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ORIGINAL RESEARCH

Alberta infant motor scale in Brazilian research: a bibliometric study

Alberta infant motor scale em pesquisas brasileiras: estudo bibliométrico

Escala Motora Infantil de Alberta en la investigación brasileña: un estudio bibliométrico

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ABSTRACT | The Alberta infant motor scale (AIMS) is an instrument for assessing the gross motor development of newborns, aged 0–18 months. This study aimed to summarize the Brazilian studies that used the AIMS and identify their objectives to know the main uses of the scale for professionals interested in child motor development. This is a bibliometric study on SciELO, PubMed, Scopus, and Web of Science databases. The searched keywords were "Alberta infant motor scale" and "Brazil," with their equivalents in Portuguese and united by "AND." Inclusion criteria were: use of AIMS with children aged 0–18 months carried out in Brazil. The variables database, journal, year of publication, language, region of the institution linked to the authors, and type of study were analyzed in a descriptive quantitative manner. Content analysis was performed on the objectives described in the articles. In total, 79 articles were included and most of them had a cross-sectional design and were linked to institutions in the South and Southeast regions. Furthermore, most studies were from the last 10 years and in English. The journal *Fisioterapia e Pesquisa* was the Brazilian journal that most published studies of the sample. The analyzed objectives were distributed into six word classes, with two large groups: psychometric validity (19.1%) and evaluative studies (80.9%). The latter considered the various child populations analyzed. We presented studies that used the AIMS to evaluate the motor development of Brazilian children, reinforcing the importance of this instrument in the national context and also encouraging its use.

Keywords | Developmental Disabilities; Child Development; Scientific Research and Technological Development; Review.

RESUMO | A *Alberta infant motor scale* (AIMS) é um instrumento de avaliação do desenvolvimento motor grosso dos recém-nascidos entre 0 e 18 meses de idade. Este estudo buscou sumarizar as pesquisas brasileiras que utilizaram a AIMS e identificar seus objetivos, a fim de fornecer um quadro das principais utilizações da escala aos profissionais interessados no desenvolvimento motor infantil. Trata-se de um estudo bibliométrico realizado por meio de buscas nas bases de dados SciELO, PubMed, Scopus, e Web of Science. Os descritores foram "escala motora infantil de Alberta" e "Brasil", com seus equivalentes em inglês, unidos pelo termo booleano "*AND*". O critério de inclusão foi a utilização da AIMS no Brasil, com crianças de 0 a 18 meses. As variáveis base de dados, revista, ano de publicação, idioma, região da instituição vinculada aos autores e tipo de estudo foram analisadas de forma quantitativa descritiva. Foi realizada análise de conteúdo dos objetivos descritos nas pesquisas, e foram incluídos 79 estudos, a maioria dos quais apresentou delineamento transversal e estava vinculada a instituições das regiões Sul e Sudeste. Boa parte das publicações era dos últimos 10 anos, em inglês, e a revista *Fisioterapia e Pesquisa* foi o periódico nacional

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que mais publicou estudos referentes à amostra. Os objetivos analisados foram distribuídos em seis classes de palavras, contidas em dois grandes grupos: validades psicométricas (19,1%) e estudos avaliativos (80,9%). Este último considerou as várias populações infantis analisadas. O estudo apresentou as pesquisas que utilizaram a AIMS para avaliar o desenvolvimento motor de crianças brasileiras. Isso reforça a importância deste instrumento no contexto nacional, além de estimular sua utilização.

Descritores | Deficiências do Desenvolvimento; Desenvolvimento Infantil; Pesquisa Científica e Desenvolvimento Tecnológico; Revisão.

