

Shaping Policy and Practice: Analyzing the Reach of Highly Cited and High Altmetrics Publications for Broader Impact on Physical Activity

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Background: A significant gap remains between the availability of physical activity (PA) evidence-based interventions and their application in real-world settings in policy and practice areas. This study aims to describe highly cited and high altmetrics publications in PA research and explore their impact on PA policy and practice. **Methods:** Mixed-methods sequential explanatory study including the identification and description of the top highly cited and high altmetrics PA publications from the last 10 years (including study design, population, type of PA study, number of citations, and altmetrics score), and interviews with key informants regarding research dissemination and implications on PA policy and practice. **Results:** When considering publication type, the most frequent highly cited publications were health consequences (40%, altmetrics = 42%), measurement/trends (23%, altmetrics = 10%), and correlates/determinants (21%, altmetrics = 26%) studies. They were predominantly cross-sectional (50%, altmetrics = 28%), systematic reviews (38%, altmetrics = 18%), and longitudinal studies (8%, altmetrics = 37%). All authors who participated in the interviews agreed that the most important factors in disseminating findings and influencing PA policy and practice were the published peer-reviewed manuscript itself, the reputation of the journal, the communication strategy, and the use of online platforms. **Conclusions:** To have a real-world influence on PA policy and practice, it is not enough to publish the results in scientific journals and participate in media outreach. To successfully involve policymakers and communities in appropriating the evidence and evaluating the extent to which these findings affect policy and practice outcomes, it is critical to lead co-creation, co-dissemination, advocacy, and capacity building efforts.

Keywords: citations, dissemination, epidemiology

Physical inactivity is causally associated with many chronic conditions and substantial morbidity, mortality, and economic costs globally.¹⁻⁴ Many evidence-based physical activity (PA) interventions are scalable, effective, and represent a good value with evidence of cost effectiveness.⁵⁻⁷ However, a significant gap remains between the availability of science-based interventions and application in real-world settings, particularly in policy and practice venues.⁸ Several health behavior models⁹ and frameworks posit the importance of policy as a facilitator of PA behaviors. As such, it is important to characterize existing policy strategies for PA promotion. Policies targeting PA tend to be cross-sectoral

(eg, transportation, city planning, education), and an important component in local, regional, national, and international PA planning and guidelines.¹⁰ Additionally, PA-related policy tends to focus on investments in resources or on regulations. However, recent studies have highlighted a lack of comprehensiveness and implementation of policies, as well as a lack of available evidence on the effectiveness of PA-related policy.^{11,12}

To assess the benefits of research in yielding real-world impacts (eg, increasing population PA prevalence, making communities healthier, and more equitable, and inclusive), both quantitative and qualitative methods can be used and can include, for instance, bibliometrics, value maps, case studies, or expert reviews.¹³ There are theoretical and methodological frameworks to evaluate the impact of health and policy research, extending from cost-benefit to decision and policymaking models.¹⁴ Impact can be measured in the short, medium, and long term in the academic (eg, publication downloads, citation rates and networks, social media scores, use of evidence in systematic reviews); practice (eg, awareness and knowledge of evidence-based practice, presence of evidence in guidelines and funding opportunities, uptake of evidence-based interventions); and policy (eg, awareness and knowledge of evidence-based policy, use of evidence in policy-making, adoption, and evaluation) settings.¹⁵

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
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The academic and policy impact of research may be measured with traditional citations, but also with alternative metrics that make possible to quantify the diffusion to a wider audience that may be more directly involved in policy and practice implementation.^{15–20} For instance, the altmetrics counts from Altmetric.com take into account how much and what type of attention is research having from policy documents, news, blogs, Twitter, postpublication peer-reviews, Facebook, Syllabi, Google+, LinkedIn, and YouTube, among others. Some people also use these metrics as proxies for social recognition and to spot the earliest signs of scientific influence.¹⁹

The ability of altmetrics to complement traditional citations' indicators as measures of scientific impact is still not clear.^{21,22} Previous literature demonstrates that highly cited publications make up a small percentage of those publications with high altmetric counts.²¹ Altmetrics may represent a different kind of impact (eg, relevant to media knowledge but not necessary to policymakers' knowledge and communications often times are unrelated to the content relevance), suggesting a need to better understand what is the impact of publications. In fact, using the best research evidence available could improve the choice and the uptake of policy for promoting population health.^{23–26} This information is important for identifying communication barriers among research and practice communities and may be helpful in moving the field forward with a better understanding of what impact on PA policy may be. Additionally, to better understand and expand on what facilitates either highly cited or highly visible (ie, high altmetric counts) research relevant for PA and public health.

