborne Disease Burden Epidemiology Reference Group (FERG), revealed that high-quality data on disease incidence was largely lacking outside of the Middle East and Eastern Mediterranean region. Based on strict screening criteria, only 29 publications were of sufficient quality for an analysis of disease incidence (7) (Fig. 5.3). Brucellosis incidence varied widely between and within countries, demonstrating that aggregated data at national or regional levels may not capture the complexities of disease dynamics, and consequently, at-risk populations or areas may be overlooked. A meta-analysis of clinical manifestations of brucellosis enabled the first informed disability weight to be calculated for brucellosis (8). Based on these findings, FERG is preparing an estimate of the DALYs due to brucellosis, enabling the global burden of this disease to be better understood and evaluated.

The results of FERG will be launched on World Health Day 2015 that will be dedicated to food safety (http://www.who.int/campaigns/world-health-day/2015/event/en/).

Challenges of brucellosis diagnostics

The lack of definitive clinical symptoms for brucellosis in both animals and humans necessitates laboratory diagnosis; however, the gold standard (bacteriology) is technically challenging – especially in resource poor contexts – therefore diagnosis usually relies on serology. Whilst not perfect, some serological tests are adequate if correctly standardized and implemented, proven by their key role in brucellosis elimination in numerous countries.

It was emphasized that the need for 'confirmatory' testing depends on the epidemiological context and the species being tested. In areas where brucellosis vaccination is not practised, confirmatory testing in animals is not necessarily required given existing serological tests are over 95% sensitive and almost 100% specific in the absence of vaccination and are robust and affordable. In humans, confirmatory tests are only important if a person is found to be seropositive in a screening test and has compatible symptoms. It was also emphasized that all brucellosis tests need careful standardization and that this is the most common problem found in the use of these tests. Novel molecular tests are being developed but their usefulness in the field has not been fully tested and further studies are required.

Finding and correctly treating patients

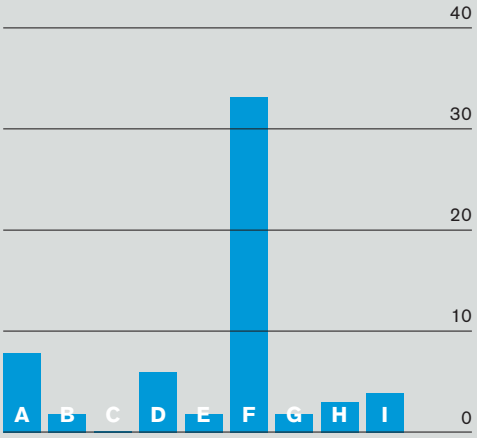
Under-diagnosis of brucellosis is a reality in many countries, with tests often not available and limited awareness of the disease among many health practitioners. Indirect information from several endemic countries of Asia and the Mediterranean basin suggest that for every reported human case another 25–50 cases remain unreported. While the emphasis on brucellosis burden has been on under-diagnosis, over-diagnosis due to poorly standardized or obsolete diagnostic tests was also suggested to be an issue.

> ***"A brucellosis accreditation scheme targeting the commercial sector was introduced in Zimbabwe after veterinarians showed this disease was a major problem. A reduction in prevalence was observed; unfortunately, after the 1990s this scheme was no longer sustainable due to budget constraints and the disease shot up."***

Professor Gift Matope, Faculty of Veterinary Science
University of Zimbabwe

Participant feedback

In your view, which of the following diseases shows the most promise for control in the next 5-10 years in your region?



A Taenia solium cysticercosis
B Echinococcus (hydatid disease)
C Zoonotic leishmaniasis
D Zoonotic African trypanosomiasis (sleeping sickness)
E Foodborne trematodes such as liver fluke
F Rabies
G Anthrax
H Bovine tuberculosis
I Brucellosis

Lessons learnt from brucellosis control in Mongolia

The long history of brucellosis control in Mongolia has highlighted, that to achieve sustainable control countries must:

1. Use an approach adapted to the context
2. Monitor the immunization process and feedback the results and recommendations to the policy-makers
3. Think long term not giving up prematurely and ensuring sufficient funds.