RESUMEN | La Escala Motora Infantil de Alberta (AIMS) es un instrumento que evalúa el desarrollo motor grueso de los recién nacidos de entre 0 y 18 meses de edad. Este estudio pretendió hacer una síntesis de estudios brasileños que utilizaron la AIMS, así como identificar sus objetivos, con el fin de proporcionar una tabla de los principales usos de la escala a los profesionales interesados en el desarrollo motor infantil. Se trata de un estudio bibliométrico, en el que se realizaron búsquedas en las bases de datos SciELO, PubMed, Scopus y Web of Science. Los descriptores utilizados fueron "escala motora infantil de Alberta" y "Brasil", con sus equivalentes en inglés, unidos por el término booleano "*AND*". El criterio de inclusión fue la aplicación de la AIMS en Brasil, con niños de entre 0 y 18 meses. Las variables base de datos, revista, año de publicación, idioma, región de la institución vinculada a los autores y tipo de estudio se analizaron de manera cuantitativa y descriptiva. Se realizó un análisis de contenido de los objetivos descritos en los estudios, y se incluyeron 79 estudios, de los cuales la mayoría presentó un diseño transversal y estaba vinculado a instituciones de las regiones Sur y Sudeste de Brasil. La mayoría de las publicaciones son de los últimos 10 años, en inglés, y la revista *Fisioterapia e Pesquisa* fue la revista nacional que más publicó estudios. Los objetivos analizados se dividieron en seis clases de palabras, que contienen dos grupos principales: validez psicométrica (19,1%) y estudios evaluativos (80,9%). Este último tuvo en cuenta las diversas poblaciones infantiles analizadas. Este estudio presentó las investigaciones que evaluaron la AIMS respecto al desarrollo motor de los niños brasileños. Esto destaca la importancia del citado instrumento en el contexto nacional, además estimula su uso.

Palabras clave | Discapacidades del Desarrollo; Desarrollo Infantil; Investigación Científica y Desarrollo Tecnológico; Revisión.

INTRODUCTION

The first months of the child's life are characterized by sensorimotor development. Thus, the lack of stimuli in this phase may delay the acquisition of essential motor skills and, consequently, in child development[1]. Therefore, standardized and validated tools for the assessment of these skills are widely used by health professionals for the surveillance of child development, as they provide the quantification of children's motor performance, which is compared with pre-established norms regarding their peers[2].

The Alberta infant motor scale (AIMS) is an instrument for assessing the gross motor development of full-term and preterm newborns aged from 0 to 18 months (38 weeks of gestational age to 18 months of corrected age or independent gait). Professional's observation provides information about the spontaneous repertoire of children's motor skills[3]. The AIMS has 58 items, divided into the following subscales: prone (21 items), supine (9 items), sitting (12 items), and standing (16 items). Each item from the subscales must be recorded based on the observation of the spontaneous description of the child's movements. The scale presents crude scores, percentiles, and categorization of motor performance as: normal (>25%), suspicious (25–5%), and atypical (<5%)[4].

Even 25 years after its publication, AIMS is still widely tested[5]. In Brazil, AIMS proved to be an efficient, reliable, and consistent tool to assess children's motor development, with predictive and discriminating power of significant delays[6]. Among the many facilities of access and use, the reasons that justify its wide use are little time needed for the application (10–30 minutes), it does not require specific materials, it is cheap, and little handling required from the child[1,7].

Motor assessment based on AIMS has guided several types of studies, especially in Brazil, whether to formulate situational diagnoses or to evaluate intervention strategies[6,8]. Although AIMS stands out

among the most used protocols for the evaluation of Brazilian children, the literature does not show quantitative surveys of the studies that used the scale. This analysis may provide essential data on the applicability and reliability of AIMS in many research centers and in different Brazilian regions. Thus, this bibliometric study aimed to summarize the Brazilian studies that used AIMS and its findings in important databases, contributing to future studies on motor development and the performance of the professional, who may use this scale to intervene in child development.

METHODOLOGY

This is a bibliometric study, with quantitative (descriptive) and qualitative (content analysis) survey, on the scope of Brazilian studies that used the Alberta infant motor scale (AIMS). The searches were performed by two reviewers, at different and independent times, in March and April 2022, in the databases SciELO, PubMed, Scopus, and Web of Science. The searched keywords were: "Alberta infant motor scale," "Brazil," "*escala motora infantil de Alberta*," and "*Brasil*." The Boolean term "AND" was used in all searches, both in English and in Portuguese.