The aim of this study was to determine the characteristics and impact on policy and/or practice of highly visible publications (highest number of citations or altmetrics) in the PA and public health field and, if there were differences between those that were highly cited versus those that gathered high mass and social media attention as measured by altmetrics.

Methods

We conducted a mixed-methods sequential explanatory study from June 2020 and April 2021 that included a rapid literature review and interviews with key informants. Four steps were conducted as follows:

Identification of Publications

The top 100 highly cited publications and the top 100 altmetrics publications were searched in Google Scholar and Altmetric.com with “physical activity,” “public health,” and “health” in the title from June 2020 to August 2020. Publications were matched for time period, with the high altmetrics publications being published in the past 5 years and the highly cited publications being published in the past 8 years (accounting for the time needed to be cited once published) (see [Supplementary Materials S1 and S2](#) [available online]).

Data Extraction

Descriptive information extracted by a pair of authors (Ramírez Varela and Serrano) and in case of doubts regarding classification, a third author was consulted (Pratt). Information was gathered on (1) study type (ie, prevalence measurement and trends, correlates and determinants, health outcomes, interventions, policy)²⁷; (2) study design (ie, cross-sectional, longitudinal, experimental [including RCTs]); (3) study population; (4) age group; (5) implications (use in local, regional, or global policy proposals/

laws/regulations); and (6) number of Google Scholar citations and altmetrics. These characteristics were compared between groups with anticipated themes including methodological style, relevance of studies, study quality, defining impact, and community interest.

Key Informant Interviews

To learn more about the impact of publications on PA policy and practice, as well as barriers and facilitators of research dissemination and communication, we conducted key informant interviews with the first authors of the publications, and the second and last authors in a few cases (1 and 3 authors, respectively) that the first authors were not available. From the list of highly cited publications and high altmetrics publications, the top 5 publications overall, in interventions and in policy from each group (ie, citations and altmetrics), were selected (see [Figure 1](#)). Twenty-nine authors (1 publication ended up on 2 lists) were identified to participate in 30-minute telephone or video interviews.

Prior to conducting the interviews, an interview guide (see [Supplementary Material S3](#) [available online]) was developed based on themes arising from the present review of publications, as well as a literature available on PA research implications on policy and practice.¹⁵ The interviews were conducted by the first 2 authors between February and March 2021, were recorded with the participants' permission, and professionally transcribed, lasting an average of 38.5 minutes.

Questions explored the background of the authors (eg, current work setting and position, policy or practice experience), the process of research dissemination and communication (eg, sharing research findings with stakeholders and wider audiences beyond publishing peer-reviewed manuscripts), and impacts of PA research on policy and practice (eg, characterization of research impact). We also included questions of facilitators and barriers of research dissemination as well as high visibility of research.

Data Analysis

Descriptive analyses were conducted for highly cited publications and high altmetrics publications in the sample using Stata (version 17.0, StataCorp). A codebook was developed with anticipated themes to facilitate the analysis of transcripts. While coding interviews, deductive focused coding techniques were then used to better represent themes present in the transcripts. All transcriptions were coded and summarized using NVivo (version 12.0, QRS International), with quotes utilized to represent key themes.

Results

Twenty authors agreed to participate in the study, providing a response rate of 69% (20 out of a possible 29 eligible interviewees). Among these authors, 11 (55%) were from the top 5 highly cited publications in the field of interventions and policy. This subgroup was comprised of 9 first authors, consisting of 8 males and 1 female, along with 2 last authors, 1 male and 1 female. In terms of geographical distribution and workplace location, the majority of authors (81.8%) were from The Americas, with representation from the United States (n = 6), Canada (n = 2), and Brazil (n = 1). The Western-Pacific region accounted for 18.2% of the authors, specifically from Australia (n = 2).

