Systematic review of the barriers and facilitators to cross-sector partnerships in promoting physical activity

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Abstract: Aims: To review the barriers and facilitators that cross-sector partners face in promoting physical activity. **Methods**: We searched Medline, Embase, PsychINFO, ProQuest Central, SCOPUS and SPORTDiscus to identify published records dating from 1986 to August 2021. We searched for public health interventions drawn from partnerships, where the partners worked across sectors and their shared goal was to promote or increase physical activity through partnership approaches. We used the Critical Appraisal Skills Programme UK (CASP) checklist and Risk Of Bias In Non-randomised Studies – of Interventions (ROBINS-I) tool to guide the critical appraisal of included records, and thematic analysis to summarise and synthesise the findings. **Results**: Findings (n = 32 articles) described public health interventions (n = 19) aiming to promote physical activity through cross-sector collaboration and/or partnerships. We identified barriers, facilitators and recommendations in relation to four broad themes: approaching and selecting partners, funding, building capacity and taking joint action. **Conclusion**: Common challenges that partners face are related to allocating time and resources, and sustaining momentum. Identifying similarities and differences between partners early on and building good relationships, strong momentum and trust can take considerable time. However, these factors may be essential for fruitful collaboration. Boundary spanners in the physical activity system could help translate differences and consolidate

common ground between cross-sector partners, accelerating joint leadership and introducing systems thinking. PROSPERO registration number: CRD42020226207.

Keywords: Systematic Review, Whole Systems Approach, Physical Activity, Cross-sector collaboration, Public-private partnership

Introduction

Systems thinking is slowly integrating into new public health agendas and policies, placing cross-sector collaboration at the forefront of resolving *wicked and complex* public health problems. What may help and what may hinder short-, or long-term collaboration across sectors remains largely unknown and understudied[1].The question of sustainability as well as the effectiveness of a systems approach also remains[1]. However, public health organisations and agencies are promoting cross-sector partnerships within a whole system as essential to decreasing sedentary behaviours and ensuring healthier future generations[2,3,4,5]. In previous systematic reviews of whole-system approaches in obesity[1] and public-private partnerships for promoting physical activity[6], it emerged that using systems approaches and cross-sector working for public health goals is still in its infancy. There is a lack of consistency in the language and definitions, and little understanding of how to navigate a whole systems approach in practical terms[1].

Partners from the public and private sector may benefit from alliances as these can be used to initiate collective action and communication between different sectors within a system[6]. Mapping tools such as *systems mapping* have begun to unveil a plethora of non-traditional partners that may have previously been excluded, capturing the wider context of promoting physical activity[7]. Linking together potential new partners who can engage in solving complex challenges could prove useful, but there is a need for a deeper understanding of these prospective new relationships and the outcomes of such collaborations. The complexities of co-ordinating actions across different sectors is well documented, albeit sporadically, and tends to reflect a narrow, rather than a dynamic, definition of cross-sector partnerships.

We aimed to retrieve, analyse and summarise the published literature on cross-sector partnerships promoting physical activity. Further, we reviewed the reported barriers and facilitators to cross-sector collaboration where the partners were working towards a shared goal related to promoting physical activity. As far as we know, this review is the first to include (a) partnerships across diverse sectors (not just public-private partnerships), (b) the promotion of physical activity of any type, scope and level and (c) the link and relationship between the partners and sectors. In this paper, we present the findings focusing on the barriers and facilitators to cross-sector collaboration in physical activity promotion, operating in different countries and settings, and with diverse populations and socio-political contexts. We hope to highlight the range of challenges and opportunities that practitioners face when collaborating across sectors and provide better guidance about navigating the common hurdles of spanning boundaries in public health.

Methods

The protocol was peer-reviewed by a systematic reviewer (SW) and an independent topic expert and researcher (BH). The protocol for this systematic review followed the PRISMA guidelines[10] and was registered and published in PROSPERO (ID: CRD42020226207) prior to conducting the systematic searches[9].

Information Sources

All search strategies were piloted by VK and peer-reviewed by a systematic reviewer (SW) and two active members of a cross-sector partnership in the sport (OH) and public health (JB) sectors. We searched seven electronic bibliographic databases (MEDLINE, EMBASE, ProQuest Central, PsycINFO, Scopus and SPORTDiscus) to identify records published in peer-reviewed journals from 1986 to August 18th, 2021. Additional records were retrieved by reference checking and citation tracking to find additional qualitative or quantitative data regarding the effectiveness, barriers and/or facilitators of the included partnerships. In our keyword strategy we used words describing "physical activity" and "cross-sector collaboration and partnerships" (Supplementary file 1).

