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# On the 125th Anniversary of the Oswaldo Cruz Institute, the Postgraduate Program in Tropical Medicine Celebrates 45 years of Achievements in an Evolving Landscape

Livia Agualuza Mangeon, Martha Cecilia Suarez-Mutis, Alda Maria Da-Cruz, Elba Regina Sampaio de Lemos, Livia Melo Villar, Marco Aurelio Pereira Horta, Márcio Neves Bóia, Vanessa Salete De Paula, Filipe Anibal Carvalho-Costa

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<sup>1</sup>Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Epidemiologia e Sistemática Molecular, Rio de Janeiro, RJ, Brasil;

<sup>2</sup>Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Doenças Parasitárias, Rio de Janeiro, RJ, Brasil;

<sup>3</sup>Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório Interdisciplinar de Pesquisas Médicas, Rio de Janeiro, RJ, Brasil;

<sup>4</sup>Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Hantavírus e Rickettsioses, Rio de Janeiro, RJ,

<sup>5</sup>Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Hepatites Virais, Rio de Janeiro, RJ, Brasil;

<sup>6</sup> Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Biologia e Parasitologia de Mamíferos Silvestres Reservatórios;

<sup>7</sup> Fundação Oswaldo Cruz-Fiocruz, Instituto Oswaldo Cruz, Laboratório de Virologia e Parasitologia Molecular

\*Corresponding author: [guaratiba@ioc.fiocruz.br](mailto:guaratiba@ioc.fiocruz.br)

## **Abstract**

This paper describes the trajectory of the Postgraduate Program in Tropical Medicine (PPGMT) at the Oswaldo Cruz Institute (IOC) over 45 years. We demonstrate the evolution and diversity of subjects, spanning 428 master's dissertations and 233 doctoral theses, from rural endemic parasitic diseases to 21st-century public health emergencies. Research fields such as molecular biology, immunology, host-pathogen interactions, entomology, molecular epidemiology, phylogeography/phylogenetics of pathogens and vectors, ecology, ecoepidemiology, immunogenetics, and health education were incorporated by the PPGMT, expanding it into many IOC laboratories. The production of scientific data on highly prevalent/incident pathogens is discussed. The paper highlights the presence of Neglected Tropical Diseases as well as major global health risks among dissertations and theses subjects. PPGMT instructors' and students' presumptions about ideas like One Health and the 2030 Agenda's Sustainable Development Goals are highlighted. Projects on low-incidence/high-lethality diseases are demonstrated, and the geographic distribution of research developed by foreign students is presented. Future challenges are glimpsed in an evolving epidemiological landscape, where infectious diseases reemerge as potential risks to public health amid reduced global vaccination coverage, misinformation, science denialism, climatic changes, and the weakening of international organizations.

**Keywords:** Tropical Medicine, Postgraduate Education, Oswaldo Cruz Foundation

## Background, inauguration and consolidation

The *stricto sensu* Postgraduate Program in Tropical Medicine (PPGMT), based at the Oswaldo Cruz Institute / Oswaldo Cruz Foundation (IOC/Fiocruz) in Rio de Janeiro, Brazil, had its bases launched in 1980. The PPGMT was implemented by Professor José Rodrigues Coura (1927 – 2021), who, in 1979, was Vice President of Research at Fiocruz and Director of IOC, where he created the Department of Tropical Medicine.<sup>(1)</sup> In 1970, Professor Coura created the Postgraduate Program in Infectious and Parasitic Diseases at the Federal University of Rio de Janeiro, the first *stricto sensu* course in medicine accredited in Brazil.<sup>(1)</sup> At the university, Professor Coura organized the Department of Preventive Medicine in the 1970s, with four disciplines: Infectious and Parasitic Diseases, Epidemiology, Occupational Medicine, and Public Health. He had replaced, in 1968, Professor José Rodrigues da Silva (1911 - 1968) in the Chair of Clinical Tropical and Infectious Diseases, created by Carlos Chagas (1879 – 1934) in 1925, which was in the Carlos Chagas Pavilion of the São Francisco de Assis Scholl Hospital, in Rio de Janeiro.<sup>(1)</sup> Before implementing the teaching of tropical diseases in the faculty of medicine, Carlos Chagas – working at IOC, the so-called Manguinhos Institute, after the district where it was built – discovered *Trypanosoma cruzi* and Chagas disease in 1909 and, ten years later, led the fight against the pandemic Spanish flu in Rio de Janeiro, by setting up and personally supervising 27 medical unities for the population. The actions of IOC scientists and doctors during the Spanish flu pandemic (both in the effort to isolate the etiological agent in their laboratories and in assisting patients in field hospitals) demonstrated their ability to adapt to combat emergency health risks, which would become a striking characteristic of the Manguinhos Institute a century later.<sup>(2)</sup>