Nine (45%) authors were from the top 5 high altmetrics publications group. Among these, 7 held the position of the first author (comprising 5 males and 2 females), while one author was

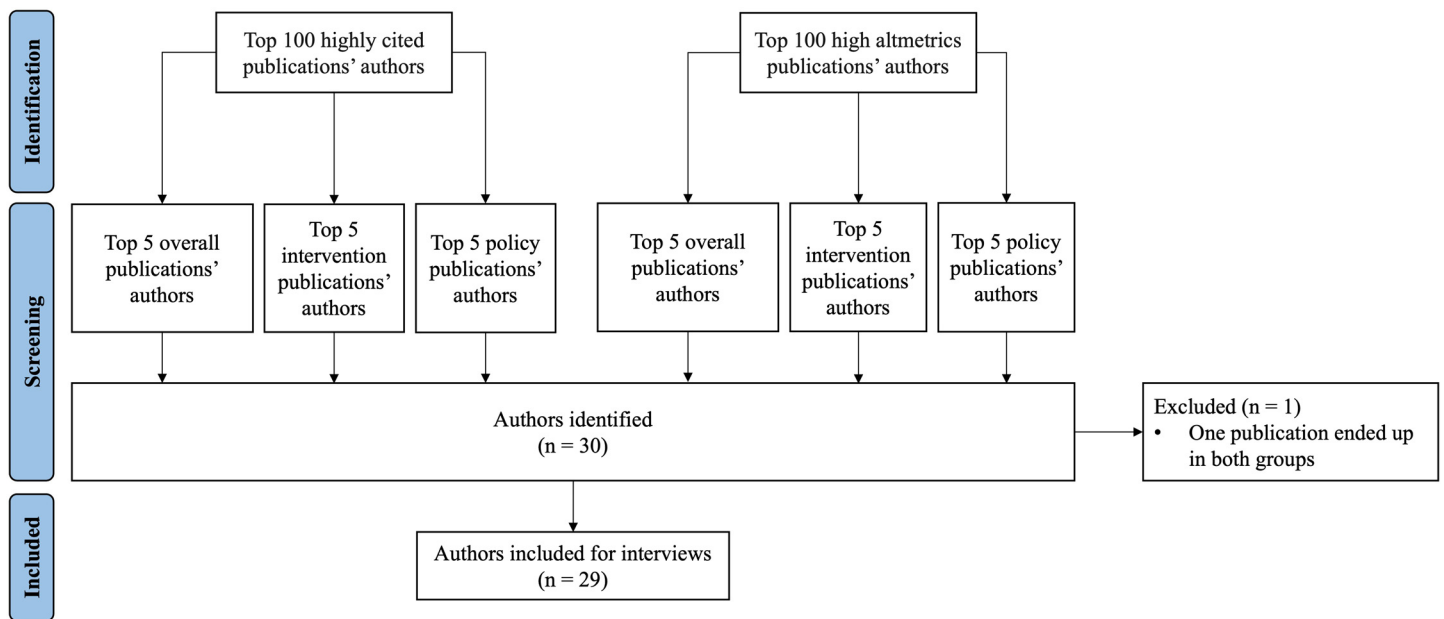


Figure 1 — Key informants' flowchart.

the last author (male), and another occupied the role of second author (male). In terms of geographical distribution and workplace location, 55.6% ($n = 5$) were based in The Americas, encompassing participants from the United States ($n = 4$) and Canada ($n = 1$). A third of the authors (33.3%) were from Europe, with representation from England ($n = 1$), Norway ($n = 1$), and Switzerland ($n = 1$). Additionally, 1 author (11.1%) was affiliated with the Western-Pacific region, specifically from Australia.

Characterizing the Most Highly Cited Publications and Those With the Highest Altmetrics Scores

Studies on health consequences dominated both the citations (40%) and altmetrics (42%) groups (see Table 1). The distribution by study type was similar for both groups, with the main difference being the proportion of studies that were interventions (ie, primary goal is increasing PA), policy (ie, public health and PA policies), and prevalence/measurement/trends (ie, measurement and surveillance of PA)²⁸ studies. The share of policy (11% in citations group and 5% in altmetrics group) and intervention (5% in citations group and 17% in altmetrics group) articles were the lowest.

The distribution by study designs varied considerably. While 50% of traditional citation publications were cross-sectional, only 28% of altmetrics publications were cross-sectional. Only 8% of traditional citations publications were longitudinal, whereas 37% of altmetrics publications had this study type. Articles with high altmetrics did not necessarily have a high citation count, and vice versa. Only 3 articles featured in the top 100 for both groups, and they had to do with tracking of PA over time, the health impacts of leisure-time PA, and the contribution of physical inactivity to the global burden of disease.

