



RESEARCH ARTICLE

The impact of physical activity to the child’s quality of life: a bibliometric study [version 1; peer review: 1 approved, 2 approved with reservations]

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Abstract

Background: The application of bibliometrics in healthcare research is becoming popular, however at present it is still an under-researched area.
Methods: In our study we used a bibliometric technique called bibliometric mapping to visualize the published research regarding the influence of physical activity to children’s quality of life. The research was visualized in the form of both chronological and cluster science landscapes. Science landscapes, contrary to conventional reviews, capture the relationships between multiple topics and concepts, enabling the generation of “synthetic reviews”.
Results: Evolutionarily, three distinct research phases appeared, namely research on influence of physical activity on various chronic non-communicable diseases; research on quality of life and childhood diseases related to physical activity; and outcome-related research. The research consists of six main topics: asthmatic child and exercising, blood diseases, health-related quality of life, obesity and chronic diseases, childhood obesity and behaviour, and depression and health outcomes.
Conclusions: The study identified some research that may be helpful to general paediatricians whose everyday practice or research is not focused on physical activity and child’s quality of life, but wants to learn about the taxonomy of the topics, the most interesting discoveries, guidelines and practices and the state of the art in the field. It also revealed some hidden association, otherwise not easily identified, even by informed researchers and clinicians.

Keywords

Physical activity, Health related quality of life, Bibliometric mapping, Scientific landscape

Open Peer Review

Reviewer Status ✓ ? ?

	Invited Reviewers		
	1	2	3
version 1	✓	?	?
published	report	report	report
16 May 2019			

- Zachi Grossman**, Maccabi Healthcare Services, Tel Aviv, Israel
- Manuel Jesus Cobo** , University of Cádiz, Cádiz, Spain
- Julije Mestrovic**, University Hospital of Split, Split, Croatia

Any reports and responses or comments on the article can be found at the end of the article.

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Author roles: **Završnik J:** Conceptualization, Methodology, Project Administration, Resources, Validation, Writing – Original Draft Preparation, Writing – Review & Editing; **Kokol P:** Conceptualization, Data Curation, Formal Analysis, Methodology, Software, Supervision, Validation, Visualization, Writing – Review & Editing; **Blažun Vošner H:** Conceptualization, Data Curation, Methodology, Project Administration, Supervision, Validation, Visualization, Writing – Review & Editing

Competing interests: No competing interests were disclosed.

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Introduction

The role of bibliometrics in healthcare research has been excellently described by Lewison and Devey¹: “Bibliometrics is to scientific papers as epidemiology is to patients.” Indeed, in 1990 bibliometrics first became a medical subject heading. Consequently, the application of bibliometrics by health professionals to analytical, clinical, informational and academic areas of interest is becoming more extensive; however, at present it is an unexploited area of a fruitful research².

Interdisciplinary research concerning the influence of physical activity and sport on children’s quality of life is increasingly becoming more and more important. In their review paper Buttitta *et al.*³ reported that several factors are associated with children’s quality of life; among them physical activity is one of the most important, especially in those with pre-existing diseases. Various malignant diseases and anticancer therapy in children both drastically affect daily life activities, including high-performance sports. However, both random and non-random feasibility studies show positive effects of physical activity on clinical and psychosocial outcomes. Consequently, every effort should be made to maintain physical activity during paediatric cancer therapy⁴. Comparable findings for congenital heart diseases, were reported by Dulfer *et al.*⁵.

Since our research area interest is multidisciplinary, we had an opportunity to employ a bibliometric technique called bibliometric mapping. Bibliometric mapping visualizes academic research in the form of scientific landscapes⁶. Science landscapes, contrary to conventional reviews, which focus on particular research questions, extract information at various levels and capture the relationship between multiple topics and concepts, creating “synthetic reviews”. Scientific landscapes are still relatively rarely used; however, those published have been well received by the scientific community⁷.

Methods

Bibliometrics could be defined as the application of mathematical, statistical and heuristic methods to scientific publications⁸. Bibliometric mapping is a recent addition to techniques already used in bibliometrics in medicine². Bibliometric mapping aims to visualize different facets of literature production based on different co-occurrences (i.e. words, authors, organisations, journals)⁹, co-citations¹⁰ and bibliographical coupling¹¹. Bibliometric mapping can be automated using various software tools. Among open licence software tools, VOSviewer¹² is very versatile and easy to use¹³. Both bibliometric mapping and VOSViewer have been successfully used in health related fields¹⁴.

