

# Research capacity for childhood obesity prevention in Latin America: an area for growth

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## Summary

**Background:** The rise of childhood obesity in Latin America calls for research capacity to understand, monitor and implement strategies, policies and programmes to address it.

**Objective:** The objective of the study was to assess current research capacity in Latin America related to childhood obesity, nutrition and physical activity.

**Methods:** We conducted a search of peer-reviewed articles on childhood obesity in Latin America with at least one Latin American author from 2010 to May 2015. We coded 484 published articles for author affiliation, study subjects' nationality, research topic and study design and extracted a series of networks per research topic, study design and collaborating country for each of the countries.

**Results:** Obesity is the most frequently explored topic. Nutrition and obesity are somewhat better developed compared with physical activity and sedentary behaviour. There are numerous observational and cross-sectional studies, indicating either a lack of capacity required for more complex research or the extent of the problem and associated factors is still unknown. The low number of intervention studies and the near absence of policy articles suggest a void in research capacity.

**Conclusion:** For childhood obesity, there is a clear need to build research capacity that documents the current state of the problem and design evidence-based prevention and intervention efforts.

**Keywords:** childhood obesity, Latin America, nutrition, physical activity.

## Introduction

As Latin America passed through epidemiologic and lifestyle transitions in recent decades, obesity prevalence among children and adolescents in the region reached startling levels (1). The most recent prevalence estimates for overweight and obesity among Latin American children younger than 20 years old is 21.7% and 7.4%, respectively, for men and 45.5% and 7.5%, respectively, for women (2). However, in many countries within Latin America, the evolution of obesity is poorly documented and understood, in part, because of a lack of research support and training to

fill all of the data needs. Much of the public health effort to build research capacity in the region over the past decades has focused on child survival and communicable disease prevention (3). Chronic conditions such as obesity and health behaviours underlying non-communicable diseases have multiple etiologies and need long-term monitoring that requires different tools and strategies than those needed for maternal and child survival (4–7). There are pressing needs in childhood obesity prevention and research in the region, but they cannot be addressed without improved research capacity (8–10).

In this paper, we assess current research capacity in Latin America related to childhood obesity, nutrition and physical activity. In addition, we identify key gaps and suggest priorities to further develop research capacity and apply it to public health policies and programmes that can address obesity prevention in the region. Research capacity has several components, including institutional infrastructure, well-trained and experienced scientists at different career points, and the ability to communicate findings at conferences and in print (11,12). We define research capacity as the ability of individuals, institutions and networks to pursue locally relevant research, maintain a career pipeline for scientists and promote a research environment that is conducive to multidisciplinary collaboration (11). For purposes of this paper, we also include the development of skill sets and support systems that enable the transfer of evidence into policy and practice. Foundations of research capacity building include individuals, institutions, network partnerships and collaborations (13).

## Methods

We elected to use indexed peer-reviewed publications as an indicator for research capacity. Publications are a product reached as a result of capacity in each of the component areas noted previously and thus give a reasonable overall estimate of research capacity (3). In particular, peer-reviewed, indexed, scientific publications are highly standardized and understood as a common metric for research productivity. By utilizing citation databases for publications in English, Spanish and Portuguese, we can compare research productivity and assess collaboration and research networks in Latin America over time by the topic areas of obesity, physical activity and nutrition; type of study design; and country affiliation of the research institution and researchers.

The bibliographic databases, PubMed and LILAC, were searched in May 2015 to identify peer-reviewed articles on childhood obesity, nutrition and physical activity in Latin America. Articles with at least one author with Latin American affiliation in English, Spanish or Portuguese from 2010 to May 2015 were included. Search terms included controlled vocabulary terms (i.e. Medical Subject Headings) and variations of the following keywords: children (i.e. anyone under 18 years old), obesity, physical activity, physical inactivity, physical fitness, nutrition/diet and Latin American countries not including the Caribbean (i.e. Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Salvador, French Guiana, Guadeloupe, Guatemala, Haiti, Honduras, Martinique, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Bartheleme, Saint Martin, Uruguay and Venezuela). EndNote Online was used to manage all retrieved and included references.

