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Uma análise das ações de divulgação e popularização da ciência na Fundação Oswaldo Cruz

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An analysis of actions taken by Fundação Oswaldo Cruz for the communication and popularization of science

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Abstract

An analysis is presented of actions taken by the Brazilian research institution Fiocruz for the communication and popularization of science, from two perspectives. The aim was to investigate how a system for the communication and popularization of science is organized at a large scientific institution and how it is articulated with the institutional discourse. A brief review is presented of how the topic has developed over the history of Fiocruz, followed by a discussion of the way it has been addressed in its official planning documents. The science communication/popularization actions undertaken in 2015 and 2016 were mapped out and classified according to how they interact with the public, giving a better understanding of this area.

Keywords: science communication; Fundação Oswaldo Cruz (Fiocruz); popularization of science; mapping; research institute.

Much of the research agenda concerning the communication and popularization of science is given over to comprehending how investments in such activities impact public perceptions of science and how a scientific culture is formed in society. In the past twenty years, several nationwide and regional initiatives have been undertaken in Brazil to understand the different methods by which scientific knowledge is shared with society.

In 2000, the Wellcome Trust published a study in partnership with the UK government's Office of Science and Technology that mapped out and analyzed that country's science communication activities. Its aim was to understand how the population interacted with science and what their perceptions of it were. The study developed a complex classification method to map out the activities in terms of audience, function, and geographical scope (Office..., 2000).

In a study commissioned by the National Research Council, which represents the national academies of sciences, engineering, and medicine in the United States, Bell et al. (2009) undertook an extensive mapping of the settings where science could be learned outside school and the main actors and factors such non-formal learning activities had in common. They also described the state-of-the-art in the country. This analysis served as the basis for several public policy recommendations for the field.

In a similar study done by McCallie et al. (2009), on commission from the Center for Advancement of Informal Science Education, actions to foster public engagement in science were analyzed from the perspective of the existing literature and the authors' own experience. Although the analysis did not focus specifically on the United States, the predominance of American authors meant the description of the initiatives tended to be US-centric. The actions were classified by the media used (exhibitions, radio, television, brochures etc.), much as seen in the study by Bell et al. (2009).

In Mexico, Barba (2013) undertook a diagnostic analysis of the different activities seen in that country. The study was produced by Sociedad Mexicana para la Divulgación de la Ciencia y la Técnica, A.C. (SOMEDICyT), and divided the actions into nine fields, analyzing the state-of-the-art in the country for each one.

A survey was published by the Latin America and Caribbean Network for the Popularization of Science and Technology (Red de Popularización de la Ciencia y la Tecnología en América Latina y el Caribe, RedPOP) (Barba, Gonzalez, Massarani, 2017), based on a questionnaire set out to institutions in the region. The study identified the main actions and strategies, their target audiences, and the actors involved. It is clear from the results that the vast majority of the institutions that engage in the communication and popularization of science in Latin America are higher education establishments or research institutions.

Similarly, Entradas and Bauer (2017) identified research institutions as important sites for science communication, and also remarked on the dearth of studies into the role such institutions play. Mapping out these institutions and what motivates their activities is therefore one way of investigating one of the levels of organization of such activities.

In this study, we map out and analyze activities for the communication and popularization of science undertaken by a large Brazilian research institution with the aim of comprehending how such a system – straddling the breach between individual

researchers and public policies – is organized. Based on this, we classify the activities undertaken by an important institution that is instrumental in enabling communication between researchers and society.

Fundação Oswaldo Cruz (Fiocruz) is a prime institution for such a study insofar as not only is it a large institution with a long tradition in scientific research and communication, but it also has a national footprint, with 11 units across Brazil. In a recent study, Centro de Gestão e Estudos Estratégicos (CGEE, 2017) found that although only 12.4% of the Brazilian population are able to name one institution that produces science and technology in Brazil, Fiocruz was the institution that most came to mind, being cited by 19.2% of the interviewees. This makes it the institution that is best known by Brazilians for the production of science and technology. In order better to understand the locus of our analysis, we will begin by presenting the institution and its historical relationship with the communication and popularization of science.

History of the communication and popularization of science at Fiocruz

Founded in 1900 by the Brazilian government with the goal of fighting the main epidemics that were afflicting the country at the time, including yellow fever, bubonic plague, and smallpox, Fiocruz is today a health research institution linked to the Brazilian Ministry of Health (Benchimol, 1990). Its earliest recorded science communication initiatives were prepared for its exhibits at the international hygiene exhibitions in Germany in 1907 and 1911 (Bevilaqua et al., 2017). Oswaldo Cruz, the institution's director, and Luiz de Moraes Jr., who designed the emblematic Fiocruz castle, took charge of the preparations for the International Congress on Hygiene and Demography in Berlin. The exhibition included architectural drawings and models of the buildings being designed and erected, entomological specimens, histopathological slides, and other items from the scientific collections that the institute was beginning to form.

In 1911, Oswaldo Cruz took the institute to the International Hygiene Exhibition in Dresden, where it participated in the Brazil pavilion. This exhibition, designed for the general public, attracted millions of visitors over a five-month period. That year, it featured the eradication of yellow fever and the discovery of Chagas disease. In a room specially constructed to present the latter, visitors could observe triatomine bugs, anatomic specimens demonstrating the disease, and sculptures that illustrated its symptoms.

