

RESEARCH

Open Access



Assessment of China's contributions to the Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses: a questionnaire survey

Hong-Mei Li¹, Ying-Jun Qian¹, Kun Yang², Wei Ding¹, Lu-Lu Huang¹, Xue-Jiao Ma¹, Lei Duan¹, Duo-Quan Wang¹, Ya-Yi Guan¹, Ning Xiao¹ and Xiao-Nong Zhou^{1*} 

Abstract

Background: The Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses (RNAS⁺) was established in 1998, which has developed close partnerships with Asian countries endemic for schistosomiasis and other helminthiasis in Asia. RNAS⁺ has provided an ideal regional platform for policy-makers, practitioners and researchers on the prevention, control and research of parasitic diseases in Asian countries. China, one of the initiating countries, has provided significant technical and financial support to the regional network. However, its roles and contributions have not been explored so far. The purpose of this study was to assess China's contributions on the supporting of RNAS⁺ development.

Methods: An assessment research framework was developed to evaluate China's contributions to RNAS⁺ in four aspects, including capacity building, funding support, coordination, and cooperation. An anonymous web-based questionnaire was designed to acquire respondents' basic information, and information on China's contributions, challenges and recommendations for RNAS⁺ development. Each participant scored from 0 to 10 to assess China's contribution: "0" represents no contribution, and "10" represents 100% contribution. Participants who included their e-mail address in the 2017–2019 RNAS⁺ annual workshops were invited to participate in the assessment.

Results: Of 71 participants enrolled, 41 responded to the survey. 37 (37/41, 90.24%) of them were from RNAS⁺ member countries, while the other 4 (4/41, 9.76%) were international observers. Most of the respondents (38/41, 92.68%) were familiar with RNAS⁺. Respondents reported that China's contributions mainly focused on improving capacity building, providing funding support, coordination responsibility, and joint application of cooperation programs on RNAS⁺ development. The average scores of China's contributions in the above four fields were 8.92, 8.64, 8.75, and 8.67, respectively, with an overall assessment score of 8.81 (10 for a maximum score). The challenge of RNAS⁺ included the lack of sustainable funding, skills, etc. and most participants expressed their continual need of China's support.

(Continued on next page)

* Correspondence: zhouxn1@chinacdc.cn

¹National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention; Chinese Center for Tropical Diseases Research; WHO Collaborating Centre for Tropical Diseases; National Center for International Research on Tropical Diseases, Ministry of Science and Technology; Key Laboratory of Parasite and Vector Biology, Ministry of Health, Shanghai 200025, China

Full list of author information is available at the end of the article



© The Author(s). 2021 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>.

(Continued from previous page)

Conclusions: This survey showed that China has played an important role in the development of RNAS⁺ since its establishment. This network-type organization for disease control and research can yet be regarded as a great potential pattern for China to enhance regional cooperation. These findings can be used to promote future cooperation between China and other RNAS⁺ member countries.

Keywords: China, RNAS⁺, Assessment, Schistosomiasis, Regional cooperation, Contribution

Background

Schistosomiasis, a serious infectious disease caused by blood flukes, occurs in a total of 78 endemic countries worldwide [1]. Until now, except in Japan where the disease has been eliminated, other Asian endemic countries are still at risk of transmission, including China, the Philippines, Indonesia, Laos, Cambodia, Malaysia, Myanmar, and so on [2, 3]. To achieve the goal set by the United Nations in the 2030 Agenda for Sustainable Development Goals (SDGs) of eliminating schistosomiasis by 2030, a comprehensive, multi-sectoral, and multi-faceted approach across countries is needed to control, and eventually eliminate, the disease in Asia [4, 5].

Efforts were made to initiate a collaboration between national research institutions and research groups within and outside Asian countries 20 years ago [6, 7]. The Regional Network on Asian Schistosomiasis (RNAS) was originated during a discussion session at an international workshop held in China in 1996, and was planned to build a formal network during another international seminar in China in 1998. RNAS was formally established during the first workshop of the RNAS network in the Philippines in 2000 [2], which aimed at uniting intersectoral, interregional, and international collaborations for multidisciplinary organizations (human medicine and veterinary medicine) and experts (researchers, practitioners, and policy-makers) in various fields from Asian disease endemic countries. The initiating areas of work included collaborative research, surveillance, and control of schistosomiasis in Asia, and the network also advanced the technology for the control of *Schistosoma japonicum* [8, 9]. In the fifth RNAS workshop in 2005, its focus was expanded from schistosomiasis to include other diseases and conditions, including cysticercosis, clonorchiasis, opisthorchiasis, paragonimiasis and fascioliasis, caused by helminthiasis treatable with praziquantel, thus forming the Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses (RNAS⁺) of what is today [2, 10, 11].