References

1. Roth F, Zinsstag J, Orkhon D, Chimed-Ochir G, Hutton G, Cosivi O et al. Human health benefits from livestock vaccination for brucellosis: case study. Bull World Health Organ. 2003;81:867–876.
2. Zinsstag J, Schelling E, Roth F, Bonfoh B, de Savigny D, Tanner M. Human benefits of animal interventions for zoonosis control. Emerg Infect Dis. 2007;13:527–531.
3. Blench R, Chapman R, Slaymaker T. A study of the role of livestock in poverty reduction strategy papers. FAO Pro-Poor Livestock Policy Initiative 2003. http://www.fao.org/ag/againfo/programmes/en/pplpi/docarc/wp1.pdf (accessed 5th February 2015).
4. Okello AL, Welburn SC, Smith J. Crossing institutional boundaries: mapping the policy process for the control of endemic and neglected zoonoses in sub-Saharan Africa. Health Policy Plan. 2014; 1–9. doi:10.1093/heapol/czu059.
5. Zolzaya B, Selenge T, Narangarav T, Gantsetseg D, Erdenechimeg D, Zinsstag J et al. Representative seroprevalences of human and livestock brucellosis in two Mongolian provinces. Ecohealth. 2014;11:356–371. doi:10.1007/s10393-014-0962-7.
6. Gwida M, Al Dahouk S, Melzer F, Rösler U, Neubauer H, Tomaso H et al. Brucellosis – regionally emerging zoonotic disease? Croat Med J. 2010;51:289–95. doi:10.3325/cmj.2010.51.289.
7. Dean AS, Crump L, Greter H, Schelling E, Zinsstag J. Global burden of human brucellosis: a systematic review of disease frequency. PLoS Negl Trop Dis. 2012;6:e1865. doi:10.1371/journal.pntd.0001865.t004.
8. Dean AS, Crump L, Greter H, Hattendorf J, Schelling E, Zinsstag J. Clinical manifestations of human brucellosis: a systematic review and meta-analysis. PLoS Negl Trop Dis. 2012;6:e1929. doi:10.1371/journal.pntd.0001929.

> *“There is a need for better statistical and epidemiological training of researchers in endemic countries to improve the quality of research studies.”*

Dr Anna S. Dean, TME/TB Monitoring and Evaluation
World Health Organization

Conclusion

Control of brucellosis in Mongolia is an impressive example of how to operationalize One Health, largely achieved through building the evidence base on the cost–effectiveness of intersectoral control. Despite initial success, concerns regarding diminishing state financial resources for disease control in both humans and animals are hindering the sustainability of this scheme.

Experience of brucellosis emergence during the Syrian war has illustrated that conflict is an important driver of disease emergence for many NZDs. There are also challenges surrounding diagnosis of bacterial zoonoses such as bovine tuberculosis and brucellosis where, particularly for brucellosis, the tests are not perfect but adequate if implemented correctly in a standardized way.

6 *Financing for the neglected zoonoses*

Research is integral to refining the tools for successful NZD control, with examples of ongoing financial commitment to research and development from donors including the European Union and the UK government.

However, in order to capitalize on these research investments, the results need to be translated into action at scale, which often requires significant advance funding beyond the scope of a public funding body. Initiatives such as development impact bonds (DIBs), which harness private sector investment models that habitually place large amounts of finance up-front, can offer generic lessons for NZD control and potentially add value to traditional donor funded platforms.

Photo ©Alexandra Shaw

> *"These types of innovative financing mechanisms make sure we are not just investing more, but investing more wisely…"*
>
> **Dr Christopher Fitzpatrick,** Health Economist, WHO

Key messages from the session

- A paradigm shift is required from financing 'inputs' to financing 'outcomes'.
- Enhanced quantification of the economic benefits of NZD control will generate greater enthusiasm for funding.
- Greater funding innovation is required; for example DIBs where the investment 'risk' is taken up by the private sector rather than the public purse.
- Affected countries themselves should consider how to best generate money from domestic sources, in addition to external donor funding.
- There is a recognized requirement for greater funding transparency and better coordination of NZD control approaches to build upon – rather than duplicate – the progress that has already been made.

Photo ©Lian Thomas

Funding opportunities: from traditional donor mechanisms to the untapped potential of private sector investors

European Union funding to address NZDs: Research Framework Programmes and Development and Cooperation Actions

The European Union has historically and increasingly provided funding under the Research Framework and the Development and Cooperation Programmes, the latter focused on developing countries. Different aspects of NZDs within the One Health approach have been supported by both of the above programmes. Activities related to the EU Research Framework Programme (RFP) are implemented via different instruments, ranging from the development of collaborative research projects to the implementation of coordination and support actions. The 7th EU RFP, which covered the period 2007 to 2013, has contributed to the funding of significant ongoing coordination and horizontal projects in the field of NZDs such as ICONZ, OH-NEXTGEN, ADVANZ, STAR-IDAZ and ANTIGONE [http://cordis.europa.eu/home_en.html].