Bibliographical dataset and corpus

The corpus was extracted from the Scopus bibliographical dataset, because of Scopus broad coverage of various journals, book chapters and conference proceedings on one hand and on the other hand because of Scopus’ extensive and easy to use search and analytical functions. The search was made on 12th January 2019 using the search keyword string *child* AND (“physical activity” or “sport”) AND “quality of life”* in information source titles, abstracts and keywords for the whole period covered by Scopus.

Data extraction and analysis

Publication year, source title and author’s country of affiliation were extracted by Scopus services. Abstracts were exported as comma separated values (CSV) files to enable further analysis by the VOSviewer (V1.6.9) and Excel software (Version 2016). Cluster and chronological scientific landscapes were generated for all terms with an occurrence frequency larger than 30. Common words such as report, significance, trial, study and baseline were ignored using a customised thesaurus file (see Underlying data¹⁵). Similarly, synonyms like body mass index and BMI were integrated into one term. The Attraction was set to 4, Min. Cluster size to 8, Resolution to 1.25; all other VOSViewer parameters were set to default values.

Meta-synthesis

The popularity of a term (size of the term font and associated square) and relatedness between terms (terms located near each other are more related than those further apart) in both cluster and chronological scientific landscapes were analysed using meta-synthesis¹⁶. An appropriate topic was determined for each cluster based on the analysis of most popular terms belonging to the cluster.

Results

The search resulted in 2334 publications (1637 articles, 419 reviews, 66 conference papers, 50 editorials, 35 notes, 29 book chapters, 19 letters, 19 short communications and 24 other types of publications; see Underlying data¹⁵). The most popular journals in which the above publications appeared are shown in Table 1. The most prolific journal was BMC Public Health with 31 publications. The highest ranked journal in the selected field was Pediatrics, with 21 publications (621st place according to SCImago Journal Rank - SJR, which ranks within the top 2%

Table 1. The most prolific source titles on the topic of research, the influence of physical activity to children’s quality of life.

Source title	Number of publications
BMC Public Health	42
Quality of Life Research	39
Haemophilia	36
Pediatric Blood and Cancer	32
Pediatrics	27
Cochrane Database of Systemic Reviews	24
PloS One	20
BMC Pediatrics	19
Developmental Medicine and Child Neurology	17
Epilepsy and Behaviour	17
Health and Quality Of Life Outcomes	17
	∑ = 290 (12.4%)

of all source titles indexed by **SciMago**. Interestingly, all of the most prolific source titles are ranked in the top quarter of all journals. Their contribution to the total literature production on our topic of interest accounts for 12.4%. As expected most of the most prolific source titles are from the field of paediatrics, others relate to quality of life or from general areas. Surprisingly no source titles related to sport or physical activity were ranked among the most prolific source titles – the first (American Journal of Sports Medicine) is in 15th place with 11 publications.

The most productive countries are presented in **Table 2**. All of them have advanced health, industrial and economic systems, high BDP and are also leading countries in research and development. The top 10 countries produced more than 83% of all publications, indicating that literature production is regionally centred.

The trends in research literature production and evolution of research topics

Shen *et al.*¹⁷ proposed a model of science discipline development based on literature production dynamics. Following their example, a graph was constructed (**Figure 1**) which reveals three distinguished phases in the production of publications regarding influence of physical activity to children’s quality of life, namely:

- initial phase in the period 1975–1989 when publications were scarce, most three publications per year;
- initiation phase in the period 1990–1999 when number of publications linearly increased from 6 to 23; and
- exponential growth phase in the period 2000–2018, when production reached its peak in 2017 with 231 publications.

Figure 2 presents the term map on the topic of research, the influence of physical activity to children’s quality of life.

Table 2. The 10 most productive countries on the topic of research, the influence of physical activity to children’s quality of life.