The investigation focused on original studies with cross-sectional, longitudinal, and methodological design, which used the scale and were published from 1994 (publication year of the scale) onward, in any language. The inclusion criteria were using AIMS as an instrument to assess motor development; inclusion of children aged from 0 to 18 months; and studies carried out in Brazil. The last criterion was chosen due to the need to know the evaluation of the motor development of Brazilian children to come up with plans to cope with motor delays that specifically affect this population. Systematic reviews were excluded from the study.

Research and initial screening were carried out based on the reading of title and abstract of the studies that were found by the keywords in the different databases, excluding the duplicates and applying the proposed inclusion and exclusion criteria. Then, the full texts were obtained to be read in full. Studies in which inclusion criteria were not explicit were also fully examined.

An electronic spreadsheet was prepared to catalog the studies data, with the following information: database; title; journal; year of publication; language; Brazilian region; authors; institution; objective; design; results; and conclusions. The study design was subdivided into longitudinal (longitudinal, clinical, experimental, and/or quasi-experimental trials) and cross-sectional (cross-sectional, methodological, reports, case, and exploratory studies)[9]. Studies on the development, validation, and evaluation of research tools and methods were considered methodological research[10]. The language identified in the spreadsheet refers to the one found in the databases, not excluding publications in another language. Regarding the related institutions and their respective Brazilian regions, the first Brazilian institution linked to the authors was considered, in the sequence of authorship.

Descriptive analysis was used to present absolute and relative frequencies of the variables "design," "database," "journal," "year of publication," "language," and "region." Data related to the objectives were examined by content analysis[11]. In the creation of the textual corpus, the terms "motor development" and "newborns" were grouped into a single term, respectively as follows: *desenvolvimento_motor* and *recém_nascidos*. For the grouping, the Interface de R pour les Analyses Multidimensionnelles de Textes et de Questionnaires program (IRaMuTeQ) was used[12].

Then, two specific types of analyses were performed: analysis of specificities, aiming to verify the differences in evocations (considering the incidence of words frequency and their hypergeometric indexes) between the objectives of the studies in variable function to the region of Brazil; and descending hierarchical classification (DCH), to recognize the dendrogram with emerging classes, in which, the higher the χ^2, the more associated the word is with the class, disregarding the words with $\chi^2<3.80$ ($p<0.05$).

RESULTS

In total, 181 studies were found; however, after the reading stage, only 79 studies constituted the final sample. Figure 1 shows the flowchart of screening and selection of articles.

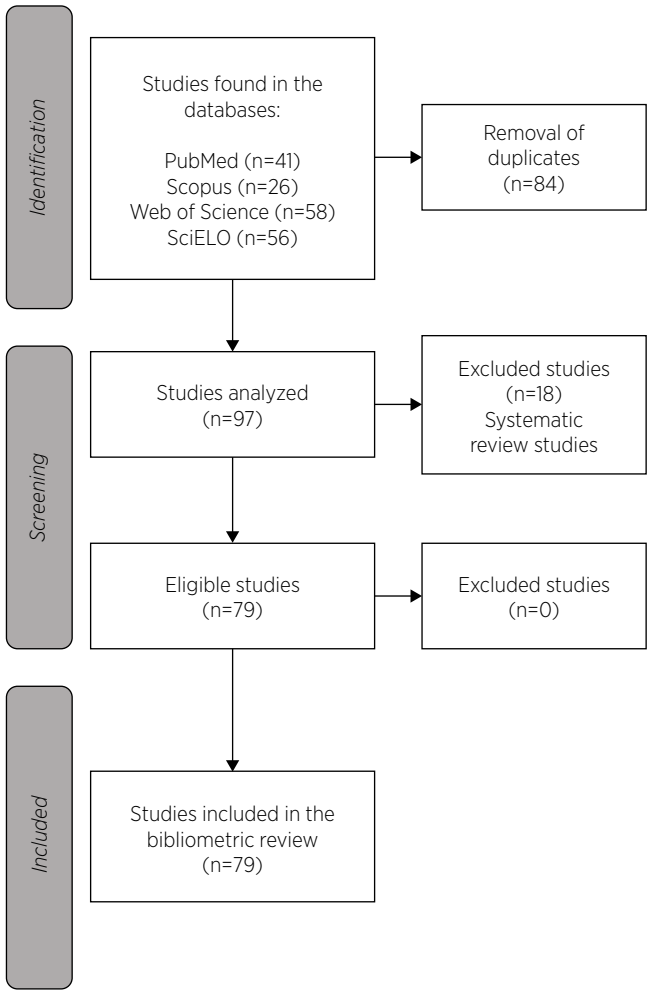


Figure 1. Flowchart of identification and selection of studies from the literature review
Source: Adapted from Page et al.[13].

