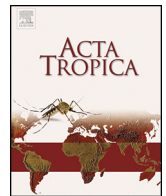




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## From gap analysis to solution and action: The RNAS<sup>+</sup> model

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### ABSTRACT

The overall aim of the Regional Network for Asian Schistosomiasis and Important Helminth Zoonoses (RNAS<sup>+</sup>) is to strengthen collaboration between control authorities in the regional, endemic countries. The network has provided critical research input during its 12 years of existence developing gradually from a small forum for information exchange. RNAS<sup>+</sup> now provides advice on regional strategies regularly and contributes to the mobilization of resources with respect to multi-country projects on several parasitic diseases in Southeast Asia, primarily schistosomiasis but also other helminth infections including polyparasitism. To make progress towards these goals, RNAS<sup>+</sup> has focused on platform design and technical standardization aiming at fostering research capacity and the development of networking capacities with easy access to information databases. This administrative body is largely virtual connecting RNAS<sup>+</sup> members via the Internet, providing database and administrative back-up. This strategy, aiming at boosting research on the target diseases, strongly emphasizes ways and means to alleviate the spectre of disease and poverty from the endemic areas.

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### 1. Introduction

The road map for elimination of neglected tropical diseases (NTDs), issued by World Health Organization (WHO) in 2012, has persuaded the global community to make a joint effort (WHO, 2012) in this direction. The People's Republic of China (P.R. China) and the Philippines are the two countries with the largest burdens of schistosomiasis japonica in the world (Bergquist and Tanner, 2010). Early efforts to introduce control and operational research by the World Bank, WHO and the National Institutes of Health (NIH) in the United States of America (USA) initiated collaboration between national research institutes and research groups within and outside the region. This led to strengthened research and development with respect to drug, vaccines, user-friendly diagnostics as

well as implementation of geographical information systems (GIS) as part of the epidemiological approach (Xianyi et al., 2005). The Regional Network for Asian Schistosomiasis (RNAS), as it was originally called, was focused on research, surveillance and control of schistosomiasis with the aim of bridging the gap between scientists and decision-makers. For instance, during the period 2009 to 2011, most of the RNAS experts assisted WHO Western Pacific Regional Office (WPRO) and health officers from the regional endemic countries in the development of the WPRO priority-setting and workplan on neglected tropical diseases (NTDs). The RNAS organization was subsequently developed into a more wide-ranging network of researchers and control programme officers fighting the NTDs in Southeast Asia under the name Regional Network for Asian Schistosomiasis and other Important Helminth Zoonoses (RNAS<sup>+</sup>). During its 12 years of existence, the RNAS/RNAS<sup>+</sup> organization initiated various activities including cooperative research projects, knowledge and technical expertise transfer among member countries, training courses and workshops, reference laboratory establishment and exercises, the setting of regional research priorities. In addition, annual workshops on a variety of topics related to NTD control were organized. These meetings developed

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gradually from a small one-day forum to exchange information to larger activities providing advice on regional strategies, on mobilizing resources and on the development of multi-country projects. For example, five collaborative research projects have been instigated, including three supported by WHO/TDR, one by NIH, USA, and one by the International Development Research Center (IDRC), Canada. More than a dozen training courses with together more than 400 participants have been arranged through the network, and four associated special issues of international journals, each with more than 30 articles have been published (Olveda et al., 2010; Zhou et al., 2010b). The above-mentioned activities have contributed significantly to the reduction of the threat of several NTDs through its 'win-win model', that means the all of partners both contribute and share the achievements resulting from the development of the network through either research or control programmes at the country- or regional level (Zhou et al., 2008, 2010b). We summarize here the various RNAS<sup>+</sup> activities that were launched, taking into account achievements and impacts contributing to the translation of findings through gap analysis, an approach which was adopted into local policy becoming part of the control programmes in the various countries of the region (Zhou et al., 2008). This approach has been considered a model for South–South collaborative networks on NTD control.