Other 7th EU RFP funded projects such as ASKLEPIOS, HERACLES and AFRICOLEISH are good examples where specific NZDs are being targeted [http://cordis.europa.eu/home_en.html]. A large part of Horizon 2020, the EU RFP for the period 2014 to 2020, addresses seven 'Societal Challenges' that include research related to human and animal health and food security. The EU Development and Cooperation (DEVCO) Programmes address the control of NZDs through national, regional and global interventions. Through the DEVCO Programmes, the EU has been supporting and contributing to OH initiatives and achievements since 1990. Three key recent examples of this EU commitment are the initiatives INNOVATE (in South and Southeast Asia), HPED (co-implemented by FAO, OIE and WHO and with focus on the South Asian Associations for regional Cooperation and on the Association of Southeast Asian Nations) and VETGOV (in Africa) [https://ec.europa.eu/europeaid/home_en]. The strategic programming of the EU funding provided under the Research Framework and the Development and Cooperation Programmes is continuous. The resulting specific topics and opportunities for funding, including the potential to address NZDs, are based on priority-setting exercises carried out in consultation with multiple actors and stakeholders.

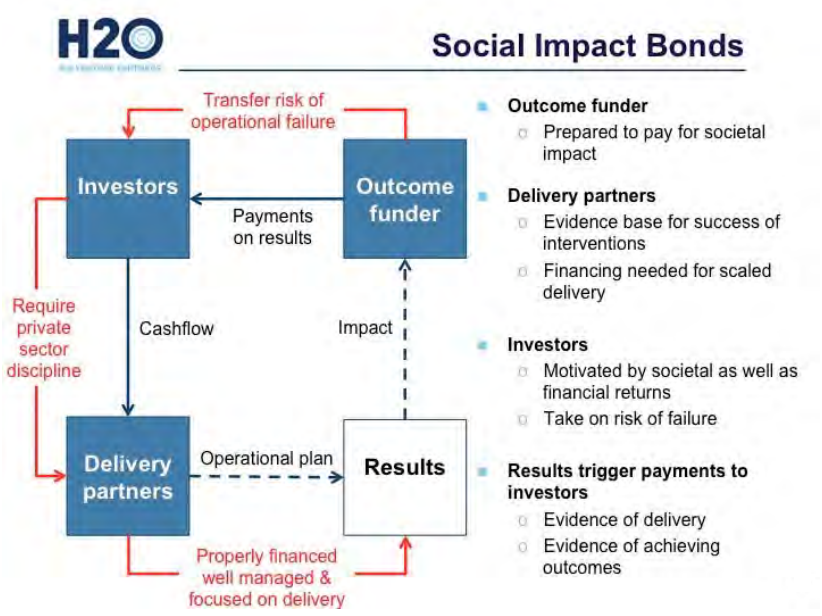
UK Biotechnology and Biological Sciences Research Council collaborative research programme on Zoonoses and Emerging Livestock Systems

There are a multitude of animal health and zoonoses funding sources available in the United Kingdom, including universities with their own research funding mechanisms, charities of varying sizes and scope of influence, and several government sources including the UK Department for International Development (DFID) and the Department for Environment, Food and Rural Affairs (DEFRA). The ICONZ Neglected

Zoonoses database produced by Liverpool University (http://www.zoonosis.ac.uk/iconz) gives a good overview of global funding into research for the NZDs, highlighting a number of UK-funded projects. Of the UK organizations funding research, the Biotechnology and Biological Sciences Research Council (BBSRC) is one of the larger funders of animal health programmes, with 591 animal health projects funded during 2011–2013 at a total budget of £122 million. Of these, 32 had a component addressing one or more of the NZDs (including leptospirosis).