Country	Number of publications
United States	688
United Kingdom	240
Canada	223
Australia	204
Germany	166
Netherlands	125
Spain	113
France	97
Italy	95
Sweden	81
	Σ = 1951 (83.6%)

According to the figure the research development went through three main phases, namely:

1. **Research on the influence of physical activity on non-communicable diseases** (approx. period from 1975 to 2011 – violet and blue colours). The associations between (1) *hypertension, diabetes, cardiovascular diseases, mortality, exercise* and positive/beneficial effects, and (2) *asthma, cystic fibrosis, medication, illness, sport and daily activity*, were the main stream of research in the first phase.
2. **Research on frequent childhood diseases and physical activity** (green and light blue colours – approx. period from 2012 to 2013). The research was focused on associations between (1) *chronic diseases, society, pregnancy, birth, sedentary life style, prevention strategies, and risk increase* (2), nutrition, promotion, blood pressure, obesity, physical activity and, fitness and (3) *anxiety, depression, stress, juvenile idiopathic arthritis, haemophilia, injury and health status*.
3. **Measuring quality of life** (light green and yellow colours – state-of-the-art research). The research in the most recent period is concerned with association between (1) *inclusion, adherence, protocol, cancer and health outcomes*, (3) *sedentary behaviour, weight status, physical activity level and physical activity interventions* and (4) *quality of life indicators, physical functioning and physical health*.

The cluster science landscape (**Figure 3**) consists of six clusters. Meta-synthesis revealed six topics, as shown in **Table 3**.

Discussion

It is interesting to note some details evident from the derived topics above and associations between terms:

- *The quantity of research concerning physical activity in relation to asthma, but not only as a single disease, but also in combination with obesity and diabetes.* Di Genova *et al.*¹⁸ claim that growing evidence shows the existence of an “obese asthma” phenotype characterised by difficult-to-manage asthma. Additionally, Atay and Berket¹⁹ show that obesity results in various co-morbidities in children and adolescent.
- *The increasing incidence of psychosomatic diseases and the beneficial effects of physical activity.* Hrafnkeldottir *et al.*²⁰ reports that less screen time and more intense physical activity lowers the risk of mental health problems.
- *The broadness of the spectrum of diseases related to child’s quality of life and physical activity.* Studies highlighted that children with overweight/obesity and related co-morbidities and lifestyle behavioural risk factors, had significantly lower healthy-related quality of life^{21,22}.