In total, 45 (57%) studies were published in English and 34 (43%) in Portuguese, which were published in 37 journals. Of these, 18 (48.6%) are Brazilian journals, in which 50 (63.3%) studies were published, and 19 (36.7%) international journals, in which 29 (36.7%) studies were published. The Brazilian journals with the highest number of publications were *Fisioterapia e Pesquisa* (n=14) and *Fisioterapia em Movimento* (n=7), and the international ones were *Pediatrics International* (n=4) and *Research in Developmental Disabilities* (n=3). The selected studies were published from 2006 onward (Figure 2).

Figure 3 shows the frequencies of studies linked to the regions where the authors' institutions are located. Furthermore, the evocations in the objectives of the studies were compared and described by the analysis of specificities, considering the frequency of incidence of words and their hypergeometric indexes, among the regions of Brazil.

Regarding the studies design, the following were recorded: 27 (34.2%) longitudinal, 25 (31.7%) cross-sectional, 16 (20.2%) methodological, 4 (5%) clinical trials, 3 (3.8%) experimental and/or quasi-experimental, 2 (2.5%) reports, 1 (1.3%) case study, and 1 (1.3%) exploratory study. Longitudinal studies had the highest frequency in the sample, of which 15 (55.6%) are from institutions in the Southeast, 8 (29.6%) from the South, 2 (7.4%) from the Midwest, and 2 (7.4%) from the Northeast. Regarding the clinical trials (n=4), 3 (75%) were from institutions in the South and 1 (25%) from the Southeast. Of the experimental and quasi-experimental studies (n=3), 2 (66.6%) were from the South and 1 (33.3%) from the Southeast (Supplementary Chart 1).