The developmental pathway of RNAS⁺ started with only two countries (China and the Philippines) in 2000 [2, 4]. Since then, its members have gradually increased to 11 countries (China, the Philippines, Cambodia, Indonesia, Laos, Thailand, South Korea, Japan, Vietnam, Myanmar, and Malaysia) in 2018 [2, 4]. Up to date, over

90% of research institutions and disease control organizations working on schistosomiasis in the 11-member countries have participated in RNAS⁺ activities [2, 12].

After two-decade operation, the RNAS⁺ has mainly been devoted to the following four areas. First, an operational mode was developed for operating the RNAS⁺ [11, 13]. An executive committee was formed to manage the RNAS⁺, which is composed of a chairman, a vice-chairman, several executive members, and several international observers. A rotating chairman system was adopted to elect the chairman. Second, a mechanism for information exchange and dissemination was developed by annually hosting academic workshops and training courses [12]. To date, 20 workshops have been held in different member countries, which have contributed to improved neglected tropical diseases (NTDs) control programs in the member countries [2]. Third, some multi-country cooperative research projects have been implemented, through which scientists from different countries have learned from one another to improve their relevant technologies for the application of serodiagnosics, ultrasound examination, mollusciciding, and surveillance response systems [14, 15]. Fourth, capacity building has been improved by more than a dozen of training courses in the field of diagnosis, molecular biology, geographic information systems, and ethical issues, specifically designed for the young generations of the member countries [4, 16].

Some studies assessed the performance and improvement on health system, capacity building, quality management, health technology [17–20], and so on. However, no published work can be found on the assessment of the contributions of any member country in regional networks on disease prevention and control. After a literature review, a qualitative study was conducted by Furnival et al. (2018) to assess the capacity improvement of six UK healthcare organizations, using semi-structured interviews, policy documents, and assessment reports as their data sources [17]. A self-assessment questionnaire proposed by the World Health Organization (WHO) was used to assess the quality of the Estonian health system and comprised four domains (policy, organization, methods, and resources) [18]. A scoring criteria were developed to assess the quality of program theory [19]. A systematic review was used to

evaluate the screening performance of maternal serum and ultrasound markers in detecting Down syndrome [20]. Moreover, methods for assessing the contributions of one country to a network to which it belongs are scant. Some researchers have recently explored a method to assess in-kind contributions in a donor-funded health capacity-building program in Africa, which estimates the monetary value of those contributions [21].

RNAS⁺ celebrated its 20th anniversary in 2018 in Shanghai, China [2]. Although China along with other member countries have provided great technical and resource support on the RNAS⁺ development, China's roles and contributions have not been explored systematically. This study aimed to perform an assessment of China's roles and contributions in the developmental pathway of RNAS⁺.

Methods

Research design

In this study, an assessment research framework was planned to assess China's contributions according to the four major achievements of RNAS⁺ in the past 20 years. This framework covers the following four topics: (i) capacity building—providing opportunities on improving skills for scientists from RNAS⁺ member countries, (ii) funding support—sponsoring the activities of RNAS⁺, (iii) coordination—responsibility for the operation and development of RNAS⁺, and (iv) cooperation programs—initiating the application of multi-country joint collaborative projects in Asia. For each topic, several corresponding quantitative indicators were formed. In addition, to obtain the direct value of China's contributions to this network, a score sheet on the above topics as well as for the overall contribution were created with scores ranging from “0” to “10.” The higher the score, the greater the contributions.

Questionnaire and data collection

An anonymous and web-based questionnaire on the above assessment research framework was designed as an assessment tool for evaluating China's contributions to RNAS⁺. Three senior professionals of RNAS⁺ provided inputs to the content of the questionnaire and revised it, before the formal survey. This questionnaire had three parts: (i) general information of the participants; (ii) the core of the evaluation on China's contributions to RNAS⁺ (Table 1), contained quantitative indicators and scoring tables on capacity building, funding support, coordination, cooperation program, and overall assessment, from the evaluation framework; and (iii) challenges and suggestions for RNAS⁺ development in the future. The questionnaire was used to collect the assessment information, and participants who

frequently attended the recent RNAS⁺ annual workshops were invited to participate in this survey.

This web-based survey was distributed by e-mail to the participants who provided their e-mail address during the three recent RNAS⁺ annual workshops from 2017 to 2019. Each participant gave a score for his/her understanding of RNAS⁺; the higher the value, the more familiar they were with RNAS⁺. In order to encourage the participants to complete the questionnaire, two reminders were sent to each participant who was also asked to send the link to their colleagues or friends who attended the RNAS⁺ annual workshops. The participants were asked to complete the questionnaire for once if they had attended more than one meeting.

