

AN OVERVIEW OF THE PHYSICAL ACTIVITY RESEARCH NETWORK IN BRAZIL

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The burden of disease in Brazil has undergone rapid changes over the past decades. Like in high-income countries, non-communicable diseases (NCDs) in Brazil have overtaken infectious disease as the main cause of death. However, this shift has been much faster in Latin America than in high-income countries, meaning health systems need to adapt quickly in order to control the epidemic of NCDs. It is important to keep in mind that over 80% of all NCD deaths occur in low- and middle-income countries^{1,2,3}.

Brazil, the largest country in the region is no exception. In the last three decades, the aforementioned transition has occurred alongside an increase in life expectancy and the proportion of the population that is more than 60 years old, and changes in living conditions such as improved sewage systems, access to electricity, technology and food, and industrialisation and

urbanisation. Despite these improvements in living conditions, there was an increase in unhealthy lifestyles, NCD prevalence and burden of disease⁴. In 2011, it was estimated that approximately 40% of the population over 40 years old had hypertension and 6 million people were diabetic⁵.

Several studies have identified physical activity as a modifiable risk factor for NCDs⁶. According to the 2012 *Lancet* Physical Activity series, 5.3 million deaths are attributable to physical inactivity every year⁷. Globally, one out of three adults and four out of five adolescents fail to reach the levels of physical activity recommended for health benefits. In 2008, it was estimated that 49.4% of Brazilians aged 15 years or older were physically inactive⁸.

Brazilian research on physical activity has increased in response to its important role in the NCD pandemic, with the number of publications increasing over the decades

since its beginnings in 1990. A 2007 review in Brazil reported that since 2000, the publication of articles had accelerated, with between six and nine new articles published per year from 2001 to 2005⁹. The review concluded that it was essential that physical activity research be strengthened in the country and that stronger collaborations be developed among local research groups in order to develop strategies to meet the country's public health and physical activity needs and to address the NCD and physical inactivity pandemics.

Some efforts have been made towards improving physical activity research in Brazil, such as via the implementation of several large-scale interventions for physical activity promotion⁹. One such intervention is among Brazil's most important examples of physical activity research – the Academia da Cidade (City Gyms) programme. This programme started in 2002 in Recife and



due to its success it contributed to the establishment of a government health system policy that aimed to involve 4000 cities by the end of 2014. The main objective of this programme is to promote health through physical activity⁹.

Despite increasing research in the field and the existence of several interventions, the burden of NCDs and physical inactivity in Brazil is a continuing cause for alarm. Therefore, an assessment of Brazil's physical activity research network is warranted. The objective of this paper is to describe physical activity research conducted in Brazil in 2013 and analyse how the collaboration network is structured.

METHODS

In July 2014, we searched MEDLINE for studies on physical activity in Brazil. The search terms were 'physical activity' and the country name either in the study title or abstract. The included articles were published between 01/01/2013 and 31/12/2013, and were those described as

physical activity studies in Brazil, which fell into the following categories:

1. prevalence, time trends or measurement of physical activity,
2. correlates and determinants of physical activity,
3. health consequences of physical activity,
4. physical activity interventions,
5. physical activity policy,
6. others.

Reviews, meta-analyses, case reports, editorials, commentaries, national plans, surveillance papers, discussions and letters to the editor were also included if they appeared in the MEDLINE search, if they were country-specific and if the author's affiliation was in Brazil. There were no age or language restrictions. Studies on exercise physiology or whose outcomes were not related to physical activity were excluded. All abstracts were assessed twice by one researcher with reading comprehension skills in Spanish, English and Portuguese.

The Brazilian physical activity research network was developed on the basis of

a list of all authors of the chosen papers. The network was built with the following information: the list of the actors composing the network (paper authors) and the list of the relationships (the interactions between actors, if they wrote a paper together).

Basic characteristics of the research network (number of articles and authors, mean number of articles per author, the author with the most publications and their number of articles), connection characteristics (average connection between authors, participation in multinational studies) and concentration characteristics (number of research or publishing groups, average number of authors in a research or publishing group and authors working alone) were identified. The network structure was visualised and built in the programme GEPHI 0.8.2 beta.

RESULTS

In the original search, 217 articles were retrieved and 121 were excluded according to the exclusion criteria, mainly on the basis

that the paper outcome was not related to physical activity and public health research. The 96 included articles were related to physical activity and public health and met other aspects of the inclusion criteria. In relation to article topics, 76 were related to NCD prevention and physical activity, 10 to counselling and physical activity promotion and 10 to instrument use, validation and comparison between instruments. In relation to the study type, 35 were about prevalence, measurement and trends, 29 about correlates and determinants, 17 about health consequences, 14 about interventions and 1 about policy. The target population in

30 studies was children and adolescents under 19 years of age and in the remaining 66 studies, adults. Six studies were multinational studies with the participation of Brazilian researchers.

