Physical activity programs for elderly persons: an evaluation of Brazilian scientific production using the RE-AIM framework

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Abstract

The RE-AIM framework is a model that analyzes both the external and internal validity of health programs. It proposes that programs should be evaluated based on five key dimensions: reach, effectiveness/efficiency, adoption, implementation and maintenance. The aim of the present study was to conduct a systematic review of physical activity programs for elderly persons published in Brazilian scientific literature using the RE-AIM framework. A total of 26 articles included in four scientific databases from 1993 to 2013 were identified and coded using a validated 52-item RE-AIM abstraction tool. Using the RE-AIM dimensions, indicators of reach (47.2%), effectiveness (36.3%), and implementation (27.5%) were reported more often than indicators of adoption (6.4%) and maintenance (4.7%). Only two articles were included in all five RE-AIM dimensions. Despite the increasing number of interventions targeting the elderly, few address the dimensions proposed by the RE-AIM framework, reducing their potential generalizability outside their original settings, and their overall external validity.

Key words: Physical Exercise; Elderly; Health.

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INTRODUCTION

Brazil's demographic profile reveals a largenumber of elderly persons, amounting to 10% of the country's total population according to the Synthesis of Social Indicators, with projections indicating a likely increase in that percentage to in excess of 22.7% by 2050.[2]

In view of this demographic profile, there has been an observable increase in the number of scientific studies investigating the relationship between healthy ageing and regular physical activity.[3,4]This increase can be credited to the fact that regular physical activity has positive effects on health and the prevention and control of chronic diseases such as diabetes mellitus type II, arterial hypertension and coronary artery disease,[5-7]as well as aiding improvements in mental health[8]and metabolic profile,[10]a reduction in cognitive decline[9]and a reduction in mortality from non-communicable diseases,[6]cardiovascular diseasesand indeed from all causes.[11]

There are a growing number of studies regarding guided intervention in the practice of regular programs of physical activity for the elderly. These publications are characterized by being conducted in a clinical, controlled environment and with motivated participants. However, studiesthat report results concerning either the external or the internal validity of the programs are rare.[12]Thisissuemust be investigatedif these programs are to be implemented in reality.

The RE-AIM model proposed by Glasgow et al. is an evaluation method that aims to analyze both the internal and external validity of health programs.[13]This model has been used in literature as a means of evaluation for studies of the systematic review of scientific articles, as in works by Antikainen & Ellis,[12] Allen et al.[14]and Kessler et al.[15] It was recently translated and culturally adapted for the Brazilian context by Almeida et al.[16]

One characteristic of the RE-AIM model is itsbroad analysis of the impact of health promotion programs, evaluating the impact of a given activity in five dimensions: reach (absolute number and proportion of the targeted audience attended to, as well as therepresentation of this audience in the program andthe evaluation of its characteristics); efficiency/effectiveness (a final outcome of the program's implementation, where its positive and negative effects are checked along with quality of life and economic results); adoption (the number and profile of staff and practitioners and of the plans to be adopted in the intervention);implementation (faithfulness to the principles of the intervention shown on the part of organizations and subjects); and maintenance (how the program continues after its implementation - Glasgow et al.;[13] Almeida et al.[16]).

Given the above, the aim of this paper was to carry out a systematic review, based on the RE-AIM model, of Brazilian scientific articles that utilized regular programs of physical activity for the elderly.

MATERIALS AND METHOD

In the selection of databases, those with the largest volumeof publications by Brazilian scientists were chosen. These were the following: PubMed, Virtual Health Library (VHL), SciELO and Scopus with a scope of January 1993 to August 2013 (the period in Brazil with the highest level of population aging[2]).

Inthe selection of articles, the following descriptors were employed: *motor activity, physical activity, locomotor activity, aged, elderly, intervention* and *Brazil*,previously consulted in the Descriptors of Health Sciences (DeCS) and Medical Subject Headings (MeSH).Thus, the terms were combined as follows: motor activity OR physical activity OR locomotor activity AND aged OR elderly AND intervention AND Brazil.