## 2. History of RNAS<sup>+</sup>

The idea of a local network, initiated by the UNICEF/UNDP/World Bank/WHO Special Programme for Research and Training in Tropical Diseases (TDR), developed from a discussion during the international workshop on "Research, Surveillance and Control of Schistosomiasis japonica" that was held in 1996 in Nanjing, P.R. China and the follow-up international workshop on "The Epidemiology and Host–Parasite Relationships of *Schistosoma japonicum* in Definitive Hosts", held in 1998 in Wuxi, P.R. China (McGarvey et al., 1999). The creation of RNAS took shape as a bid to corral stakeholders to unite in order to step up the fight against schistosomiasis japonica in the region (Leonardo and Bergquist, 2002).

Operational research is an important component of the national control programmes in P.R. China, which has contributed to the past successes in control and elimination of NTDs. For example, the role played by the 10-year World Bank Loan Project (WBLP) in the 1990s in controlling schistosomiasis in P.R. China is hugely important since its support led to a dramatic drop in prevalence of the disease (Xianyi et al., 2005; Zhang et al., 2012). Interestingly, this reduction in prevalence is not primarily due to praziquantel but the result of a sustained, multi-pronged strategy with a strong snail control component (Uttinger et al., 2005). In addition, research received a major boost from the WBLP. About 2% of the total funding that consisted of 80 million US dollars and matching funds from the Chinese Government was used for stimulation of schistosomiasis research projects. In contrast to the situation in the Philippines, whose control programme was not funded in this focussed way, and not at this level, P.R. China not only benefitted from this major control effort, but has also been able to sustain a country-wide control programme that has brought the prevalence down to a level, from where it might be possible to eliminate the disease within the next decade (King, 2009; Wang et al., 2009).

From the extended collaboration of regional (Cambodia, Indonesia, Japan, Lao P.D.R., Philippines and P.R. China) with extra-regional scientists, RNAS rapidly reached the level where the number of member states, target diseases as well as scope of research interest required a change of its constitution (Zhou et al., 2008). Consequently, Vietnam, Thailand and Korea were brought onboard, along with a number of endemic diseases

besides schistosomiasis, which includes cysticercosis, clonorchiasis, opisthorchiasis, fascioliasis, and paragonimiasis. With this strengthening of its capacities, RNAS became RNAS<sup>+</sup> and when its 10th annual workshop was celebrated in Wuxi, China in 2010, a total of 120 participants from 19 countries and international organizations participated (Olveda et al., 2010). In workshops, held in conjunction with the annual meetings, the ideas that RNAS<sup>+</sup> had been working on over the last decade showed that progress can be made even by a relatively small network supported by limited funding. RNAS<sup>+</sup> also developed linkages with the Regional Network for Schistosomiasis in Africa (RNSA, <http://www.rnsa.org.zm/>), the Cysticercosis Working Group in Eastern and Southern Africa (CWGESA, <http://www.cwgesa.dk/>) as well as the Global Network for Geospatial Health (<http://www.gnosigis.org>) (Malone et al., 2001; Mukaratirwa and Lekule, 2008; Osei-Atweneboana et al., 2012; Uttinger et al., 2011), the output of each network enhanced through joint training activities and participation in each other's meetings.

At the latest annual meeting of RNAS<sup>+</sup> in November 2012 in Hanoi, Vietnam, a workshop supported by the Department of Neglected Tropical Diseases, WHO was included together with a research project on eco-health aspects that was supported by the IDRC of the Canadian International Development Agency (CIDA) through their Global Health Research Initiative (<http://www.ghri.ca>) in partnership with the Australian Agency for International Development (AusAID). The successful research project proposals that were sent to the above organizations provide evidence that RNAS<sup>+</sup> has matured and achieve the critical mass needed to build capacity for future research and control activities, which are much needed in the face of the current challenging situation posed by the target diseases. The network now has the means to control many of these target diseases but it also needs to find the way to apply them in a sustainable manner (Olveda et al., 2010; Yang et al., 2010).