Data analysis

All original data of this web-based questionnaire were downloaded as a .sav file format from the back-stage management platform. Because all the questions in the web-based questionnaire were required, all the data were compliant with the integrity verification requirements. Data analysis was performed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY., US). Frequency and related percentage were reported to describe classified variables. The arithmetic average was reported for continuous variables, as well as a bar chart to present the numerical distributions. Highcharts were used to analyze the open-ended questions.

Results

General information

Of 71 participants who participated in the 2017, 2018, and 2019 RNAS⁺ annual meetings and provided e-mail addresses, 41 responded to the survey. The general information of the respondents is presented in Table 2. Twenty-seven participants were male; 85.37% (35/41) were aged > 35 years; most (37/41, 90.24%) were from the RNAS⁺ member countries; the remaining 4 (4/41, 9.76%) were international observers at RNAS⁺. The biggest number of respondents were from Indonesia (8/41, 19.51%), followed by China (7/41, 17.07%).

As shown in Fig. 1, most of the respondents were familiar with RNAS⁺ (38/41, 92.68%), their understanding of RNAS⁺ was greater than 60%, and only 3 (3/41, 7.32%) respondents had less than 40%. Importantly, 31.71% (13/41) indicated that they had 100% understanding of RNAS⁺, and the average value of understanding of RNAS⁺ was 83.17%.

The overall assessment of China's contributions to RNAS⁺

According to the survey, every participant gave a score to assess China's contributions to RNAS⁺ (Table 3). The average score for the overall assessment of China's contributions to RNAS⁺ was 8.81 (10 maximum score). The average score of China's contributions to the

Table 1 Assessment framework of interview questions

| Assessment framework | Assessment questions |
|------------------------------|---|
| Topic 1: Capacity building | 1. How many times have the RNAS ⁺ training courses been held in China? 2. Have you ever attended the short-term training organized by China (except for the RNAS ⁺ annual meeting/training)? 3. Which skills did you learn from China (by workshops and trainings)? |
| Topic 2: Funding | 4. How many times have you received China's grant to attend RNAS ⁺ annual meeting/training? 5. How many RNAS ⁺ annual meetings / trainings were mainly sponsored by China but not held in China: |
| Topic 3: Coordination | 6. Currently, there are already five committee chairmen of RNAS ⁺ . Do you know how many of them are Chinese? 7. Have you ever been invited by China to be the instructor of RNAS ⁺ training / the speaker of the annual meeting? 8. Do you know the address of the RNAS ⁺ website? |
| Topic 4: Cooperation program | 9. Did you participate in the IDRC project? 10. Are you willing to apply the new "Belt & Road Initiative" related program with Chinese experts? |
| Scoring sheet | Please indicate a score of 0 to 10 for China's contributions / roles in RNAS ⁺ (Description: "0" is no contribution, "10" is 100% contribution): 11. China's contributions / roles in improving capacity building of RNAS ⁺ ? 12. China's funding contributions / roles to RNAS ⁺ ? 13. China's contributions / roles in the coordination of RNAS ⁺ ? 14. China's contributions / roles in applying for cooperation program / project jointly with RNAS ⁺ member institutions? 15. The overall assessment of China's contribution / role in RNAS ⁺ ? |

RNAS⁺, Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses; IDRC, International Development Research Centre

improvement of capacity building, funding support, coordination, and the application of cooperation projects in RNAS⁺ were 8.92, 8.64, 8.75, and 8.67, respectively (10 for maximum score).

China's contributions in improving capacity building of RNAS⁺

According to the survey, four RNAS⁺ annual training courses were held in China. In addition, 7 (17.07%) respondents had attended the short-time training in China, including on snails control and schistosomiasis diagnosis skills. A total of 38 (92.68%) participants indicated that they had learned useful skills from training activities held in China, and the top three were control strategy, diagnosis, and geographic information system (GIS) (Fig. 2).

China's funding contributions to RNAS⁺

Most respondents (73.17%) had received China's grants to attend RNAS⁺ annual workshops, and 26.83% (11/41) had received more than 5 times. In addition, China also sponsored the annual workshops held outside of China. Most respondents (70.73%) attended the RNAS⁺ annual workshops mainly sponsored by China but held outside of China for more than once. Among respondents, 34.15% (14/41) said that China provided grants to support the annual workshops held outside of China at least 5 times.

China's contributions to the coordination of RNAS⁺

NIPD was one of the two institutions participating in the RNAS⁺ initiative. Chinese experts played important roles in the initiation and scale of the network. Up to now, two out of 5 experts had served as chairmen of RNAS⁺, 53.66% (22/41) of the respondents had invited/coordinated with China as instructors in the RNAS⁺ training courses or as the speaker at the annual workshops. China established the RNAS⁺ website and is responsible for website maintenance and information updates, while 68.29% (28/41) of the respondents know the address of the RNAS⁺ website.