In relation to the network structure, 418 active researchers in the physical activity and public health field were identified in Brazil, with 119 non-Brazilian authors from the following countries: USA, Canada, Spain, Sweden, Italy, France, Greece, Hungary, Austria, UK, Australia, Belgium, Colombia, Puerto Rico, Peru, Japan, Norway, New Zealand, China, Lithuania, Portugal, Denmark and Switzerland.

Non-Brazilian researchers participated in 30% (29/96) of the papers. In these 29 papers, the average proportion of non-Brazilian authors was 0.14 (SD 0.28). Three percent of the papers (3/96) were authored by non-Brazilians alone. Table 1 summarises the characteristics of Brazil's 2013 physical activity research network.

DISCUSSION

Knowledge production and attainment of scientific breakthroughs requires a collaborative approach¹⁰. In recent decades, Brazil's physical activity research network has grown and evolved and is currently

TABLE 1

Characteristics

<i>Total number of articles</i>	<i>96</i>
<i>Number of authors</i>	<i>418</i>
<i>Mean number of articles per author</i>	<i>0.23</i>
<i>Number of non-Brazilian authors</i>	<i>119</i>
<i>Author with more publications</i>	<i>Hallal PC</i>
<i>Number of articles of the author with more publications</i>	<i>14</i>

Connection

<i>Connections of the author with more publications</i>	<i>55</i>
<i>Connection indicator (average connections between authors)</i>	<i>7.01</i>
<i>International connections (participation in multicountry studies)</i>	<i>6</i>
<i>Brazilian authors participating in multicountry studies</i>	<i>5</i>
<i>Ratio of non-Brazilian to Brazilian researchers</i>	<i>1:3.5</i>

Concentration

<i>Concentration (number of communities/publishing groups)</i>	<i>55</i>
<i>Concentration index (average of authors per community)</i>	<i>7.7</i>
<i>Isolated nodes (authors working alone)</i>	<i>1</i>

Table 1: Brazil 2013 research network in the topic of physical activity and public health.

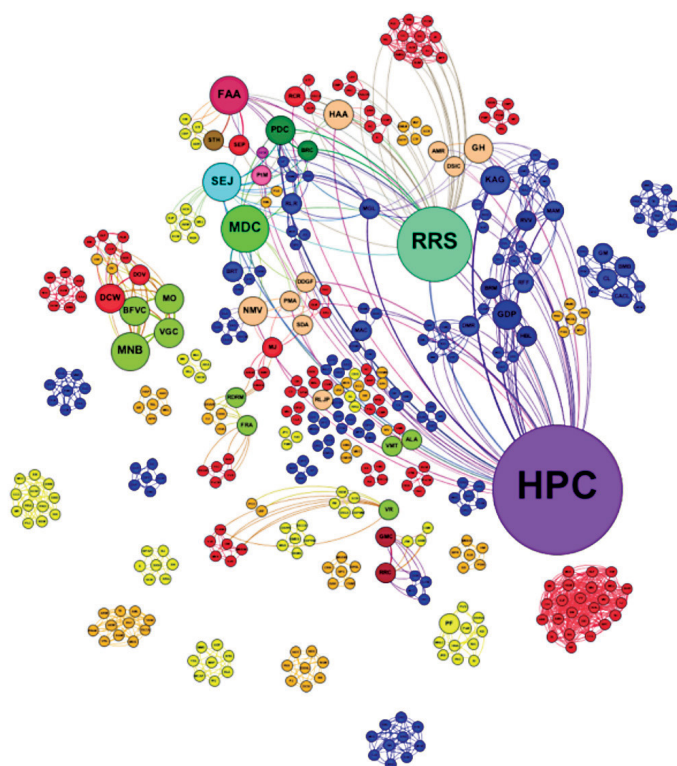


Figure 1: Structure of Brazil's 2013 physical activity research network.

Studies colour conventions: blue=prevalence, measurement and trends; red=correlates and determinants; yellow=health consequences; orange=intervention; Green=policy. The other colours are product of a mixture of study type in authors that collaborate within the network.