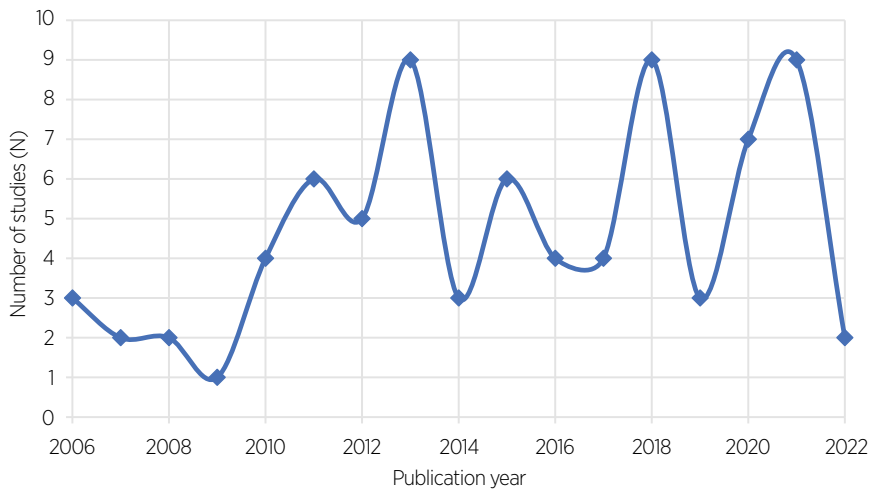


Figure 2. Number of studies published per year

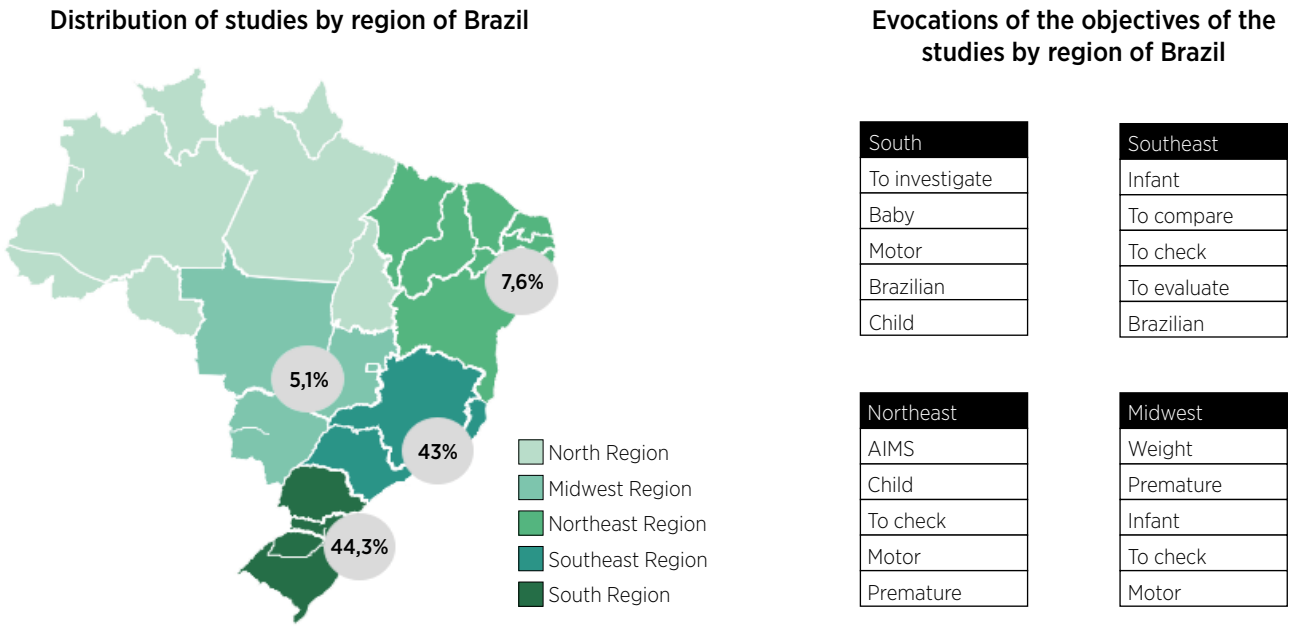


Figure 3. Distribution of studies according to the region of Brazil and the main evocations present in the objectives of the studies, classified by region

Among the 25 studies with a cross-sectional design, 15 are from institutions in the South (60%), 8 (32%) Southeast, 1 (4%) Northeast, and 1 (4%) Midwest. Among the methodological studies found (n=16), all investigated the reliability of the scale and its respective validations in the Brazilian public, in which 7 (43.7%) were from institutions in the South, 7 (43.7%) from the Southeast, and 2 (12.5%) from the Northeast. Two reports were found, 1 (50%) linked to an institution in the South and 1 (50%) in the Southeast. Moreover, a case study from an institution in the Southeast region and an exploratory study from an institution in the Northeast region (Supplementary Chart 2) were found.

The corpus was composed of 68 textual segments (86.0%). In total, 1,932 occurrences (words and forms) were found, of which 462 were distinct words and 284 had a single occurrence. The analyzed content was categorized into six classes (Figure 4).

The segments of Class 1 refer to the evaluation of the motor development of infants participating in interventions: aquatic intervention, cognitive-motor intervention, guidance for maternal practices, parental intervention, and telehealth. This class of words was prevalent in the South region (χ^2=4.85).