The exhibition also included a cinematography room, specially prepared for showing films, in which four short documentaries were screened. Two of these were produced by Instituto Oswaldo Cruz, as the institution was known at the time. One showed scenes of the fight against yellow fever in Rio de Janeiro; the other contained footage of Chagas disease patients shot in Lassance (Moraes, 2015). The researcher Eduardo Thielen suggests that these two documentaries, partially preserved, could be the oldest scientific films in Brazil (Cinematógrafo..., 2011).

The institution's first museums were established in the Moorish castle, the headquarters of Fiocruz to this day. After Oswaldo Cruz's death in 1917, his office was preserved and then renamed the Oswaldo Cruz Museum (Soares, Nogueira, 2013). As the space was gradually

developed, other personal and scientific objects were added, constituting Fiocruz's first ever museological archive.

On the third floor, on the other side of the castle, plans were made to install a science museum to preserve the institution's earliest collections, to be open only to researchers and eminent visitors (Oliveira, 2003). Once the building was completed, the collections, which had been put together since the institution was founded, were transferred to the new premises, inaugurating the Museum of Anatomical Pathology (Bevilaqua et al., 2017). It was a first of its kind in Brazil, which at the time had fewer than ten science museums, none of which had a significant collection in the areas of anatomical pathology or histopathology, according to the museums record maintained by Instituto Brasileiro de Museus (Ibram, 2018).

After a time of interference and persecutions that is known at Fiocruz as the "Manguinhos Massacre" (Lent, 2019; Santana, 2018) during the military dictatorship (1964 to 1985) in Brazil, Fundação Oswaldo Cruz, or Fiocruz, as it was named in 1974, once again began to open its doors to society. The Instituto Oswaldo Cruz Science Museum and the Marquis of Barbacena Teaching Museum (Bevilaqua et al., 2017) were created in the second half of the 1970s, but were short-lived.

In the 1980s, as democratic rule was restored in the country, Fiocruz underwent its own internal democratization process in parallel to the movement for a health reform, which in 1988 gave rise to the creation of the public health service, Sistema Único de Saúde (SUS). Thinking of democracy also meant thinking of a more democratic way for the institution to interact with society. This scenario was conducive for the emergence of new programs for the communication and popularization of science. In 1982 the National School for Public Health (Escola Nacional de Saúde Pública, Ensp) created the Radis Communication and Health program, designed to produce "analyses and broadcast information about health" (Radis, 2018).

In 1986, during the administration of Sergio Arouca, Casa de Oswaldo Cruz (COC) was created as a new scientific unit with the mission of preserving cultural heritage and memory, researching history, and communicating science (Iglesias, Santos, Martins, 2014). Upon its establishment, COC took responsibility for Fiocruz's historical heritage, including its documental, architectural, and museological collections. In the following year, the Casa de Oswaldo Cruz Museum was founded in the former stables building, but once again it was a short-lived affair, giving way to a new museum in the 1990s (Bevilaqua et al., 2017). With its mission to promote culture and preserve memory, COC began to produce events open to the public. It was around this time that the Joaquim Venâncio Polytechnic School of Health (Escola Politécnica de Saúde Joaquim Venâncio) was founded, providing training for healthcare workers, as well as the Institute of Scientific and Technological Communication and Information in Health (Instituto de Comunicação e Informação Científica e Tecnológica em Saúde).

In 1994, Fiocruz launched its own television channel, the Health Channel (Canal Saúde), whose goal was to spread the concept of health and encourage the people to feel they belonged to the public health service, SUS, drawing on the resolutions from the ninth National Health Conference. In the same decade came VídeoSaúde Distribuidora da Fiocruz, with responsibility for the safeguard, production, and distribution of audiovisual material on health, based on its mission of sharing scientific knowledge. Another novelty in the

same period was the event "Fiocruz for You" ("Fiocruz para você"), a social outreach day when the institution would open its doors during the vaccination campaign in a bid to connect with the region's residents.

In the late 1990s came a new museum, the Museum of Life (Museu da Vida). Run by COC, it was designed to be more inclusive and engage actively in science communication and education (Bevilaquaet al., 2017). On May 25, 1999, the museum opened its doors to the public, going on to become one of Fiocruz's principal science communication spaces.

In the 2000s, Fiocruz continued to grow and diversify its range of programs and products for the communication and popularization of science, restating its commitment to assuring free public access to the knowledge it produced (Fiocruz, 31 mar. 2014). In 2015, it was awarded the José Reis Award for Science and Technology Communication ("institution or media" category) from Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) "for its historical engagement for the benefit of the population and the communication of science, technology, and innovation."

National Science and Technology Week at Fiocruz (2013-2018) as an element of cohesion for the communication and popularization of science

Considered one of the biggest events in the communication and popularization of science in Brazil, the National Science and Technology Week (Semana Nacional de Ciência e Tecnologia) quickly became a feature on the calendars of Brazil's scientific institutions. One indicator of this is the increase in visitor numbers over the almost 15 years during which the event was held, as indicated in a survey of public perceptions of science held in 2015 (CGEE, 2017). Created in 2004 by presidential decree, the idea of the week was to bring people into contact with science and technology through events at hundreds of institutions across the country (Ferreira, 2014).

Fiocruz engaged consistently in the initiative from the very first year, holding open days and organizing special activities at its units in different states. As of 2013, the National Science and Technology Week became the focal point around which Fiocruz galvanized its multiple activities in the communication and popularization of science. Table 1 shows the visitor numbers to its Manguinhos campus and the number of activities and units/institutions that took part.