## 3. Future of RNAS<sup>+</sup>

Science is inherently non-directional and not easily regulated; these characteristics contribute to increasing inequality at various levels. The field of parasitic diseases is no exception, and it is quite clear that improvements need to be directed towards those in the greatest need, i.e. poor people in the developing countries which cannot unilaterally sustain long-term control programmes (Zhou, 2012). Promoting the utility of academic research and novel thinking is a priority, but progress must be steered towards specific targets and new findings harnessed into accessible repositories. This is not only appropriate but, indeed, the best way forward in spite of the need for continuous review of progress towards priorities that accompany targeted research. By administering projects professionally, science moves closer to the business model and research support can thus be seen as an investment that demands future payoff in the form of lower burdens of disease and mitigation of poverty (Zhou et al., 2013). It is quite clear that the countries of Southeast Asia account for a considerable burden of disease, much of which consists of the diseases of poverty (Hotez and Ehrenberg, 2010; Schratz et al., 2010). The trematode parasites play an important role here as they cause diseases that include both schistosomiasis japonica and the food-borne trematode infections. Mass drug administration (MDA) is now in place for the control and elimination of lymphatic filariasis (LF) as well as morbidity control aimed at school-aged children at risk for intestinal helminths (Sudomo et al., 2010). Liver flukes remain highly focal resulting in local epidemics in P.R. China, Laos, Thailand and Vietnam (Qian et al., 2012; Sripa et al., 2010). While mechanisms are being created to control the majority of these regional NTDs by

the next decade (Hotez and Ehrenberg, 2010; Huntington, 2012), it is understood that success requires accountability, a process of bringing stakeholders together and encouraging administrators and donors to become more involved in the scientific process. On the part of RNAS<sup>+</sup>, this approach has led to the establishment of a vision which includes six diseases, i.e. schistosomiasis, cysticercosis, clonorchiasis, opisthorchiasis, fascioliasis, and paragonimiasis involving scientists and control managers from nine countries endemic for one or more of these target diseases (Olveda et al., 2010; Zhou et al., 2008).

To achieve its goals, RNAS<sup>+</sup> has developed a set of ideas through its concept of gap analysis (Zhou et al., 2010b). There is a good chance that the network will achieve this within the next few years as it commands five strengths: (i) strong partnership in the regional research area that has attracted the majority of experts on helminth research and control who are united by a business-like coordinating framework; (ii) has availability of specialists in various areas capable of improving and promoting both research and control aspects (the membership of the network includes more than 30 global experts who are working on better diagnostics, vaccine development and GIS-supported epidemiology (Bergquist and Lustigman, 2010; Johansen et al., 2010; Malone et al., 2010; Utzinger et al., 2010); (iii) successful activities in the translation from research to the field application, i.e. RNAS<sup>+</sup> pushes ahead with respect to development and evaluation of diverse control strategies for a number of different helminth infections, while experts working within the network have the capacity to develop training packages on GIS applications, diagnostic tools, implementation/evaluation of health metrics and molecular biology research (Utzinger et al., 2010; Zhou et al., 2010a); (iv) establishment of a strong platform capable of promoting the mechanisms of sharing information through its website, databases, publications and meetings. Finally, RNAS<sup>+</sup> has shown that it can foster collaboration and joint work on operational research, thus promoting a multi-disciplinary approach that has generated multi-country proposals for disease control at the national or regional levels through direct linkage with different academic and research institutions in the region. Importantly, all experts involved in the network are linked with control programmes of the endemic member countries in the region.

A vision to become the recognized platform for evidence-based information and intersectoral communication has been developed based on these characteristics. The overriding aim of RNAS<sup>+</sup>, i.e. bridging the gap between research scientists and control authorities for the prevention of NTDs in Southeast Asia, is gradually being realized providing a forum for the exchange and dissemination of information. Current research and development, aspiring at the ultimate elimination not only of Asian schistosomiasis but also other parasitic, helminthiasis the hinder health and progress in general, will be achieved through encouraging sustained collaboration and communication among scientists in the field and decision-makers, and this work will not stop at the geographic borders.

The future working plan for the RNAS<sup>+</sup> has been defined with the goal to reduce the disease burdens due to schistosomiasis and other NTDs through training, research and information dissemination (Zhou et al., 2010b). Approaches will be implemented with the sights set on:

- (i) improving the research environment through standardization of technologies, procedures and protocols used in prevention and control;
- (ii) facilitating dissemination of reliable and up-to-date information about Asian helminth zoonotic infections including the production of risk maps for the target diseases; and

- (iii) developing a surveillance and response system for the diseases that are approaching the elimination goal.