Perceived Barriers and Facilitators of Research Dissemination and Impact

The interviews unveiled the authors' perceptions on what facilitated or hindered the process of research dissemination, the impact

on policy and practice of PA, and the visibility of their publications (see Table 2).

Participants' Background

All interviewees had degrees in Exercise Science or Public Health (including Epidemiology), with one exception (a computer scientist). Those that did work in the healthcare sector were primarily academic researchers. Policy experience was reported by more than half of respondents (55%) mentioning having worked on and/or contributed to developing health recommendations or guidelines. Participants' professional backgrounds were similar in the citations and the altmetrics groups with slightly more proportion of participants in the altmetrics group reporting having clinical experience, while those in the citations group had a greater proportion of individuals working for government agencies.

Research Dissemination

Process of Research Dissemination

The peer-reviewed manuscript itself was considered to be the primary component of sharing research findings with stakeholders and wider audiences. Research was often shared with participants' networks, including the use of social media. However, some pointed out the lack of much done after this step.

I see that quite frequently. Like you see, students quite frequently say I'm going to present at a peer-reviewed conference, and that's how I'm going to disseminate and, and we know it's much more than that, right?

Only a few of the interviewees shared results outside of their own networks, and those who did so mentioned having the necessary resources (such as funding or a communications office) at their disposal. When appropriate resources were available, research was disseminated to nonacademic media. A focus of this process was successfully framing the research, making

Table 1 Descriptive Characteristics of the Top 100 Physical Activity Publications for Both Traditional Citations and Altmetrics Groups

| | Citations (N = 100) | | Altmetrics (N = 100) | |
|---|---------------------|------|----------------------|------|
| | n | % | n | % |
| Study type | | | | |
| Health consequences | 40 | 40.0 | 42 | 42.0 |
| Prevalence, measurement, and trends | 23 | 23.0 | 10 | 10.0 |
| Correlates and determinants | 21 | 21.0 | 26 | 26.0 |
| Interventions | 5 | 5.0 | 17 | 17.0 |
| Policy | 11 | 11.0 | 5 | 5.0 |
| Study design | | | | |
| Cross-sectional | 50 | 50.0 | 28 | 28.0 |
| Longitudinal | 8 | 8.0 | 37 | 37.0 |
| Case control | 0 | 0.0 | 1 | 1.0 |
| Experimental (including randomized controlled trials) | 4 | 4.0 | 16 | 16.0 |
| Systematic review/meta-analysis | 38 | 38.0 | 18 | 18.0 |
| Study population | | | | |
| Children and adolescents (<18 y of age) | 27 | 27.0 | 13 | 13.0 |
| Adults (18–60 y of age) | 2 | 2.0 | 13 | 13.0 |
| Older adults (≥60 y of age) | 5 | 5.0 | 9 | 9.0 |
| Pregnant women | 1 | 1.0 | 0 | 0.0 |
| More than one population group or not specific for children and adolescents, adults, older adults, and pregnant women | 65 | 65.0 | 65 | 65.0 |

Table 2 Key Characteristics of Highly Cited and High Altmetrics Publication Authors' Responses on the Process of Research Dissemination, Impact on Policy/Practice, and Research Visibility