China's contributions to the application of cooperation programs jointly running with RNAS⁺ member institutions

NIPD, along with national research institutes of the Philippines, Laos, Cambodia, and other countries, jointly applied and received two rounds of funds from the International Development Research Centre (IDRC), Canada, 36.59% (15/41) of the respondents attended this IDRC project. Most respondents, 82.93% (34/41) are willing to apply the new "Belt & Road Initiative"-related program with Chinese experts in the future.

Challenges and suggestions for RNAS⁺ development

From the survey, both the challenges faced by RNAS⁺ and some pieces of advice on what China should do in the future are summarized in Figs. 3 and 4 by highcharts.

Table 2 Characteristics of the survey respondents

| Variable | Description | Frequency | Percent(100%) |
|--------------------------------|-------------------------------------|----------------------|---------------|
| Gender | Male | 27 | 65.85 |
| | Female | 14 | 34.15 |
| | Total | 41 | 100.00 |
| Age (years) | ≤35 | 6 | 14.60 |
| | > 35 | 35 | 85.40 |
| | Total | 41 | 100.00 |
| Education level | Diploma and below | 2 | 4.88 |
| | undergraduate | 0 | 0.00 |
| | Postgraduate | 17 | 41.46 |
| | Doctor | 22 | 53.66 |
| | Total | 41 | 100.00 |
| Nationality | Cambodia | 5 | 12.20 |
| | Indonesia | 8 | 19.51 |
| | Laos | 1 | 2.44 |
| | The Philippines | 4 | 9.76 |
| | Thailand | 7 | 17.07 |
| | Vietnam | 3 | 7.32 |
| | Myanmar | 2 | 4.88 |
| | China | 7 | 17.07 |
| | Others | 4 | 9.76 |
| | Total | 41 | 100.00 |
| | Current employer | Government Authority | 8 |
| University/ Research Institute | | 29 | 70.73 |
| Company / Enterprise | | 2 | 4.88 |
| Others: Retirement | | 2 | 4.88 |
| Total | | 41 | 100.00 |
| Current focus area | Health management | 1 | 2.44 |
| | Diseases prevention and control | 20 | 48.78 |
| | Research and development technology | 18 | 43.90 |
| | Health policy | 2 | 4.88 |
| | Total | 41 | 100.00 |

