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ORIGINAL ARTICLE

Impact of dengue research funded by the Ministry of Health in Brazil

Impacto de pesquisas de dengue financiadas pelo Ministério da Saúde no Brasil

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ABSTRACT This study assessed the impact of 24 dengue research projects funded by the Department of Science and Technology of the Ministry of Health, in partnership with the National Council for Scientific and Technological Development, in the years 2006, 2008, and 2012, using the dimensions of knowledge advancement, research capacity, informed decision-making, and health impacts as reference from the Impact Evaluation Framework of the Canadian Academy of Health Sciences. Data were collected through document reviews, questionnaires, and interviews with the coordinators of the dengue research projects. A total of 1,107 impacts were identified, with the majority in the dimensions of knowledge advancement (712) and research capacity (314). Within these two dimensions, notable mentions include disseminating results at conferences (390) and publishing scientific articles (166). There was less impact in the dimensions of decision-making (75) and health impacts (7); however, it is essential to highlight the dissemination of research results in the media (43) and impacts on health determinants (5). This study highlighted the diversity of impacts produced by dengue research across the evaluated dimensions, demonstrating the importance of impact evaluation in identifying benefits and justifying investments. Thus, it contributes to strengthening the capacity of the Brazilian research system to address dengue.

KEYWORDS Health research evaluation. Dengue. Brazil.

RESUMO *Este estudo avaliou o impacto de 24 pesquisas sobre dengue financiadas pelo Departamento de Ciência e Tecnologia do Ministério da Saúde, em parceria com o Conselho Nacional de Desenvolvimento Científico e Tecnológico, nos anos 2006, 2008 e 2012, utilizando como referência as dimensões avanços do conhecimento, capacidade de pesquisa, tomada de decisão informada e impactos na saúde da Matriz de Avaliação de Impacto da Canadian Academy of Health Sciences. Os dados foram coletados por levantamento documental, questionários e entrevistas com os/as coordenadores/as das pesquisas de dengue. Foram alcançados 1.107 impactos, sendo a maioria nas dimensões avanços do conhecimento (712) e capacidade de pesquisa (314). Nessas duas dimensões, destacaram-se: divulgação dos resultados em congressos (390) e publicação de artigos científicos (166). Houve menor impacto nas dimensões tomada de decisão (75) e impactos na saúde (7), porém, ressalta-se a disseminação dos resultados das pesquisas nas mídias (43) e impactos em determinantes de saúde (5). Este estudo evidenciou diversidade de impactos produzidos pelas pesquisas sobre dengue nas dimensões avaliadas, o que demonstra a importância da avaliação de impacto para identificar os benefícios e justificar os investimentos. Assim, contribui para o fortalecimento da capacidade do sistema de pesquisa brasileiro para enfrentamento da dengue.*

PALAVRAS-CHAVE *Avaliação da pesquisa em saúde. Dengue. Brasil.*

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Introduction

Science, Technology and Innovation in Health (CTIS) contributes to the improvement of public health services and policies, as well as qualifying decision-making in health promotion, prevention, treatment and rehabilitation actions[1-3]. In low- and middle-income countries, where health systems are often overburdened and require sustainable solutions, CTIS needs to be focused on solving these problems[4].

The importance of investing in scientific research relevant to the health of the population is under increasing discussion[5-7]. Thus, CTIS can be an important ally in the control of global diseases such as dengue, the most prevalent arbovirus in the world that affects more than 100 countries[8,9].

Brazil is one of the countries most affected by dengue fever, having historically faced epidemics that overwhelm health services and interfere with the work capacity of infected individuals[10,11]. In 2019, the dengue outbreak in the country affected the workforce, reducing the overall Gross Domestic Product (GDP) by US$876 million (0.05% of total GDP). 11 Between 2014 and 2024, approximately 16.7 million probable cases of the disease were recorded in the country, of which more than 12 thousand resulted in death. It is worth noting that, in 2024, Brazil recorded the largest dengue epidemic in history, with more than 6 million probable cases and 4 thousand deaths[12,13].