The following were adopted as inclusion criteria: a) studies involving individuals aged 60 yearsor over; b) studies published between January 1993

and August 2013; c) interventions involving regular programs of physical activity; d) articles published in English, Portuguese and/or Spanish; e) studies that applied some type of intervention (traditional or educational, for example) which involved the practice of regular programs of physical activity for the elderly. In terms of exclusion criteria, studies involving the following in their methodology were ruled out:meta-analysis, systematic review, literature review or observational study.

After a data search, as shown in Figure 1, 174 articles were found: 23 in VHL, 58 in PubMed, 19 in SciELO and 74 in Scopus.After reading of the titles, 51 were selected to have theirabstractsexamined. Of these, 26 articles were included for detailed reading based on the adopted inclusion criteria. The selection of articleswas madeafterseparate analysis by three evaluators, withthe agreement of at least two required before an article was chosen.

The principalexclusion criteriathat resulted in the removal of most studies were: duplicate studies across two or more databases, observational studies and studies based onsystematic review, meta-analysis or literature review.Accordingly, a total of 20 articles published in VHL, 45 from PubMed, 9 from SciELO and 73 from Scopus were excluded, as shown in Figure 1.

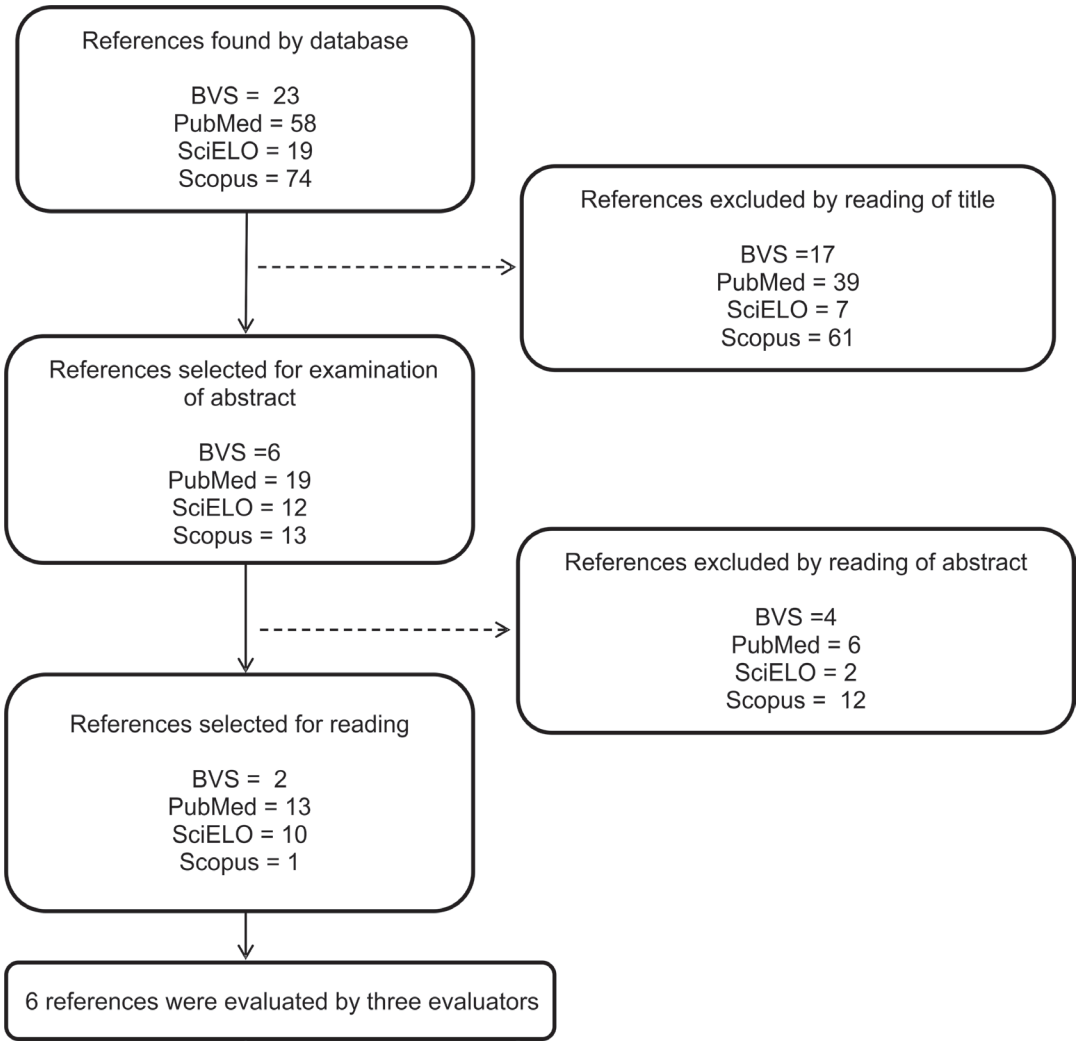

Figure 1. Flowchart of the article selection process for the period 1993-2013. Jequié, BA, 2014.

For analysis of the 26 articles, the codifying tool previously validated by Arkers et al. was used, with its aim being to evaluate the five dimensions of RE-AIM model:reach, effectiveness/efficiency, adoption, implementation and maintenance. The method used for the selection of articles was also adopted for this codifying process. For analysis of the data, descriptive statistic procedures (single frequency, percentage) were employed using the*SPSS 16.0* program.

RESULTS

The 26 articles demonstrated a certain tendency, as shown in Table 1. With a mean age of 69.45 (±6.33) years and great variability in the number of individuals (a minimum of eight and a maximum of 100 participants). The majority of the studies were of a quantitative variety, utilized a control group in an experimental model, weredeveloped in controlled environments (laboratories and/or universities) and came from the southeast region of the country(the most economically developed area of Brazil).