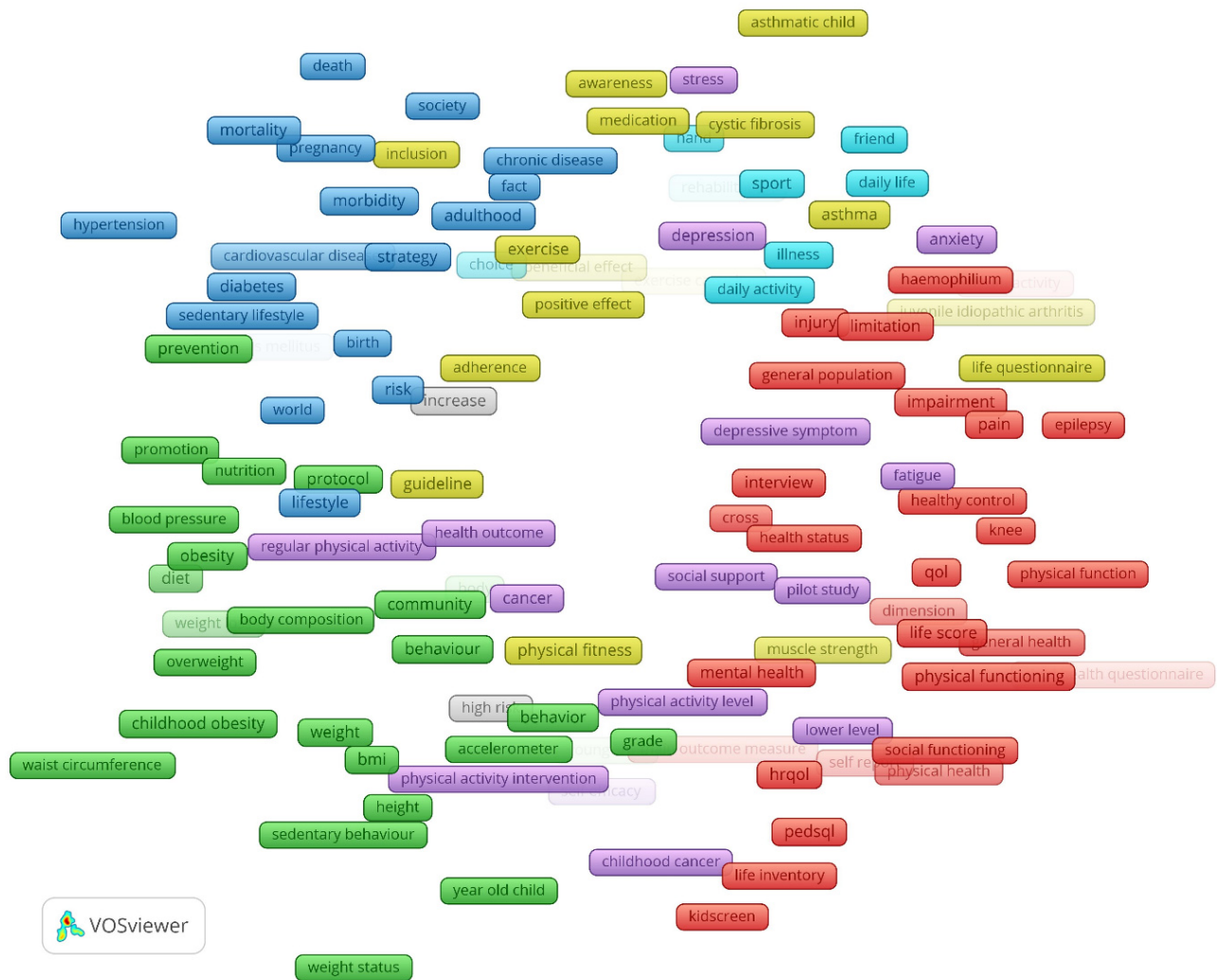


Figure 3. The cluster science landscape on the topic of research, the influence of physical activity to children’s quality of life.

Table 3. Topics derived from the cluster science landscape.

Topic	Cluster colour	Popular terms
Childhood obesity and behaviour	Green	Childhood obesity, BMI, behaviour, community, obesity, weight
Chronic diseases and lifestyle	Blue	Diabetes, cardiovascular diseases, hypertension, chronic diseases, risk, life style, morbidity
Asthmatic child and exercising	Yellow	Asthma, asthmatic child, exercise, physical fitness, positive effect, awareness, medication
Health-related quality of life and physical and social functioning	Red	Health-related quality of life (HRQOL), paediatric quality of life ((PESQL), social functioning, physical functioning, physical health, life inventory, Kidscreen, pain
Illness and sport	Light blue	Illness, daily activity, sport, friend
Depression and regular physical activity	Violet	Depression, anxiety, stress, fatigue, physical activity intervention, health outcome, social support

- *The introduction of modern technology such as various sensors in both research and practice supporting the empirical research in areas that were previously very subjective.* Traffic-related air pollution and noise may lead to adverse health outcomes, including increased blood pressure, myocardial infarction, and respiratory health in paediatric population. Measuring the physical activity and environmental factors revealed that such measurements can lead to better understanding of the relation between above factors²³. Another study investigated the use of a carbohydrate intake based on continuous glucose monitoring trends during physical activity of children with diabetes to objectively assess the association between these two variables²⁴.
- *The state-of-the-art efforts in the development of specific child's quality of life indices and instruments to measure their relatedness to other paediatric indices.* Moghaddaszadeh *et al.*²⁵ measured the paediatric quality of life indicators and their relations to enjoyment levels and physical attractiveness.
- *The relationship between acute lymphoblastic leukaemia and haemophilia, and physical activity.* Acute lymphoblastic leukaemia treatment in children can result in muscle weakness and motion limitations. A study showed that active dorsiflexion range of motion combined with physical activity had a positive correlation with strength/agility standard score²⁶. Haemophilia management recommends physical activity in children with haemophilia. In a study researchers adapted and validated the adult Haemophilia & Exercise Project-Test-Questionnaire (HEP-Test-Q) for children aged 6–17 years, reformulated questionnaire items to make them understandable to children²⁷.