Despite the advances achieved, there are still gaps in knowledge, as well as the need to seek effective solutions to combat the disease, such as: development of methodologies for vector control, treatment and detection of biomarkers for severe forms, rapid diagnostic tests and predictive models for epidemic prevention[14,15].

In this context, in Brazil, the Department of Science and Technology (DECIT) of the Ministry of Health (MS) is responsible for promoting scientific and technological development to solve the problems of the Unified Health System (SUS)[16]. The DECIT works in partnership with several collaborators to promote research, one of the main ones being the National Council for Scientific and Technological Development (CNPq), linked to the Ministry of Science, Technology and Innovation (MCTI)[17]. In this context, public calls are periodically launched for the selection and contracting of research projects, guided especially by the National Agenda for Health Research Priorities (ANPPS)[18].

Thus, given its epidemiological importance in Brazil and the role of CTIS in advancing knowledge and improving health policies and systems, it is essential to evaluate the impacts achieved by research on dengue financed with public resources by DECIT/MS.

Impact assessment of dengue research can help in tackling the disease, as it identifies the benefits of research to society, health systems and policies; provides support for evaluating financing strategies and justifies investments, directing resources to research with more promising results for public health[7,19,20]. In Brazil, there are few studies on impact assessment of research[17-19], and none of them concern dengue, making this the first investigation carried out in the country.

This study evaluated the impact of research on dengue funded by DECIT/MS, in partnership with CNPq, through public calls in 2006, 2008 and 2012, using as reference the adapted research impact assessment matrix of the Canadian Academy of Health Science (CAHS).

Material and methods

Study design

This is a study evaluating the impact of 24 studies on dengue fever funded by DECIT/MS public calls, in partnership with CNPq, in 2006, 2008 and 2012. The aim of the calls was

to support research that contributed to the advancement of knowledge; the generation of products; and the improvement of the health of the population in the following areas: clinical and laboratory studies; diagnosis; vectors; epidemiology, surveillance and control; health education; pathogenesis and clinical and epidemiology[21,23].

The selection criteria for the calls were: a) having Neglected Tropical Diseases (NTDs) as the main theme and containing thematic lines for dengue; b) launched from 2004 onwards, after the start of DECIT/MS management based on ANPPS; c) research already completed, aiming to ensure a greater chance of identifying impacts in the medium and long term[7].

Data collection and source

The four-dimensional indicators of the CAHS research impact assessment matrix were used as a reference[6]:

- Advances in knowledge: discoveries from health research and the scientific publications produced from these discoveries;
- Research capacity: training of human resources, financing and structure for conducting research;
- Informed decision-making: use of research results for decision-making;
- Impacts on health: benefits of research on health status, health determinants, and the performance of health systems and services.

The CAHS matrix demonstrates how research can influence decision-making and result in socioeconomic and health changes[6,24]. This methodology was chosen for the following reasons: a) it is an improved matrix based on the payback framework model; b) it is flexible and can be adapted according to the needs of users; and c) it allows the evaluation of different types of research and funding sources from different perspectives, in addition to having indicators for evaluating informed decision-making.

The research was classified by type, as defined by CAHS[6], as follows: a) biomedical: in vitro and in vivo research that seeks to understand the mechanisms of health and disease through the development of methods for diagnosis, treatment and prevention of illnesses and diseases; b) clinical: involves human beings and seeks to qualify the diagnosis and treatment of diseases or conditions; c) on health services: evaluates health systems or services regarding their organization, financing, costs and user access; and d) on population and public health: investigates the determinants of health of a population. The classification was made by peers, and disagreements were resolved by consensus.