Table 1. Details of the scientific articles analyzed. Jequié, BA, 2014.

Author	Type of study	Control Group	n	Study location	Study region
Benedetti et al.(2012)[18]	Quantitative-Qualitative	Yes	100	Community	South
Bonganha et al.(2012)[19]	Quantitative	Yes	32	University	Southeast
Burke et al.(2010)[20]	Quantitative	Yes	33	University	Southeast
Canonici et al.(2012)[21]	Quantitative	Yes	32	Laboratory	Southeast
Caromano et al.(2006)[22]	Quantitative	Yes	20	Laboratory	Southeast
Castro et al.(2007)[23]	Quantitative	No	70	Community	Southeast
Cavalcante et al.(2011)[24]	Qualitative	No	18	Community	Northeast
De Araújo et al.(2013)[25]	Quantitative	Yes	28	Community	Centre-west
Fernandes et al.(2012)[26]	Quantitative	No	8	-	Northeast
Ferreira et al.(2008)[27]	Quantitative	No	401	Community	Southeast
Fonseca et al.(2012)[28]	Quantitative-Qualitative	No	21	Community	Southeast
Gobbi et al.(2009)[29]	Quantitative	No	34	Laboratory	Southeast
Hernandez et al.(2010)[30]	Quantitative	Yes	16	Laboratory	Southeast
Ide et al. (2005)[31]	Quantitative	Yes	59	University	South
Lustosa et al. (2011)[32]	Quantitative	Yes	32	-	Southeast
Lustosa et al. (2013)[33]	Quantitative	Yes	32	Laboratory	Southeast
Machado et al. (2013)[34]	Quantitative	No	20	Community	Southeast
Nascimento et al. (2013)[35]	Quantitative	Yes	42	Laboratory	Southeast
Raso et al. (2007)[36]	Quantitative	No	14	Laboratory	Southeast
Renno et al. (2005)[37]	Quantitative	No	20	Community	Centre-west
Sá et al. (2012)[38]	Quantitative	Yes	32	Laboratory	Southeast
Santana et al. (2012)[39]	Quantitative	Yes	32	Laboratory	Southeast
Stella et al. (2011)[40]	Quantitative	Yes	20	Laboratory	Southeast
Tanaka et al. (2009)[41]	Quantitative	No	94	Laboratory	Southeast
Ueno et al. (2012)[42]	Quantitative	Yes	27	Laboratory	Southeast
Vale et al. (2009)[43]	Quantitative	Yes	35	University	Northeast

Reach

After a review of the literature, we found that an average of 47.2% of the reach indicators were presentinthe studies evaluated. Among the categories evaluated "sample size" (100%), "inclusion criteria" (96.2%) and "exclusion criteria" (96.2%) were the most reported. In contrast, the "cost of recruitment of participants" and "use of qualitative criteria for measuring reach" indicators were not reported in any of the evaluated studies (Table 2).