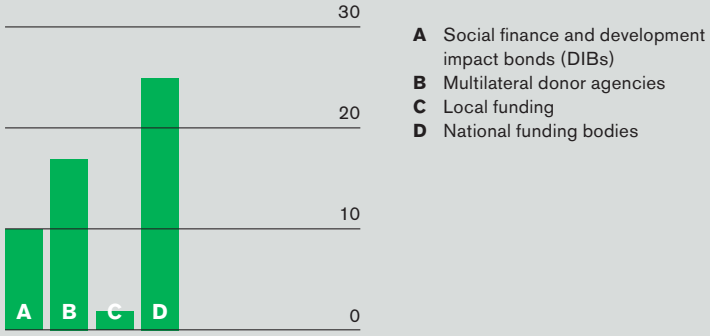
The recently launched five-year BBSRC programme 'Research on Zoonoses and Emerging Livestock Systems' (ZELS) is funded by several UK government funding sources including DFID, four Research Councils and the Defence Science and Technology Laboratory. With a budget of £20.5 million (US$ 33 million equivalent), the programme aims to reduce the impact of zoonoses on the poor and their livestock, whilst forging mutually beneficial inter- and multidisciplinary research partnerships. All 11 projects will be working in partnership with each other, national government and research groups, and local level stakeholders, both in Africa and Asia. The research projects will also be closely linked to major international stakeholders such as the OIE, WHO, FAO and the EU, as well as learning from previous research projects such as ICONZ and ADVANZ. Field research activities will be rolled out in 10 countries: six in Africa and four in Asia. The grants consist of two forms: smaller topic-specific grants of 3 years that review gaps in knowledge, including several NZDs such as brucellosis and hybrid schistosomiasis. The seven research partnership grants are larger, truly multidisciplinary projects of 4–5 years. Several have many research groups working together, also on a number of NZDs including brucellosis and bovine tuberculosis, with a postgraduate programme that will train a cohort of students.

Fig. 6.1
Overview of the social impact bond funding mechanism



Participant feedback

Out of the possible funding options discussed, which one do you feel will be most suited to NZD control in your region?



Funding for the future: the potential for private sector investment models

There is an increasing need for the NZD community to transform research into action; leveraging private sector funding to realize this is one opportunity, with examples of public–private investment models such as social impact bonds (SIBs) gaining traction in other areas of development. The SIB model (Fig. 6.1) includes traditional donors such as USAID or DFID playing the role of an 'outcome funder'; actors prepared to pay for societal impact. There is also a delivery partner – for example a research institute – that has an evidence base for an effective intervention but not the required human and financial resources to deploy the intervention at scale. Lastly, there are private sector investors, motivated by societal change and the possibility of making a return on their investment. To underpin such investments, it is necessary to identify robust and measurable results that can act as indicators for that societal change.

This type of model works in that private investors are persuaded to provide 'up-front' funding, based on their willingness to pay for societal impact, in order to deliver the intervention at scale. The delivery partners then implement their operational plan, resulting in verifiable results that equate to impact. The government or donor outcome payer then reimburses the private sector the cost of the intervention; a form of payment by result. The resultant transfer of risk of

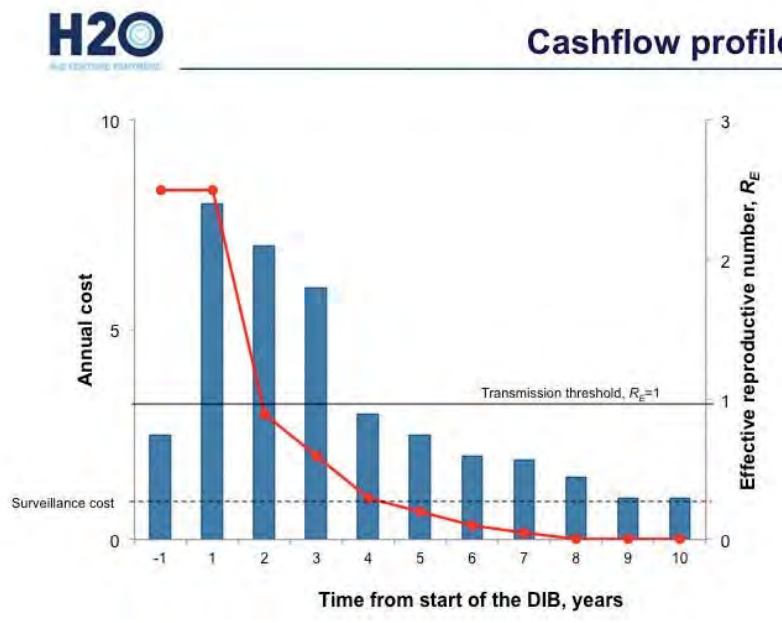
operational failure from public purse to private investor is an important factor to note in the SIB model. If results are not reached, the private investor loses their money, hence this partner enforces rigour on the operational delivery, so that everyone is focused on success.