The CAHS matrix allows the introduction or adaptation of indicators to assess impacts according to the needs observed by the user. In this study, the following indicators were used: a) Original: without modification; b) Adapted: they are part of the matrix, but have some modification to adapt to the reality of Brazilian research; and c) New: they are not part of the matrix, but have relevant data for research in Brazil[22]. The indicators were selected according to the criteria of validity, relevance, replicability, comparability, data availability and timeliness of collection[6] (*box 1*).

Box 1. Indicators and data sources used to assess the impact of dengue research by dimension of the adapted research impact assessment matrix from the Canadian Academy of Health Science (CAHS)

Dimension	Indicator	Data Source
Knowledge advancement	Number of articles published Number of books/book chapters published Number of papers published in conference proceedings Number of papers presented at conferences Number of doctoral theses, master's dissertations, course completion papers and scientific initiation reports produced based on research results Number of presentations to healthcare professionals and decision makers	• Lattes CV of the research coordinators and research team • Final research report • Virtual questionnaires conducted with the research coordinators • Virtual interviews with the research coordinators
Research Capacity	Number of students trained through research (doctors, masters, undergraduate and scientific initiation students) Number of visiting researchers and postdoctoral researchers in the research team Number of partnerships established to carry out research on dengue fever	
Informed Decision-Making	Number of books/protocols/health guides/manuals/guidelines/training and consultancies for policy makers that cited the research or used its results as a reference Number of presentations for the general public Number of citations in the media Number of registered patents Number of consultancies for industries	• Lattes CV of the research coordinators and research team • Final research report • Virtual questionnaires conducted with the research coordinators • Interviews with the research coordinators • Institutional websites • Google
Health Impacts	Number of studies that impacted indicators of the population's health status: mortality, prevalence and incidence. Number of studies that impacted indicators of health determinants: • Modifiable risk factors; • Environmental determinants; • Social/cultural determinants. Number of studies that impacted health system performance indicators: • Adequacy – practice was in accordance with the most up-to-date evidence • Acceptability – impact of population/individual experiences in relation to health services or new practices; • Effectiveness – impact of conditions requiring the use of specialist care services; • Safety – impact of adverse effects in relation to an intervention.	• Final research report • Virtual questionnaires conducted with research coordinators • Interviews with research coordinators

Source: Prepared by the author, adapted from the Canadian Academy of Health Science (CAHS)[7,22].

Data collection was carried out through documentary surveys, questionnaires and virtual interviews with the research coordinators.

For the indicators of the knowledge advancement dimension, the classification was carried out by themes: a) Vector Control: new mechanisms for vector control of the *Aedes aegypti* mosquito or evaluation of existing technologies; b) Health Surveillance: implementation or formulation of actions for dengue surveillance and control; c) Diagnosis and Treatment: therapeutic alternatives, diagnostic methods or evaluation of existing technologies; d) Immunology and Virology: immunological mechanisms, virus specificities and in vitro and in vivo behavior. The classification was made by pairs, with disagreements resolved by consensus.

In the documentary survey, the final research reports (requested from CNPq through the Access to Information Law No. 12,527, of November 18, 2011[25]) and the CVs of the coordinators and team members were read to identify the impacts achieved. Information was also identified on Google, institutional websites (MS, CNPq, MCTI, Coordination for the Improvement of Higher Education Personnel/Ministry of Education) and the institutions to which the coordinators are affiliated. The search and selection of data were carried out in pairs, and disagreements were decided by consensus.

For the questionnaires and interviews, 22 researchers who coordinated 24 dengue studies (two of whom were selected twice in public calls for proposals in different years) were invited to participate in the study by email, on up to three occasions. Both the questionnaires and interviews were intended to complement the information collected in the documentary analysis. The interview also sought to understand the researchers' perception of the impacts of their research and its relevance to the SUS. Four coordinating researchers declined the invitation, and eight agreed to participate, answering the questionnaire and participating in the semi-structured interviews. The others did not return the invitation sent.