During the 1980s, Professor Coura performed in IOC a vigorous process of reestablishing it as a locus for research and education at the *stricto sensu* postgraduate level in Tropical Medicine, since activities had been interrupted in 1970.<sup>(1)</sup> These educational activities had been initiated in the institute by Oswaldo Cruz (1872 – 1917) in 1908, and the so-called *Curso de Aplicação* (Application Course) had, as professors, Brazilian scientists working in IOC, including Antonio Cardoso Fontes, Adolpho Lutz, Arthur Neiva, Alcides Godoy, Gaspar Vianna, and Henrique Figueiredo de Vasconcellos, besides Carlos Chagas.

In the early 1980s, Professor Coura invited several scientists to join the research team at Fiocruz during the restructuring process, including Leonidas and Maria Deane, Luis Rey, Helio and Peggy Pereira, Zigman Brenner, Zilton and Sonia Andrade, and Henrique and Jane Lenzi, some of whom were impeached during the Brazilian dictatorship of the 1970s.<sup>(3)</sup> The

process of rebuilding educational activities at the IOC was based on its vocation and expertise not only in producing scientific evidence to control tropical diseases (represented mainly by parasitic diseases considered *rural endemics*), but also in basic and applied science in the fields of pharmacology, biochemistry, pathology, and immunology, among others.

The PPGMT aimed to train doctors willing to integrate clinical practice with field epidemiology and laboratory research, following the tropicalist tradition of the IOC, which had, among its main activities, scientific expeditions to the Brazilian back lands. These expeditions allowed the mapping of many diseases in central, Amazonian, and northeastern Brazil in the early 20<sup>th</sup> century, providing a diagnosis of the health conditions of populations living in remote areas of the country's hinterlands.<sup>(4)</sup>

The first research projects hosted by the PPGMT prioritized parasitic diseases and, in this way, Tropical Medicine, understood as a multidisciplinary field of research, became one of the structuring fields for the resumption of teaching and research in IOC. The theses produced within the PPGMT had a wide geographic scope and were developed in several regions of the country and Latin America, contributing to the training of specialists who achieved prominence in scientific production. The classes were smaller (on average, five students), and the projects prioritized clinical-epidemiological aspects supported by laboratory diagnosis. Figures 1A and 1B show the topics developed in the PPGMT during its first 26 years, between 1980 and 2006 (80 master's dissertations and 32 doctoral theses) and their topics.

### **Growing up in an evolving landscape**

The PPGMT was aimed at physicians until 2007, when it became a multiprofessional program. The entry of students trained in other areas led to an exponential increase in the number of projects, which enabled great diversification of dissertations and theses topics. From 2007 to 2024, the PPGMT graduated 348 master's degrees and 201 doctors, totalling 428 master's degrees and 233 doctors in 45 years. The master's program now has an average of 20 students per year, and the recruitment of doctoral projects has made it possible to graduate an average of 15 doctors annually. Following this diversification, research fields such as molecular biology, immunology, host-pathogen interaction, entomology, molecular epidemiology, phylogeography/phylogenetics of pathogens and vectors, ecology, ecoepidemiology, immunogenetics, and health education, among others, were incorporated by the PPGMT, expanding it into many IOC laboratories, incorporating young researchers as supervisors as well as researchers from other Fiocruz scientific units

as professors and collaborators. Brazilian Federal Agency for Support and Evaluation of Graduate Education (CAPES) awarded four PPGMT theses addressing malaria, dengue, sporotrichosis, and arenaviruses. In addition to awards at scientific conferences, students have been awarded other important prizes at the national level, such as Research for the Unified Health System and the annual prize for the best doctoral thesis at Fiocruz. PPGMT students have produced scientific articles as well as books (including one in braille), games, and videos. In the last decades, PPGMT has been directly involved with the empowerment of the scientific community and increased chances of initiating *stricto sensu* postgraduate studies in other Brazilian states, such as Mato Grosso do Sul, Amazonas, Pará, Rondônia, Roraima, Acre, Ceará and Piauí, through interinstitutional cooperations. Within a South-South cooperation perspective, 55 masters and 26 doctors graduated by PPGMT throughout its 45 years came from other countries in Latin America, Caribbean, and Africa, as presented in the maps in Figure 2. The international scientific missions of PPGMT professors have been conducted in the Netherlands, South Africa, United States, France, Portugal, Spain, and Italy. PPGMT professors have organized international courses on neuroinfections and vectors of infectious diseases in partnership with foreign institutions.