The network's priorities will focus on documentation and development of health metrics that are not only useful in practice, but also support research on the impact of social determinants and economic issues on the epidemiology of Asian helminth zoonotic infections (Supplementary Table 1). To this end, important activities include the promotion of GIS and remote-sensing techniques for the study of climate change and direct, epidemiological applications, development of new products, equipment and techniques to improve and standardize diagnostic capabilities, and implementation research related to control strategies. In addition, RNAS<sup>+</sup> aims to encourage the study of genetics and the immune responses against parasites to better understand the pathology caused and, ultimately, to apply in the development of a schistosomiasis vaccine. Activities will be organized through the network with the following four aspects at hand:

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.actatropica.2013.06.016>.

#### 4. Conclusion

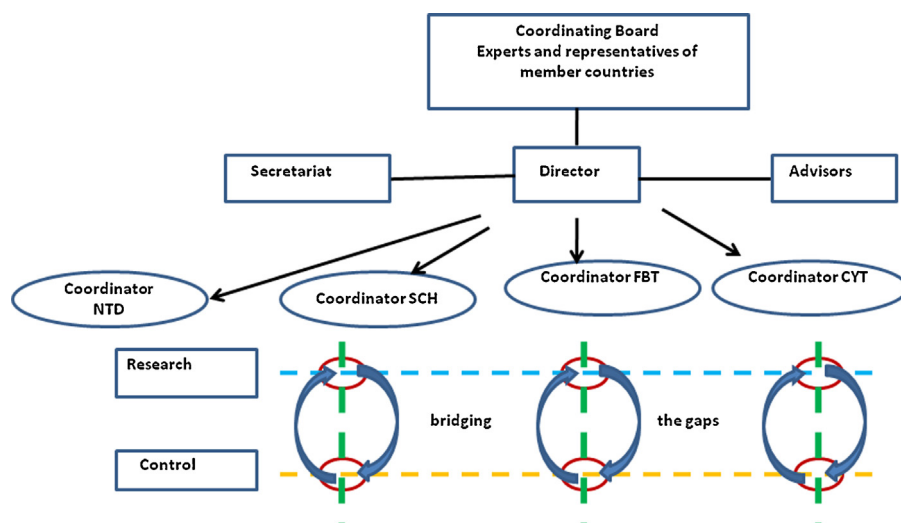
The RNAS<sup>+</sup> network has provided critical research input with regard to several parasitic diseases that are common in Southeast Asia, including polyparasitism. Success has been achieved based on an overall aim to strengthen collaboration between scientists and the authorities responsible for disease control in the regional, endemic countries. New initiatives addressing the NTDs are urgently needed and there is an increasing awareness of the role of climate and the environment in determining the epidemiological patterns. Rapid growth of key technologies (health metrics, sensitive diagnostics, GIS, remote-sensing, etc.) and the development of evidence-based policies are seen as particularly important (Sen-Hai, 2010). Based on workshop discussions on the need for speedy progress and building of local technical standards, available mechanisms for information-sharing includes the network framework, the website, databases, publications and meetings (Bergquist and Whittaker, 2012).

Future emphasis will focus on platform design and technical standardization aiming at fostering strengthened research capacity and the development of networking capacities and easy access to information. The sketch below depicts an administrative body acting as centre for network members to interact (Fig. 1). This administrative body is largely virtual connecting RNAS<sup>+</sup> members via the Internet, providing database and administrative back-up, i.e. a strategy that reflects the tactic to boost research on target diseases with a strong emphasis on ways and means to alleviate the spectre of disability and poverty. The current philosophy is based on the notion that the overall goal would benefit from the creation of interconnected disease-specific groups capable of operating as "nodes" of the RNAS<sup>+</sup> website (<http://www.rnas.org.cn>).