The virtual questionnaire had six blocks of questions related to the indicators analyzed, which were completed in an average time of 40 minutes. The interviews were conducted and recorded through Microsoft Teams®, with an average duration of 40 minutes, addressing the following topics: a) perception of the coordinating researchers about the impacts of their research on dengue; b) dissemination of the results of research on dengue; and c) research priorities for dengue.

Data analysis

The data collected were consolidated in a Microsoft Excel® spreadsheet to calculate the indicators according to each dimension assessed by CAHS[6]. The unit of analysis was the impacts achieved, and the results were presented in absolute and relative frequencies using tables and graphs.

The content analysis technique was used in the interviews. All the interviews were transcribed and read in full in order to identify the central ideas and those that were most repeated. Subsequently, the statements were grouped for analysis by dimension of the CAHS[6] matrix.

Ethical aspects

The research was approved by the Research Ethics Committee of the Faculty of Ceilândia – University of Brasília (CAEE No. 46003821.0.0000.8093; Opinion No. 4,704,533), in accordance with Resolution 466/2012[26] of the National Health Council. Participants received, by email, the Informed Consent Form and the Authorization Form for Use of Image and Voice Sound for research purposes, and signed these terms ensuring the confidentiality of the information obtained. To guarantee the anonymity of the participants, excerpts from the interviews were cited using the term 'Researcher' followed by the number that corresponds to the order in which the interviews were conducted.

Results

Global overview of the impacts of dengue research

Table 1 shows the distribution of the impacts of dengue research. A total of 1,107 impacts were identified, the majority of which were in the dimensions of knowledge advancement (712; 64.3%) and research capacity (314; 28.3%). All research achieved impacts in at least one of the dimensions evaluated.

Table 1. Distribution of research and research impacts on dengue by dimensions of the Canadian Academy of Health Sciences (CAHS) research impact assessment matrix. Brazil, 2006, 2008 and 2012

CAHS Dimension/ Impacts Achieved	Indicators	Number of Studies (%)*	Number of Impacts (%)**
Knowledge advancement (n = 712 - 64.3%)***	Published articles	19 (79.2%)	134 (18.8%)
	Published books/book chapters	4 (16.7%)	5 (0.7%)
	Dissemination of papers at conferences	19 (79.2%)	390 (54.8%)
	Doctoral thesis	16 (66.7%)	53 (7.4%)
	Master's dissertation	16 (66.7%)	53 (7.4%)
	Course completion paper	3 (12.5%)	21 (2.9%)
	Scientific initiation report	10 (41.7%)	36 (5.1%)
	Presentation for health professionals and decision makers	5 (20.8%)	20 (2.8%)
Research Capacity (n = 314 - 28.3%)***	Training of doctoral students	20 (83.3%)	58 (18.5%)
	Training of master's students	15 (62.5%)	55 (17.5%)
	Training of undergraduate students	12 (50.0%)	73 (23.2%)
	Visiting researchers from foreign institutions	4 (16.7%)	10 (3.2%)
	Visiting researchers from national institutions	24 (100.0%)	113 (36.0%)
	Postdoctoral researchers	3 (12.5%)	5 (1.6%)
Informed Decision-Making (n = 75 - 6.8%)***	Citation in books	1 (4.2%)	4 (5.3%)
	Citation in manuals/guides/health protocols	4 (16.7%)	9 (12.0%)
	Training for health professionals	4 (16.7%)	16 (21.3%)
	Consulting for policy makers	-	-
	Educational material for the population	1 (4.2%)	1 (1.3%)
	Presentations given at public hearings	-	-
	Presentations given to the general public	-	-
	Citations in the media (newspapers, interviews, and others)	7 (29.2%)	43 (57.3%)
	Patented products	2 (8.3%)	2 (2.7%)
	Consulting for industries	-	-

Table 1. Distribution of research and research impacts on dengue by dimensions of the Canadian Academy of Health Sciences (CAHS) research impact assessment matrix. Brazil, 2006, 2008 and 2012