Inclusion and Exclusion

There were no restrictions on language of publication. We included any population targeted by a cross-sector partnership promoting physical activity. We included records reporting local, regional, national and global partnerships promoting physical activity, if at least two of the named partners were not from the same sector. We did not filter or exclude for publication based on language and used the Google translator tool for any publications not written in English. We excluded expert opinion pieces, audio/visual data, newsletters, informal communications and multi-media (e.g. slide-decks) presentations at the stage of title and abstract screening. We expected interventions to fall into the following categories: collaboration, coalition building, and community organising, advocacy social marketing, and policy development and enforcement[8]. We expected sectors such as: health, sport, leisure, transport, environment, city planning / urban design, education or academia, tourism, recreation and civil society, or as public sector, third sector and private sector. Records retrieved during the database searches were screened for title and abstract by one reviewer(VK).

Screening process

VK ran the systematic searches, retrieved the records and screened the titles and abstracts and included those that seemed to fulfil the eligibility criteria. The full texts of eligible records were retrieved and assessed by VK

(100%, n=110) and SW (23%, n = 25). Disagreements were resolved through discussion until consensus was reached and the reasons for excluding records at that stage were recorded. Included records were critically appraised independently by VK (100%, n=32) and SW (28%, n = 9). We scored the risk of bias using the CASP checklist[11] for qualitative or mixed-methods research studies and ROBINS-I[12] for quantitative primary studies. We did not exclude based on the critical appraisal findings, as to avoid excluding 'low quality' records that may still generate valuable qualitative insights.

Thematic Analysis

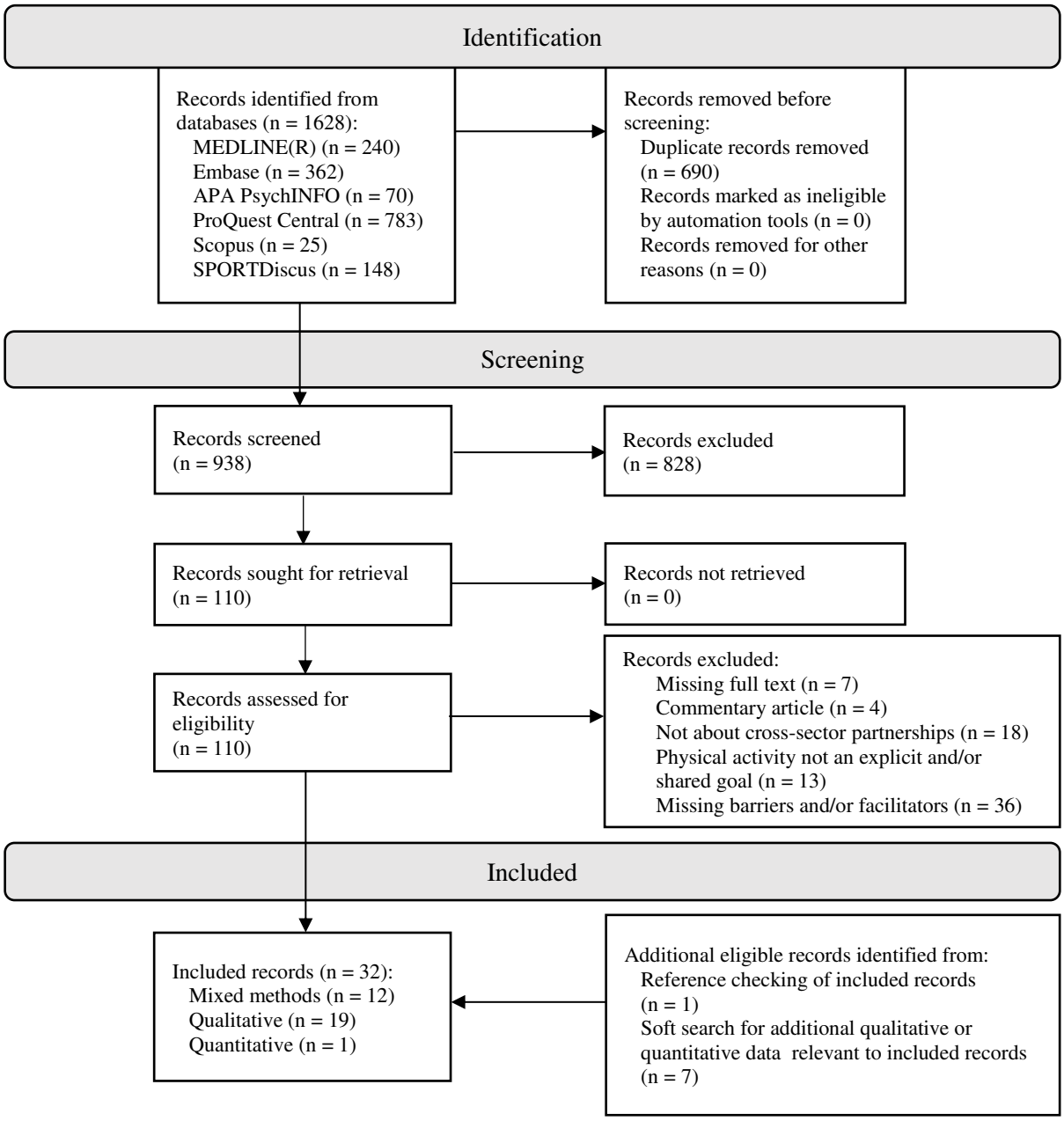
VK extracted relevant data from the final included reports using a data extraction proforma which was peer-reviewed by the systematic review team (all authors). Extracted information from included records was inductively and deductively summarised using thematic analysis[13] by VK. In the first phase of analysis, VK read and re-familiarised with the included public health interventions and partnerships making draft notes of general observations and common trends in the context or relationships of the partnerships. In the second phase, VK inductively coded for the barriers, facilitators, impact & quantitative outcomes, geography, shared aim and length of partnership. After the initial codes, VK produced codes deductively using Braun and Clarke's[13] approach . VK met with NB and DC several times to discuss the codes and naming the broad themes, until consensus was reached.