Table 2. Indicators for the *reach* dimension from the RE-AIM model of the analyzed studies. Jequié, BA, 2014.

Reach	%
Description of the target population	30.8
Demographic and behavioral information regarding the target population	26.9
Method of identification of the target population	50.0
Recruitment strategies	42.3
Inclusion criteria	96.2
Exclusion criteria	96.2
Number of personseligible forand invitedto recruitment	42.3
Sample size	100
Participation rate	34.6
Cost of recruitment	0
Use of qualitative methods to assess reach	0

Effectiveness/Efficiency

On average, 36.9% of the indicators of effectiveness/efficiency were present, with 100% of the studies providing "reports of the primary results" and a "report of the mediators," but none providing information regarding the "negative consequences" and "cost–effectiveness" categories (table 3).

Table 3. Indicators for the *effectiveness/efficiency* dimension from the RE-AIM model of the studies analyzed. Jequié, BA, 2014.

Effectiveness/Efficiency	%
Report of primary results	100
Report of mediators	100
Report ofmoderators	24.0
Intention of treatment or monitoring	26.9
Quality of life measurements	26.9
Measurement of unintended consequences (negative) in the results	0
Percentage of dropouts (at the program's conclusion)	34.6
Cost-effectiveness	0
Use of qualitative methods to assess the effectiveness/efficiency	20.0

Adoption

Adoption was analyzed both at an organizational level and at a staff level. A limited percentage of articles (n=10) met at least one of the adoption criteria, with on average 7.6% of the organizational adoption indicators and 4.9% of staff adoption indicators being attended to. In terms of the evaluation of adoption at the organizational level, the most frequently cited categories were "number of participants" (19.2%) and "description of the target site" (15.4%); at the group levelthe category "staff training" (18.7%) was that referred to most among the studies analyzed. However, the categories of "participation rate" and "measurement of adoption cost" were not cited in any of the studies (Table 4).

Table 4. Indicators for the *adoption* dimension from the RE-AIM model of the analyzed studies. Jequié, BA, 2014.

Adoption	%
Organizational Level	
Number of persons eligible and invited	3.8
Number ofparticipants	19.2
Participation rate	0
Description of the target site	15.4
Criteria for inclusion/exclusion of scenarios	7.7
Description of the site of the intervention	7.7
Method of identification of the scenario	7.7
Average number of people served by the scenario	0
Staff Level	
Number of persons eligible and invited	3.8
Members of the total group who agreed to participate	7.7
Participation rate	0
Method for identification of the delivery agent to the destination	3.8
Agent's knowledge level	15.4
Criteria for inclusion/exclusion of agents	3.8
Measurement of adoption cost	0

Implementation

Findings regarding the extent of implementation of the programs indicated that 27.5% of the indicators were reported in the studies.The "number of intervention contacts" (76.9%), the "period of contacts" (68%) and the "duration of contacts" (60%) were the most cited categories. The category "consistency in implementation across scenarios and enforcement officers" was not reported in any study (Table 5).

Maintenance

Maintenance was the least reported dimension across the studies analyzed, with on average only 4.7% of its indicators reported. When analyzing this category at its two levels (individual and organizational), it was found that 10.3% of studies reported information regarding maintenance at an individual level (most cited category: "dropouts", at 15.4%)and 1.9% regarding maintenance at the organizational level (table 6).

Table 5. Indicators for the *implementation* dimension from the RE-AIM model of the analyzed studies. Jequié, BA, 2014.

Implementation	%
Theories	7.7
Number of contacts of the intervention	76.9
Period of the contacts	68.0
Durationof the contacts	60.0
Measure of whether the protocol was performed as expected	3.8
Consistency in implementation across scenarios and enforcement officers	0
Rates of attendance/completion of the participants	19.2
Measures of cost	3.8
Use of qualitative methods to measure implementation	7.7

Table 6. Indicators for the *maintenance* dimension from the RE-AIM model of the analyzed studies. Jequié, BA, 2014.