CAHS Dimension/ Impacts Achieved	Indicators	Number of Studies (%)*	Number of Impacts (%)**
Health Impacts (n = 7 - 0.6%)***	Mortality/incidence/prevalence	1 (4.2%)	1 (16.7%)
	Modifiable risk factors	-	-
	Environmental determinants	2 (8.3%)	2 (33.3%)
	Social/cultural determinants	-	-
	Adequacy	2 (8.3%)	2 (33.3%)
	Acceptability	1 (4.2%)	1 (16.7%)
	Safety	1 (4.2%)	1 (16.7%)

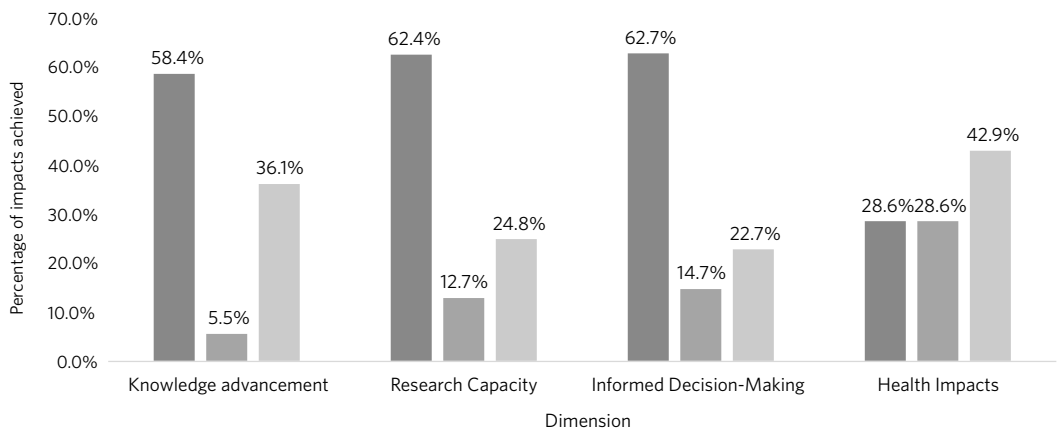
Source: Final reports of dengue research, Lattes CVs of the dengue research coordinators and team, institutional and search websites, questionnaires and interviews conducted with the research coordinators.

CAHS – Canadian Academy of Health Science; * Percentage in relation to the total research evaluated; ** Percentage in relation to the total impacts produced in each dimension; *** Percentage in relation to the total impacts produced.

Overview of dengue research funded by research type

Of the impacts achieved, biomedical research accounted for the majority in the dimensions of knowledge advances (58.4%), research capacity (62.4%) and informed decision-making (62.7%), except in the dimension of health impacts, in which research on population and public health achieved the highest percentage of impacts (42.9%) (*graph 1*).

Graph 1. Percentage of impacts achieved by dimension of the Canadian Academy of Health Science (CAHS) research impact assessment matrix and type of research



Source: Final reports of dengue research, Lattes CVs of the dengue research coordinators and team, questionnaires and interviews conducted with the research coordinators.

The following results were presented according to the CAHS dimensions.

KNOWLEDGE ADVANCEMENT

Of the indicators evaluated, 79.2% of the research produced impacts mainly in relation to the dissemination of results at conferences (390) and publication of scientific articles (134) (*table 1*).

In the interviews, the relevance of disseminating research results to achieve recognition of scientific competence by research groups outside the country was verified.

> *With your publications, you attract the scientific community from around the world and they start wanting to collaborate with you, and that's what happened. A group invited me to join the dengue study network, which was a multicenter study across the world.* (Researcher 8).