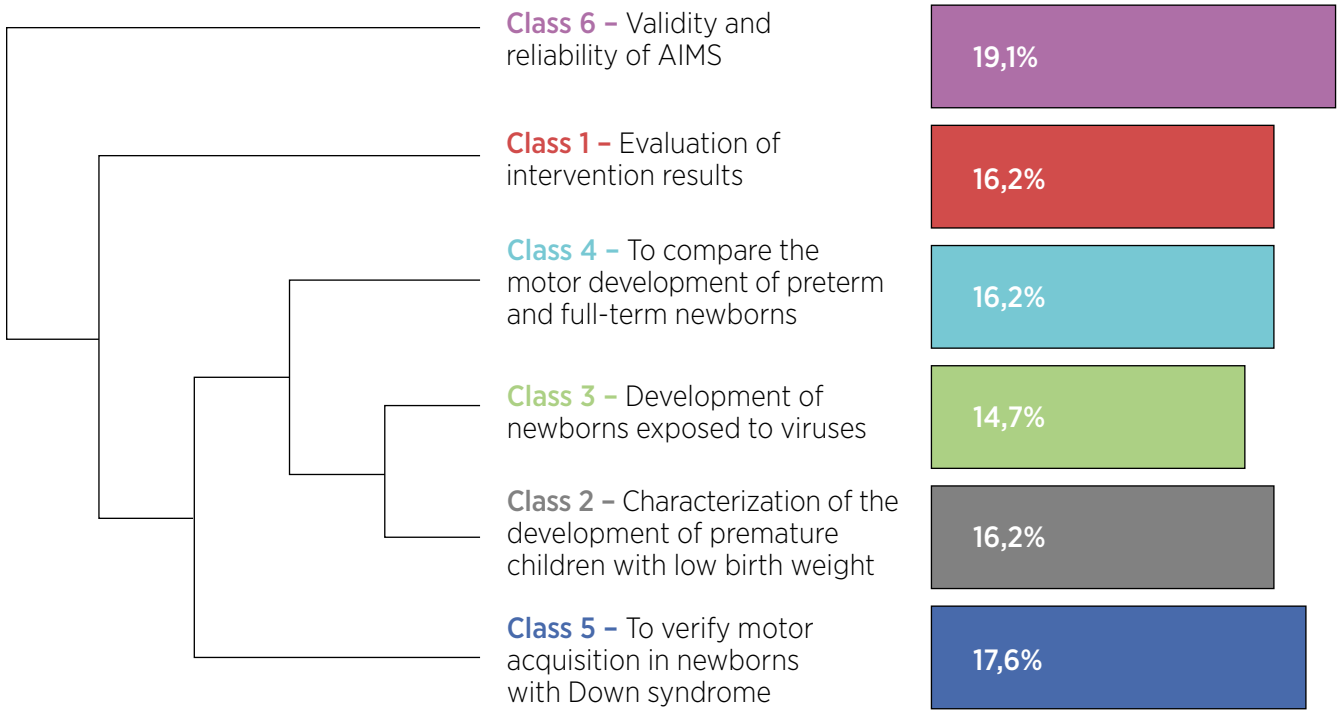
Class 2 refers to terms related to the evaluation of motor development of premature children with low weight, verifying the influence of adequate sleep, length of hospital stay, and quality of the environment. This class of words was prevalent in the Midwest region (χ^2=16.26).

Class 3 is related to terms referring to the evaluation of motor development of children exposed to Zika virus and human immunodeficiency virus (HIV) and their possible consequences, such as cerebral palsy in children with congenital Zika virus syndrome.

Class 4 is composed of terms referring to the comparison between the development of preterm and full-term infants regarding segmental trunk control, postural control, and gait. This class of words was prevalent in the Southeast region (χ^2=3.9).

Class 5 includes terms related to the characterization of the development of children with Down syndrome and the verification of their difficulties in the acquisition of motor skills.

Finally, Class 6 presents terms referring to the validity and reliability of AIMS. The instruments used for comparison were the third edition of the Bayley Scales of Infant and Toddler Development (Bayley III) and the gross motor function measure (GMFM). Groups of children exposed to HIV and premature infants were also included. These studies contributed to the aspects of the Brazilian version of the scale, which also served as a comparator regarding the test of infant motor performance (TIMP). This class was prevalent in the Northeast region (χ^2=5.83).