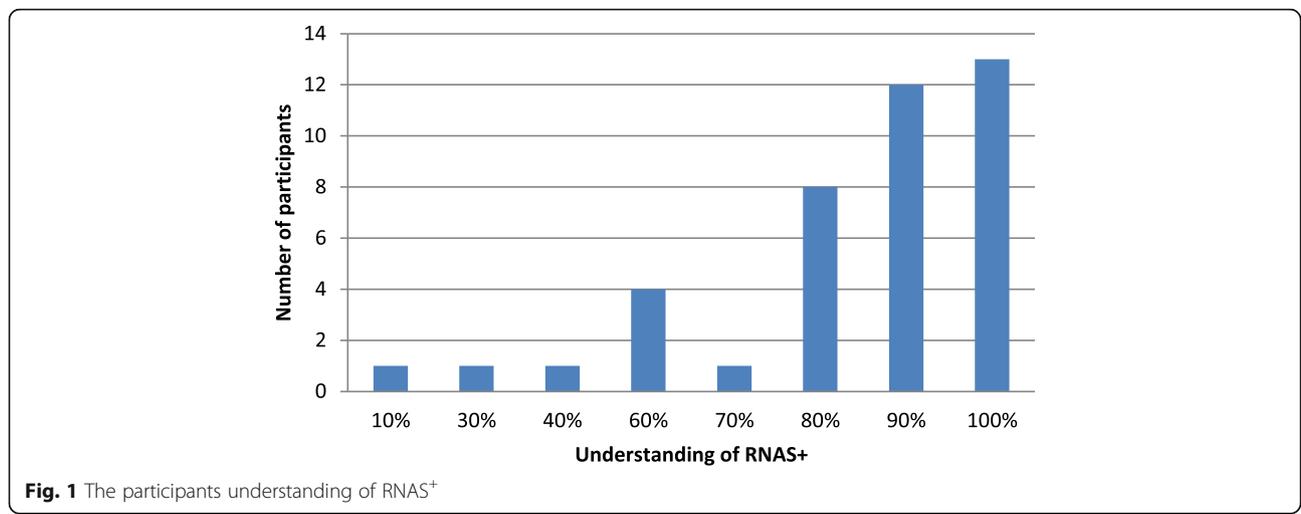


Fig. 1 The participants understanding of RNAS⁺

Table 3 Assessment score of China’s contributions to RNAS⁺ by survey respondents

| Variable | Score* | | | | | | | | | | Average score** | |
|---|--------|-------|-------|-------|----------|----------|----------|-----------|-----------|------------|-----------------|------|
| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | | 10 |
| China’s contributions to improving of capacity building of RNAS ⁺ ? N(%) [#] | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 4(11.11%) | 8(22.22%) | 11(30.56%) | 13(36.11%) | 8.92 |
| China’s funding contributions to RNAS ⁺ ? N(%) [#] | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 1(2.78%) | 0(0%) | 2(5.56%) | 4(11.11%) | 7(19.44%) | 9(25%) | 13(36.11%) | 8.64 |
| China’s contributions to the coordination of RNAS ⁺ ? N(%) [#] | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 1(2.78%) | 2(5.56%) | 3(8.33%) | 6(16.67%) | 11(30.56%) | 13(36.11%) | 8.75 |
| China’s contributions to applying for cooperation programme / project jointly with RNAS ⁺ member institutions? N(%) [#] | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 2(5.56%) | 1(2.78%) | 3(8.33%) | 7(19.44%) | 11(30.56%) | 12(33.33%) | 8.67 |
| The overall assessment of China’s contributions in RNAS ⁺ ? N(%) [#] | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 0(0%) | 2(5.56%) | 2(5.56%) | 8(22.22%) | 13(36.11%) | 11(30.56%) | 8.81 |

* The scores given by the respondents about China’s contributions to RNAS⁺ from the questionnaire, “0 score” means no contribution, and “10 score” indicated 100% contribution. The higher the score, the more important China’s contributions to RNAS⁺

** Average score: the sum of all scores marked by the respondents / the total number of respondents

[#] N(%): the number of respondents by each score (the number of respondents by each score/total number of respondents × 100%)

First, the most important challenge of RNAS⁺ was lack of the sustainable financial support, and more than half of the participants (26/41) mentioned the word “funding” in the open-ended question. Second, some participants pointed out that there were some challenges with the research and diagnosis skills that need to be addressed on NTDs in the region. Other aspects, such as the emerging and re-emerging disease control as well as the multi-country collaborations among scientists and control authorities also need to be supported. Third, how to enhance the impact of this network and improve interregional conflicts are important issues that should be addressed.

Regarding China’s future contributions to RNAS⁺ development, most of the participants indicated that it is essential for China to continue her support in the following five areas: funding, research and technology, capacity building, and RNAS⁺ annual workshops as well as in training activities. In the future, the participants proposed that China should continually share in the work experience and resources, jointly apply bilateral/multilateral partnership projects with member countries, and expand more members and international agencies to RNAS⁺, to strengthen the operation of the network.

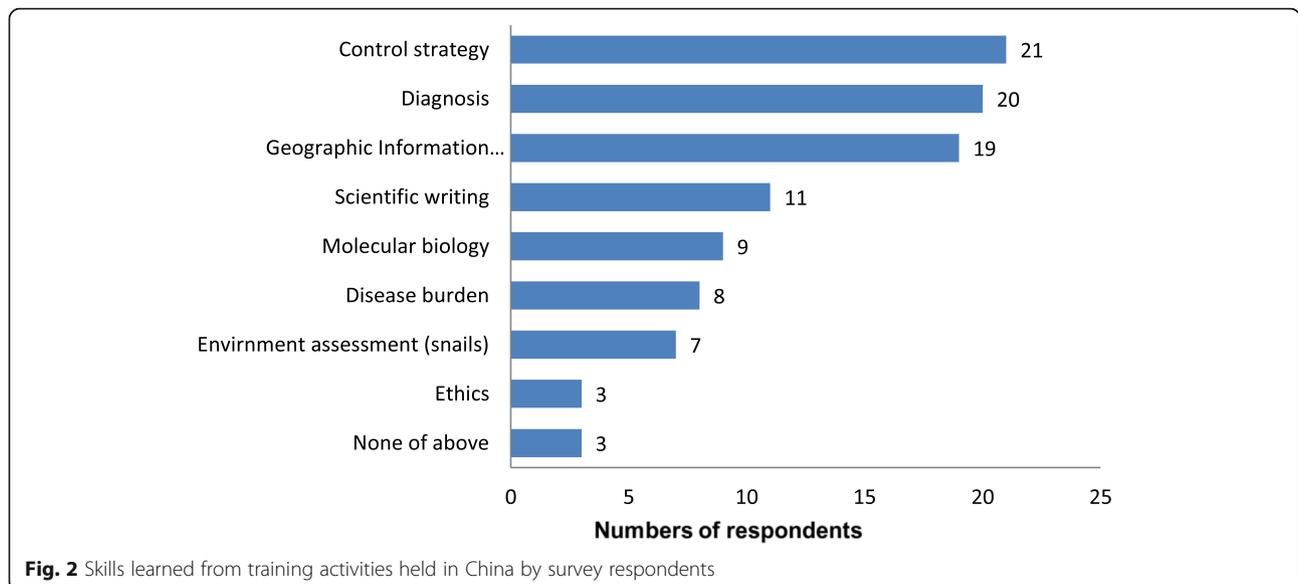


Fig. 2 Skills learned from training activities held in China by survey respondents

information to enhance multi-country, multi-diseases, and multidisciplinary collaboration in the Asian region. As a result of the highly collaborative projects among member countries, RNAS⁺ has promoted the understanding of various aspects of schistosomiasis and other diseases, and emphasized that an integrated control approach can be established to eliminate the disease through intersectoral collaboration. On this issue, China's contributions have also been affirmed on the four parts, such as capacity building [13], funding support [13], coordination [2, 15], and cooperation program [4, 14–16], of the development of RNAS⁺.