Results

Screening

We retrieved 1628 records across seven databases, of which 690 were duplicates (Figure 1). We screened the title and abstract of 938 records, and the full text of 110 records. We included, 32 records in our final sample, all published in English. Additional records (n = 8) were retrieved from citation tracking and reference checking of the included records (n=32) reporting 19 public health interventions.

Figure 1. PRISMA 2020 diagram.



Critical appraisal

We used the CASP checklist for qualitative (n = 19) or mixed methods records (n = 12), and the ROBINS-I guidance/tool for the quantitative record (n = 1). Most records reported qualitative methods to a satisfactory level to be included, but some were missing information or missing transparency about the research methodology and limitations, and the relationship between the researcher, the funder and the participants. The records reporting mixed-methods research were scored using the CASP checklist as a guide and only the relevant qualitative data from these records were extracted for the purposes of this paper.

Data extraction

We extracted data from the included records using a proforma (Supplementary file 3).The included records reported various types of public health interventions (n = 19) (Table 1): collaboration (n = 6), health teaching (n = 1), coalition building (n = 3), community organising (n = 2), advocacy (n = 1), social marketing (n = 3), and policy development and/or enforcement (n = 5), as defined in "The Wheel" of public health interventions[8]. The shared goal was to promote or increase physical activity in different ways such as: improving the built environment (n = 3), community investment (n = 1), promoting active travel (n = 2) or active living (n = 4), increase sports participation (n = 2) building system-level capacity (n = 7) and developing or implementing policies (n = 7). The partners and stakeholders operated in various organisations across diverse sectors including public health, sport, leisure, transport, environment, city planning / urban design, education or academia, tourism, recreation and civil society, or as public sector, third sector and private sector. Partnership working would in some case be assisted by interlinking agents. These were described as backbone organisations, cross-linking agents or boundary spanners. Some examples are: an organisation serving as a link between academia and industry[14], individuals called *care sport connectors* tasked with linking social care organisations and sports organisations[45], a "think-do" tank engaging lenders with communities struggling to finance initiatives[15], a social marketing organisation engaging third-, private and public sector partners[29, 30], a partnership centre engaging diverse sector partners[31,32] and a local council team brokering connections and limiting duplication within the obesity-prevention system[40,41,42].

Table 1. Overview of the public health interventions (n = 19) aiming to promote physical activity through cross-sector partnerships according to the public health intervention type, the partners' shared goal(s), the intervention's target population and the partners' sectors.