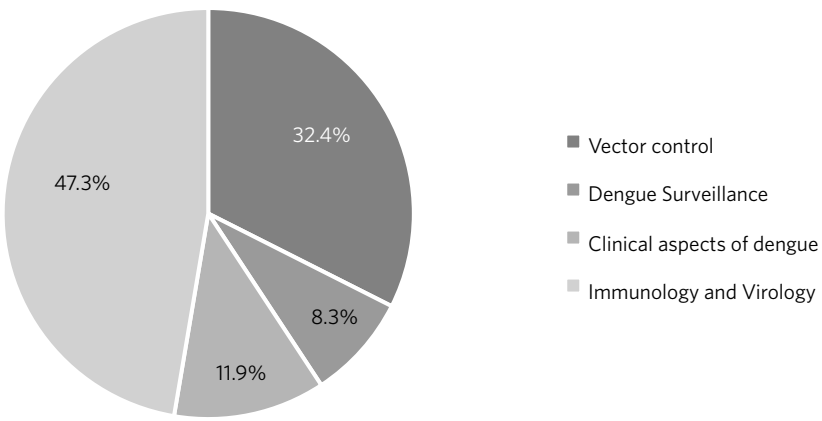
Despite recognizing the importance of disseminating research, most coordinators pointed out difficulties and the need for qualified people to help disseminate results to other audiences: "*I would think it would be really cool to have someone specialized, because sometimes that person could train us or someone on the team*" (Researcher 5).

These difficulties in disseminating research results beyond academia are reflected in the few studies that achieved impacts on the indicator 'presentation to health professionals and decision-makers' (5 studies and 20 impacts) (*table 1*). The statements revealed the need to expand the dissemination methods for health management teams, as shown in the following report.

> *[...] we not only presented to the dengue advisory committee, but also to the manager at the time... we also have to be in touch with the people who disseminate scientific knowledge, because it's not just about taking it to conferences, it's not just about writing the paper, it's about trying to speak in clear language [...].* (Researcher 7).

In *graph 2*, it was found that immunology/virology (47.3%) and vector control (32.4%) were the most studied topics in articles, books and book chapters, works published at conferences and academic works.

Graph 2. Theme of publications of research on dengue identified in the knowledge advencement dimension



Source: Final reports of dengue research, Lattes CVs of the dengue research coordinators and team, questionnaires and interviews conducted with the research coordinators.

These themes had their importance ratified in the interviews when recognizing the need to study subjects such as: "*The dynamics of the spread of the virus itself, the dynamics of circulation*" (Researcher 6).

RESEARCH CAPACITY

Most of the research contributed to the training of 186 students, the majority of whom were undergraduates (73) (*table 1*). These impacts were acknowledged in the interviews:

> *If I think about the master's student, for example, who did that project as the main person actually working, she is a postdoctoral student in England, so it has an impact on forming a person [...].* (Researcher 3).

Also in the interviews, the coordinators reported other impacts of the research capacity dimension, such as the structuring and maintenance of research teams and laboratories and obtaining financing.

> *We managed to obtain substantial funding at the time, which made it possible to purchase important equipment... and it is still being used today for the development of other research.* (Researcher 5).

> *Another impact was the formation of a clinical trials group at the university... this same team was the embryo of the team that tested CoronaVac.* (Researcher 6).

Some speeches demonstrated the relevance of impacts for scientific advances, enabling the strengthening of research, development and innovation capacity in other themes:

> *This research taught us something very important about the regulatory system of viral infections that involve hyperinflammation. Then came COVID, which is also a disease that has hyperinflammation associated with severe cases. So we took the tools we studied in dengue and applied them to COVID, and we are amazed that the results are very similar.* (Researcher 6).

The composition of research teams and the establishment of institutional partnerships were also analyzed. The teams were formed by 308 researchers from 90 different institutions (*table 1*). Partnerships were established with 77 institutions (65 national and 12 foreign). The relevance of these partnerships for the formation of scientific collaboration networks was highlighted in the interviews, as exemplified in the statement: "*The ideal is to work in a network... because that is the only way we can deepen our knowledge*" (Researcher 8).