Additional challenges identified in the survey for the RNAS⁺ mainly focused on sustained funding, as well as research grants, which have also been reflected in recent RNAS⁺ publications [32]. RNAS⁺ has no sustainable funding by itself, nor fixed support from any large-scale transnational cooperation programs, indicating huge lack of financial support, and this has been confirmed by most respondents who mentioned the necessity to increase financial support. Moreover, RNAS⁺ inspired research and cooperation projects are limited, and continuous skills and programs are needed to combat NTDs and emerging parasitic diseases in this region. Additionally, how to improve the impact of the network and how to deepen the cooperation are also the challenges. Undoubtedly, more donors are needed to assist the network in its current and future activities [31].

Several ways to enhance China's contribution to RNAS⁺ development in the future were suggested. First, China has made great progress in schistosomiasis control in the past 70 years [33, 34], China should continually share its experiences to enhance cooperation within member countries as an important matter listing in the profile agenda [35, 36]. Second, due to the need for capacity building by RNAS⁺ members, China can continue to support annual workshops and technical trainings as well as collaborative research activities [37, 38]. Third, China can motivate more institutions and international organizations to join and enlarge the institutional coverage of RNAS⁺. Fourth, the practice of RNAS⁺ suggests that establishing a network-type organization is a good approach, therefore, in addition to schistosomiasis and NTDs, other diseases requiring particular control with joint efforts in one specific region can also refer to this mode of networking for regional cooperation [39].

To our knowledge, this is the first attempt of an assessment on China's contributions in regional networks, using an assessment questionnaire with the quantitative indicators in combination with four parts and scoring method. This is only one possible attempt to assess the contribution in the network. However, there are some limitations to this survey. Most of all, the number of participants is limited, and no responses were received

from Japan and South Korea, which are two member countries of RNAS⁺, thus, the results may not represent those of all experts from all member countries. Moreover, this assessment was not carried out by an independent third party, which may have bias affected the results' explanation to some extent. However, this survey has valuable reference on the role of China in the development of regional cooperation networking, e.g. RNAS⁺.

Conclusion

This survey showed that China has played an important role in the development of RNAS⁺ network since its establishment in the fields of capacity building, funding support, coordination, and cooperation programs. China has effectively shared experience and provided professional support on technologies and resources to member countries during the past 20 years. The challenges of RNAS⁺ includes lack of sustainable funding, less research activities, few new skills promoted, and lower impacts at global level. China's continual support is needed, especially in organizing annual workshops, capacity building, and cooperative research. The network-type organization, of RNAS⁺, which focuses on the cooperation for disease control and research, can yet be regarded as a great potential pattern for China to enhance regional cooperation. Thus, the research findings can be used to promote future cooperation between China and other RNAS⁺ member countries.

Abbreviations

RNAS⁺: Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses; RNAS: Regional Network on Asian Schistosomiasis; SDGs: Sustainable Development Goals; NTDs: Neglected Tropical Diseases; WHO: World Health Organization; NIPD: National Institute of Parasitic Diseases; China CDC: Chinese Center for Disease Control and Prevention; GIS: Geographic Information System; IDRC: International Development Research Centre; ASEAN: Association of Southeast Asian Nations

Acknowledgements

We are grateful to Dr. Don Eliseo Lucero-Priso III and the anonymous reviewers for their helpful advice in improving the quality of this article. We gratefully acknowledge the people who participated in this survey, thanks for their farseeing and helpful advice and suggestions.

Authors' contributions

HML, YJQ and KY drafted and modified the questionnaire. HML and XNZ completed the manuscript. WD, LLH, XJM and LD helped the survey and collected the data. DQW, YYG, NX and XNZ supplied the technology support and coordination for the whole project. The author(s) read and approved the final manuscript.

Funding

This work was supported by the programme of Chinese Center for Tropical Diseases Research (No. 131031104000160004), China-UK Global Health Support Programme funded by UK DFID (No. GHSP-CS-OP2-02), and National Science and Technology Key Projects (No. 2016ZX10004222-004).

Availability of data and materials

Please contact author for data requests.