| Domain | Question | Highly cited publications' authors | High altmetrics publications' authors | Highly cited and high altmetrics publications' authors |
|---|---|--|---|---|
| Background (current work setting and position, policy, or practice experience) | Do you have any policy or practice experience? | <ul style="list-style-type: none"> • Prior work for government agencies | <ul style="list-style-type: none"> • Clinical experience | <ul style="list-style-type: none"> • Academic professors in health fields • Medical professionals • Health organizations/agencies • Participation on relevant councils (eg, committees on recommendations and guidelines) |
| Process of research dissemination (sharing research findings with stakeholders and wider audiences beyond publishing peer-reviewed manuscripts) | Who are the intended audiences of this dissemination of research? | <ul style="list-style-type: none"> • Key stakeholders (ie, decision makers, policymakers) | <ul style="list-style-type: none"> • Intended audience decides how research should be disseminated (not systematic, but strategic) | <ul style="list-style-type: none"> • Mostly academic |
| | What are the facilitators of research dissemination? | <ul style="list-style-type: none"> • Sharing with and through networks of colleagues and organization | <ul style="list-style-type: none"> • Press/communication office is key | <ul style="list-style-type: none"> • Publication is primary component • Conference presentations • Social media • Framing of the issue or topic |
| | What are the barriers to research dissemination? | <ul style="list-style-type: none"> • Institutions with weak communications centers | <ul style="list-style-type: none"> • Academic culture that emphasizes publications over anything else | <ul style="list-style-type: none"> • Communication skills |
| | What are the requirements to effectively disseminate your own research to wide array audiences? | <ul style="list-style-type: none"> • No standard process | <ul style="list-style-type: none"> • Anything beyond publications stems from intrinsic motivation | <ul style="list-style-type: none"> • Minimal beyond peer-reviewed publications or conference presentations |
| | What are your own practices and behaviors with regard to dissemination? | <ul style="list-style-type: none"> • Importance of experience in mentorship of trainees | <ul style="list-style-type: none"> • Training and practice vital for self-efficacy, including running a blog | <ul style="list-style-type: none"> • General confidence in each individual's research dissemination process |

(continued)

Table 2 (continued)

| Domain | Question | Highly cited publications' authors | High altmetrics publications' authors | Highly cited and high altmetrics publications' authors |
|---|---|---|---|--|
| Impact on policy/practice (eg, characterization of research impact) | How do you characterize research impact on physical activity policy/practice? | <ul style="list-style-type: none"> Definitions for policy and practice became intertwined (eg, translating policy into practice) | <ul style="list-style-type: none"> Raise awareness and encourage people to read the research | <ul style="list-style-type: none"> Research impact on practice included informing and guiding practitioners Research impact on policy included the impact on guidelines |
| | What are the facilitators of impact on policy/practice? | <ul style="list-style-type: none"> Media attention | <ul style="list-style-type: none"> Reaching wider audiences | <ul style="list-style-type: none"> Clearly worded, concise, and comprehensible messages Networking (eg, stakeholders, government, researchers, journalists) Knowledge translation |
| | What are the barriers of impact on policy/practice? | <ul style="list-style-type: none"> Weak influence on political decisions Lack of funding | <ul style="list-style-type: none"> Easier to impact practice than policy | <ul style="list-style-type: none"> Lack of resources |
| Research visibility | What are the facilitators of research visibility? | <ul style="list-style-type: none"> Quality and experience of the authorship team Media attention | <ul style="list-style-type: none"> The general public's interest in and relevance of the topic | <ul style="list-style-type: none"> Importance of the journal's visibility and media strategy Social media |
| | What are the barriers of research visibility? | <ul style="list-style-type: none"> Lack of media attention | <ul style="list-style-type: none"> Timeline (older publications have more citations) | <ul style="list-style-type: none"> Social media |

sure audiences understood the issue and the importance of the work. Compared with the citations group, altmetrics authors reported frequently using press releases as a key component of dissemination.

Resources Available for Research Dissemination

The most frequently reported resource available was a research dissemination/media/communications unit (center, core, or in some cases an individual). This was available to researchers at different levels.

I can tell you that the quality of the media team at the three institutions has varied tremendously. And what I find is that some institutions are ready to take a pilot study and put it on the front page of the New York Times and other places are really conservative.

Typically, these units were a part of the author's university/department. This resource was sometimes funded by the authors themselves (inside their own centers/projects or through a consulting firm) or, on occasion, by the journal in which the authors were publishing. Less commonly cited resources were funding and training on communication/dissemination.

Requirements of Research Dissemination

Most respondents claimed they did not have to disclose their research findings beyond what was required by the institutions that provided funding. A plan for dissemination appeared to be necessary for some funding channels, but beyond publishing, no enforcement or follow-up was mandated. Rather, it was up to the researcher to disseminate to different audiences.

Research Dissemination Audience

Participants' research dissemination audience included those in the field (their larger networks), communities that they have worked with, and funding agencies—including local, state, and national

government representatives. The most cited papers' authors referenced key stakeholders as target audience more often, while the authors of the papers with the highest altmetrics more frequently reported that the target audience influences research dissemination strategies:

Meetings with stakeholders and policymakers, briefing key leaders who have a chance who have the ability to make changes and to create opportunities for policy change at multiple levels.