In the singular epidemiological transition of Brazil and other developing countries, the burden of noncommunicable diseases is added to (but does not replace) infectious diseases. In line with this epidemiological trend, the first decades of the 21st century saw Brazil dealing with a series of viral infections that represented a great threat to public health, according to Morel (2022): “*i) the resurgence of well-known diseases, such as dengue and yellow fever; ii) the emergence of diseases that were restricted to other continents (Zika/microcephaly and chikungunya); iii) new epidemics (influenza H1N1) or iv) pandemics (COVID-19)*”.<sup>(5)</sup> This picture demanded updates from the PPGMT staff and research lines that could incorporate projects on these topics, representing public health emergencies of international concern declared by the World Health Organization (WHO).<sup>(6)</sup>

The IOC hosts reference centers for the study of arboviruses and respiratory viruses. This structure was decisive for PPGMT researchers and students in contributing to the production of scientific data for the control of emerging health risks, demonstrating the team’s ability to adapt to society’s health demands.<sup>(7,8)</sup> In addition to the prolific scientific production of PPGMT virologists, a vast amount of information on arboviral vectors (Culicidae) were produced by entomologists and their postgraduate students during the development of theses and dissertations describing the distribution, ecological aspects, and insecticide resistance.<sup>(9,10)</sup> In the field of viral infections, the IOC’s reference center for viral

hepatitis, in addition to laboratory research, provides medical assistance in specialized outpatient clinics. Viral hepatitis is the cause of half of the liver transplants in Brazil, and several dissertations and theses have been carried out, generating scientific data that have contributed decisively to diagnosis, vaccination strategies against hepatitis B, treatment of hepatitis B and C, and surveillance of outbreaks mainly associated with fecal-borne (A and E) hepatitis viruses.<sup>(11)</sup> Figure 3 presents the frequency and annual distribution of dissertations and theses targeting arboviruses, respiratory viruses such as pandemic H1N1 and SARS-CoV-2, and viral hepatitis in PPGMT.

In parallel with these well publicized health risks, several diseases listed by the WHO as neglected tropical diseases (NTDs), remain endemic in Brazil, including Chagas disease, leishmaniasis, leprosy, schistosomiasis, soil-transmitted helminthiasis, snakebites, taeniasis/cysticercosis, trachoma, hydatidosis, filariasis, deep mycoses, onchocerciasis, and rabies. NTDs have been defined by the WHO as *“a diverse group of communicable diseases that are prevalent in tropical and subtropical regions in 149 countries – they affect more than one billion people and cost developing economies billions of dollars each year”*.<sup>(12)</sup> The population living in poverty is the most affected. Several NTDs have been the subject of dissertations and theses at the PPGMT, which has kept pace with current research in the field of Tropical Medicine.

Concerning the most prevalent NTDs, Brazil has the second highest incidence of leprosy in the world, after India. Several dissertations and theses on leprosy have been developed in laboratories and the specialized leprosy clinic housed by the IOC, which integrate clinical and laboratory data and carry out translational research, allowing the training and education of several professionals within the PPGMT.<sup>(13)</sup> One thesis on leprosy provided scientific evidence to improve strategies to block the transmission of the disease and was awarded the best thesis in the medical field at the Oswaldo Cruz Thesis Award by Fiocruz.<sup>(14)</sup>

The IOC is one of the largest producers of knowledge in the field of protozoology. Chagas disease and leishmaniasis, which are recognized as NTDs, persist as endemic diseases in many Brazilian regions. The projects on Chagas disease developed as PPGMT theses cover a wide range of topics, ranging from the ecology of vectors and the characterization of transmission cycles in the Amazon and other regions, to important contributions to the evolution and treatment of chronic heart disease developed by doctors from the IOC and the Evandro Chagas National Institute of Infectology (INI) / Fiocruz.<sup>(15-18)</sup> Regarding leishmaniasis, researchers belonging to the PPGMT have supervised theses

that shed light on the parasite-host interaction and immunology of the cutaneous, mucosal, and visceral forms of the disease, carrying out cutting-edge research in experimental models.<sup>(19,20)</sup> PPGMT maintains an important scientific production in the field of medical mycology, represented by the contributions of Professor Bodo Wanke (1941 – 2021) and his team on paracoccidioidomycosis, coccidioidomycosis, and other deep mycoses that represent the subjects of many theses.<sup>(21,22)</sup> Currently, studies on PPGMT hosts sporotrichosis, a zoonotic fungal disease that poses an important risk to public health in Brazil and the recovery, in the Amazon environment, of pathogenic fungi, such as *Cryptococcus neoformans*.<sup>(22,23)</sup> INI/Fiocruz has been a partner in this and in other topics. Figure 3 presents the frequency and distribution of dissertations and theses targeting NTDs in PPGMT, with emphasis on leprosy, Chagas disease, leishmaniasis, and deep mycoses, which are frequent topics.