Ethics approval and consent to participate

This study was approved by the Ethical Review Committee of the National Institute of Parasitic Diseases (NIPD), Chinese Center for Disease Control and Prevention (China CDC) (Approval No.2019006). This survey was anonymous

and voluntary, and the submission of the responses to the questions online implied willingness to participate in this survey.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Author details

¹National Institute of Parasitic Diseases, Chinese Center for Disease Control and Prevention; Chinese Center for Tropical Diseases Research; WHO Collaborating Centre for Tropical Diseases; National Center for International Research on Tropical Diseases, Ministry of Science and Technology; Key Laboratory of Parasite and Vector Biology, Ministry of Health, Shanghai 200025, China. ²Jiangsu Institute of Parasitic Diseases, Wuxi 214064, China.

Received: 28 August 2020 Accepted: 15 January 2021

Published online: 17 February 2021

References

- LoVerde PT. Schistosomiasis. *Adv Exp Med Biol.* 2019;1154:45–70.
- Leonardo L, Bergquist R, Utzinger J, Willingham AL, Olveda R, Zhou XN. Milestones of networking and global engagements for the Regional Network on Asian Schistosomiasis and other helminthic Zoonoses (RNAS⁺). *Adv Parasitol.* 2019;105:1–21.
- Gordon CA, Kurscheid J, Williams GM, Clements ACA, Li Y, Zhou XN, et al. Asian Schistosomiasis: Current Status and Prospects for Control Leading to Elimination. *Trop Med Infect Dis.* 2019;4(1):40.
- Lydia L, Robert B, Li SZ, Lv S, Virak K, Somphou S, et al. Collaborative RNAS⁺ research: priorities and outcomes. *Adv Parasitol.* 2019;105:23–52.
- Zhou XN, Wayling S, Bergquist R. Concepts in research capabilities strengthening positive experiences of network approaches by TDR in the People's Republic of China and Eastern Asia. *Adv Parasitol.* 2010;73:1–19.
- Zhou XN, Acosta L, Willingham AL, Leonardo LR, Minggang C, Aligui G et al. Regional Network for Research, Surveillance and Control of Asian Schistosomiasis (RNAS). *Acta Trop.* 2002;82(2):305–11.
- Leonardo LR, Bergquist R. Regional network on Asian schistosomiasis. *Trends Parasitol.* 2002;18(10):434–6.
- Zhou XN, Ohta N, Utzinger J, Bergquist R, Olveda RM. RNAS(+): A win-win collaboration to combat neglected tropical diseases in Southeast Asia. *Parasitol Int.* 2008;57(3):243–5.
- Yang GJ, Utzinger J, Lv S, Qian YJ, Li SZ, Wang Q, et al. The Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses (RNAS(+)) target diseases in face of climate change. *Adv Parasitol.* 2010;73:101–35.
- Olveda R, Leonardo L, Zheng F, Sripta B, Bergquist R, Zhou XN. Coordinating research on neglected parasitic diseases in Southeast Asia through networking. *Adv Parasitol.* 2010;72:55–77.
- Zhou XN, Olveda R, Sripta B, Yang GJ, Leonardo L, Bergquist R. From gap analysis to solution and action: the RNAS⁺ model. *Acta Trop.* 2015;141(Pt B): 146–9.
- Zhang LJ, Xu J, Lv S, Li HM, Guan YY, Zhou XN. Development and role of Regional Network for Asian Schistosomiasis and Other Helminth Zoonoses. *Chin J Schisto Contr.* 2018;30(1):5–8.
- Zhou XN, Leonardo L, Utzinger J, Lv S, Xu J, Willingham AL, et al. Needs and coordination mechanism for capacity building by the RNAS⁺. *Adv Parasitol.* 2019;105:53–68.
- Leonardo L, Bergquist R, Olveda R, Satrija F, Sripta B, Sayasone S, et al. From country control programmes to translational research. *Adv Parasitol.* 2019; 105:69–93.
- Bergquist R, Leonardo L, Zhou XN. From inspiration to translation: Closing the gap between research and control of helminth zoonoses in Southeast Asia. *Adv Parasitol.* 2019;105:111–24.
- Leonardo L, Bergquist R, Li SZ, Lv S, Khieu V, Sayasone S, et al. Multi-disciplinary integration of networking through the RNAS⁺: Research on other target diseases. *Adv Parasitol.* 2019;105:95–110.
- Furnival J, Boaden R, Walshe K. Assessing improvement capability in healthcare organisations: a qualitative study of healthcare regulatory agencies in the UK. *Int J Qual Health Care.* 2018;30(9):715–23.