Table 1: Visitor numbers, activities undertaken, and units/institutions involved in activities during the National Science and Technology Weeks, 2013- 2017

Year	Number of visitors	Number of activities	Number of participating units/ institutions
2013	1,337	10	22
2014	2,817	9	24
2015	2,602	13	27
2016	2,766	16	53
2017	2,891	19	56

Source: Fiocruz General Coordination for National Science and Technology Weeks, 2018.

It was Fiocruz's involvement in the National Science and Technology Weeks that prompted its management to improve its dynamics and create regulatory and institutional guidelines, such as its inter-institutional integration policy. This led, in 2014, to the proposal to map out Fiocruz's initiatives in the communication and popularization of science, which was carried out in the following two years.

Documental analysis of internal congress reports

Today, Fiocruz has democratic methods for its public communication of science that are designed to foster greater dialogue with the public and empower citizens to take a proactive stance towards scientific progress in order to assess its impacts and benefits. It also advocates science education as a means of promoting health, based on the concept of the social determinants of health. This commitment can be seen in several of the final reports from the internal congresses held by Fiocruz since 1988.

These congresses, involving representatives elected from among its employees, set the main strategic guidelines and multi-year plans. In the final reports, it is possible to identify the institution's position toward the communication and popularization of science.

At the second Internal Congress, a proposal was made for the creation of an interactive museum of science in response to this desire to enable dialogue between the institution and the public and to contribute to science education. The chapter on Science and Technology Information and Social Communication in Health from the report on the event, held in 1993, notes that "it is increasingly essential to work with a broadened concept of information that is capable of taking account of the diversity of means and forms of taking action, including: libraries, archives, scientific collections, museums, broadcasting, social communication, databases etc." (Fiocruz, 1994, p.14). One of the key proposals was the "creation of the Science Museum, so that an educational dimension can be added to the immense information potential of Fiocruz, bridging the gap between specialists and the general public for whom the results of scientific activity should be destined" (p.16). This proposition led to the creation, in 1999, of the Museum of Life, materializing the institution's desire to create an interactive science museum that would contribute positively to science education and the spread of knowledge.

The fourth Internal Congress, held in 2002, enunciated one of the main pillars of Fiocruz's work in the following terms: "The popularization of science, especially through a combination of communication, education, science communication, and health promotion, understood as an integral part of doing science, constitutes as a strategic area for science and technology activities with society" (Fiocruz, 2002, p.5). In the same report, there was a section given over to "education and communication in science and health," stating, among other things: "At Fiocruz an increase in science communication and education activities has been seen in the last decade. Nonetheless, this has taken place without improving coordination and integration among different initiatives" (p.35). This same discourse was reiterated in several subsequent congresses. Need for a special program for the area also appeared for the first time as a proposal: "to implement the Institutional Program in Science Education and Science Communication" (p.35).

At the next congress, held in 2005, the communication and popularization of science was not given such prominence; indeed, the only mention it received was in two guidelines in the Fiocruz Policy. The first of these reproduced the proposition from the previous congress: "To coordinate education and science communication experiences with health promotion programs, helping to increase public participation in questions relating to the biomedical sciences and their implications or life in society" (Fiocruz, 2005, p.61). A new guideline also proposed the "consolidation of museological activities as a national reference for policies for the popularization of science and technology, with the expansion of proposals for travelling exhibitions and educational projects" (p.62). This was the first time the prospect of travelling exhibitions was envisaged at an internal congress.

In 2010, the year of the sixth Internal Congress, Fiocruz again made science communication part of its overall plan. In its institutional profile, one of its values was stated as the "democratization of knowledge," by which Fiocruz took on a "commitment to the democratization of knowledge and considers public access to information a strategic value for reinforcing the relationships between science, health and society" (Fiocruz, 2010, p.22). One of the strategic goals classified under "results for society" was "to strengthen activities for the communication and popularization of science in partnership with other institutions, expanding access to knowledge and public engagement with health science and technology" (p.24). What was new in this formulation was that it made explicit mention of public engagement with science. Furthermore, it also articulated the importance of collaborating with other institutions.

In alignment with this perspective, the popularization of science was established as one of Fiocruz's key processes, as defined in the macro-process: "popularization of science and technology in health as an instrument for reducing social inequalities and inequities and the development of citizenship," expressed in the strategic goal to "strengthen the popularization of science, especially by combining initiatives in communication, education, science communication and promotion of health, understood as an integral part of doing science" (Fiocruz, 2010, p.53). This goal relates to the thesis approved in 2002 about the role of the popularization of science. This macro-process is broken down into several objectives, outcomes, and deliverables per area. In particular, one of its outcomes should be the "development of an integrated policy for the popularization of science" (p.54). Another important component was the need for "defining indicators and evaluation instruments" for the area.

This commitment comes back in 2014, at the seventh Internal Congress, in the following terms:

> For science, technology, and innovation to work effectively as determinants of sustainable development, it is imperative in contemporary society to stress the role of education, information, communication, dissemination, science communication, and science popularization in a quest for new and creative forms of interaction and dialogue with society. Fiocruz is taking the lead and should improve its programs and actions with the aim of enabling greater understanding by the public of the role and results of scientific research in health, making science instrumental in the development of democracy and citizenship and a channel for social participation (Fiocruz, 2014, p.16).

The text then lists Fiocruz's priorities in this area: "to strengthen and enhance the institution's presence in socially marginalized territories; to take Fiocruz's actions to

inland parts of the country and to integrate, diversify, and expand its actions for the popularization of science" (Fiocruz, 2014, p.16). One point that returns here is the idea of having travelling activities, specifically to inland parts of the country. It also makes explicit mention of socially marginalized areas for the first time in association with the communication and popularization of science. The text ends by linking these activities to heritage and culture – another innovation at this congress.