Malaria, tuberculosis, and AIDS are not considered neglected diseases by the WHO due to the investments dedicated to their control by international funding agencies, the pharmaceutical and biotechnology industries, and governments, due to the enormous burden they represent for populations on a global level, being present in Brazil as a prominent public health concern.<sup>(24-26)</sup> Like NTDs, this group of diseases, denominated as the *Big Three Infectious Diseases*, has a disproportionately large impact on the poorest and most vulnerable segments of society.<sup>(25)</sup> Certain communities, including sex minorities, sex workers, people in prisons, people who inject drugs, crack cocaine users, migrants, refugees, displaced people, street people/homeless, artisanal gold miners, and indigenous peoples, are at a greater risk of acquiring these diseases.<sup>(25)</sup> Malaria, tuberculosis, and AIDS are the subjects of many dissertations and theses in the PPGMT, illustrating once again the program's ability to stay up-to-date with the global and Brazilian health agendas. The interaction between malaria and gold mining activities in the Amazon, which represents a major challenge for control, has been demonstrated along the border of Guyana.<sup>(27,28)</sup> Figure 3 presents the number of dissertations and theses developed on malaria, tuberculosis, and AIDS in PPGMT over the past 45 years.

The PPGMT has also addressed other issues that pose important health risks. In this sense, projects on toxoplasmosis, schistosomiasis, varicella, pertussis, giardiasis and other protozoan intestinal parasitic diseases, West Nile fever, bartonellosis, onchocerciasis, Q fever, cytomegalovirus, gastroenteritis viruses, soil-transmitted helminthiasis, herpesviruses, HTLV infection, measles, angiostrongyliasis, strongyloidiasis, among many others, are addressed by PPGMT students and professors. Toxoplasmosis, recently

included in the neonatal screening test in Brazil, has been the subject of research aimed at characterizing the transmission cycles and domestic animals as reservoirs.<sup>(29)</sup> The IOC hosts reference centers for enteroviruses, HIV infection, hepatitis, gastroenteritis, hantaviruses, leprosy, carbuncle, enteric bacteriosis, leptospirosis, rickettsiosis, Chagas disease, malaria, leishmaniasis, hydatidosis, malacology, and onchocerciasis/filariasis, which allow the aggregation of a wide range of projects with diversities of themes. Regarding rickettsial diseases, arenaviruses, and hantaviruses, PPGMT professors led a team capable of generating rapid responses for health interventions to save lives in cases of outbreaks of Brazilian spotted fever and other diseases with high lethality despite their low incidence rate. Several theses have been developed on these topics within a specialized reference center, including a study in which two new species of arenaviruses were discovered.<sup>(30,31)</sup>

According to the WHO, One Health is “*an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems*”.<sup>(32)</sup> The One Health approach is widely used in PPGMT projects in which environmental and epidemiological data are often integrated by experts in animal reservoirs, leading teams with extensive fieldwork experience. In this sense, zoonotic potential of pathogens has been characterized by students in PPGMT.<sup>(33)</sup>

Several PPGMT projects have used vaccines as subjects. One of these projects has contributed to the development of the LepVax vaccine against leprosy. In one project, community circulation of vaccine-derived rotavirus was demonstrated in a pioneering manner in Brazil.<sup>(34)</sup> Genomic data generated on SARS-Cov-2 and influenza H1N1 have contributed to vaccination strategies.<sup>(7,35)</sup> In a doctoral thesis, the importance of meningococcal vaccination in indigenous children living in remote Indian villages was demonstrated in the Amazon region in three ethnic groups.<sup>(36)</sup> The potential impact of anti-HPV vaccination has been demonstrated in Paraguay and one project has addressed the BCG vaccine.<sup>(37,38)</sup> This demonstrates the commitment of PPGMT to the National Immunization Program at a time of great effort for its recovery by the Ministry of Health. In addition, the PPGMT has developed extension activities related to tropical diseases aimed at different population groups, with an emphasis on projects aimed at vulnerable areas.