This search resulted in 1,253 articles. Articles were excluded if they had any of the following: lacking author with an identifiable affiliation in Latin America; study participants were not from Latin America or were 18 years of age or older; published outside of the 2010–2015 range; participants with specific diseases; articles that only focused on micronutrient deficiencies or undernutrition; systematic reviews or meta-analysis; and main research topic unrelated to overweight/obesity, physical activity, physical inactivity, physical fitness and nutrition/diet. An initial review eliminated 684 articles. The remaining 569 articles were then reviewed and coded by two reviewers. This process resulted in an additional 85 articles being excluded, leaving 484 coded articles for analysis.

For each abstract reviewed, the following information was extracted and coded: author's affiliation nationality, research topic and study design. Research topics were based on the main variables of interest (exposure or outcome) described in the abstract (or full article, when the abstract was not sufficient to define the topic). Articles could include one or more of the following research topics: obesity, physical activity, physical inactivity, physical fitness and nutrition/diet (Table 1) and one or more of the following study designs (Table 2). Additionally, for each abstract reviewed, we coded the study design (i.e. if the study was longitudinal or cross-sectional).

## Data analysis

We extracted a series of networks from the coded publication data to show the numbers of publications per research topic, study design and collaborating country for each of the countries in the analysis. Networks were extracted from the coding data using the Science of Science (Sci2) tool (14) to connect the affiliation country of the lead author to the coded research topic, study design and any additional Latin American country affiliations of other authors on each paper. Papers coded to multiple research topics or study designs were counted once for each research topic or study design, rather than fractionally. The networks were then visualized using GEPHI (15).

## Results

Given the numerous underlying causes of childhood obesity in Latin America, as described in (16), these research topics were intended to address the multifaceted nature of childhood obesity prevention. The most frequently explored topic, seen in about 50% of the papers was obesity, followed by nutrition, physical activity, physical inactivity and physical fitness (Fig. 1). With the exception of physical inactivity and physical fitness, the number of articles for each topic rose each year. All topics had a modest growth in articles until 2014, when there was a spike in

**Table 1** Research topic description

Topic	Description (could include any of the following)
Obesity	Measures of BMI, waist circumference, waist-to-height, adiposity, BMI-for-age, weight-for-age, overweight, obesity and nutritional status (only if it included overweight and/or obesity and was not focused on undernutrition only)
Physical activity	Vigorous or moderate-intensity physical activity; any type of leisure, organized activities or sports; and occupational, household, transportation or commuting physical activity
Physical inactivity	Any type of sedentary behaviour measure or proxy such as screen or television time
Physical fitness	Any physiologic characteristic (measured in the field or in a laboratory setting) including aerobic capacity, muscular strength, muscular endurance and flexibility
Nutrition/diet	Diet, energy, nutrients, food, food group or dietary pattern intake; biomarkers of nutrients

**Table 2** Study design description

Study design	Description (could include any of the following)
Descriptive statistics	Studies that quantify descriptive estimates, trends and/or patterns of the topics of interest (e.g. prevalence, surveillance and incidence). This design category included articles that performed association or stratified analysis with non-modifiable variables such as age, sex, place or time
Qualitative	Focus groups, interviews, observations, study of the "why," "how" or beliefs
Measurement	Studies focused on development of new measurement techniques, improving existing techniques and comparing measurement techniques, validity and/or reliability studies
Correlates	Studies aiming to identify determinants or consequences of our topics of interest (excluding non-modifiable determinants). Analyses including measures of associations such as correlation or regression coefficients, odds ratios, risk ratios and hazard ratios
Interventions	Randomized controlled trials, community trials, non-national programme evaluations, natural experiments, interventions and other quasi-experimental designs focused on modifying at least one of our topics of interest
Policy	Public health and research recommendations, national programme evaluations, national plans and policy evaluations
Other	Descriptive studies including an aspect of temporality, e.g. longitudinal cohorts and nested case-control studies

publication numbers. The number of articles related to obesity, physical inactivity or physical fitness almost doubled during 2014. As the search was conducted in May of that year, data for 2015 are incomplete.