The "results for society" indicate the need to "formulate and strengthen initiatives and policies in health communication and information, science communication, and the popularization of science that are capable of fostering public debate about health and ST&I, with a view to empowering the population" (Fiocruz, 2014, p.26). Finally, the proposal for an institutional policy for the area reappears in the internal processes section as a pending issue from previous congresses: "to consolidate a policy for the communication and popularization of science" (p.26).

At the most recent Internal Congress, held in 2017, the communication and popularization of science appear as part of two institutional and policy guidelines: "to strengthen and coordinate institutional policies for the communication and popularization of science, magnifying the impact of actions in order to stimulate a culture of science and democracy in society, in permanent dialogue with different audiences, especially those who have been historically excluded" (Fiocruz, 2018, p.33). Once again, we read of an institutional policy for the communication and popularization of science. The other guideline: "to strengthen the communication and popularization of science and innovation in order to bring society closer to the knowledge generation process and its results, fostering the social appropriation of science by articulating popular and scientific knowledge" (p.34). This is the first time the concept of the social appropriation of knowledge is mentioned explicitly.

Over 24 years, from the second (1993) to the most recent (2017) internal congress, we can see how Fiocruz has positioned itself institutionally toward the communication and popularization of science. We should recall that these congresses are processes of democratic participation, which means in theory the position they represent should be aligned with the thinking of the Fiocruz employees as a whole. Interestingly, this topic has been on its strategic agenda throughout this almost three-decade-long period as its terms and priorities have evolved, in line with changes in the academy itself.

Mapping methodology

In order to get a better understanding of this core area, we mapped out the actions taken by Fiocruz. The aims in doing this were: to identify the different actions undertaken at the institution and the actors involved in them; to supply inputs for institutional policymaking in the communication and popularization of science; to showcase the science communication and popularization initiatives currently underway; and to foster internal synergies for these initiatives. Besides constituting a managerial tool, this research also has the power to bring forth details of the functioning of an institution of the size of Fiocruz and understand, as proposed by Entradas and Bauer (2017), what these activities involve and what their goals are in the intermediate stratum in which they are performed.

In 2015 and 2016, we mapped out the actions undertaken at Fiocruz for the communication and popularization of science. The data were gathered using a FormSus questionnaire from the Ministry of Health's DataSus platform. The questionnaire consisted of 11 open-ended questions and three yes/no questions, which could be elaborated on should the answer be "yes." The aim was to make the questionnaire as simple as possible to encourage uptake. The information requested was: the title and a description of the initiative; the target audience; if it was part of a research group (if so, which?); if it was conducted in partnership (if so, with which partners?); if it received external funding (if so, where from?); how often, how many times, and where it was undertaken; contact data; and general observations. As answers could be supplied by a huge number of people (Fiocruz has over 10,000 employees, around 1,000 of whom are researchers), two email campaigns were run to publicize the initiative throughout the institution. The only requirement for respondents was that they consider their work to involve science communication. As well as the general email invitations, specific invitations were sent to people who had taken part in previous National Science and Technology Weeks. After these three email invitation campaigns, the research team undertook an active search for Fiocruz researchers who had received funding via specific calls for projects targeting the communication and popularization of science from funding agencies between 2003 and 2014, covering every unit of the organization across the country.

Like any mapping initiative, ours was a snapshot of a given moment and could be incomplete. As there was no requirement for employees to reply, some actions may have been missed either because the person responsible for them was not identified, or because they were unaware of the survey or were not interested in it. As there was no pre-existing list of initiatives or other similar mapping initiatives, there were no existing results to compare our findings with. It was hard to establish parameters, because no comparable studies were found in the literature. As such, this mapping will itself serve as a reference for future studies. The most important omissions noted by the research team were in the institutional communication structure, either because of a failure to identify with this field of research or because the people involved lacked the motivation or time to fill out the questionnaire. It is therefore more than likely that the full range of science communication initiatives in traditional media is underestimated here.

A total of 168 questionnaires were received. Duplicates, incomplete entries, and actions unrelated to the target field were then excluded. Also, some actions were reported in aggregate, not individually, and had to be separated out. After this data treatment process, 150 actions remained, which were then classified and analyzed.

There is no standard method for classifying actions for the communication and popularization of science, with different authors suggesting different categories (Bell et al., 2009; McCallie et al., 2009; Bultitude, 2011; Barba, 2013; Jucan, Jucan, 2014; Barba, González, Massarani, 2017; Entradas, Bauer, 2017). Each of the international surveys presented in the first section of this paper developed its own categories, illustrating the complexity of the dynamics of this field and the difficulty of generating functional categories for analysis.

A first set of categories was developed from the preliminary data analysis and was presented at RedPOP, in 2018 (Bevilaqua et al., 2018). After the data had been presented

a number of times, the categories were refined in the light of new references in the field, and a new set of categories was developed.

In the new organization, the actions are divided into five major categories (see Table 2).

Table 2: Categories and sub-categories proposed for classifying actions for the communication and popularization of science

Categories	Sub-categories
Traditional Media	Radio and TV programs and the press (own or participation in others); audiovisual
Internet	Social media; blogs and websites; video or audio channels (podcasts)
Educational and Communication Material	Books, textbooks, and atlases; pamphlets, leaflets, brochures, and booklets; games; multimedia and digital games; newsletters; magazines; 3D educational models
In-Person Activities	Science exhibitions, museums, and "Mobile Science" programs; theater and other art forms; talks, lectures, and public debates; festivals, fairs, seminars, and other public events; interactive workshops; activities with schools and teachers; community actions; training activities
Citizen Science	

Source: compiled by the authors.