Self-Efficacy of Research Dissemination

Interviewees reported varying levels of self-efficacy of research dissemination, but in both groups, most discussed confidence in their own individual process. However, participants also identified that they lacked self-efficacy to communicate to wider audiences or relied on other resources. The authors of the papers with the highest altmetrics reported feeling confident in using social media to disseminate the research findings. One author of the highest altmetrics papers explicitly stated his belief in relying on others for research dissemination rather than his own:

That's not my job. My job is to identify people that can disseminate information.

... helping researchers understand how to appropriate with mass and social media is an enormous factor in the success.

Facilitators and Barriers of Research Dissemination

Facilitators for research dissemination involved similar components as resources for research dissemination, such as dissemination/media/communications units. One participant discussed a facilitator as follows:

I think a factor that plays very heavily is institutional reputation.

Other facilitators mentioned were participants' own training and behaviors, the publishing journal, and paper authorship. Some

also cited situational factors, such as current importance/relevance of the topic, which could be facilitated how the paper message and language could be framed. Citations authors stressed sharing research through networks, while altmetrics authors more often stated that press/communication offices are key facilitators.

Barriers for research dissemination included not actionable findings, the publishing journal (can be both a facilitator and a barrier depending on the journal), and not having appropriate facilitators/resources. One participant acknowledged that, even with access to resources available for research dissemination, lack of communication can be a barrier to effective use of them:

Research personnel at the college level seem to come and go. Their level of motivation to actually work with researchers comes and goes. Something will get started, and it won't be completed. There seems to be a lack of coordination between the college University and the community.

Regarding barriers for research dissemination, some altmetrics authors also commented on the existence of an academic culture emphasizing the number of publications, meaning anything beyond publication stems from intrinsic motivation.

Impact on Policy and Practice

Participants found it difficult to distinguish between policy and practice impact, and often used both interchangeably. The general consensus on practice impact was research leading to the implementation of programs and policies—“doing the physical activity work,” frequently connected with health departments/practitioners' scope of work. Policy impact was commonly defined as research linked to guidelines/recommendations or also vaguely described as “research leading to the implementation of policies.”

When asked about how they would characterize research activity relate to practice and policy, one participant discussed the extent of it:

Minimal. Ninety something percent of the physical activity research that's published . . . is going to make no difference to policymakers whatsoever.

However, other participants declared that they observed the influence that research has on documents like the PA guidelines:

. . . any particular study, even a single review may not and appropriately probably should not affect policy, but when those are all synthesized, and aggregated, and in use for something like the Physical Activity Guidelines Advisory Committee report, I think they can have a tremendous impact.

One participant discussed how research impacts policy on the Canadian context:

I think it's been very, very impactful. You know some of the things that we've done, and other people have done, have definitely changed the way that programs are delivered in the country, our 24-Hour guidelines, for example, have changed the curriculum all the way from kindergarten through to the end of university.

Facilitators and Barriers for Policy and Practice Impact

No specific themes arose in this area. Most participants answered these questions thinking of facilitators of dissemination/visibility.

Two participants stressed the importance of disseminating to a wider audience:

I think the impact on practice . . . has to be disseminated in such a way that you know it's not just colleagues that are here are part of your tribe, so to speak. You know in other words preaching to the choir is an expression that we use sometimes when you . . . are seeing your efforts just on those that are part of your network.

To create a group of people who have contacts and connections in a variety of areas, whether they're federal government, state government, research policy, local government, it's I think one of the most important things right now.

Most examples of impact were linked to recommendations, guidelines, or overarching institutions or networks (eg, The Global Observatory for Physical Activity—GoPA!). One specific example of impact was a community that sustained a specific intervention. Citations and altmetrics authors expressed the importance of a clear message on the path to generate impact on PA policy and practice.

Similarly, to the discussion on facilitators of impact, many of the barriers discussed were also related to visibility and weak influence on political decisions. One participant's view on the barriers for policy and practice impact was as follows:

Only a small fraction is actually policy relevant and is constrained by the drivers of (1) the research culture of physical activity (2) the research drivers of funding agencies like our national funding agencies.

There was also some indication that not one publication alone would be able to bridge the connection between research and impact on policy/practice on its own. Additionally, funding was also emphasized as a barrier for impact:

. . . lack of funding makes things very difficult because you know when funding is short, we do not have support to go on and our big interventions that we need, will not happen.