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**Fig. 1.** The RNAS<sup>+</sup> framework and working mechanism (note: FBT stands for food-borne trematodes, CYT stands for cysticercosis, SCH stands for schistosomiasis, and NTD stands for neglected tropical diseases). Under this mechanism, multiple-stakeholders from different disciplines will communicate with one another on the platform of the RNAS<sup>+</sup> network through workshops, training courses, and collaborative projects.

## Competing interests

The authors have no financial, professional or personal competing interests related to this article. The funding agencies cited above played no role in the design of the study, the execution of the work, the preparation or submission of this article.

## References

- Bergquist, R., Lustigman, S., 2010. Control of important helminthic infections vaccine development as part of the solution. *Adv. Parasitol.* 73, 297–326.
- Bergquist, R., Tanner, M., 2010. Controlling schistosomiasis in Southeast Asia: a tale of two countries. *Adv. Parasitol.* 72, 109–144.
- Bergquist, R., Whittaker, M., 2012. Control of neglected tropical diseases in Asia Pacific: implications for health information priorities. *Infect. Dis. Poverty* 1, 3.
- Hotez, P.J., Ehrenberg, J.P., 2010. Escalating the global fight against neglected tropical diseases through interventions in the Asia Pacific region. *Adv. Parasitol.* 72, 31–53.
- Huntington, D., 2012. Health systems perspectives – infectious diseases of poverty. *Infect. Dis. Poverty* 1, 3.
- Johansen, M.V., Sithithaworn, P., Bergquist, R., Utzinger, J., 2010. Towards improved diagnosis of zoonotic trematode infections in Southeast Asia. *Adv. Parasitol.* 73, 171–195.
- King, C.H., 2009. Toward the elimination of schistosomiasis. *N. Engl. J. Med.* 360, 106–109.
- Leonardo, L.R., Bergquist, R., 2002. Regional network on Asian schistosomiasis. *Trends Parasitol.* 18, 434–436.
- Malone, J.B., Bergquist, N.R., Huh, O.K., Bavia, M.E., Bernardi, M., El Bahy, M.M., Fuentes, M.V., Kristensen, T.K., McCarroll, J.C., Yilma, J.M., Zhou, X.N., 2001. A global network for the control of snail-borne disease using satellite surveillance and geographic information systems. *Acta Trop.* 79, 7–12.
- Malone, J.B., Yang, G.J., Leonardo, L., Zhou, X.N., 2010. Implementing a geospatial health data infrastructure for control of Asian schistosomiasis in the People's Republic of China and the Philippines. *Adv. Parasitol.* 73, 71–100.
- McGarvey, S.T., Zhou, X.N., Willingham, 3rd, A.L., Feng, Z., Olveda, R., 1999. The epidemiology and host–parasite relationships of *Schistosoma japonicum* in definitive hosts. *Parasitol. Today* 15, 214–215.
- Mukaratirwa, S., Lekule, F., 2008. Medical and veterinary doctors, social scientists and agricultural researchers meet to carry forward the fight against cysticercosis, a neglected and fatal disease of the poor. *J. S. Afr. Vet. Assoc.* 79, 2.
- Olveda, R., Leonardo, L., Zheng, F., Sripa, B., Bergquist, R., Zhou, X.N., 2010. Coordinating research on neglected parasitic diseases in Southeast Asia through networking. *Adv. Parasitol.* 72, 55–77.
- Osei-Atweneboana, M.Y., Lustigman, S., Prichard, R.K., Boatin, B.A., Basanez, M.G., 2012. A research agenda for helminth diseases of humans: health research and capacity building in disease-endemic countries for helminthiasis control. *PLoS Negl. Trop. Dis.* 6, e1602.
- Qian, M.B., Chen, Y.D., Liang, S., Yang, G.J., Zhou, X.N., 2012. The global epidemiology of clonorchiasis and its relation with cholangiocarcinoma. *Infect. Dis. Poverty* 1, 10.