To classify each action, three of the authors made independent judgements and the majority classification was picked. When three different categories were picked for the same initiative, a consensus was reached by means of a group analysis.

Results of mapping and analysis

Figure 1 shows 150 actions undertaken by Fiocruz grouped into the categories described in Table 2.

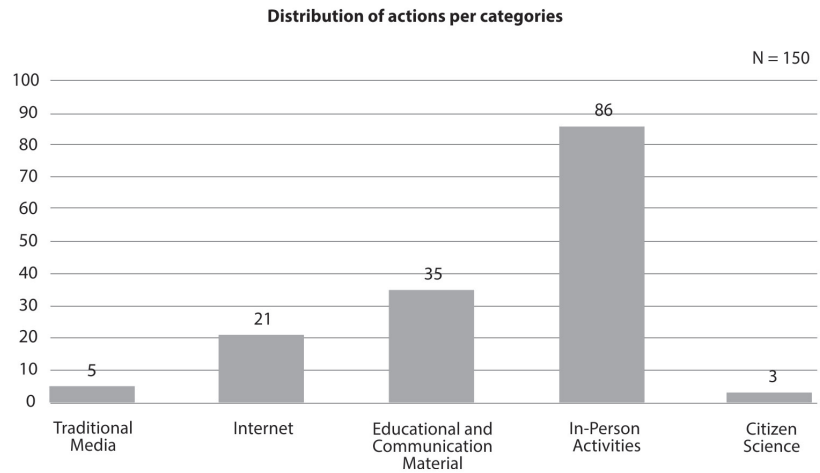

Figure 1: Actions grouped by categories (Source: compiled by the authors)

Most of them were found to be in-person. This number is skewed because of the number of museological initiatives run at Museum of Life, which by its very nature has a great many in-person activities (36 identified). However, even if these are discounted, in-person activities are still the main form in which science is communicated and popularized at Fiocruz. Much of this may be attributed to activities for school groups and teachers, training activities, and museological initiatives by other sectors. We can see from Figure 2 how the in-person activities break down into subcategories.

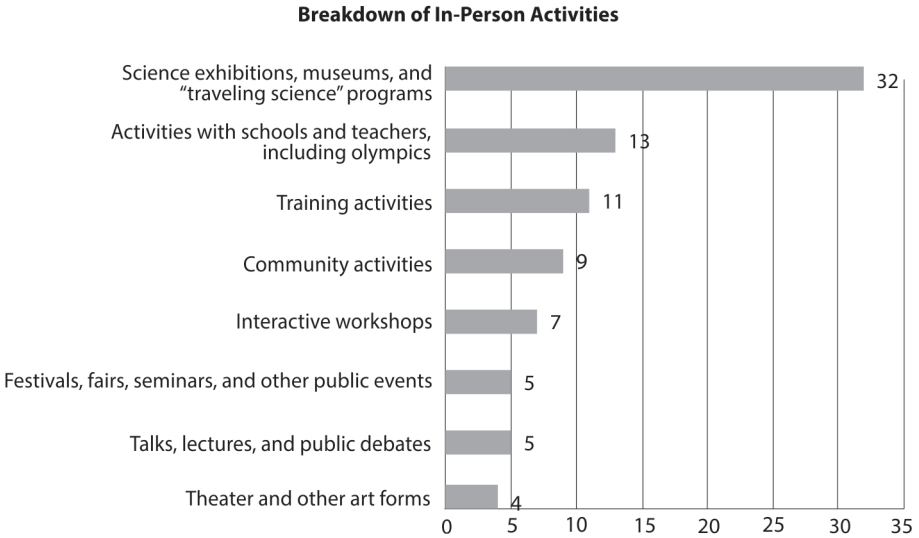

Figure 2: Breakdown of in-person activities into sub-categories (Source: compiled by the authors)

By and large, in-person activities have significant potential for public engagement (Office..., 2000). They foster direct contact between visitors and a science communicator, providing a greater opportunity for the exchange of knowledge and dialogue. The preponderance of such actions is consistent with the official view at Fiocruz, described at its internal congresses, in which it sees the communication and popularization of science as a dialogic process. However, it should be noted that interactivity is not guaranteed in in-person activities, as they may be developed around the deficit model. Investigating such activities in detail to analyze whether they are undertaken from a dialogical or one-way perspective is something that could be done in a qualitative study in the future.

The second largest category is educational and communication materials, which is dominated by printed matter, usually for distribution free of charge to the general public. A breakdown of the sub-categories can be seen in Figure 3.