Public health intervention(s) (n=19)	Type	Shared Goal(s)	Population(s)	Partners
Clinton Extension and Public Health Expanding Community Teams (EPHECT) coalition[14]	Coalition building	To improve the infrastructure and increase participation in physical activity opportunities.	Residents in Clinton County Kentucky USA	Backbone support organisation: FCS Extension, building coalitions with representatives from local public health department, public library, schools, health care providers, managed care organizations and insurance companies, faith-based organizations, the parks and recreation department the chamber of commerce the fitness/wellness centre, social services agencies, the county judge office, and the senior centre and more.
"Fun 'n FITchburg (FnF)" partnership, Omaha and Douglas County partnerships, and the Neighborhood Health Improvement Strategy.[15]	Policy development and enforcement	To promote physical activity through community investing strategies.	Wider population USA	Financial Innovations Roundtable (FIR) and hospitals, funders, universities, non-profits, and government agencies.
Pennsylvania Advocates for Nutrition and Activity (PANA)[16]	Coalition building	To build capacity to create environmental and policy changes related to nutrition and physical activity.	Residents in Pennsylvania USA	Multiple public agencies, non-profit organizations, institutions of higher education, corporate interest groups that operate at the municipal, county, regional, and state levels.

Active Living by Design (ALbD)[17,18,19,20,21]	Community organising	To make it easier for people to be active in their daily routines through innovative approaches to community design, public policies, and communication strategies.	Residents in twenty-five communities USA	Health sector and schools, parks and recreation, urban design, planning and transportation, community leaders, policymakers and decision makers (i.e., elected officials, tribal councils, appointed officials), other government (i.e., housing authority, community or economic development, social services, public works, law enforcement), advocacy sector, business sector, media sector, community- and faith-based partners (e.g., neighbourhood associations, walking/biking clubs, little leagues, individual volunteers).
Healthy People Alliance (HPA)[22]	Coalition building	To implement the Action Communities for Health, Innovation, and Environmental Change (ACHIEVE) to prevent and reduce prevalence of physical activity, nutrition, and tobacco use.	Residents in Klickitat County USA	National Association of County and City Health Officials (NACCHO) and local health departments, non-profit organizations, faith-based organizations, businesses, conservation and environmental groups.
Green Schools Travel (GST)[23]	Health teaching	To promote the use of sustainable modes of transport to school e.g. walking, cycling and public transport use.	Primary and Secondary School Pupils Ireland	Government departments (e.g. Department of Transport, Department of Agriculture and Department of Education), NGO and school partners (parents, teachers, principal and students)

Active Transportation Partnership[24]	Collaboration	To create a plan to promote active transportation. There were five broad goals including increasing walking and cycling, improving safe travel, and building an active transportation culture in the city.	Residents in a mid-sized urban city Canada	Multiple stakeholders from the city, health sector, and non-health sector organizations.
Scottish Green Health Partnerships (GHPs)[25]	Policy development and enforcement	To raise awareness of green health e.g. social prescribing and physical activity referral, across key policy sectors and to develop and strengthen links and referral pathways between health and social care and green health projects and providers.	Individuals with an established disease Scotland	Lead partners were the National Health Service and the local authority of each area, with partners from leisure providers, the environment sector, the voluntary, community and third sectors
Joint Action CHRODIS PLUS National Programs[26]	Collaboration	To support European countries to improve the prevention of chronic diseases as well as their management, by piloting and implementing innovative approaches that have proven to be successful in other countries or settings.	Various Portugal, Lithuania, Italy , Finland, Denmark, Spain, Croatia, Iceland, Hungary, Netherlands, Poland and others (n = 14)	Professionals from the healthcare sector, employment sector, patient organizations, public health and health promotion and more.
Partnerships for a Healthier America (PHA)[27,28]	Policy development and enforcement	To encourage industry to offer and promote healthier options (nutrition and physical activity).	Staff and Children in Child Care Centres USA	Partnerships for a Healthier America (PHA) and private sector partners such as: Bright Horizons, Learning Care Group, KinderCare, and New Horizon Academy, Y-USA, Boys & Girls Clubs of America (BGCA) and the National Recreation and Park Association (NRPA), U.S. Tennis Association, Kaiser Foundation Health Plan.

ParticipACTION[29,30]	Social marketing	To promote physical activity through social marketing, communications, and partnership synergy.	Various (mostly children and youth) Canada	ParticipACTION (backbone support organisation) and national, provincial, and local organizations: governmental, not-for-profit, private sector.
Australian Prevention Partnership Centre[31,32]	Collaboration	To develop systems approaches for the prevention of lifestyle-related chronic diseases.	Wider population Australia	Researchers, policymakers and practitioners from education, government, and third sector (charitable organisations).
National Physical Activity Plan (NPAP)[33,34,35,36,37]	Policy development and enforcement	To develop and launch the NPAP to inform further development of state and community-based physical activity plans within the United States (Bornstein 2014, Evenson 2014) To implement and adapt the NPAP in West Virginia (Elliott 2014, Abildso 2016) and San Antonio (Esparza 2014)	Wider population and Residents in West Virginia, and San Antonio USA	Public and private sector organisations/academies, alliances/associations/societies/club. Education, Business and Industry, Healthcare, Parks, Recreation, Fitness, and Sports, Public Health, Transportation, Land Use, Community Design, non-profit and volunteer organisations, policy and community representatives (San Antonio).
State Obesity Prevention and Control Programs[38]	Policy development and enforcement	To prevent and control obesity and other chronic diseases by supporting states in the development and implementation of science-based nutrition and physical activity interventions targeting all levels of socioecological influence.	Residents in Selected States (n = 28) USA	Universities or colleges, county and municipal health departments and medical centres or hospitals, school districts, American Heart Association. state dietetic association, parks and private sector.