Study design could serve as an approximate reflection of where a country is in their capacity to address childhood

obesity. Cohort and mechanistic studies are more expensive and require more research infrastructure than surveillance and cross-sectional studies. The vast majority of study designs found by this review were identified as correlates and descriptive statistics research. Almost all of the studies are cross-sectional. Despite a modest increase between 2010 and 2015, measurement studies, which include tool and survey validation, and intervention experiments, which examine the results of modifying some aspect of childhood obesity, are still in their infancy in Latin America. The review identified only one policy research publication. Similar to the research topics in Fig. 1, there was an increase in the number of publications across all study designs in 2014, perhaps reflecting an increase in research capacity. However, intervention and policy studies are rising at a slow rate, indicating that additional training or capacity may be needed in these areas (Fig. 2).

Studies focusing specifically on obesity had the largest number of publications across topics of investigation and study design; obesity also had the highest number of cohort and observational longitudinal studies followed by studies that focused on nutrition. However, very few studies in the region have been published from longitudinal data. We estimate that of the 484 publications included in this review, only 56 (8.6%) were of the generally stronger (for understanding causality) longitudinal or cohort design. Although obesity had a greater range of study designs compared with the other topics, obesity and nutrition had almost the same overall number of intervention and qualitative studies. In contrast, most of the papers on physical activity, inactivity or fitness were correlates or descriptive design, suggesting that these topics may still be in an earlier phase of research capacity development (Fig. 3).

Including lead author country affiliation in the analysis, it appears that Brazil, Mexico and Chile have the highest representation in all research topics. These three countries likewise have the largest representation in terms of correlates and descriptive research. Meanwhile, smaller countries like Bolivia and Uruguay have very little representation within the literature. The regional patterns of research productivity are virtually identical across both the research topic and the study design categories with the majority of publications coming from Brazil, Mexico and Chile (Figs 4 and 5).

An analysis of the connection between article authors from different countries demonstrates that despite the large number of publications there were few apparent collaborations between countries. Authors from Brazil had the highest number of joint publications with authors from other countries. However, of its total number of publications, Brazil collaborated on only approximately 8% of articles. This network analysis shows that there is very little co-authorship between countries for these research topics (Fig. 6).

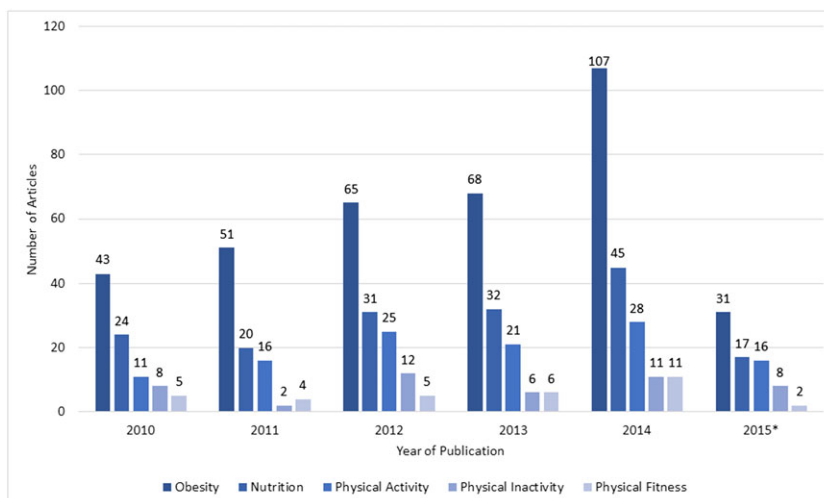


Figure 1 Number and percent of published studies by year of publication and research topic.