- Polluste K, Habicht J, Kalda R, Lember M. Quality improvement in the Estonian health system—assessment of progress using an international tool. *Int J Qual Health Care.* 2006;18(6):403–13.
- Issen L, Woodcock T, McNicholas C, Lennox L, Reed JE. Criteria for evaluating programme theory diagrams in quality improvement initiatives: a structured method for appraisal. *Int J Qual Health Care.* 2018;30(7):508–13.
- Fonn S, Hu J, Igumbor JO, Gatoto D, Muula A, Ezeh A. Quantifying the cost of in-kind contributions to a multidonor-funded health research capacity-building programme: the case of the Consortium for Advanced Research Training in Africa. *BMJ Glob Health.* 2020;5:e002286.
- Tu S, Rosenthal M, Wang D, Huang J, Chen Y. Performance of prenatal screening using maternal serum and ultrasound markers for Down syndrome in Chinese women: a systematic review and meta-analysis. *BJOG.* 2016;123(Suppl 3):12–22.
- Xu J, Bergquist R, Qian YJ, Wang Q, Yu Q, Peeling R, et al. China-Africa and China-Asia Collaboration on Schistosomiasis Control: A SWOT Analysis. *Adv Parasitol.* 2016;92:435–66.
- Shi L, Li W, Wu F, Zhang JF, Yang K, Zhou XN. Epidemiological Features and Control Progress of Schistosomiasis in Waterway-Network Region in The People's Republic of China. *Adv Parasitol.* 2016;92:97–116.
- Xu J, Xu JF, Li SZ, Zhang LJ, Wang Q, Zhu HH, et al. Integrated control programmes for schistosomiasis and other helminth infections in P.R. China. *Acta Trop.* 2015;141(Pt B): 332–41.
- Yang GJ, Liu L, Zhu HR, Griffiths SM, Tanner M, Bergquist R, et al. China's sustained drive to eliminate neglected tropical diseases. *Lancet Infect Dis.* 2014;14(9):881–92.
- The website of RNAS⁺: supported by the Information Center of National Institute of Parasitic Disease, China CDC. <http://rnas.ipd.org.cn/> (2013). Accessed 22 Jan 2021.
- Olveda DU, Li Y, Olveda RM, Lam AK, McManus DP, Chau TN, et al. Bilharzia in the Philippines: past, present, and future. *Int J Infect Dis.* 2014;18(1):52–6.
- Sithithaworn P, Andrews RH, Nguyen VD, Wongsarot J, Sinuon M, Odermatt P, et al. The current status of opisthorchiasis and clonorchiasis in the Mekong Basin. *Parasitol Int.* 2012;61(1):10–6.
- Olveda DU, Olveda RM, Lam AK, Chau TN, Li Y, Gisparil AD, et al. Utility of Diagnostic Imaging in the Diagnosis and Management of Schistosomiasis. *Clin Microbiol.* 2014;3(2):142.
- Yang K, Zhou XN, Jia TW, Yang GJ, Wu XH, Shi XW, et al. Eco-social determinants of *Schistosoma japonicum* infection supported by multi-level modelling in Eryuan county, People's Republic of China. *Acta Trop.* 2015; 141(Pt B): 391–8.
- Zhou XN, Leonardo L, Bergquist R. Preface: Sustained cooperation on research and control of neglected tropical diseases among multisectors and multipartners across borders in Southeast Asia. *Adv Parasitol.* 2019;105:xi-xiii.
- Leonardo L, Bergquist R, Utzinger J, Li SZ, Venturina M, Zhou XN. Challenges and way forward. *Adv Parasitol.* 2019;105:125–32.
- Qian MB, Chen J, Bergquist R, Li ZJ, Li SZ, Xiao N, et al. Neglected tropical diseases in the People's Republic of China: progress towards elimination. *Infect Dis Poverty.* 2019;8(1):86.
- Hotez PJ. Whatever happened to China's neglected tropical diseases? *Infect Dis Poverty.* 2019;8(1):85.
- Xu J, Li SZ, Zhang LJ, Bergquist R, Dang H, Wang Q, et al. Surveillance-based evidence: elimination of schistosomiasis as a public health problem in the Peoples' Republic of China. *Infect Dis Poverty.* 2020;9(1):63.
- Yang X, Zhang Y, Sun QX, Zhou JX, Zhou XN. SWOT analysis on snail control measures applied in the national schistosomiasis control programme in the People's Republic of China. *Infect Dis Poverty.* 2019;8(1):13.
- Dong Y, Du CH, Zhang Y, Wang LF, Song J, Wu MS, et al. Role of ecological approaches to eliminating schistosomiasis in Eryuan County evaluated by system modelling. *Infect Dis Poverty.* 2018;7(1):129.
- Bergquist R, Zhou XN, Rollinson D, Reinhard-Rupp J, Klohe K. Elimination of schistosomiasis: the tools required. *Infect Dis Poverty.* 2017;6(1):158.
- Agrawal MC, Rao VG. Some facts on south asian schistosomiasis and need for international collaboration. *Acta Trop.* 2018;180:76–80.