Conclusion

Using bibliometric mapping we created two scientific landscapes on the topic of research, the influence of physical activity

to children's quality of life. To the best of our knowledge, this is the first such attempt in the paediatric field. We identified six distinct topics and also visualised the chronological aspect of the research literature production. The study revealed some knowledge that might be helpful to an "outsider" who wants to learn about the taxonomy of the topics, the most interesting discoveries, guidelines and practices and the state of the art in the field. It can also help the "seasoned insiders" better understand more specialised research including that is out of their immediate scope of interest. Additionally, it can reveal hidden facts, not easily identified, even by informed researchers and clinicians.

Data availability

Underlying data

Open Science Framework: Physical activity and quality of life in children. <https://doi.org/10.17605/OSF.IO/WXSQE>¹⁵

This project contains the following underlying data:

- Map.txt (Map file for VOSViewer software)
- Network.txt (Network file for VOSViewer software)
- Scopus1.csv (Extracted articles from Scopus 2011–2019)
- Scopus2.csv (Extracted articles from Scopus 1975–2010)
- Thesaurus_terms.txt (Customised thesaurus file defining terms to be omitted and synonyms)

Data are available under the terms of the [Creative Commons Zero "No rights reserved" data waiver](#) (CC0 1.0 Public domain dedication).

Grant information

The author(s) declared that no grants were involved in supporting this work.

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Open Peer Review

Current Peer Review Status:   

Version 1

Reviewer Report 02 September 2019

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Julije Mestrovic

National Paediatric Society of Croatia/Medical School of Split, University Hospital of Split, Split, Croatia

The work is interesting for readers and should be indexed. The following should be done first:

1. In the discussion, explain briefly the possible relationships between illness and physical activity. Namely, it is important to note what are the mechanisms of how physical activity can affect disease, but also vice versa, in a wide range of conditions, from asthma to air pollution.
2. In discussion, avoid overlapping conditions (asthma and obesity).

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Yes

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Paediatric intensive care and quality of life.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 25 July 2019

<https://doi.org/10.5256/f1000research.20643.r50557>

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Manuel Jesus Cobo

Department of Computer Science and Engineering, University of Cádiz, Cádiz, Spain

The manuscript develop a science mapping analysis of the physical activity on children and the effect in their quality of life. To do that, VOSViewer software tool is employed.

In general, the paper is well organised and written. Moreover, the software tool is appropriate for this analysis and authors use it properly.

In what follows, some comments and suggestions are listed:

- I miss some references to the origins of co-word analysis, science mapping, or generally, science of science. Authors focus too much on bibliometrics on health, but there are important references out of this field. Moreover, authors should cite some recent bibliometric studies developed in health, for example in cancer, rehabilitations, etc.
- The reference to VOSViewer is incorrect. Author should cite the paper where the software is presented.
- Figure 2 is confusing. Authors should provide other kind of visualisation. Also, authors should describe better the conceptual evolution of this research field.
- Discussion should be better described. At this moments it is just a sequence of itemises. Author should provided a clear speech.
- Conclusions are just a summary of the paper.

Is the work clearly and accurately presented and does it cite the current literature?

No

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Bibliometric and science mapping analysis

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 17 June 2019

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Zachi Grossman

Pediatric clinic, Maccabi Healthcare Services, Tel Aviv, Israel

I find this manuscript interesting since it gives a new perspective on the literature.

I would like to propose the following changes in order to improve the conclusions:

1. Single papers on blood diseases - haemophilia and leukaemia - are not enough to draw conclusions from. Therefore, I would tend to disregard these papers both in the discussion and in the abstract.
2. I am not so convinced in the existence of three distinguished time phases. I would prefer a two time phases division: before and after 1995.

Is the work clearly and accurately presented and does it cite the current literature?

Yes

Is the study design appropriate and is the work technically sound?

Yes

Are sufficient details of methods and analysis provided to allow replication by others?

Yes

If applicable, is the statistical analysis and its interpretation appropriate?

Not applicable

Are all the source data underlying the results available to ensure full reproducibility?

Yes

Are the conclusions drawn adequately supported by the results?

Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: General paediatrics

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

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