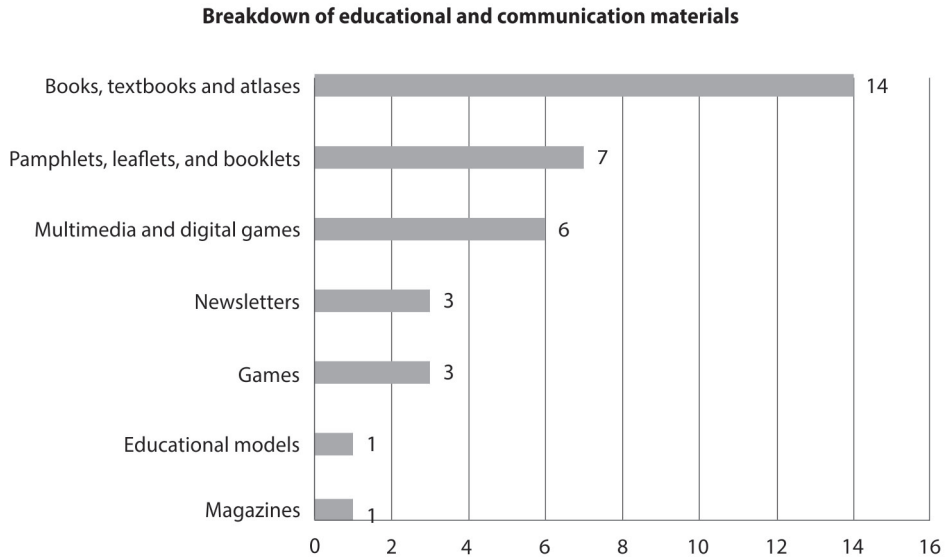

Figure 3: Breakdown of educational and communication material into sub-categories (Source: compiled by the authors)

The use of the internet for science communication is on the rise and gaining ground in the field. In a survey of public perceptions about science conducted in 2015 (CGEE, 2017), the internet appeared as the second most important source of information for the Brazilian population in general, but was already the number one source of information for youth aged 16 to 17. At Fiocruz, internet-based initiatives are the third largest of the five major groups, which indicates the internet is underexploited by the institution. Figure 4 shows these activities divided into sub-categories.

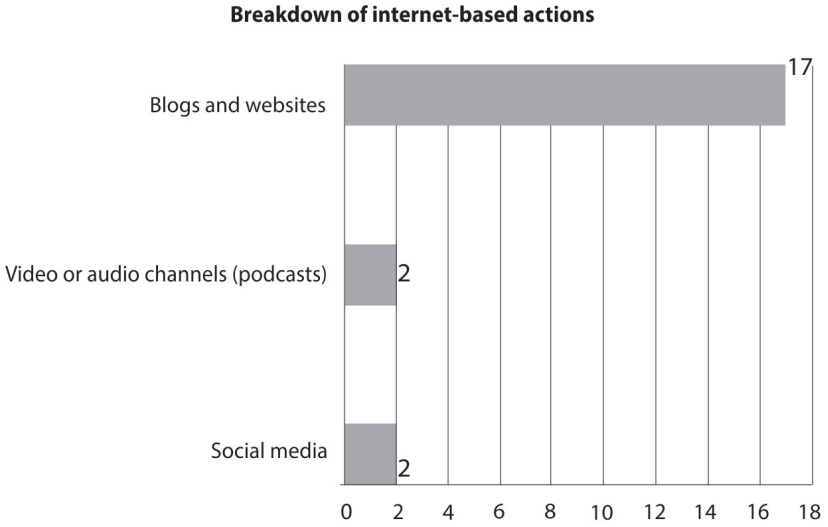

Figure 4: Breakdown internet-based actions into sub-categories (Source: compiled by the authors)

As Figure 4 shows, most of the initiatives are blogs or websites. Using social media for science communication is less common, as is the use of video channels and/or podcasts. However, these formats are very much on the rise and there are new proposals in the pipeline.

Although they are infrequent, it is important to stress the existence of "citizen science" initiatives. This kind of activity enables the public to engage more intensely with science, with laypersons acting as co-producers of knowledge.

In terms of the target audience, 61% of the actions were designed for the general public, while 39% were for one or more specific audiences. The predominance of activities geared towards the general public is traditional in science communication. Over the years, and from the perspective of different authors, it has been seen as something that should be for the lay public in general – people who have no knowledge of the subject (e.g., Brossard and Lewenstein, 2010). This attitude seems to prevail to the present day in many activities, in line with the deficit model. However, it is increasingly understood that science communication can and often should be targeted toward specific groups in order to be more effective, taking their knowledge of the topic into consideration.

We classified the actions (39% of the total) that focused on one or more specific group into seven main categories: school community; children and adolescents; female public; socially marginalized populations; health workers and users; farm workers; and others, which included several groups less often targeted in the actions, like journalists and social movements. Some of the actions fell into more than one category. The classification showed that the specific group to which most activities were geared was "school community" (teachers, students and families), accounting for 43% of the initiatives (16% of the general total), which was the top group among all five categories. This finding is consistent with Fiocruz's tradition of science education, reflecting the fact that its communication and popularization of science has historically been organized around formal education programs, especially the science centers of the 1970s, the education sectors of the science museums, and the non-formal educational materials. Another group that has traditionally been targeted by science communication initiatives in Brazil, especially in connection with science museums and centers, is "children and adolescents." At Fiocruz, 27% of the actions for specific groups targeted this group (10% of the total).

In line with the discourse developed at the internal congresses, in which the strategic importance of the field is stressed for its power to help overcome inequalities, actions classified as being for "socially marginalized populations" corresponded to 20% of the ones geared toward specific groups (and 7% of all the actions). The aim of these actions is to communicate and popularize science among populations who have historically had limited access to scientific knowledge and its innovations and benefits. As a public health institution, Fiocruz is expected to prioritize such groups. Even so, these actions represent a very small proportion of the total and there is room for improvement in fostering the social appropriation of knowledge, as the institution itself wrote in its last internal congress report.

The other low-frequency groups are "healthcare workers and users," actions for whom account for just 11% of the total for specific groups (4% overall); "farm workers" accounting for 5% of actions for specific groups (2% overall); and "female public," with 4% for specific groups (1% overall). Another 5% of actions were geared toward "Others."

As for the engagement of research groups, most of the actions were not linked to any registered Fiocruz group (Figure 5).