- Schratz, A., Pineda, M.F., Reforma, L.G., Fox, N.M., Le Anh, T., Tommaso Cavalli-Sforza, L., Henderson, M.K., Mendoza, R., Utzinger, J., Ehrenberg, J.P., Tee, A.S., 2010. Neglected diseases and ethnic minorities in the Western Pacific Region exploring the links. *Adv. Parasitol.* 72, 79–107.
- Sen-Hai, Y., 2010. Major parasitic helminths in Southeast Asian and the People's Republic of China. Preface. *Adv. Parasitol.* 72, xix–xx.
- Sripa, B., Kaewkes, S., Intapan, P.M., Maleewong, W., Brindley, P.J., 2010. Food-borne trematodiasis in Southeast Asia epidemiology, pathology, clinical manifestation and control. *Adv. Parasitol.* 72, 305–350.
- Sudomo, M., Chayabejara, S., Duong, S., Hernandez, L., Wu, W.P., Bergquist, R., 2010. Elimination of lymphatic filariasis in Southeast Asia. *Adv. Parasitol.* 72, 205–233.
- Utzinger, J., Bergquist, R., Olveda, R., Zhou, X.N., 2010. Important helminth infections in Southeast Asia diversity, potential for control and prospects for elimination. *Adv. Parasitol.* 72, 1–30.
- Utzinger, J., Zhou, X.N., Chen, M.G., Bergquist, R., 2005. Conquering schistosomiasis in China: the long march. *Acta Trop.* 96, 69–96.
- Utzinger, J., Rinaldi, L., Malone, J.B., Krauth, S.J., Kristensen, T.K., Cringoli, G., Bergquist, R., 2011. Geospatial health: the first five years. *Geospat. Health* 6, 137–154.
- Wang, L.D., Chen, H.G., Guo, J.G., Zeng, X.J., Hong, X.L., Xiong, J.J., Wu, X.H., Wang, X.H., Wang, L.Y., Xia, G., Hao, Y., Chin, D.P., Zhou, X.N., 2009. A strategy to control transmission of *Schistosoma japonicum* in China. *N. Engl. J. Med.* 360, 121–128.
- WHO, 2012. Accelerating Work to Overcome the Global Impact of Neglected Tropical Diseases – A Roadmap for Implementation. WHO Press, Geneva.
- Xianyi, C., Liying, W., Jiming, C., Xiaonong, Z., Jiang, Z., Jiagang, G., Xiaohua, W., Engels, D., Minggang, C., 2005. Schistosomiasis control in China: the impact of a 10-year World Bank Loan Project (1992–2001). *Bull. World Health Organ.* 83, 43–48.
- Yang, G.J., Utzinger, J., Lv, S., Qian, Y.J., Li, S.Z., Wang, Q., Bergquist, R., Vounatsou, P., Li, W., Yang, K., Zhou, X.N., 2010. The Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses (RNAS(+)) target diseases in face of climate change. *Adv. Parasitol.* 73, 101–135.
- Zhang, Z.J., Zhu, R., Bergquist, R., Chen, D.M., Chen, Y., Zhang, L.J., Guo, J.G., Zhao, F., Jiang, Q.W., 2012. Spatial comparison of areas at risk for schistosomiasis in the hilly and mountainous regions in the People's Republic of China: evaluation of the long-term effect of the 10-year World Bank Loan Project. *Geospat. Health* 6, 205–214.
- Zhou, X.N., 2012. Prioritizing research for “One health-One world”. *Infect. Dis. Poverty* 1, 1.
- Zhou, X.N., Bergquist, R., Leonardo, L., Yang, G.J., Yang, K., Sudomo, M., Olveda, R., 2010a. Schistosomiasis japonica control and research needs. *Adv. Parasitol.* 72, 145–178.
- Zhou, X.N., Wayling, S., Bergquist, R., 2010b. Concepts in research capabilities strengthening positive experiences of network approaches by TDR in the People's Republic of China and Eastern Asia. *Adv. Parasitol.* 73, 1–19.
- Zhou, X.N., Bergquist, R., Tanner, M., 2013. Elimination of tropical disease through surveillance and response. *Infect. Dis. Poverty* 2, 1.
- Zhou, X.N., Ohta, N., Utzinger, J., Bergquist, R., Olveda, R.M., 2008. RNAS(+): a win-win collaboration to combat neglected tropical diseases in Southeast Asia. *Parasitol. Int.* 57, 243–245.