EPODE-derived Intersectoral community Approaches towards Childhood Obesity (IACO)[39]	Collaboration, Social Marketing and Advocacy	To address obesity determinants on the micro- (child), meso- (family) and macro level (community context), thereby accounting for the multi-factorial aetiology of childhood obesity.	Youth and children Netherlands	Healthcare, welfare & sports, educational and private sector.
Obesity *Prevention* and Lifestyle (OPAL) program[40,41,42]	Collaboration	To prevent childhood obesity using systems-wide approaches and to increase healthy eating and active living in children.	Children Australia	Local government (mayor, councillors, CEO, planners, community services, library), non-government organisations, local businesses, health, education, early childhood, state government (housing, police) and community members.
Active City (pseudonym)[43]	Social Marketing	To have all citizens make regular physical activity part of their daily lives, through strategic marketing campaigns.	Local residents Canada local	Community-based sport and health sector partners.
Antwerp Community Sport Program (CSP)[44]	Collaboration	To increase sport participation rates and physical activity levels.	Disadvantaged communities in Antwerp Antwerp, Belgium	Antwerp Sports Administration and sports, social, health, cultural and youth partners.
Dutch sport-for-health partnerships[45]	Community organising	To increase sports participation of socially vulnerable youths, through care sport connectors.	Socially vulnerable youth Netherlands	Youth-care workers, representatives from community sports clubs, and care sport Connectors (brokers).

Thematic analysis

During the thematic analysis steps, we identified broad themes across the reported partnerships for what prevents (barriers) and what helps (facilitators) the collaboration between a variety of cross-sector partners. We categorised the barriers and facilitators into four overarching themes: approaching and selecting partners, funding, building capacity and taking joint action. Common barriers were funding insecurity, instability or insufficiency[17,18,22,23,25], passive engagement or intermittent partner representation and member turnover[17,18,29,30,32], collaboration capacity limitations or capacity misalignment [17,24,32,34,39,43], significant time

commitment and low willingness for co-production [29,32,33]. Common facilitators were cross-linking agents that connected partners [14,31,45], capacity and skills of potential partners being confirmed and agreed early on [17,22,31,40,44,45], diverse partners from different geographical regions [17,26,35], clear and detailed expectations from partners and representatives, timelines and roles [17,31,38,45,15,26,34], transparency of true intentions and "buy-in" or mutual benefits [44,38,26,35,42,16,37], using and sharing partners' existing networks [43,17,34,29,16] and building trust and leveraging support from partners [17,44,14,25]. Below we present detailed diagrams of the barriers and facilitators reported in the sample, organised by level (system, sector, partnership and partners) and theme (Figure 2 and Figure 3).

Figure 2. Diagram showing the reported barriers to working in cross-sector partnerships by level (system, sectors, partnership, partners) and theme.

Figure 3. Diagram showing the reported facilitators to working in cross-sector partnerships by level (system, sectors, partnership, partners) and theme.

Discussion

Despite recent efforts to strive for whole-systems action for the promotion of physical activity, the process and impact of cross-sector collaborations and partnerships in such systems is poorly understood and sporadically documented. Understanding the relationships in such partnerships across sectors and developing recommendations of *what works* could accelerate the adoption of whole systems action. There are few systematic reviews about *what works* in cross-sector partnerships for promoting physical activity.