For example, DFID-funded support with Edinburgh University and Social Finance (www.socialfinance.org.uk) is trying to design an operational plan for control of human African trypanosomiasis in Uganda, with the outcome (result) being a sustainable reduction in the level of human infective rhodesiense in cattle reservoirs (2). Rabies is also a promising model, given the strong evidence base and the relatively simple vaccine control intervention; the constraint is operational, not technical, therefore it should be relatively easy to implement at scale with the right frontloaded funding (Fig. 6.2). It also supports a One Health approach, with veterinarians, medical officers and environmentalists all focused around the goal of outcome payment.

References

1. Okello AL, Beange I, Shaw A, Moriyón I, Gabriël S, Bardosh K, et al. (2015) Raising the Political Profile of the Neglected Zoonotic Diseases: Three Complementary European CommissionSFunded Projects to Streamline Research, Build Capacity and Advocate for Control. PLoS Negl Trop Dis 9(3): e0003505. doi:10.1371/journal.pntd.0003505
2. Development Impact Bond Working Group Report: consultation draft. Centre for Global Development. http://www.cgdev.org/sites/default/files/DIB_WG_REPORT.pdf (accessed 3 February 2015).

Fig. 6.2
'Linking cash to epidemiology': the example of rabies



"The red line is R0 – how many secondary infections appear from a single infected dog. The goal is to take this red line below 1. For this you need 'effort' in the form of funding; depicted by the blue bars. You need to hit the disease as hard as possible at the start to reduce Ro below 1, then maintain it via surveillance and risk assessment. The cash flow profile described here is very well suited to a social finance model such as DIBs."

Conclusion

Research remains key to addressing the NZDs, with the requirement for research funding outputs to lead to change as highlighted by the London Declaration on NTDs. As well as an exciting number of upcoming public funding opportunities to address various NZD initiatives, donors are now also looking to bring private sector leverage alongside public investments, enabling new models of financing that provide the necessary funding over a long enough timescale to deliver results.

The current dialogue occurring in the NZD community around innovative financing opportunities is timely, given the release in February 2015 of the third global report on NTDs, where a strong theme will be innovative investment mechanisms to overcome the burden of NTDs.

7 Beyond NZD4: progressing from advocacy to action

The fourth international meeting on neglected zoonotic diseases brought together over 120 participants from all WHO regions. Representatives from academia, national government ministries, multilateral agencies and the private sector showcased the progress made in the 10 years since the first meeting was convened in 2005.

During this time, the NZD community has progressed from a requirement for basic epidemiological data to a point at which control for many of these diseases may be feasible using the currently available tools. It is now time to capitalize upon this significant progress and operationalize One Health to 'remove the N from the NZDs'.

Participants of the fourth International Meeting on Neglected Zoonotic Diseases, World Health Organization Headquarters, Geneva, Switzerland.

> *"The last mile is the toughest to see these programmes through, [however] without the guys on the ground you'll never get to that last mile."*
>
> **Dr Luke Gamble,** WVS and Mission Rabies

Key messages from the session

- Despite the progress made in tackling these diseases during the past decade, meeting participants recognized the large – but often still unquantified – burden placed by the NZDs on the poorest of the poor.
- Control tools are available in most instances, although refinement is still required.
- Impressive examples of control programmes are now available, along with data demonstrating cost–effectiveness that can act as encouragement for other willing partners to embark upon NZD control programmes.
- The global-level advocacy required for successful NZD control can be led by the FAO–OIE–WHO tripartite, coupled with strong political will at the national ministerial level.
- Good examples exist to date of One Health operationalization for the NZDs in several countries; the Tripartite further supports individual counties in their wish to implement locally acceptable One Health mechanisms.
- Lack of funding is still a major barrier to control of some NZDs; hence novel investment opportunities should be explored where possible.

Photo ©Franck Boué

Moving from advocacy to action for future zoonotic control

Address the immediate priorities

Rabies and *T. solium* cysticercosis were identified as priority diseases by the majority of participants. This view is validated by the inclusion of these diseases on the 2012 WHO roadmap for NTD control and the targets set therein (1). Participants considered rabies to show the most promise for control within the next 5–10 years, likely inspired by the recent successful campaigns in Bangladesh and South Africa and the readily available toolbox for this disease. Despite the current priority to achieve the targets set by the NTD roadmap, other diseases are not being overlooked. Success stories such as the elimination of echinococcosis in Cyprus and New Zealand were cited as inspiration for control of a broad range of NZDs, along with the recognition that the lead may be taken by agencies other than the WHO for some initiatives.