Others identified barriers in not having facilitators/resources related to dissemination.

The capability to impact PA policy and practice depends highly on contextual factors as one participant stated:

Your piece is one piece of that story. It's good to have it in there, but it's not going to change the world by itself. The impact depends on the political and funding context, and all those other things.

In addition, one participant addressed this in the Canadian context:

Canada is definitely one of the main examples of how there is like a direct like flow between research and practice and policy, which is a completely different process in different countries. Sometimes it's just totally blocked and it's difficult to get this information translated and maybe some papers that are really important, they remain just as papers and never get any translation.

Research Visibility

General facilitators of research visibility were in line with facilitators for dissemination, with additional emphasis on the

publishing journal. Facilitators cited by authors of publications with high altmetrics that were emphasized were use of different communication channels (especially social media), framing/catchiness (some talk on importance of title), the reputation/visibility of the publishing journal, access to a communications team, how recent the publication is, and consideration of who is it important for/does it matter to? Meanwhile, facilitators cited by authors of highly cited publications discussed the publishing journal/authors, the type of study (larger population-level epidemiologic studies or systematic reviews that can make an important statement more highly cited than specific interventions), and the participants/procedures used in the study. Compared with the altmetrics group facilitators, the use of different communication channels was still regarded as important, but there was a sense of these other facilitators being more important.

General barriers for research visibility were the publishing journal (same for research dissemination, can be a facilitator or barrier depending on the journal), the type of study/findings, and other dissemination barriers. One participant emphasized the difficulty of reach:

I might speculate it's probably harder because of the plethora of open-source journals. I mean, we're just being inundated by articles, and so I would say, if anything, that's probably made it a little more challenging to get visibility and impact.

Discussion

The key findings from the study are as follows: (1) Authors from the highly cited and high altmetrics papers reported that the published peer-reviewed manuscript per se along with the journal's reputation, communication strategy, and use of online platforms are the most important factors for disseminating findings and influencing PA policy and practice; (2) knowledge translation of research is an essential step to impact policy and practice, yet once manuscripts are published there are insufficient efforts or mechanisms to reach larger audiences beyond academia; and (3) not all highly cited publications were concurrently in the high altmetrics group, and vice versa, suggesting a mismatch on dissemination and access of information between researchers and the broader non-academic community.

All authors relied heavily on publication of their work in scientific journals to disseminate their findings, and 65% of them had ties to public relations or communication departments to enhance the process, yet there was little to no strategy for spreading the word outside the academic community. Though accessibility of publications was explored, both the most highly cited and high altmetrics publications had a similar percentage of publications considered to be open access (ie, 85% and 87%, respectively). Only 10% of authors went beyond publishing in scientific journals to try to influence the process. Similarly, a study by McVay et al²⁹ found that American researchers in the fields of public, occupational, and environmental health ranked in-person meetings with stakeholders, academic journals, press releases, policy briefs, and media interviews as the top 5 channels they believed had the greatest impact on public health; however, respondents relied on academic publications more frequently (100%) than in-person meetings with stakeholders (68%).

The reputation of the publishing journal was considered important for impact on PA policy and practice. Journals that actively engage in social media attract more readers and authors.³⁰

A previous study found that journals that had a Twitter account received 34% more citations compared with journals that did not.¹⁹ In addition, the use of digital communication tools is on the rise since they are an efficient and cost-effective way to spread information and encourage PA.³¹ The correlation between altmetrics counts and article citations suggests that incorporating social media plugins (eg, Twitter, Facebook, Mendeley) into journal webpages may also aid in increasing research visibility and impact.³²

Social media sites have increased their applicability to disseminating research findings.¹⁹ However, a balance between traditional publication on scientific journals and social media is looked-for.³³ Working with the public relations or communication offices found in most universities and research organizations helps to get the word out about the research through the mainstream media. The Lancet Physical Activity Series are examples of worldwide academic publications of PA with significant citations and media coverage.³⁴ In the long run, even authors who only share their work with other academics (ie, inreach) will reach other researchers. However, by combining research dissemination through the academic network and other communication channels, authors can reach effective advocacy efforts and, potentially, new audiences (ie, outreach)³⁵ (see Figure 2). Nonetheless, in the process of research dissemination, there is a need to effectively frame the study to ensure that audiences not only grasp the nature of the problem being addressed, but also place the research findings in a social and political context to better understand the range of possible solutions and social strategies, and the significance of the research being done to influence political will and policy action.^{36–38}

The framework by Richmond and Kotelchuck^{36,37} that includes the 3 main determinants of public policy (knowledge base, political will, and social strategy) could support public policy effectiveness in the field of PA and health. Also, the model by Schmid et al³⁸ that accounts for connections between policy, the environment, individual actions, and health can be used to prioritize and implement policy initiatives to increase PA levels in the population.