Jumping through hoops

Partnerships may be expected to operate inside the grey overlap area of sectors, industries, communities and populations and across different organisational missions and agendas. Orchestrating joint action across sectoral boundaries may burden the responsibility of sharing the lessons and impact of such collaborations solely to partners from academia that may wish to publish in journals, or to independent third-party agencies that may be conducting an evaluation that may be made publicly available. This may cause considerable delay in systems approaches being adopted, as the available evidence would remain widely uncaptured or unpublished. *Whole systems thinking* remains largely theoretical and/or conceptual in nature, so intentional data capture and sharing of lessons is often led by government-led programmes and cross-sector partnerships which may require close monitoring and evaluation by an independent third party[27]. A recent review found that local evaluations of interventions, and access to funding and resources are important for implementing a whole systems approach to obesity and other public health areas[1]. However, partnerships that operate independently from the more traditional public and government orientated set-ups may struggle to find adequate funding or capacity to conduct an evaluation, or find it difficult to agree on how to measure their impact [30,45,23,25,17,18,22].

Collateral benefits and mutual inconvenience

The *relationship between cross-sector partners* naturally evolves as the partnership ages, as a working relationship is established, and trust is built. However, challenges such as finding common ground and restructuring activities so they align towards a shared goal, can often delay observing any impact. Evaluating the success and impact of any collaboration between sectors is dynamic and, in most situations, not pre-agreed. In fact, it has been suggested that the impact of cross-sector partnerships should include indicators of success that are familiar to non-traditional partners, e.g., increased sports participation for sport sector partners[45], number of people using new bike paths[24] etc., in the promotion of health behaviour choices like physical activity.

Sharing knowledge about harder-to-reach populations may also help some partnerships. One example of that is a social care group that collaborated with a sports organisation and shared valuable insights to guide the local sports programme in engaging vulnerable youths who were less likely to participate in sport[45,44]. Agreement of the *shared goals and measurable outcomes* early on in any collaboration may be essential for maintaining momentum and building trust, while avoiding conflict and delays. We found from our review that signing a *partnership contract* may not be sufficient to drive the partnership forward, but may be a solution to setting clear roles and responsibilities, capacity and availability which, reported in our review, are major barriers to collaboration[17,44,31,45,22,40].

Finding partners who are willing and able to contribute to shared initiatives is an essential requirement at the early stages of collaborations. One example of this is a project coordinator who was integral to the leadership of one agency's involvement and had continuous oversight and invested interest in the partnership long-term, even when her role was concentrated elsewhere[17.] Continuity of key partnership members promotes long-term momentum. Although, current trends of whole systems thinking may spark the interest of professionals and organisations to respond to related public health agendas and funding, the question remains about the sustainability of those strategic intentions.

Current trends of systems-mapping may lead to new combinations of partners but may also lead to blocking genuinely interested potential partners or even indirectly widening the health inequalities gap by a lack of representation or knowledge of the population of interest[14]. More evidence on the tools and the outcomes from systems-mapping is needed as it could help shape the new combinations of partners in promoting physical activity.

Bees in a system

Boundary spanners may offer a solution by acting as the cross-pollinators within a dynamic and complex system, similar to bees in a garden. Active individuals, groups or organisations that may already view themselves as having a role in promoting physical activity or recruiting non-traditional organisations or groups that could contribute new knowledge may serve as boundary spanners[31,45]. Considering that the main challenges that partners face are related to the limits of time, resources and will to collaborate, boundary spanners may offer a flexible and dynamic yet structured approach to engaging the whole system.

However, it has been reported that one barrier for boundary spanners and backbone organisations is that fixed-term funding like grants may reinforce working in silos[15] possibly preventing *boundary spanners* to sustain and

build on their role in the long-term. Current guidance and (limited) evidence suggests that whole systems approaches require a shift towards holistic thinking and funding that is not solely based on quick surface-level impact [2,4,5,1]. More evidence is needed on how to evaluate the cross-pollination, and therefore demonstrate system-level change.

Limitations

It is worth acknowledging that this systematic review and thematic synthesis was conducted under several limitations, so we advise some caution when interpreting the results. Firstly, some relevant records in the literature may have been missed due to the search strategy we used, which did not include terms such as "inter-disciplinary" or "cross-disciplinary" which may appear in relevant records but would have broadened our search too widely.

Secondly, the screening of abstracts and full texts, scoring risk of bias, data extraction and qualitative synthesis was predominantly conducted by VK, a doctoral student. This was reflected in the scope and scale of the research window available to conduct the review and the significant role played by the main researcher. Whilst it may have introduced greater opportunities for bias and/or errors during the various stages undertaken, we tried to mitigate this by introducing the use of a Systematic Reviewer (SW) and following a systematic review protocol, all necessary checks were implemented by a specialist (SW) to oversee screening and scoring bias, and the use of authors NB and DC to peer-review all principal stages and JW in the latter stages of the refining process.

Thirdly, the content of the included papers may reveal some limitations in our sample which did not include an exhaustive list of partnership types and partner sectors that may be documented elsewhere in the literature. However, we included what we deemed as the most likely types and settings.