Address the gaps in knowledge

Although much progress has been made in increasing the recognition of NZDs at an international level, it was agreed that underreporting is still a valid concern. Issues such as low levels of community awareness, limited diagnostic capacity and ineffective reporting systems continue to hamper fully understanding the burden imposed by these diseases. *Opisthorchis viverrini* – a major zoonotic cause of bile duct cancer in South-East Asia (2) – was highlighted as a key example of disease misclassification, given global burdens are recorded simply as 'cancer', without specifying the causative agent. Despite a similar paucity of epidemiological data for many zoonotic diseases, the overwhelming consensus from participants was that the NZD community is now in a position where the focus must lie on moving forwards with control programmes and utilizing the available tools and data.

Fund control

Not surprisingly, access to funding remains an important barrier to NZD control. Positively, participants considered that the international NZD community had progressed substantially in the 10 years since NZD1, with a shift in the funding priorities from research needs to operationalization and outcomes. However, as discussed earlier in this report, there are now opportunities to investigate innovative finance models such as DIBs, which may provide the required up-front investment in order to address these diseases in a sustainable way. Evidence of a successful economic case for the control of some zoonoses, such as that for brucellosis control in Mongolia (3), also helps provide a sound evidence base for investment.

There is a need to capitalize on specific drivers for disease control, with examples such as tsetse and rabies elimination from the tourist areas of Botswana and India respectively. Although it is important to look towards large donors for control programmes, it was also stressed that donor funding may in fact represent only a small proportion of national budgets in many countries, and that governments must have ownership of their programmes and be free to apply their own priorities.

Promote cross-sectoral collaboration and programmatic integration

Cross-sectoral collaboration and integration at the international, national and local levels go hand in hand for NZD control (4). Participants agreed that cross-sectoral collaboration was of fundamental importance for moving forwards with the NZD agenda, with examples and opportunities for inter-departmental collaboration identified at all levels. It was also recognized that in many instances, cross-sectoral working – particularly at the community level – is not possible without an enabling policy environment facilitated by those working at the various governmental levels.

Integration may mean different things in different settings, but examples showed the potential for integrated approaches at various administrative levels. At an international level, there was a call for the integration of NZD control with the global health security agenda, which may assist in raising the profile of these diseases and in turn the ability to access funding. At the implementation level, integration may take the form of 'piggy-backing' different strategies upon one another. An example was given of treating the 'dog zoonoses cluster' in Morocco where application of rabies vaccination, insecticidal collar for leishmaniasis control and anthelminthics against echinococcosis are being combined. It was made clear that WHO wishes to provide an evidence-based 'toolbox' for NZD control, from which willing country partners may choose the tools that fit their local situation.

Health education to encourage behaviour modification was also shown to be a key part of many of the NZD control options, with participants acknowledging that communities require a certain level of knowledge in order to increase their stake in disease control and ensure sustainability of control programmes.

Although empirical data are not available on the efficacy of health education in many cases, it was considered that most of the currently available NZD control interventions require at least some level of human behaviour change; however, the difficulty and time periods required to achieve behaviour modification were also acknowledged. It remains to be seen whether currently available resources are being used adequately to influence behaviour change. Platforms such as ADVANZ (http://www.advanz.org/) provide an opportunity to collate all available resources for health education. Having a single, easily accessible repository for materials will allow for continual improvement in materials and an opportunity for open discussion about how they are best deployed in the field.

Closing remarks from this important final session reiterated that One Health has now gained traction globally and, in conjunction with resolution WHA66.12 (5), provides both the conceptual and policy frameworks for NZD prioritization and control via collaborative and integrated approaches. We are in a position where many control tools are now available: they may not yet be perfect but

> *"Neglected diseases are not new; however, they require a new approach. National health, agriculture and environmental ministries can be an important concentration of scientists and specialists that we should access through national budgets to use in the fight against these diseases."*
>
> **Professor Idriss Alfaroukh,** Directeur général, Institut de recherches en élevage pour le développement (IRED), Chad

> *"Put simply, if you want to combat poverty, what greater gift to give communities than their health?"*
>
> **Prof Sue Welburn,** ICONZ Coordinator, University of Edinburgh