INFORMED DECISION MAKING

In the informed decision-making dimension, citations stood out in 13 documents – such as books, manuals/guides/health protocols –, in 16 training courses for health professionals and in 43 citations in the media (*table 1*). Among the findings, the following stood out: a) most training courses were the result of research on population and public health; b) only clinical research results were cited in books; c) only biomedical research registered patents; and d) the only educational material used the results of a research on population and public health.

In the coordinators' statements, this production of impacts is confirmed when they affirm the use of knowledge for informed decision-making:

> *[...] knowledge that filled some gaps and generated knowledge to be included in the Ministry of Health's Medical Care Manual for patients with dengue fever.* (Researcher 7).

HEALTH IMPACTS

The health impacts dimension was the one that produced the lowest number of impacts (7) (*table 1*).

It is worth highlighting that three of these impacts – one on environmental determinants, one on acceptability and another on safety – were produced from a survey on population and public health, commissioned in the 2006 public call.

Despite the low result in this dimension, the interviews recognized the importance of obtaining impacts that can be applicable to the SUS.

> *I tried to work not only by producing articles and providing guidance, but also by working on what I believed in, together with the Ministry of Health... I understand that this is not just a research project. It was an applied research project!* (Researcher 4).

> *There's no point in doing research... I'll have a collection of papers, a collection of students, but what about the applicability of this, which is more important for the country, which is more important for the SUS?* (Researcher 8).

Discussion

This study revealed that dengue research achieved impacts mainly in the dimensions of knowledge advancement and research capacity, followed by the dimensions of informed decision-making and health impacts.

In this investigation, most of the funded research was biomedical, which can be explained by the fact that most of the thematic lines of the public calls were focused on conducting biomedical research. Biomedical research helps in understanding the health-disease process and in the search for new treatments and diagnostic methods[6]. It is also believed that the concentration of funding in biomedical research may have resulted in fewer impacts on the dimensions of informed decision-making and impacts on health, since the results of this type of research, due to its methodological nature, may take longer to be applied or even fail to evolve to other phases of execution. It is worth noting that, for biomedical research to have an impact on the health of the population, there must be investments in its subsequent phases[27].

As in other research impact assessment studies conducted in Brazil and other countries[24,28-33], the research in this study achieved greater impact in the dimensions of knowledge advancement and research capacity. These findings highlighted the relevance of the research for qualifying and strengthening Brazilian research capacity in the search for innovative solutions to combat dengue.

The high dissemination of results at conferences, the publication of articles and the establishment of partnerships for carrying out research attracted attention. These results can boost the establishment of connections with researchers from different countries, allowing the exchange of knowledge, the expansion of scientific production and the effective use of available resources[15,34,35].

Furthermore, the contribution of research to the training of human resources was also highlighted. The search for new knowledge about dengue fever associated with the training of qualified human resources are crucial aspects for Brazil to reduce its dependence on foreign technologies and increase its international competitiveness[14,15,36,37].

The indicators of the dimensions knowledge advancement and research capacity are measures generally used to assess the performance of researchers and institutions responsible for research, scientific progress and to identify knowledge gaps; however, they may not be sufficient to demonstrate the benefits of health research, especially with regard to its social aspects[38-42]. Thus, it is necessary to reflect on the importance of establishing strategies in the governance of the research system that encourage the achievement of impacts in other dimensions, since scientific production and the qualification of research capacity alone do not guarantee results that can generate impacts for health systems and policies and for the population[43-46].

The scope of impacts in the dimension of informed decision-making and impacts on health is complex, as it requires research to seek new horizons beyond the traditional academic path[6]. This difficulty can be seen from the smaller number of impacts identified in these two dimensions in this study. It can also be translated through the statements of researchers who consider it important, but difficult, to implement research results in the health system, after their completion, as well as to disseminate the results to different audiences.