Finally, we included records that may have included physical activity as a cross-sector partnership's shared goal regardless of whether it was the main or secondary or the "add-on" goal, which was found to be frequent in obesity-focused interventions. We acknowledge that these limitations may limit the applicability of this review's findings to some degree and to the types of partnerships and contexts included here.

Strengths

This is, to our knowledge, the first review to explore partnerships across a more diverse sample of sectors promoting physical activity of any type, scope or level and focusing on the relationship between the partners and

between the sectors, as well as the barriers and facilitators faced by all within the whole system. Furthermore, the broader terms and concepts used in the keyword strategy compared to previously published similar reviews, demonstrate a balanced heterogeneity and similarity within the sample of included records and rich information provided in the records about the context of the partnerships. We included partnerships operating in different countries and settings, and with diverse populations and socio-political contexts. It is the contention of the authors that these strengths have contributed to a more innovative review and a far more comprehensive review of cross-sector partnerships than has been previously reported.

Conclusion

Overall, our review resulted in themes around the limitations of time, resources and motivation of the cross-sector partners engaging in whole-systems approaches to physical activity. Boundary spanners may offer a solution to some of the challenges of cross-sector collaborations, boost local community efforts and continuously adapt to engage new partners supporting a long-term agenda. The deeper meaning of whole systems approaches remains largely unexplored with cross-sector working arrangements fluctuating between coalitions, community organising efforts, spontaneous collaborations or partnerships. In future research, the effectiveness of cross-sector partnerships and their true impact in the long-term should be investigated to update current and future guidelines for physical activity and systems thinking.

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Supplementary file 1. Search strategy as searched in MEDLINE.

Ovid MEDLINE(R) ALL <1946 to February 01, 2021>
1 Exercise/
2 (physical* adj2 activ*).tw.
3 Sports/
4 sport*.tw.
5 Sedentary Behavior/
6 sedentar*.tw.
7 (physical* adj2 inactiv*).tw.
8 ((healthy or healthi* or active) adj2 (lifestyle or living)).tw.
9 ((healthy or healthi* or active) adj2 (cit* or communit* or neighbo?rhood*)).tw.
10 Healthy People Programs/ or ("healthy people" adj2 program*).tw.
11 ((walk* or cycl* or bicycl*) adj5 (capacity build* or infrastructur* or built environment*)).tw.
12 (active travel* or active transport*).tw.
13 Public-Private Sector Partnerships/ or Intersectoral Collaboration/
14 Public-Private Sector Partnership*.tw.
15 (Intersector* adj2 Collaborat*).tw.
16 Systems Theory/ or (whole* adj2 system* adj2 approach*).tw.
17 integrated health promotion.tw.

18 ((multiagency* or crossagency* or interagency* or transagency* or cross?agency* or multiorgni?ation* or crossorgani?ation* or interorgani?ation* or transorgani?ation* or cross?organi?ation* or multiinstitution* or interinstitution* or transinstitution* or cross?institution* or multisector* or intersector* or cross?sector*) adj2 (partnership* or coalition* or alliance* or community organi?ing* or linkage*)).tw.

19 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12

20 13 or 14 or 15 or 16 or 17 or 18

21 19 and 20
Number of results: 240.

Supplementary file 2. Summary of quality assessments for the included records (n = 32), using the CASP checklist for records reporting qualitative (n = 19) and mixed-methods (n = 12) research and ROBINS-I for quantitative research (n = 1). Asterisks next to the citations indicate the records (n = 9) that were independently double-screened. Rating refers to the number of CASP questions answered as "Yes" out of 10 questions in total , or the ROBINS-I rating.

Citation (n=32)	Scoring tool (CASP, ROBINS-I)	Rating	Reasons
Mixed methods research			
McGladrey et al. 2020*	CASP	7/10	Lacks details of researcher reflexivity, data collection and analysis.
Van Dale et al. 2020*	CASP	8/10	Physical activity was the outcome of most partnerships but not all.
Horne et al. 2013	CASP	4/10	Data sources are discussed but details of research instruments e.g. survey questions, are not given. Most questions scored as Can't Tell.
Abildso et al. 2016	CASP	8/10	The data analysis is not described in detail and researcher reflexivity not mentioned either.
McKee et al. 2020	CASP	9/10	Detailed research design and findings.
Ramanathan et al. 2018	CASP	10/10	Detailed research design and findings.
Brennan et al. 2012	CASP	8/10	Detailed research design and findings.
Evenson et al. 2012	CASP	8/10	Detailed research design and findings.
Claus et al. 2012	CASP	5/10	Detailed research design and findings.
Hersey et al. 2012	CASP	7/10	Evidence from partnerships targeting obesity and physical activity, but unclear if findings relate to physical activity only or obesity only or both.