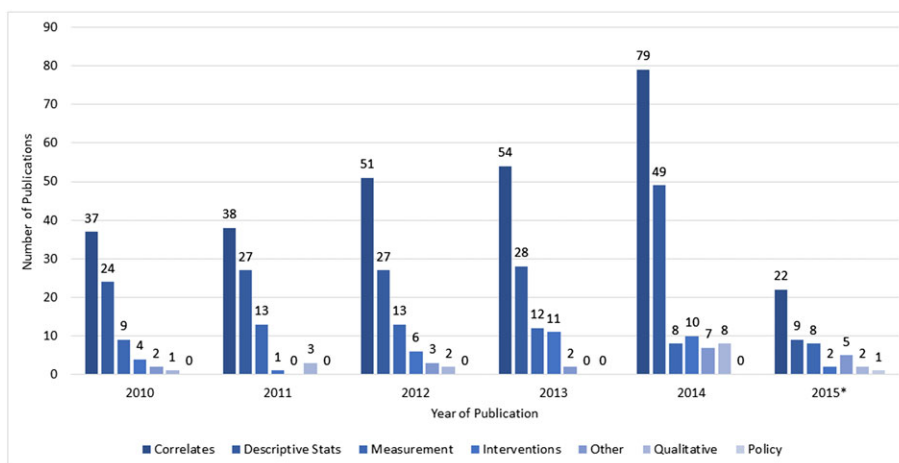


Figure 2 Number and percent of published studies by year of publication and study design.

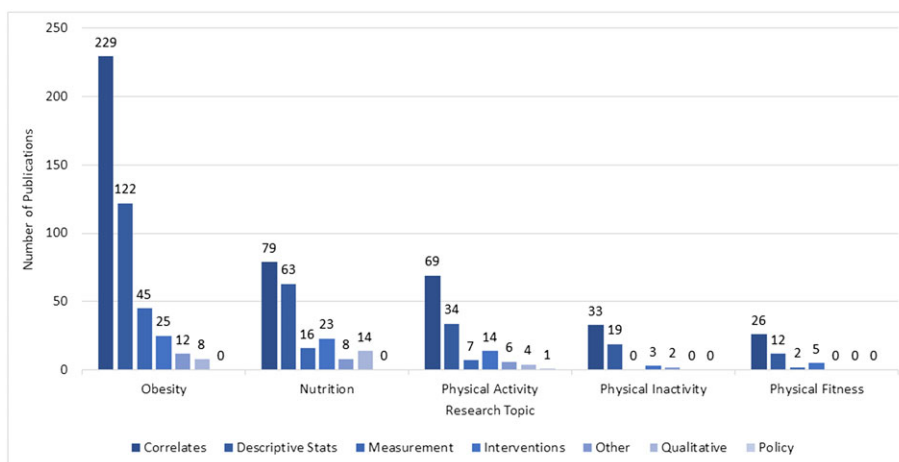


Figure 3 Number of published studies by research topics and study design.