The 2030 Agenda for Sustainable Development adopted by the United Nations provides “*a shared blueprint for peace and prosperity for people and includes 17 Sustainable Development Goals (SDGs), which are an urgent call for improve health and education and reduce inequality*”.<sup>(39)</sup> The PPGMT has frequently incorporated SDGs that

can be empowered by the generation of scientific evidence, including SDG1 (No poverty), SDG2 (Zero hunger), SDG3 (Good health and well-being), and SDG6 (Clean water and sanitation) in its projects. In this sense, the United Nations SDGs have been the target of research developed on a community basis, with vulnerable populations in both rural and urban settings, by researchers with great expertise in field epidemiology, who focus their work on identifying the social determinants and impact of pathogens, such as soil-transmitted helminthiases and gut parasitic protozoa, and their association with malnutrition.<sup>(40,41)</sup> A comprehensive analysis of the water quality provided by the domestic rainwater storage strategy and its relationship with intestinal parasitism in the Brazilian semiarid region was developed as a doctoral thesis.<sup>(42)</sup> A complete panel of diseases/pathogens addressed in the PPGMT from its implementation until 2024 is presented in Table I.

### **Prospects and new challenges**

The COVID-19 pandemic has taught the scientific community and healthcare networks that there are unpredictable public health risks. This will potentially require new updates to PPGMT research. Massive refugee displacement due to ongoing wars, declines in vaccination coverage associated with anti-vaccination movements, homelessness, opioid and crack cocaine crises, scientific denialism, reductions in research funding, and misinformation disseminated through social media biased by big technologies are contemporary factors potentially associated with the emergence of new health risks. Climatic change and global warming are also considered new risks for the expansion of the geographic scope of infectious diseases, a topic that has already been addressed by PPGMT researchers.<sup>(43)</sup> The weakening of the WHO due to cuts in funding by member countries will make it more difficult to manage new public health emergencies of international concern, as well as to support the control of endemic and epidemic diseases in many regions of the world. For example, cutting international funding for HIV/AIDS treatment in South Africa in 2025 will put the lives of millions of people at risk.<sup>(44)</sup> Increased HIV-associated mortality has been observed in Russia, associated with the marginalization of vulnerable groups.<sup>(45,46)</sup> In 2018, a measles outbreak in the Brazilian Amazon was associated with massive emigration from Venezuela and a decline in measles vaccine coverage in both countries.<sup>(47)</sup> In the early 2020s, illegal gold-mining activities triggered a humanitarian crisis characterized by malnutrition, malaria, tuberculosis, COVID-19, and diarrheal diseases, with high mortality among the Yanomami Indians in Brazil.<sup>(48)</sup> In Haiti, an economic and political crisis was accompanied by cholera re-emergence.<sup>(49)</sup> A multi-

country outbreak of mpox once again demonstrated the public health consequences of pathogen spillover.<sup>(50)</sup> As mentioned above, the PPGMT has been a promoter of inter-institutional cooperation that has strengthened several institutions, not only in other Brazilian states but also in Latin America, Caribbean, and Africa, prospecting growing internationalization. PPGMT future research projects will certainly deal with new health risks in a transitional world within a Global Health perspective.

In 2025, the PPGMT celebrates its 45th anniversary, whereas the IOC completes 125 years. Coordinators, professors, administrative staff, students, and alumni have contributed to history by enabling Manguinhos Institute tropicalist tradition to aggregate projects capable of generating scientific evidence for the current health risks posed by infectious diseases. The scientific evidence generated in the PPGMT and in other IOC postgraduate programs produces several situational diagnoses and reveals bottlenecks in the control of infectious diseases in Brazil. The strong social determination of tropical diseases and their constantly evolving epidemiological scenario evokes the thought of Sérgio Arouca (1941 – 2003), former president of Fiocruz: “*Societies create cycles that are either cycles of misery or cycles of development.*” In this sense, the PPGMT aligns itself with the institutional mission of the IOC and produces “*science for the health of the Brazilian population,*” seeking to generate knowledge applicable to the improvement of the control of diseases frequently linked to the living conditions of the population. Here’s to another 45 years!

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the past 45 years, as well as those who have taught classes and provided training without being part of the faculty.

### **Conflict of interests**

The authors declare no conflicts of interest.

### **Authors' contribution**

LAM produced the database with the dissertations and theses of the PPGMT in 45 years and characterized its content, subject and region where each study was carried out. MCSM, AMDC, MNB and FACC are former PPGMT coordinators; ERSL and MAPH are former PPGMT assistant coordinators. VSP and LMV are the current PPGMT coordinator and assistant coordinator, respectively.

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**Table I.** Specific topics developed in the Fiocruz Postgraduation Program in Tropical Medicine of the Oswaldo Cruz Institute as doctoral theses and master's dissertations.