Baker et al. 2012	CASP	7/10	Detailed research design and findings.
Alhassan et al. 2021*	CASP	8/10	Paper reported 3 partnerships where only one was for physical activity.
Qualitative research			
Bornstein et al. 2014	CASP	3/10	Researchers' opinion/reflections. Missing limitations and researcher reflexivity.
Elliott et al. 2014.	CASP	5/10	Missing ethical considerations and limitations. Resembles a project report rather a research article.
Evenson et al. 2014	CASP	6/10	Somewhat detailed research design and findings.
Esparza et al. 2014*	CASP	3/10	Authors/ researchers' reflections. Information about the instruments for data collection are missing. Missing limitations.
Simon et al. 2017*	CASP	3/10	Authors have declared conflicts of interest. Not clear if the evaluations were from a third party. Most questions cored as Can't Tell.
Faulkner et al. 2009	CASP	9/10	Detailed research design and findings.
Rios et al. 2006	CASP	9/10	Author embedded in research may add limitations not discussed in text.
Kraft et al. 2012	CASP	9/10	Detailed research design and findings.
McHale et al. 2020*	CASP	10/10	Detailed research design and findings.
Van der Kleij et al. 2016	CASP	10/10	Just four out of five cases studies were targeting physical activity.
Jones et al. 2017	CASP	8/10	Detailed research design and findings.
Jones et al. 2021	CASP	10/10	Detailed research design and findings.
Marlier et al. 2015*	CASP	9/10	Detailed research design but lacking researcher bias reflexivity.

Aytur et al. 2016	CASP	7/10	Methods described in detail. Lacks details about researchers' reflexivity and bias.
Misener et al. 2016	CASP	8/10	Active member researcher may pose limitations to study.
Wutzke et al. 2018*	CASP	10/10	Detailed research design and findings.
Slaytor et al. 2018	CASP	2/10	Most questions were N/A, because the authors present their views and experiences without the use of data collection and analysis.
Hayes et al. 2019*	CASP	10/10	No mention about study limitations. Fidelity was checked and discussed in text.
Hermens et al. 2017	CASP	10/10	Detailed research design and findings.
Quantitative research			
Bell et al. 2019	ROBINS-I	Low to moderate risk	Quantitative research. Supporting outcome data about physical activity change. The study provides sound evidence for a non- randomized study but cannot be considered comparable to a well-performed randomized trial.

Supplementary file 3. Data extraction proforma sections

Study citation	*Authors, Title, Year, Journal*
Peer-reviewed	*Yes/No*
Link to more relevant data (from reference list checking)	*Quantitative data for physical activity outcome / Qualitative data about context,barriers and facilitators of cross-sector collaborations*
Country	
Corresponding author contact details	*Name, Email, Address*
Research methods	*Quantitative/ Qualitative/ Mixed-methods/ Participants/ Participant sample size etc.*
Public health intervention(s)	*Name/ Type/ Collaborating Sectors/ Scope or Target Population/ Intervention's Scope/ Length Of Time Partnership Was Active etc.*
Partner's experience	*Barriers, Facilitators/ Opportunities/ Recommendations/ Other Qualitative Findings*

Intervention or partnership outcomes	*Binary / Continuous Outcomes etc.*

Supplementary file : PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist.

TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	Lines 1-2
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	Lines 4-23
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	Lines 37-41
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Lines 42-44
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	Lines 51-53
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Lines 63-74
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional records) in the search and date last searched.	Lines 54-62
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	Supplementary file 1
Study selection	9	State the process for selecting records (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	Lines 75-83
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	Supplementary file 2
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	Lines 70-74
Risk of bias in individual records	12	Describe methods used for assessing risk of bias of individual records (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	Lines 79-83
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	N/A
Synthesis of results	14	Describe the methods of handling data and combining results of records, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	N/A

Risk of bias across records	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within records).	N/A
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	N/A
RESULTS			
Study selection	17	Give numbers of records screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	Lines 95-99, Figure 1
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	Table 1
Risk of bias within records	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	Supplementary file 3
Results of individual records	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	N/A
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	N/A
Risk of bias across records	22	Present results of any assessment of risk of bias across records (see Item 15).	N/A
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	N/A
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	Lines 176-230
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	Lines 232-250
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	Lines 262-269
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	Lines 401-405