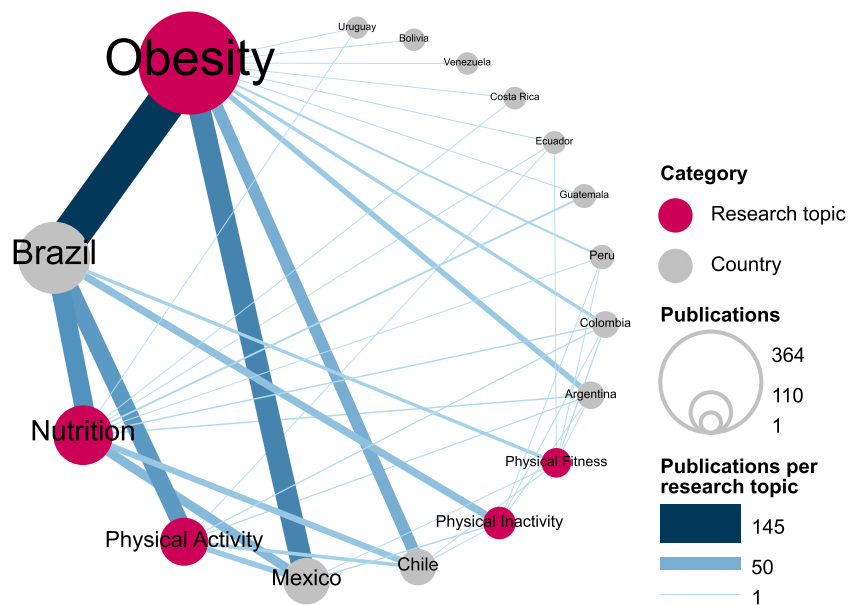


Figure 4 Published studies by lead author country affiliation and research topics.

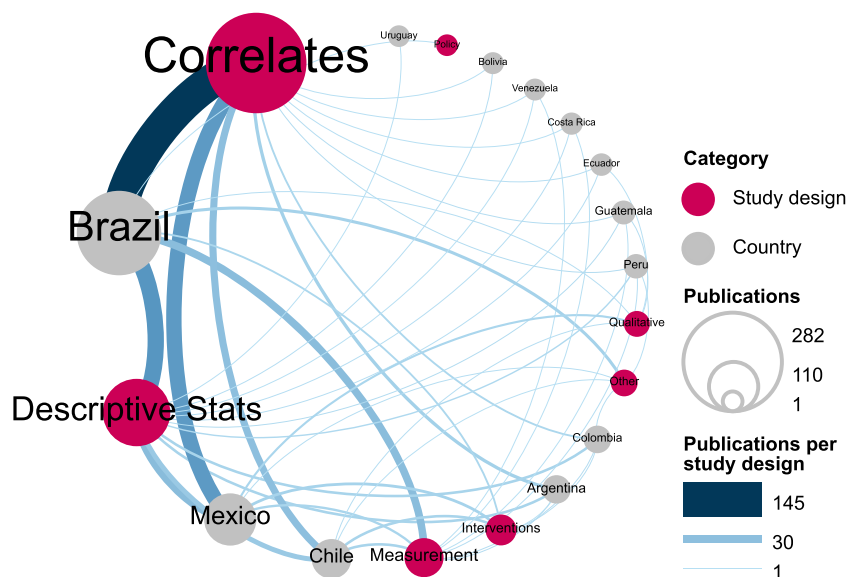
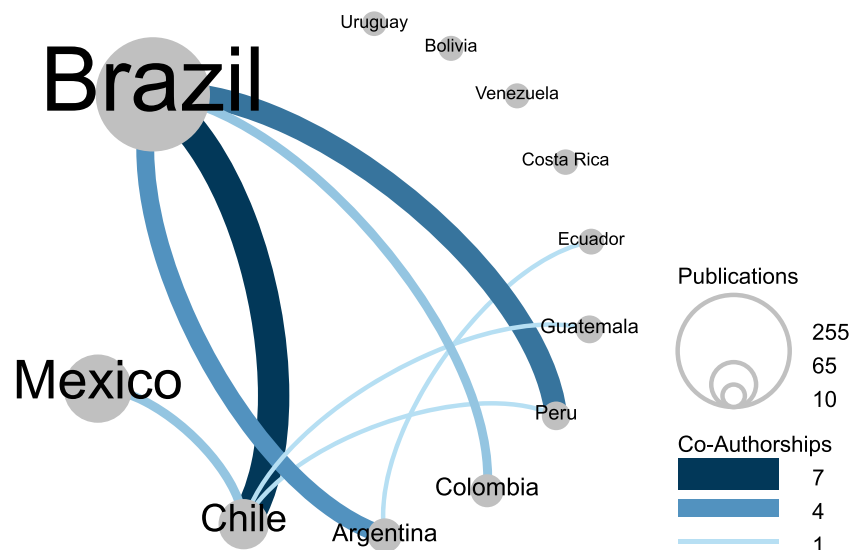


Figure 5 Published studies by lead author country affiliation and study design.