Maintenance	%
Individual Level	
Was individual behavior evaluated at some point after the intervention's completion? (duration of observation)	7.7
Drop outs	15.4
Use of qualitative methods to assess individual maintenance	7.7
Organizational Level	
Report regarding alignment with the organization's mission	3.8
Is the program still in operation?	3.8
If no: Reasons for discontinuation	0
If yes: was the program has been modified? Be specific	3.8
Was the program institutionalized?	0
Waste	0

By individually examiningthe studies, as shown in Table 7, it was found that 11 articles attended to more than 50% of the reachcategories, while only three attended to more than 50% from the effectiveness/efficiency dimension. It should be noted that: a) in the dimension of*adoption at organizational level*, eight articles attended to at least one element of the checklist, with an emphasis onthe study by Benedetti et al. which included 75% of the items proposed in the RE-AIM model; b) in the dimension of*adoption at staff level,*only four studies presented an affirmative question; c) in the dimension of *implementation,* most studies referred to only three of the nine analysis items; d) in the dimension of *maintenance*on an individual level, the study by Caromano et al. study stood out,[22] presenting 100% of the items; e) in the*maintenance* dimension*,* only the study by Benedetti et al.[18] included the organizational level,attending to 50% of the total codification items. Thus, it was observed that the study by Benedetti et al.[18]best attended the RE-AIM model, referring to 35 items (66%) of

the model's codification list,[17,44]and indeed in its reachutilized part of this model. The study by Gobbi et al.[29]least attended to the codification evaluated, with reference made to just seven categories.

Table 7. Detailing the percentage per article of conformity to the dimensions of the RE-AIM model. Jequié, BA, 2014.

References	R (%)	E (%)	Ao (%)	As (%)	I (%)	Mi (%)	Mo (%)
Benedetti et al.(2012)[18]	63.6	66.7	75.0	71.4	66.7	66.7	50.0
Bonganha et al.(2012)[19]	45.5	33.3	0	0	33.3	0	0
Burke et al.(2010)[20]	54.6	44.4	12.5	0	33.3	0	0
Canonici et al.(2012)[21]	27.3	33.3	0	0	44.4	0	0
Caromano et al.(2006)[22]	27.3	33.3	0	0	0	100	0
Castro et al.(2007)[23]	45.5	33.3	0	0	11.1	0	0
Cavalcante et al.(2011)[24]	45.5	55.6	0	0	22.2	0	0
De Araújo et al.(2013)[25]	36.4	22.2	0	0	33.3	0	0
Fernandes et al.(2012)[26]	36.4	33.3	0	0	44.4	0	0
Ferreira et al.(2008)[27]	81.8	44.4	12.5	14.3	22.2	66.7	0
Fonseca et al.(2012)[28]	63.6	33.3	0	0	0	0	0
Gobbi et al.(2009)[29]	9.1	22.2	12.5	0	33.3	0	0
Hernandez et al.(2010)[30]	36.4	33.3	0	0	11.1	0	0
Ide et al.(2005)[31]	54.6	44.4	12.5	0	33.3	0	0
Lustosa et al.(2011)[32]	54.6	33.3	12.5	0	33.3	0	0
Lustosa et al.(2013)[33]	27.3	22.2	0	0	33.3	0	0
Machado et al.(2013)[34]	72.7	66.7	50.0	0	0	0	0
Nascimento et al.(2013)[35]	54.6	33.3	0	0	11.1	0	0
Raso et al.(2007)[36]	45.5	33.3	0	0	33.3	0	0
Renno et al.(2005)[37]	81.8	33.3	0	0	22.2	0	0
Sá et al.(2012)[38]	54.6	44.4	12.5	28.6	33.3	0	0
Santana et al.(2012)[39]	36.4	22.2	0	0	22.2	0	0
Stella et al.(2011)[40]	36.4	44.4	0	0	33.3	33.3	0
Tanaka et al.(2009)[41]	36.4	33.3	0	14.3	44.4	0	0
Ueno et al.(2012)[42]	54.6	22.2	0	0	11.1	0	0
Vale et al.(2009)[43]	27.3	33.3	0	0	33.3	0	0
Total (%)	46.5	36.8	7.7	5.0	26.9	10.3	1.9

R= reach; E= efficiency/effectiveness; Ao= adoption – organizational level; As= adoption – team;

I= implementation; Mi= maintenance – individual level; Mo= maintenance– organizational level.