	Doctoral theses from 1991 to 2024; Frequency (n)	Master's dissertations from 1987 to 2024; Frequency (n)
<b>Bacterial diseases</b>		
<i>Acinetobacter</i>	1	-
Bartonella	-	3
Cholera	1	1
<i>Escherichia coli</i>	1	-
<i>Klebsiella pneumoniae</i>	1	2
Leprosy	8	17
Bacterial meningitis	4	2
<i>Pseudomonas aeruginosa</i>	1	-
Pertussis	-	1
Q Fever	1	2
<i>Rickettsia</i> / spotted fever	3	4
Sepsis	-	1
Syphilis	1	3
Trachoma	-	1
Tuberculosis	5	19
<i>Yersinia enterocolitica</i>	1	1
Antibiotic resistance	-	4
Endocarditis	-	1
Leptospirosis	-	1
<b>Fungal diseases</b>		
Coccidioidomycosis	1	1
Histoplasmosis	-	2
Cryptococcosis	2	5
Jorge Lobo disease	1	-
Molecular diagnosis of mycoses	1	-
Paracoccidioidomycosis	1	7
Respiratory manifestations of mycoses	1	-
Sporotrichosis	1	5
Candidiasis	-	1
<b>Helminthiases</b>		
Angiostrongyliasis	2	-
Intestinal parasitism	9	11
Onchocerciasis	1	1
Schistosomiasis	2	8
Strongyloidiasis	2	-
Ascariasis	-	1
Dirofilaria	-	1

Hookworm	-	2
Hydatidosis	-	1
Lymphatic filariasis		1
<b>Protozoan diseases</b>		
<i>Balantidium</i>	1	-
Chagas disease	26	36
<i>Entamoeba histolytica</i>	-	1
Free-living amoebas	-	1
<i>Giardia duodenalis</i>	3	1
Leishmaniasis	21	40
Malaria	14	30
Toxoplasmosis	4	11
<i>Anopheles</i>	-	1
Paragonimiasis	-	1
Phlebotominae	-	1
<b>Viral diseases</b>		
Arboviruses		5
<i>Aedes aegypti</i>	6	4
Arenavirus	1	1
Asseptic meningitis	1	-
Astrovirus	1	-
Chikungunya	2	3
COVID-19	6	24
Culicidae	2	6
Cytomegalovirus	-	3
Dengue	13	20
Enterovirus	1	4
Epidemiology of arboviroses	2	-
<i>Haemagogus</i>	1	1
Hantavirus	2	7
Hepatitis A	-	6
Hepatitis B	5	6
Hepatitis B and C	2	1
Hepatitis A, B and C	-	1
Hepatitis C	3	15
Hepatitis Delta	1	3
Herpes	2	5
HIV/AIDS	10	32
HPV	1	-
HTLV	2	5
Influenza	4	5

Lymphocitic choriomeningitis	-	1
Measles	2	2
Parvovirus	1	-
Rabies	-	1
Respiratory viruses	1	-
Rotavirus	4	2
Saint Louis encephalitis	-	1
Syncitial respiratory virus	-	1
Varicella	-	1
Variola	-	1
West Nile Fever	1	-
Yellow fever	1	2
Zika / microcephaly	4	5
<b>General subjects</b>		
Child mortality	1	1
Health Education	2	-
Sexually transmitted infections	1	1
Snake bites	2	1
Social determinants of diseases	2	-
Vaccinology	1	1
Blindness	-	1
Cervical cancer	-	1
Cystic fibrosis	-	1
Diarrheal diseases	-	2
Hospital infection	-	3

