

Current status and challenge of Human Parasitology teaching in China

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Parasitic infection profile in China has been changed greatly with the rapid economic development in China since the 1980s, such as the tremendous decreased infection rate of the soil-borne helminthiasis, the elimination of filariasis, the control of malaria, and the initiation to eradicate malaria in 2020. Some food-borne parasitic infections have increased such as *Clonorchiasis*, *Cysticercosis*, and *Echinococcosis*, probably because of the increased chances of eating out. This trend directly affected the status of Human Parasitology teaching in medical universities, such as the shorten length of this course, re-adjusted contents structure and teaching manners, even the change of the name of this course. In this paper, we analyzed the current status and challenges of Human Parasitology teaching in medical universities, and discussed the requisite contents and manners in course delivery and measures to improve the quality of Human Parasitology teaching in China.

Keywords: Human parasitology, Teaching, China

Introduction

Parasitic infections used to be one of the most important public health problems in China. Outstanding progress has been achieved in the control of serious parasitic diseases, such as malaria, filariasis, hookworm diseases, and leishmaniasis since the 1950s, especially with the rapid economic development in China since the 1980s.¹ According to the Ministry of Health of the People's Republic of China's national survey on the current status of important parasitic diseases in the population in 2005,¹ infection with soil-borne helminthes decreased from 536 million in 1990 to 129 million in 2004 representing a decrease in infections by 76%. The numbers of infected people with *Schistosoma japonicum* decreased by 92.74% from 1.16 million in the early 1950s to 0.84 million in 2003,¹ and decreased to 0.37 million in 2009.² *Leishmania* spp. and *Lishmaniasis* were basically eradicated in the 1950s. China is the first country to eliminate nematodes causing filariasis among the endemic countries.¹ The number of malarial infections decreased from 24.0 million in the 1970s to 7.4 million in 2004, the endemic area has greatly been reduced, and *Plasmodium falciparum* has been eradicated except in Yunnan and Hainan

Provinces,³ and China has launched a plan to eradicate malaria in 2020.³

However, on the other hand, the number of food-borne parasitic infections had increased.¹ The infection rate of *Clonorchis sinensis* had increased 75% from 1990. The prevalence of *Taenia* spp. has been increasing and it is now 0.52% nationally, with prevalence of up to 97% and 98% in Tibet and Sichuan Provinces, respectively.¹ The prevalence of *Echinococcus* spp. is approximately 1% in the 12 provinces of Western and Northern China accounting for about four million infected individuals. Infection rates of sexually transmitted parasites (such as *Trichomonis vaginalis* and pubic louse), and opportunistic parasites (such as *Toxoplasma gondii* and *Cryptosporidium* spp.) also increased gradually in these 10 years.⁴⁻⁶ Cases of uncommon parasitic infections such as *Angiostrongylus cantonensis*, *Naegleria fowleri*, and *Acanthamoeba* spp. have been documented in China.⁷⁻⁹ Since more and more Chinese people like to raise dogs or cats as pets in metropolitan cities or the other suburban districts, but it is most neglected in China at present, there is only one literature reported that and the seroprevalence of *Toxocara* spp. in the children in Chengdu is about 2.1–17.7%.¹⁰ Unfortunately, the success in some serious parasitic infections control has led to a deemphasizing of the importance of Human Parasitology instruction, a similar situation that has occurred in many developed

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countries,^{11,12} regardless of the rampancy of the other emerging and re-emerging parasitic infections.¹³

Objectives of Human Parasitology Teaching to BMSc Students in China

There are more than 70 medical universities/colleges, containing more than 1.4 million students, in mainland China that offer a Bachelor of Medical Science (BMSc) degree. The basic and required courses of medical science are very similar among the different majors and all include Human Parasitology.