Despite the few impacts identified in these two dimensions, they can be considered positive results, given the difficulty in measuring them, as they show that the results achieved by some research on dengue managed to permeate the academic world and reach diverse audiences[45,47]. It is also worth noting that these impacts were achieved spontaneously by the research, since the public calls did not request activities that could generate them. These findings highlight the impact assessment of research as a tool to identify the benefits of research for society.

The dissemination of research to management, health professionals and society has been driven by the need to legitimize the social practice of research by the scientific community, funders and oversight bodies. However, it still faces challenges, such as the lack of institutionalization of the use of evidence by managers and health professionals, the adaptation of information to facilitate understanding by different audiences, the need for training for researchers and hiring of professionals specialized in the area of dissemination, and the implementation of knowledge translation policies[48,49,52].

Regarding the applicability of the results in the health system, it is expected that the research will contribute with innovative solutions to face social challenges. To increase the chances of success of the research and the possibilities of using the evidence in practice, it is essential to approach and involve those interested in its development (researchers, policy makers, health professionals, population) since the beginning[47,52-55].

In view of this, the impact assessment, in addition to helping to measure the results of dengue research, identifying its relevance to the 'real world'[42], assists funders and researchers in implementing strategies aimed at translation knowledge[50-52,56].

In studies that analyzed the funding provided by DECIT/MS[55,56], it was found that, between 2004 and 2020, dengue research, when compared to other NTDs, received the largest share of the department's financial resources, totaling R$164.03 million. The research impact assessment, in this case, can be used as a tool to analyze the funding policy, helping to direct resources to priority areas and to finance research with potential applicability in the health system, or as a way of accounting for the investments made to society.

This study had strengths and limitations. The following can be cited as strengths: i) the identification of the impacts produced by research on dengue, a disease that requires attention worldwide; ii) the demonstration of the importance of evaluating and monitoring research, aiming to direct funding to research with the potential to produce relevant results for health systems and the population. On the other hand, the limitations were: i) the impact assessment of dengue research did not allow the generalization of the results to other topics and other research funded by other federal government agencies, MS departments or funding agencies; ii) the data sources may have lacked or errors in recording, and research coordinators may have forgotten some information ; iii) the failure to include policy makers or other stakeholders in the research results in the interviews made it impossible to understand other perceptions regarding the impacts; iv) the low adherence of researchers to participate in the questionnaires and interviews, which may compromise the identification of impacts in the dimensions of decision-making and impacts on health.

Final considerations

This study analyzed the impacts achieved by 24 dengue research projects funded by DECIT/MS in partnership with CNPq. Most of the research projects were biomedical and produced several impacts in the dimensions evaluated, but mainly in terms of advances in knowledge and research capacity. Research is widely disseminated to other researchers, who expressed the importance of incorporating the results into the health system.

These findings are timely to confirm the relevance of assessing the impact of research to: a) identify how research helps build knowledge and strengthen scientific capacity to combat dengue; b) monitor and evaluate the results of funded dengue research and, thus, direct or not new research priorities on the topic; c) justify investments, since their results can be a reference for directing actions to prevent, care for and control the disease. Furthermore, they can support a future evaluation of the dengue research funding policy promoted by DECIT/MS and guide priorities for allocating resources in a responsible and sustainable manner.

Therefore, it is recommended that impact assessment be incorporated by health research funding bodies and agencies, together with the funding policy review process, as an ongoing tool, aiming to seek robust research results for the scientific and technological development of dengue, the valorization of science in Brazil and the qualification of the health system.

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Collaborators

Melo GBT (0000-0002-6758-0834)* contributed to conception and design of the study, collection, analysis and interpretation of data, preparation and final review of the manuscript. Obara MT (0000-0001-6872-0096)* contributed to conception and design of the study, critical review and approval of the final version of the manuscript. Angulo-Tuesta A (0000-0002-3231-5918)* contributed to conception and design of the study, analysis and interpretation of data, critical review and approval of the final version of the manuscript. ■

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