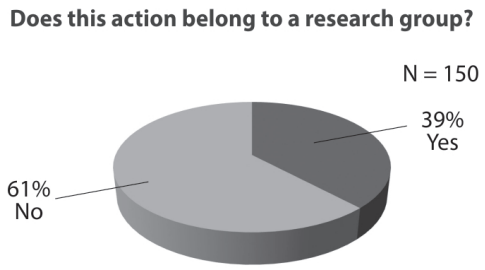

Figure 5: Breakdown of actions into association with research groups (Source: compiled by the authors)

The 58 actions (39%) identified as being involved with research groups were associated with 38 groups in all. Given that Fiocruz had 366 research groups registered on the CNPq platform in 2016, we are talking about around 10% of this total. For an institution that specializes in research, this means there is still much to be done to galvanize researchers to get involved in the communication and popularization of science.

As for actions in partnership, some proved very important for promoting collaboration, as shown in Figure 6.

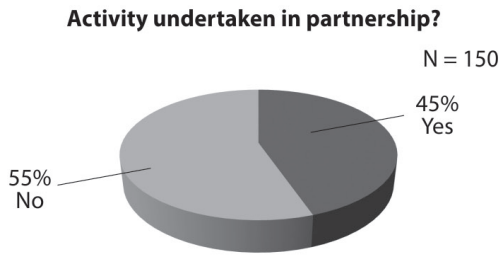

Figure 6: Breakdown of actions by whether or not they involve partnerships (Source: compiled by the authors)

In the main, most of the joint actions are collaborations with external institutions. A similar picture was reported recently in the internal congress reports, indicating a lack of internal cohesion and synergy for joint activities.

Around half the actions received some kind of external funding (Figure 7).

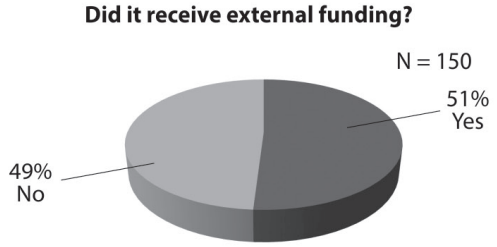

Figure 7: Breakdown of actions by external funding
(Source: compiled by the authors)

Besides being an important driver of communication between a scientific institution and society, activities for the communication and popularization of science are also crucial for the obtainment of funding for the institution.

The actions can also be broken down into the different Fiocruz units: 16 scientific units in Rio de Janeiro and five other states (Paraná, Minas Gerais, Bahia, Pernambuco, and Amazonas); four offices (units in the pipeline) in Piauí, Ceará, Mato Grosso do Sul, and Rondônia; one special office in Brasília; four technical and administrative units (all in Rio de Janeiro); and one special office in Mozambique. As such, Fiocruz is present in 11 states in Brazil, even if most of its activities take place in Rio de Janeiro. The geographical distribution of the units can be seen in Figure 8.

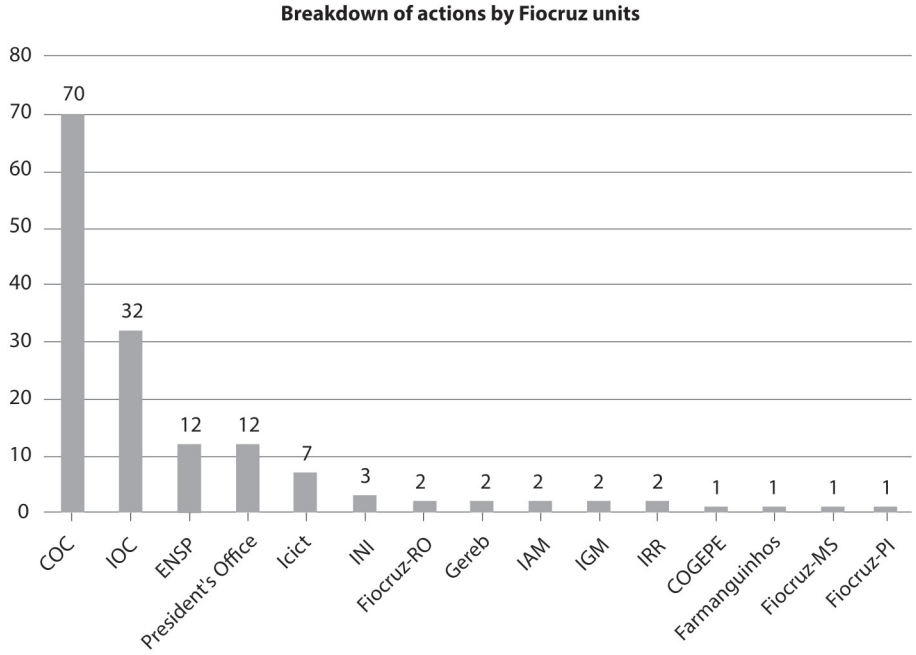

Figure 8: Breakdown of Fiocruz actions by the units responsible for them (Source: compiled by the authors)

As mentioned, most of the activities are undertaken in Rio de Janeiro. However, the following regional units are also involved: Fiocruz-RO (Rondônia state), Regional Brasília Office (Gereb, Federal District), Instituto Ageu Magalhães (IAM, Pernambuco), Instituto Gonzalo Moniz (IGM, Bahia), Instituto René Rachou (IRR, Minas Gerais), Fiocruz-MS (Mato Grosso do Sul), and Fiocruz-PI (Piauí). The most representative units, in descending order, are Casa de Oswaldo Cruz (COC), Instituto Oswaldo Cruz (IOC), and Escola Nacional de Saúde Pública Sergio Arouca (Ensp).