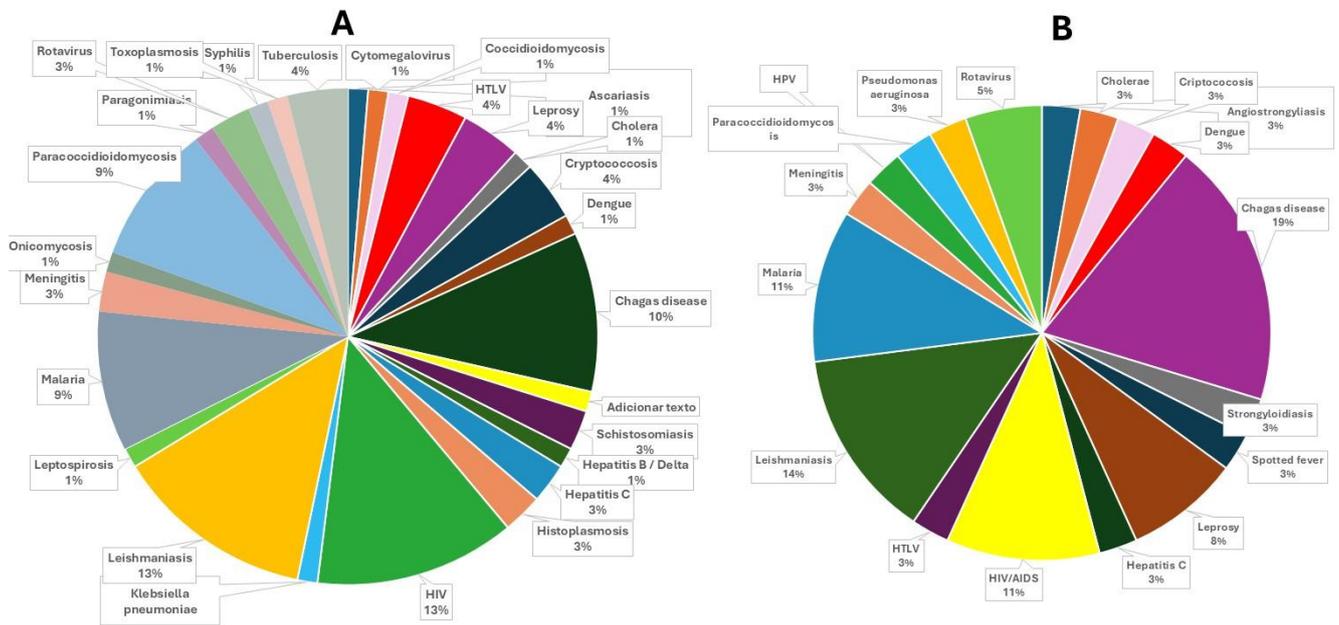


Figure 1. Topics developed as master's dissertations (A) and doctoral theses (B) from the 1980s to 2006, a period in which Postgraduate Program in Tropical Medicine aimed only physicians.