DISCUSSION

A high percentage of Brazilian studies presented interventions based onregular programs of physical activity for the elderly.These are studies of a quantitative nature,predominantlyfeaturing traditional interventions with a control group design which, in the majority of cases, demonstrated the effectivenessof the programs in terms ofimprovements made in aspects of physical fitness, for example, cardiorespiratory improvement,[39]improved muscle strength[33]and posturalimprovement among elderly persons with osteoporosis.[20]

Other common characteristics featured in themajority of the studies includedthe strict control of variables, since the majoritywere carried out in laboratories or universities, and sample homogeneity, with the aim of ensuring the programs' internal validity.[45]However, due to this reductionist characteristic for the control of variables, this type of study is difficult to reproduce in reality.[45,46]This is one of the reasons whythe studies tentatively contemplated the items proposed in the codification of the RE-AIM model, especially with regard to the adoption and maintenance dimensions. Antikainen & Ellis[12] pointed out that few physical activity intervention programs include the dimensions proposed in the RE-AIM framework, and information regarding the external validity of these studies is scarce.

Among the studies analyzed, thatby Benedetti et al.[18]best attended the five dimensions of the RE-AIM model(despite only referring to66% of the total categories),featuring dialogue regarding both quantitative and qualitative measures, with execution occurring in the community itself.

It is worth noting that the reach dimension(46.5%) was better attended than that of effectiveness/efficiency (36.8%), since most of the research analyzed came from a position of reductionist scientific logic.[45,46]However, as a resultof this inversion,issues such asthe qualitative method, unintended outcomes and cost-effectiveness are little discussed, in line with the scientific proposals adopted by most of the researchers. This data contrasts with the analysis of programs that utilize interventionsusingthe theories based onphysical activity conducted by Antikainen & Ellis,[12]or in other words,the studies analyzed by the authors reported more informationregarding the effectiveness/efficiency of interventions, even if on a superficial level, than of theirreach.

There is also the fact that the studies did not show figures for the cost-effectiveness of the program in any dimension, with the exception ofthe study by Benedetti et al.,[18] which attended to the "Cost Measures" categoryin the implementation dimension.The cost-effectiveness relationship is an important element for interventions that are incorporated into the BrazilianSistema Único de Saúde("Unified Health System"),[47]in which funding acts as a major constraint to the effectiveness of public policies.For Silva,[47]the ideal scenario for public health in Brazil is to strike a balance between the effectiveness of a program and its cost, with the technique with thehighest level of effectiveness and lowest level of cost being chosen.

It should alsobe noted that while the present study aims to initiate discussion regarding the reality ofBrazilian studies of intervention programs through regular programs of physical activity for the elderly, it possesses some limitations. These includea) analysis of the programs using the RE-AIM model was conducted usingthe reports of the articles. In this case, it is possible that these articles are part of a larger study and, therefore, may not reflect the entire research project; and b) the restriction on the number of databases selected. The selection,made from just four databases, may not have incorporatedstudies which presentedexternal validation, for example.

However,despite these limitations, the results yielded were similar to those from other studies conducted with different populations[12,14]in which the adoption and maintenance dimensions were also little reported.

CONCLUSION

It appears that articles regarding the intervention of regular programs of physical activity for the elderly in Brazil have advanced from the point of view of understanding their effects on a homogeneous group. However, observing each dimension of the RE-AIM model, it was found that less than 50% of the categories from each dimension were attended to by the articles. These findings are reflected in the impracticality of other researchers or organs reproducing these physical activity programs.

Accordingly, there is a notable lacuna in Brazilian scienceas regards the study of dissemination and implementation of programs of physical activity for the elderly, and therefore studies aimed at ensuring the development of common practices and policies should be encouraged, thus ensuring the publication of externally validated studies, facilitating an expansionin the analysis of interventions aimed at the incorporation of these interventions in different contexts.

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