Human Parasitology is taught either included in Pathogen Biology or a specific class independently. The teaching objectives are to introduce the students to current knowledge on: (1) the morphological features and life cycles of principal human parasites; (2) the pathogenic mechanisms by which parasites cause disease, and the immune responses of the host; (3) methods for accurate diagnosis of the principal human parasites; (4) anti-parasitical treatment and control of parasitic infections; and (5) the epidemiology and prevention for parasitic diseases.

Course Delivery and Topics of Human Parasitology

Human Parasitology is usually taught in the fourth or fifth semester for undergraduates, which receives 32–54 total hours in the majority of institutions in China. The length and percentage of lecture and laboratory instruction in some of the medical schools in China are shown in Table 1. The lecture hours devoted to didactic teaching of general parasitology and individual parasites including diseases caused by them vary depending upon institution. The practical (laboratory) classes are taught in the laboratory for the observation of morphological features and diagnosis of parasitic infections (Table 2). Most Chinese universities adopt a taxonomic approach when teaching Human Parasitology at the undergraduate level, whereas a few universities prefer to teach the subjects using a system based approach (i.e. blood parasites, intestinal parasites, etc.)

Teaching Team and the Evaluation of Teaching Effect

Human Parasitology is team taught by individuals (including professors, associate professors, lecturers, and technicians) usually having a focus on some

aspects of parasite research. Professors, associate professors, and lecturers present the lectures to the class, while technicians are usually responsible for the collection and preparation of parasite materials for the laboratory portion of the class. Annual mandatory, intensive training courses on general teaching skills and elective training courses (like bilingual teaching, problem-based learning method) are provided at the university or department level to train new teachers. Experienced lecturers are also required as mentors to help new staffs. In addition, national forums on various aspects of Human Parasitology teaching are held every year, e.g. ‘the National Teaching Forum for Human Parasitology’ is held every year in China.

Courses (including Human Parasitology) are evaluated by students and faculty peers experienced in teaching. The students using computerized evaluation forms to evaluate the course are also encouraged to provide written comments that they deem helpful. A peer evaluation committee of experienced retired professors who attend classes randomly assesses the presentation of the subject. Based on the feedback of the students and the teaching committee, modifications to courses and subject delivery are discussed at regular meetings at the department level, and renovations or modifications are implemented in the next round teaching.

Evaluation of Student Performance

To assess whether students have achieved an acceptable level of knowledge and understanding of the subject material outlined in the teaching syllabus, they are administered quizzes throughout the semester. These quizzes usually account for 30–50% of their grades and are combined with a cumulative final examination, which accounts for 50–70% of their grades. The final cumulative examination is composed of two components, a written or electronically administered portion on theory and a practical portion on diagnostic and laboratory skills.

Postgraduate Teaching of Human Parasitology in China

Master or Doctorate programs in medicine usually take 3 years to complete in China and involve both course work and a research project. For master and doctorate students majoring in Human Parasitology,

Table 1 The teaching composition of Human Parasitology in the medical universities in China at present

University	Fudan University	Sun Yat-Sen University	Huazhong University of Science and Technology	Southern Medical University	Shanxi Medical University	Wenzhou Medical College
Total length (hour)	54	50	54	45	40	32
Theory teaching (hour)	36	26	24	24	24	20
Percentage	67%	57%	44%	60%	60%	63%
Laboratory teaching(hour)	18	24	30	21	16	12
Percentage	33%	43%	56%	40%	40%	37%

Table 2 Typical syllabus for BMSc students taking Human Parasitology in medical universities in China