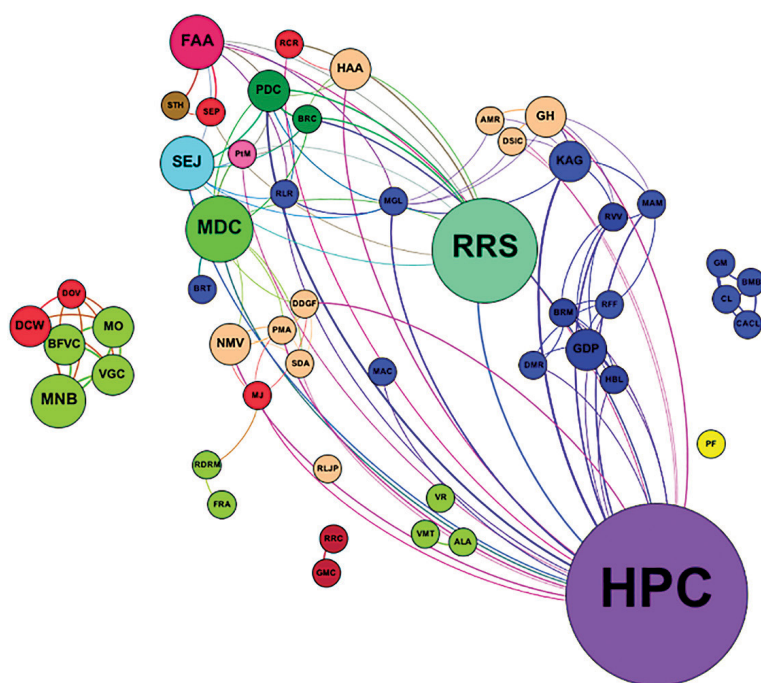


Figure 2: Structure of Brazil's 2013 research network of authors with two or more papers.

Studies colour conventions: blue=prevalence, measurement and trends; red=correlates and determinants; yellow=health consequences; orange=intervention; Green=policy. The other colours are product of a mixture of study type in authors that collaborate within the network.

characterised by high-impact, highly cited publications, worldwide connections and partnerships, and multidisciplinary working groups with a considerable number of researchers located in many countries. This reflects the increased productivity and broader scope that the Brazilian network has been able to achieve.

The study types and research methodologies cover a considerable percentage of the research priorities in the country and among the authors it is possible to identify leaders in the areas of policy, interventions, counselling and clinical practice. It is evident that there has been progress and professional development in the field. The number of papers per year has increased from one in 1990 to 96 in 2013. The research network reflects scientific teamwork with the following characteristics:

1. average number of 0.23 papers per year per researcher,
2. highly connected researchers with an average of seven connections each,
3. partnerships between researchers from all Brazil's regions,
4. 55 working groups each with an average of seven members,
5. strong collaboration, with non-Brazilian researchers contributing to 30% of the papers and 14% of the authorship in these papers,
6. participation in six multinational international studies,
7. 3% (3/96) of the country's physical activity research done completely by foreign researchers,
8. low frequency of papers authored by a single researcher, which reflects the trend of working collaboratively.

With respect to the need to respond to the NCD epidemic, 79.2% (76/96) of the papers were related to NCD prevention but only 10.4% (10/96) to counselling and promotion of physical activity, which is also a priority. This highlights the need to strengthen research in physical activity promotion and counselling.

Study types were distributed in a more even fashion, with prevalence studies as the main study type and policy studies as the least frequent type. This result shows that it is extremely important to integrate physical



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activity and public health research actions with local governments and to be able to propose actions and interventions that transform scientific findings in policies^{11,12}. The role of physical activity researchers is to become active agents in building and supporting movements to increase awareness of physical inactivity and its consequences at regional and national level^{13,14}.

It is essential that the number of active researchers in the field be increased to produce more research findings in Brazil

and help mitigate the effects of the NCD pandemic and physical inactivity on the population. Considering Brazil's population of almost 200 million people, the results of this study suggest there is one physical activity researcher per 475,254 people and in 2013 there was one physical activity and public health article published per 2,069,334 million people, which also highlights the need to educate more Brazilian professionals in the field.

In order to continue evolving in the coming decades, Brazil's physical activity

research network needs to set clear collaboration objectives, find methods to maximise the associated benefits and knowledge use and flow from the global network, as well as develop strategies to respond to NCD epidemic research needs with new knowledge and leadership in the country.

CONCLUSIONS

There is no doubt that the Brazilian network will continue evolving and contributing with new knowledge to the physical activity and public health field. It is important to strengthen research collaboration among Brazilian regions to help with the development of new groups with less experience – thereby moving the entire network towards high-quality research and recognition of its members as leaders at the local and national level. Also it is very important to empower and support research in the areas of policy and interventions in the country. The scientific outcomes need to be known by policy makers and need to be implemented by practitioners and within the community.



The role of physical activity researchers is to become active agents in building and supporting movements to increase awareness of physical inactivity and its consequences at regional and national level



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