COC is the unit that runs Museum of Life and has science communication as part of its institutional mission, so it was expected that it would be active in this area. Even if we discount the activities of Museum of Life, COC is still active in other ways that are strongly influenced by historical research and heritage education. IOC, for its part, is the Fiocruz unit devoted to basic research in the field of biomedicine. It is, indeed, the mother unit of the institution insofar as it is the direct descendent of the Federal Serum Therapy Institute, run by Oswaldo Cruz, with a long-established tradition in the communication and popularization of science. Its activities cover a whole range of categories and are undertaken by many of its constituent groups. Meanwhile, Ensp is the unit devoted to public health research. Its great variety of activities are geared primarily toward the promotion of health.

Final considerations

The mapping process undertaken for this study brought to light the dynamics of the activities for the communication and popularization of science undertaken at Fiocruz and enabled them to be understood in terms of how the institution interacts with the field. From a managerial perspective, it is hoped that this process may contribute to the development of an institutional policy for the communication and popularization of science that forges synergies and closer ties with Brazilian society.[1] The purpose of mapping out these activities was both managerial and exploratory, in a bid to understand how they are undertaken at large, complex scientific institutions with relatively autonomous sub-structures. The aim of the study was to provide parameters – practically non-existent at the present time – for the analysis of activities for the communication and popularization of science at large universities and science and technology institutions.

The documents consulted and the survey undertaken reveal that the communication and popularization of science is regarded as strategic and valuable by Fiocruz, which has a reputation for excellence in science communication. As discussed in the documental analysis, this finding is the outcome of a continuous, systematic policy maintained over at least 30 years to value and recognize the communication and popularization of science as a core part of science per se and indissociable from academic excellence. This central position has been confirmed repeatedly by its internal community and receives consistent funding from the institution and from funding agencies.

Almost every Fiocruz unit is engaged in some kind of activity. However, they are not uniform, but respect the individual nature of each technical and scientific unit with its specific focal area and mission. A significant proportion of the activities are undertaken at Museum of Life, whose mission is to divulge and popularize science. There are more

activities in Rio de Janeiro than elsewhere in the country, but this is gradually changing, although the decentralization of the communication and popularization of science is still a big challenge in Brazil. Despite the great strides taken in recent decades, especially thanks to new public policies, the geographical concentration of the country's scientific and cultural assets is more marked than its concentration of wealth. This is replicated on different levels, not just between regions of the country, but also between cities, and between more central and more peripheral and socially marginalized parts of a given municipality. It is important to stress that the Fiocruz documents consulted identify science communication as a driver for tackling such inequality, and there are indeed several actions identified in this mapping initiative that would take science to inland parts of the country.

Although Fiocruz constantly champions the communication and popularization of science as a dialogic process designed to engage the public in science, many of its actions are still devised from the perspective of the deficit model. A great many of its initiatives involve one-way communication with the public and very little real dialogue. Even so, most of them have great potential to promote dialogue and engagement. Indeed, it is worth mentioning the citizen science actions, which achieve considerable public engagement. However, what prevails at Fiocruz is the model that is still widespread throughout Brazil's scientific community: the production of educational material designed to convey information in a one-way direction on topics chosen by researchers themselves.

Many of the actions enable collaborative networks, which is underlined as important in the internal congress reports. However, there is little interrelationship between the actions themselves, and limited synergy within the institution. These actions and products are rarely featured in the official Fiocruz communication channels, which makes it hard for the public to access them.

Finally, although deemed important on an institutional level, only a small proportion (10%) of the Fiocruz research groups engage in the communication and popularization of science, showing there is room for improvement in this area. Despite institutional and even governmental support, the main mechanisms of researcher evaluation are still the traditional indicators of scientific publications. Few calls for projects include science communication as a prerequisite for the obtainment of public funding, and even when they do, the verification of the actual results tends to be little more than a formality. Accordingly, most researchers put little effort into communicating and popularizing the research they conduct. This is reflected in the fact, confirmed in research, that most of the population are unaware of what science is produced in Brazil.

The aim of this study was to map out and analyze the activities taken by Fiocruz in the communication and popularization of science. Other institutions, such as the Universidade Federal de Minas Gerais, have structured their actions of this nature into internal policies and systems. Understanding in comparative terms how these systems have been structured is important for understanding how this field is developing in Brazil. It is mainly at universities and research institutes that science communication is undertaken. That is why it is so important to analyze how public policies result in concrete actions within such establishments. This is a strategic field for helping improve the public's understanding of science and engaging the public in a bid to promote a culture of science in our society. In

the contemporary context of burgeoning anti-science movements and the rapid propagation of fake news about science, sometimes even to the detriment of the population's health, this is a task that the field of science can no longer overlook.

DEDICATION

This study is dedicated to Loloano Claudionor da Silva, a young astronomer, science communication enthusiast, anarchist, ardent activist, and research companion. He was a person who always sought to truly help the people close to him. He was about to begin his master's in Science, Technology, and Health Communication at Fundação Oswaldo Cruz when he died, on January 2, 2019, when this article was close to completion. This is our tribute to Loloano.

NOTE

[1] On December 10, 2020, after the acceptance of this article for publication, the Fiocruz board approved its first Science Communication Policy, based on a draft document prepared by a working group set up specifically for this purpose. The policy addresses many of the challenges set forth in this article. Its text, which is still being edited, will shortly be posted on the Fiocruz portal and included in is institutional repository.

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