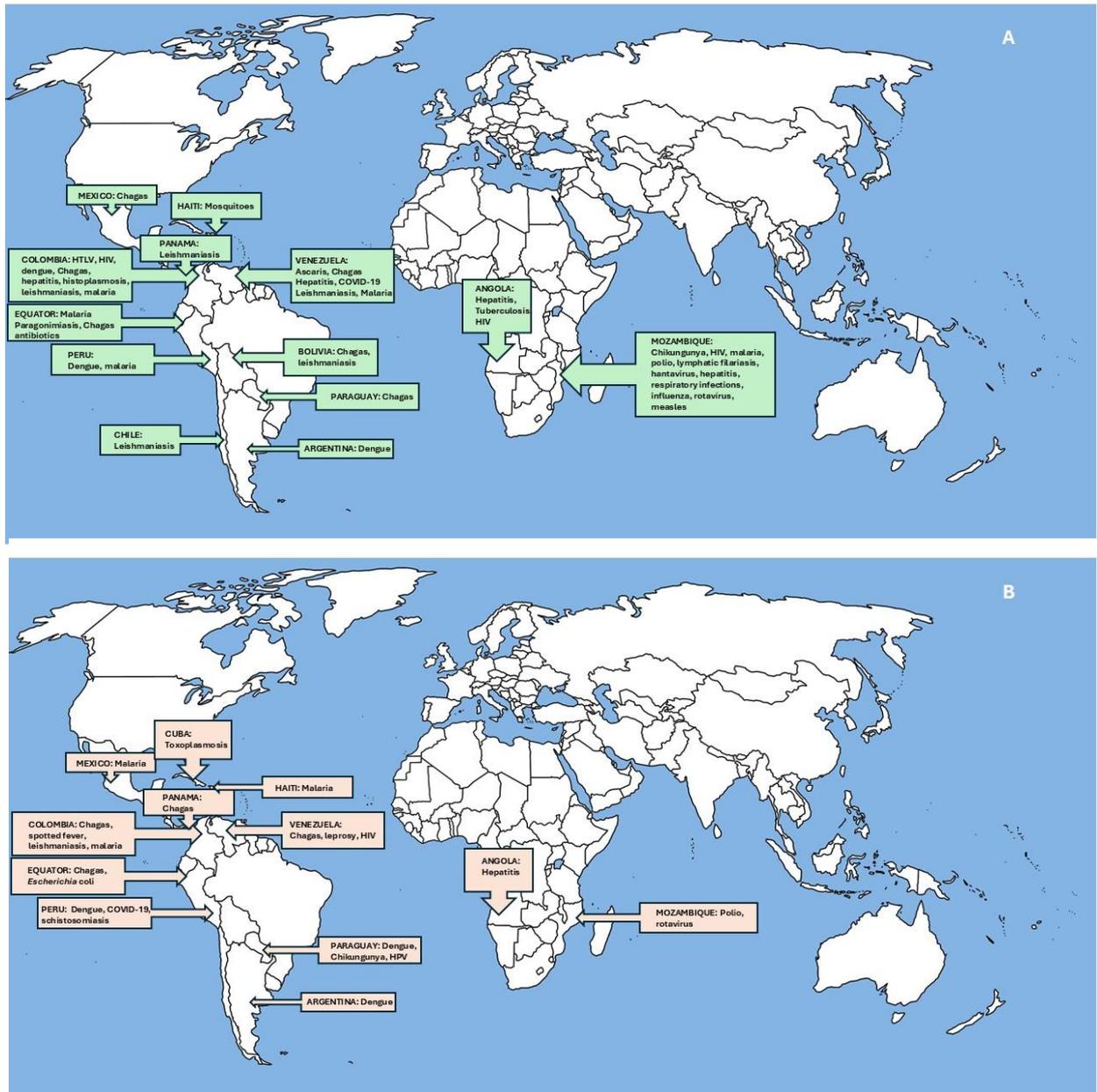


Figure 2. Geographic distribution of topics developed as master's dissertations (A) and doctoral theses (B) by foreign students of the Post Graduate Program in Tropical Medicine of the Oswaldo Cruz Institute from the 1980s to 2024.

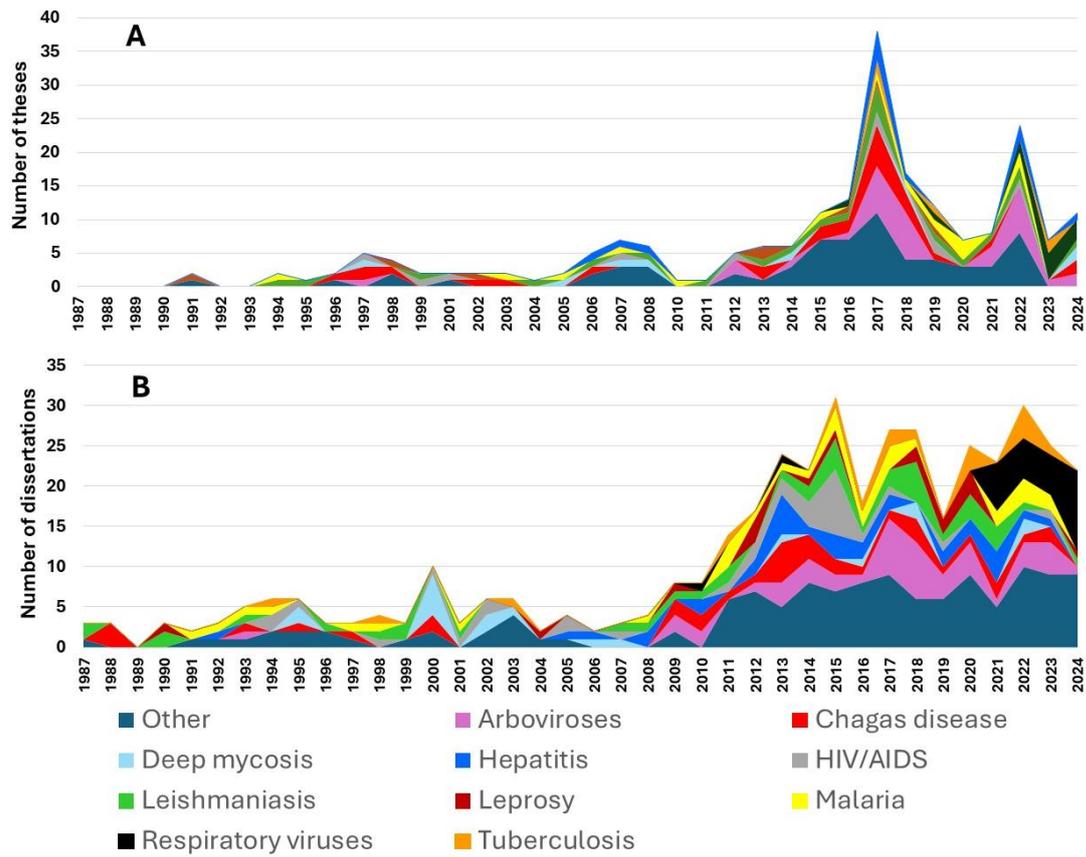


Figure 3. Topics developed as doctorate thesis (A) and master's dissertations (B) in the Postgraduate Program in Tropical Medicine of the Oswaldo Cruz Institute by year, throughout 45 years.