Class 1	χ^2
newborn	42,65
cognitive	34,1
intervention	34,1
effect	22,2
program	12,26
risk	12,37
early	10,85

Class 2	χ^2
weight	40,45
low	40,44
premature	25,05
influence	16,21
birth	5,09
child	4,96

Class 3	χ^2
zika	24,65
virus	18,02
to expose	12,32
to evaluate	7,66

Class 4	χ^2
term	22,2
development	9,66
to check	8,3
preterm	5,9

Class 5	χ^2
Down	30,71
acquisition	25,81
syndrome	20,52
infant	14,59
relationship	14,44
skill	9,62
to identify	5,19

Class 6	χ^2
AIMS	55,68
validity	33,1
Brazilian	23,8
version	22,83
reliability	17,98
value	13,28
competitor	13,28

Figure 4. Dendrogram of the descending hierarchical classification of the study objectives of the sample and its percentage and the most prevalent words in each class, with the value of χ^2

AIMS: Alberta infant motor scale.

DISCUSSION

By bibliometric search, this study aimed to answer the following question: what is the scope of the studies that used AIMS to evaluate the motor development of children aged from 0 to 18 months in Brazil? Most studies had a cross-sectional design, aiming to delimit values and characteristics of motor development and reference curves of AIMS for premature and full-term Brazilian children.

The longitudinal design studies reinforce AIMS robustness and its consolidation in clinical practice. However, methodological studies contribute mainly to the safety in the choice of AIMS, since it is necessary that the screening and developmental assessment instruments have psychometric validation. Efforts in this direction are very necessary in Brazil[14].

The methodological studies showed the efficacy, validity, and reliability of AIMS, by establishing curves and norms for Brazilian children. In clinical practice, professionals should choose motor development assessments based on psychometric properties aimed at the context of the child in evaluation. Thus, studies on the predictive validity, reliability, and responsiveness of gross motor assessment tools are highly important. The AIMS proved to be a valid, reliable, and effective instrument for the evaluation of motor development in Brazilian children, including contemporary samples[5].

The South and Southeast regions had the largest number of institutions linked to the selected studies. The survey of articles by region is essential to trace the development trajectory of each one since regional differences, considering the culture and social context,

can influence motor development[15]. Furthermore, we found no studies on this topic in the North region, and few studies were linked to the Midwest and the Northeast Brazil, showing regional asymmetries in the national scientific production on the subject. The higher concentration of graduate programs, considering area 21 (Physical Education, Physical Therapy, Occupational Therapy, and Speech-Language Pathology and Audiology) of the Coordination for the Improvement of Higher Education Personnel (CAPES), may increase the incidence of published studies on the subject in certain Brazilian regions. In 2021, the Southeast and South regions covered about 71% of the graduate programs in this area, while only 8.2% of these were in the North region. It is possible that there are, in the final sample, studies with authors linked to institutions from all regions of Brazil. However, since these regions are not those of the first authors or of the institutions highlighted as the place where the study was developed, they were disregarded.

Notably, the great concentration of recent studies may indicate that this is a subject that aroused greater interest recently, with great potential for expansion and innovation. Furthermore, most studies in the sample were published in English, even though most of them are present in Brazilian journals.

Regarding the distribution of word classes in the dendrogram, we observed a first division between psychometric validity studies and evaluative studies. This second category encompasses most of the studies, considering the various child populations analyzed. These studies are essential since they meet a great need of our country: the monitoring of the development of our children[16].

Therefore, our findings can contribute to obtain a broader view of the evaluation of motor outcomes in children and highlight its importance for the promotion of good strategies for early motor intervention in Brazilian children. One of the study limitations is the disproportion of the studies regarding the types of design and the subjects studied, which promotes a significant number of studies for some themes and scarcity of others.

CONCLUSION

Most studies using AIMS with Brazilian children are cross-sectional, followed by longitudinal and methodological studies. Furthermore, most studies provided values, developmental trajectories, and reference curves of the scale for premature and full-term children, as well as good criteria for the scale.

The thematic categories of the objectives of the studies present classes regarding validation and evaluation studies of the development of premature children, exposed to viruses, with low birth weight, and Down syndrome. This reveals the growing use of AIMS to monitor the development of Brazilian children by broad and reliable instruments.

Considering these findings, future studies on these topics, covering Brazilian children, should be conducted. These future studies face a great challenge: the training and improvement of health professionals (physical therapists, physical education professionals, pediatricians, among others) for a detailed evaluation of aspects suspected of causing the delay in motor development of Brazilian children.

Supplementary material

The supplementary material can be found at https://osf.io/xdcjn.

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