References

1. Accelerating work to overcome the global impact of neglected tropical diseases: a roadmap for implementation. Geneva: World Health Organization; 2012 http://whqlibdoc.who.int/hq/2012/WHO_HTM_NTD_2012.1_eng.pdf (accessed 5 February 2015).
2. Sripa B, Kaewkes S, Sithithaworn P, Mairiang E, Laha T, Smout M et al. Liver fluke induces cholangiocarcinoma. PLOS Med. 2007;4:e201. doi:10.1371/journal.pmed.
3. Zinsstag J, Schelling E, Roth F, Bonfoh B, de Savigny D, Tanner M. Human benefits of animal interventions for zoonosis control. Emerg Infect Dis. 2007;13:527–31.
4. Doble LF, Fèvre EM. Focusing on neglected zoonoses. Vet Rec. 2010;166:546. doi:10.1136/vr.c2373.
5. Resolution WHA66.12. Neglected tropical diseases. Geneva: World Health Assembly Resolution; 2013. http://www.who.int/neglected_diseases/mediacentre/WHA_66.12_Eng.pdf (accessed 5 February 2015).

Photo © Sue Welburn

are nevertheless ready for deployment. Moreover, there have been outstanding achievements for the control of some NZDs such as rabies and *T.b. rhodesiense* trypanosomiasis, which should serve as motivation for other diseases and countries. Rabies, in particular, has demonstrated the advocacy generated by public-private partnerships, and the importance of strong political will that feeds down to the community level in order to generate action for control. The methodology for this may, of course, vary from country to country, given the range of policy models available; however, it cannot be denied that the international NZD community now bears the responsibility for focussing attention on what needs to be done, and setting time-linked goals for which it is accountable.

Conclusion

The participants of NZD4 acknowledged that tools are now available that allow for concerted efforts towards control of many NZDs. Resolution WHA66.12 provides the internationally agreed policy framework to support a new era in disease control and elimination programmes.

The challenge has been set and the international NZD community – as researchers, funders or implementers, from medical, veterinary or transdisciplinary backgrounds, representing the public or private sectors within national or international organizations – all must now take responsibility for achieving the goals that have been set.

Appendix A – meeting agenda

Day 1 – 19th November

Session 1 Welcome and Scene Setting
Chair: Professor Peter Holmes, Strategic and Advisory Group for Neglected Tropical Diseases (STAG-NTDs)

Dr H. Nakatani, WHO

Dr Katinka de Balogh, FAO

Dr Alex Thiermann, OIE

Dr Dirk Engels, WHO

Prof Be-Nazir Ahmed, Bangladesh

Honourable Manoj Kumar Roy, Bangladesh

Honourable Rwamirama K. Bright, Uganda

Session 2 The Value of Intersectoral Working (One Health)
Chair: Professor Paul Gibbs, The University of Florida

Co-Chair: Professor Sue Welburn, The University of Edinburgh

Introduction to intersectoral collaboration and One Health
Professor Paul Gibbs

Launch of Pan-African OH NZD platform
Professor Samson Mukaratirwa

One Health at the Ministerial level
Dr Austine Orinde

Control of Trypanosomiasis in Uganda (COCTU)
Professor Charles Waiswa

Pan American Health Organization s work on zoonosis in the region
Dr Victor Del Rio

Panel Members: Dr Yuichi Kishita, Dr Julius Keyyu, Professor Peter Holmes, Dr Bernadette Abela-Ridder, Dr Katinka de Balogh, Dr Alex Thiermann

Session 3 Interventions for dog borne zoonoses
Chair: Professor Be-Nazir Ahmed, Ministry of Health and Family Welfare, Bangladesh

Co-Chair: Professor Louis Nel, Global Alliance for Rabies Control

Introduction to control of dog-borne NZDs
Professor Be-Nazir Ahmed

A stepwise approach to rabies elimination
Dr Katinka de Balogh

Rabies elimination and dog bite prevention, lessons from BMGF rabies control programme
Mr Daniel Stewart

A Global Campaign for Rabies Elimination
Professor Louis Nel

Dealing with Hydatid in Morocco and dog integrated packages
Dr Mohammed Bouslikhane

Echinococcosis control in Mongolia
Dr Bolor Bold

Panel Members: Dr Simeon S. Amurao, Dr Luke Gamble, Dr Bernadette Abela-Ridder, Dr Katinka de Balogh, Dr Alex Thiermann