Classes mode			
Sections		Theory approximately 20–36 hours	Laboratory practice 12–30 hours
Introduction of Human Parasitology	General Human Parasitology	2	0
Medical Nematoda	<i>Ascaris lumbricoides</i> , <i>Trichuris trichiura</i> , <i>Enterobius vermicularis</i> , <i>Trichinella spiralis</i> , hookworm, and Filaria	4–6	2–6
Medical Cestoda	<i>Spirometra mansoni</i> , <i>Taenia solium</i> , <i>Taenia saginata</i> , <i>Hymenolepis nana</i> , <i>Echinococcus granulosus</i>	4–6	2–6
Medical Trematoda	<i>Schistosoma japonicum</i> , <i>Clonorchis sinensis</i> , <i>Paragonimus westermani</i> , <i>Fasciolopsis buski</i>	4–6	2–6
Medical Protozoa	<i>Entamoeba histolytica</i> , <i>Leishmania</i> spp., <i>Giardia lamblia</i> , <i>Trichomonas vaginalis</i> , <i>Plasmodium</i> spp., <i>Toxoplasma gondii</i>	4–8	4–6
Medical Arthropoda	Mosquitoes, flies, ticks, mites, fleas, lice	2–8	2–6
Overview of the topics taught in Human Parasitology	General Human Parasitology Individual parasites and the diseases they caused	Parasitism, types of parasites and hosts, host–parasite relations, classification and taxonomy of parasites, parasite immunology, epidemiology of parasitic diseases, diagnostic techniques, and general control measures for parasite infections. The principal protozoan, cestode, trematode, nematode, and arthropod parasites and their roles as primary pathogens or vectors, emphasizing their morphological characteristics, life cycles, pathogenesis, clinical symptoms and signs, methods of diagnosis and treatment, epidemiology, and prophylaxis	

Advanced Parasitology is a required curriculum, such as Advanced Parasitology taught in Zhongshan (Sun Yat-sen) University, Modern Pathogen Biology taught in Fudan University, Advances in Pathogen Biology Research taught in Shandong University, Parasitic Infection and Immunology taught in Shantou University, and Diagnosis, Treatment and Prevention of Parasitic Diseases taught in Sichuan University.¹⁴ It is usually delivered as a series of seminars on research advances in various aspects of parasitology, including: genomics and genetics of parasites; molecular biology and biochemistry of parasites; advanced technology in parasitology; parasite immunology, molecular parasitology, immunodiagnosics and vaccine development for parasitic diseases; host–parasite relationships; and novel control strategies for parasitic diseases. This course also includes a series of experiments in molecular parasitology, parasite immunology, and traditional parasitology with the purpose of training the students in the necessary experimental skills.

The Challenges of Human Parasitology Teaching in China

Human Parasitology teaching in China may be a victim of its own success. Clinicians and medical researchers have been successful in bringing about a decrease in the prevalence of human parasitic infections. Because of this success, there has been a gradual de-emphasizing of Human Parasitology instruction. A lessening emphasis on parasite control, the declining numbers of Parasitology faculty, and the decreasing numbers of contact hours in Human Parasitology courses are evidence of this decline in perceived importance. However, a heavy burden of

parasitic infection is still present in China and serious newly emerging and re-emerging parasitic diseases continue to be a medical problem.^{1,7–9} Despite its continued public health importance, Human Parasitology is facing the challenge of being deemphasized and marginalized.

Changed or integrated name of Human Parasitology into Pathogen Biology

In 1997, the National Committee of Education and the Committee of Academic Degree in State Council of China jointly promulgated a new list of disciplines and/or curricula for high education and in part of medical science, ‘Pathogen Biology’, which integrates Microbiology and Human Parasitology, was specified as a newly named discipline.¹⁵ Since then, Human Parasitology has been integrated into or just changed its name into ‘Pathogen Biology’ and new Pathogen Biology departments have been formed and have incorporated graduate programs in Human Parasitology.

Shorten course length of Human Parasitology

Clinic medicine is usually a representative major in the medical universities/colleges, so we take this major as an example here. In the 1950s, the average length of teaching for Human Parasitology for this major in Chinese medical schools was around 120 hours. In the 1980s, it dropped to 65–80 hours. Presently, the length of Human Parasitology teaching is 32–56 hours (Table 1). The reduced instruction time for the teaching of Human Parasitology presently may have a negative impact on the knowledge and skills of the future doctors and could consequently have a detrimental impact on the quality of clinic practitioners.