### Discussion

Our results suggest that research publications on childhood obesity are somewhat better developed in the Latin American literature in comparison with those that focus specifically on nutrition and physical activity. In addition, there remains a high reliance on observational and cross-sectional studies with a descriptive and correlational focus. This is an indication that countries either have an issue with lack of capacity required for more complex research or are still looking to understand the extent of the problem and

associated factors. The very low number of intervention studies and the near absence of policy research published suggest a void in research capacity for these types of studies in Latin America. In addition, it suggests that public health efforts for obesity prevention in the region are working with very little context-specific evidence regarding what will be most effective in Latin America. Overall, there is an indication that capacity building, or at least awareness in the region as it relates to the topic of childhood obesity, is increasing; this can be seen by the growing number of publications since 2010 with a substantial increase in



**Figure 6** Network analysis of joint publications by author's country affiliation.

2014. This spike observed in 2014 may be due to increased capacity in the region. However, further research will be needed to confirm this assumption.

If progress is to be made, strategic investment in regional research capacity that addresses each childhood obesity prevention topic must be a priority. There were more articles on obesity than on topics related to nutrition and physical activity that require more specialized collection and analysis methods. Moreover, it is important to note that we were able to obtain a more informative and detailed picture of research related to physical activity, because the measures and activities pertaining to each of its three subtopics (physical activity itself, physical inactivity and physical fitness) are clearly distinctive and straightforward to classify, which is not the case with nutrition and diet. If all of the physical activity subtopics were added together, then nutrition had the least amount of published articles. Understanding the reasons for this, whether it is a result of fewer funding opportunities, low levels of expertise or some other reason, will be important to identifying how to make nutrition research a bigger priority than it currently is.

There is a substantial geographic concentration of research in Latin America with Brazil, Mexico and Chile accounting for the majority of the research pertaining to childhood obesity prevention. Regional collaboration is currently limited, but the opportunity for capacity building led by Brazil, Mexico and Chile is clear. Mechanisms and initiatives such as the UnitedHealth and the National Heart, Lung, and Blood Institute's Collaborating Centers of Excellence in Latin American countries appear to have facilitated collaboration between research institutions. Programmes like these are crucial for building the research and training infrastructures needed to conduct research across the region (17,18). Another similar successful model

for collaboration from Latin America is the Guide for Useful Interventions for Physical Activity in Brazil and Latin America Project, which drew upon resources from the USA and Brazil, partnering academic and government institutions to successfully conduct physical activity research in Latin America (19,20). Initiatives such as these should be prioritized and supported in order to reduce the large gap between the few countries in the region with substantial research productivity and the majority of countries with limited capacity and productivity. Given their large populations, relative wealth and strong universities, Argentina and Colombia are surprisingly under-represented in published research on childhood obesity prevention. This is likely due to the limited opportunities for advanced training, postgraduate degrees and research funding in both countries.

There is a dearth of partnerships and collaborations within the region. Despite the large number of publications, few articles had authors from multiple countries. Given the similarities in terms of challenges and research agenda across the countries (16), it may be useful for researchers from different countries to collaborate to target some of the obvious gaps in research related to childhood obesity prevention. By working together, institutions not only build their own capacity but they also promote a research environment conducive to multidisciplinary collaboration. In addition, when establishing cross-national partnerships and collaborations, countries and research institutions are better able to leverage financial and human resources. Harnessing complementary expertise from different institutions may also facilitate learning from each other and cross-fertilizing of lessons learned in different settings and populations within the region. Examples of this type of collaboration can be seen in the areas of communicable diseases and HIV in Africa (21).