Session 4 Control of parasitic zoonotic NTDs
Chair: Dr Banchob Sripa, WHO Collaborating Centre for Research and Control of Opisthorchiasis, Thailand

Co-Chair: Professor Maria Vang Johansen, WHO Collaborating Center for Research and Training on Neglected and other Parasitic Zoonoses

Introduction to control of parasitic zoonotic NTDs
Dr Banchob Sripa

Report on WHO informal consultation on cysticercosis
Professor Eric Fèvre

Cysticercosis control in Peru; moving from research to programme
Dr Armando Gonzalez

Health education as a specific' intervention tool
Dr Isaac Phiri

Panel Members: Dr Nguyen Thu Thuy, Professor Marshall Lightowlers, Ms Kate Medlicott, Dr Bernadette Abela-Ridder, Dr Katinka de Balogh, Dr Alex Thiermann

Day 2 – 20th November

Session 5 Forgotten Bacteria – from silent suffering to recurrent epidemics
Chair: Dr Rudovick Kazwala, Sokoine University of Agriculture

Co-Chair: Dr François Meslin, Former WHO NZD Team Leader

Introduction to Bacterial Zoonoses – overview of policy briefs
Dr Rudovick Kazwala

Inter-sectorial work in Mongolia on Brucellosis
Dr Felix Roth

Burden of brucellosis
Dr Anna S. Dean

Brucellosis outbreak in Syria
Dr Halah Kutaish

Panel Members: Dr Nguyen Thu Thuy, Professor Gift Matope, Dr Adrian Whatmore, Dr Awa Aidara-Kane, Dr Bernadette Abela-Ridder, Dr Katinka de Balogh, Dr Alex Thiermann

Session 6 Financing for NZDs
Chair: Honourable Bright Rwamirama, Minister of State, Animal Industry and Fisheries Uganda

Co-Chair: Professor Ian Maudlin, The University of Edinburgh

Introduction to Financing for NZDs
Honourable Rwamirama K. Bright

European Union funding addressing NZD: Research Framework, Programmes and Development and Cooperation Actions
Dr Luis Vivas-Alegre

Development Impact Bonds (DIB)
Dr Paul Coleman
Dr Peter Stevenson

Panel Members: Ms Louise Savell, Professor Idriss Oumar Alfaroukh, Dr Yuichi Kishita, Christopher Fitzpatrick, Dr Bernadette Abela-Ridder, Dr Katinka de Balogh, Dr Alex Theirmann

Session 7 Beyond NZD4
Chair: Chair: Professor Peter Holmes, Chair STAG-NTD

Co-Chair: Professor Paul Gibbs, University of Florida

Appendix B – participant info

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Appendix C – abbreviations

ADVANZ	Advocacy for Neglected Zoonotic Diseases
AFRICOLEISH	EU project to develop effective treatment for leishmaniasis in East Africa
ANTIGONE	EU project 'Anticipating the global onset of novel epidemics'
ASKLEPIOS	EU project 'Advanced Studies towards Knowledge on Lyssavirus Encephalitis Pathogenesis Improving Options for Survival'
BBSRC	UK Biotechnology and Biological Sciences Research Council
BMGF	Bill & Melinda Gates Foundation
CCH	Crimean–Congo haemorrhagic fever
DBM	dog bite management
DEFRA	Department for Environment, Food and Rural Affairs
DEVCO	Development and Cooperation
DFID	UK Department for International Development
DIB	development investment bond
DISCONTOOLS	research prioritization for animal disease control
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FP7	Seventh Research Framework Programme
GARC	Global Alliance for Rabies Control
HERACLES	European register of cystic echinococcus
HPED	highly pathogenic and emerging diseases
ICONZ	Integrated Control of Neglected Zoonoses
IDSR	Integrated Disease Surveillance and Response
MDA	mass drug administration
MDV	mass dog vaccination
NZD	neglected zoonotic disease
OH-NEXTGEN	Training of the One Health Next Scientific Generation in the Sahel and Maghreb
OIE	World Organisation for Animal Health
PEP	post-exposure prophylaxis
PRP	Partners for Rabies Prevention
RFP	Research Framework Programme of the European Union
SARE	step-wise approach towards rabies elimination
SIB	social impact bond
SOP	standard operating procedure
STAR-IDAZ	Global Network for Animal Disease Research
VETGOV	veterinary governance in Africa
WHO	World Health Organization
ZELS	Zoonoses and Emerging Livestock Systems

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