The pressure of great increased number of medical students

China has undergone major socioeconomic development in the last two decades and one of the benefits is that more students have the opportunity to undertake a BMSc degree — the annual student enrolments of most universities have increased significantly over the last 10 years. Chinese universities are facing some difficulties and problems in teaching Human Parasitology: (1) the quality of laboratory teaching is compromised by the large number of students, relatively restricted budgets, and limited laboratory facilities; and (ii) the lack of well-qualified teaching staff in some universities affects the quality of Human Parasitology teaching. To solve these problems, there is a trend to smaller groups of students in a teaching section. Universities are constructing new teaching facilities, and recruiting new teaching staffs with attractive work condition, salary, and benefits packages.

The Renovation in Human Parasitology Teaching Increase in the use of multimedia facilities and web

The teaching techniques have become more modernized in China. Multimedia teaching is widely used including computer-assisted instruction (CAI) courseware, DVD movies, and cartoon animations, which are broadly used in every medical school. Many websites for the essence courses and the bilingual teaching of Human Parasitology have been constructed and used routinely since 2003.

Reform of the course delivery manners and topics

Textbooks and laboratory manuals are compiled and submitted for approval to a national consortium of experienced parasitologists from different universities to ensure that the overall content of material is the same throughout China. The traditional parasites seen in China, such as *Plasmodium* spp., *Schistosoma* spp., *Leishmania* spp. Filarial, and hookworms, still receive a great deal of coverage. Teaching parasites causing food-borne parasitosis such as *Angiostrongylus cantonensis* and *Strongyloides stercoralis*, and opportunistic parasitic pathogens such as *Toxoplasma gondii* and *Cryptosporidium* spp. are also covered to a lesser extent. While the different districts have different infection profiles, for example, in Western China, some parasitic infections such as soil-transmitted helminthiasis, cysticercosis, echinococcosis, leishmaniasis, clonorchiasis, paragonimiasis, taeniasis, amebiasis, and giardiasis have a relatively higher rate than the other parts. It is still very necessary to address the importance of Parasitology course teaching in Western China, because it will be beneficial not only to Chinese people, but also to foreign visitors, so that if they were infected with parasites, they would not receive a misdiagnosis.¹⁶

Bilingual teaching of Human Parasitology

With the globalization and the multi-culture development, China has become an active member in economic and cultural communication with the other countries. English is the major scientific language. In 2001, the Ministry of Education of China began emphasizing the importance of bilingual teaching, especially English/Chinese teaching in higher education. Currently, most of the key universities have adopted bilingual teaching as a standard practice. Some universities use full English in teaching Human Parasitology not only to Chinese students but also to foreign students.¹⁴ Only some provincial/municipal colleges are still using full Chinese teaching. More and more teachers are sent to native English-speaking countries for 0.5–2 years training to improve their efficiency in English teaching.

Summary

China has undergone fast economic development since the 1980s. The parasitic infection profile has been changed greatly due to several traditional severe parasitic diseases having been well controlled. Because of this success, Human Parasitology instruction has been deemphasized and the discipline of Human Parasitology is facing a risk of being marginalized in China. To solve these problems, more support and acknowledgement of parasite problems from the Chinese government are needed. Medical educators should be embraced by the teaching of Human Parasitology in the universities/colleges. The teaching renovations of Human Parasitology have been instituted in medical schools, such as changing the components of topics for teaching, adding new laboratory experiences, and applying bilingual teaching and new teaching methods/manners. We believe that under the great efforts of all of the teaching staffs and with the support from the different channels, the teaching quality of Human Parasitology can be improved step by step to meet international standards. We believe that improved teaching plays an essential role in the prevention of parasitic diseases in China.

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Competing Interests

The authors declare that they have no competing interests.

Author's Contributions

H-JP, CZ, and X-GC are involved in manuscript draft, and H-JP, CZ, and C-MW collected the parasitic epidemic data. All authors read and approved the final manuscript.

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