Several other limitations in capacity building may contribute to the lack of development of childhood obesity research in Latin America. Deficient English language proficiency, the primary language for high impact factor peer-reviewed publications, is a significant barrier for communicating and disseminating research findings (22). Without proper training, it is difficult to obtain, process or analyse quality data, which further curbs productivity. Although progress has been made in the last decade, it is still not common for professionals in Latin America to undertake more specialized training and obtain the postgraduate degrees that provide the necessary training for analysing data and conducting research. This is in part due to a lack of incentives in the professional world, both in terms of economic reward and in recognition and support at the work place, as evaluation and research are not always valued or emphasized. Some of these limitations result from budgetary restrictions, undervalued intervention evaluation and inability to publish in international recognized journals. A common observation among researchers working in the region is that even when data are collected and projects are complete, all too often the results are not published.

Childhood obesity is a complex, multifactorial issue that requires multidisciplinary approaches and methods (e.g. spatial epidemiology, economics, sociology, policy science, anthropology and behavioural sciences) beyond traditional epidemiological and efficacy trials. One of Latin America's strengths is addressing childhood obesity in multidisciplinary centres and departments. This is partly due to the relatively recent recognition of childhood obesity as a problem. In this sense, the academic and medical communities have had to be resourceful in order to face this new phenomenon. Examples include the Pan-American Health Organization and Food and Agriculture Organization's recent recognition of Chile for efforts in combating childhood obesity with a mixture of non-traditional research and evaluation interventions and methods (23), and Brazil and Mexico's work to address obesity through consumer education, fiscal measures, civil society engagement, media and advertising restrictions and public campaigns strategies (24–27). Encouraging the development of multisector teams and broadening them to include media, economics and many other fields will be essential for future research and evaluations. Together, they will move translational work and implementation science to a new level. These intersections, interactions and opportunities will require researchers to become familiar with designing and evaluating complex interventions (28–30) and learning to synthesize evidence (31). Multidisciplinary approaches that examine nutrition and physical activity together have the best potential to improve understanding of the multiple influences on healthy behaviours and obesity prevention and how they may operate differently in various populations.

## Study limitations

Several limitations need to be acknowledged in the current review. An ideal examination of research capacity in Latin America would utilize data sources from across the region that included information on the components of capacity building. However, with standardized data across the countries in the region difficult to come by, we were restricted to indexed peer-reviewed publications as an indicator for research capacity. First, a lack of data and low representation of some of the countries in the region limits the generalization of the results. Second, reliance on published studies only is missing work that is completed but not yet published. Third, there was difficulty in delineating the correlate studies primarily focused on descriptive data that included some measures of association from the correlate studies focused on understanding modifiable determinants of health behaviours, which could be expected to guide intervention research and strategies. A few of these correlate studies were classified in the other category, which may limit the specificity of our results.

Given the growing concern for the increasing prevalence of childhood obesity in Latin America and the need to document the current state of the problem and design successful prevention and intervention efforts, there is a clear demand for increasing research capacity and extending studies from the merely observational to intervention and policy analyses. While adequate research funding and generating well-trained investigators are fundamental conditions for capacity building, our data show that there is still limited interaction among existing groups within and across countries. Efforts to foster data sharing and scholar exchange can be started immediately and should be a component of any strategic capacity building plan. This interaction is also essential to permit smaller countries, with limited resources, to participate in multi-country studies and develop their own team of qualified scientists.

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### Conflict of interest statement

The Fogarty International Center at the US National Institutes of Health sponsored travel for each, non-local author to attend the “Preventing Childhood Overweight and Obesity in Latin America: Linking Evidence to Policy and Practice” workshop, the precursor for this article. The following author declares a further conflict of interest as specified in his ICMJE disclosure: Benjamin Caballero.

The content is solely the responsibility of the authors and does not necessarily represent the official views of the US Department of Health and Human Services, the National Institutes of Health or the Fogarty International Center.

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