Moreover, the need of knowledge translation to be at the forefront was highlighted since physical inactivity levels continue to be high^{39–41} despite the exponential increase in PA research.^{28,42–44} Making evidence more relevant and accessible when disseminating research findings helps encourage its use by end users.^{45,46} To transform policy into reality and prevent research from sitting on a shelf, an effective dissemination strategy that aims to persuade a target audience¹⁵ is required. However, knowledge translation is not straightforward as it is dynamic, iterative, and comes with challenges of resources and effort.⁴⁷

Only 3 publications^{1,48,49} were discovered to be in both top 100 highly cited publications, and the top 100 altmetrics publications. Since health outcomes were still the primary focus of study through 2012,²⁸ it is not unexpected that 2 of the publications dealt with health consequences. These articles may have done well in terms of citations and altmetrics because they tied their findings to a familiar concept, such as the fact that inactivity kills as many people each year as smoking does around the world,¹ the importance of getting enough exercise to prevent premature death or increase longevity,⁴⁸ or the value of using one's smartphone or wearable device to keep track of this data.⁴⁹ Provocative titles⁵⁰ and data like these are easy to employ to back up claims that PA has positive effects. Additionally, it has been shown that this process requires not just the reliability and credibility of the source but also the use of both social and research relationships.⁵¹ There is

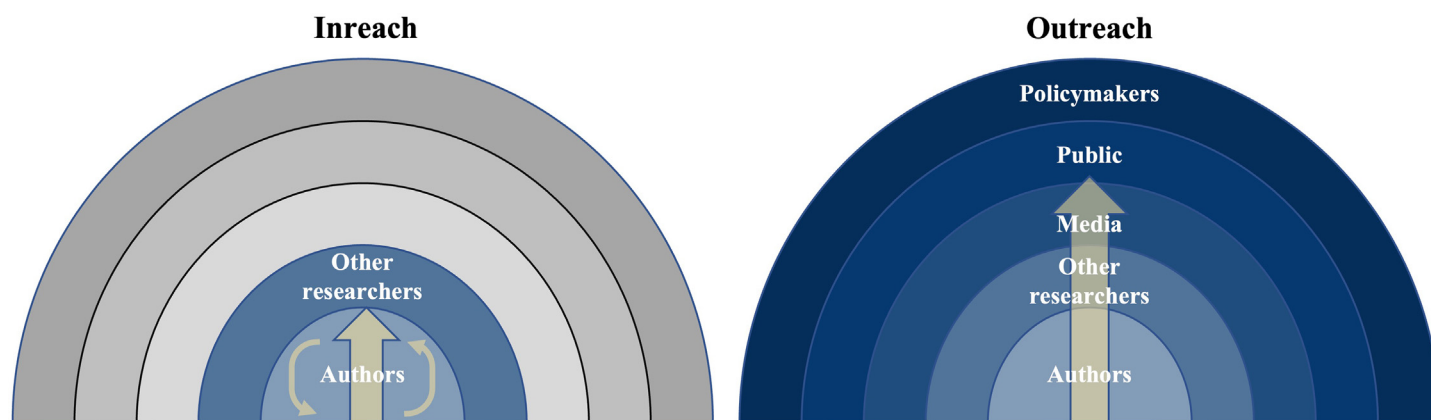


Figure 2 — Conceptual framework of inreach and outreach research dissemination. Left: Authors may initially only reach other authors and potentially other researchers. Right: Authors may initially only reach other researchers, but in the future (arrow), they will also gain followers among the media, the general public who are not scientists, and eventually policymakers. Adapted from FACETS by Côté and Darling, 2018. © Canadian Science Publishing.³⁵

evidence of the relation of authors publishing the research on Twitter and better citation counts and widespread attention to their work.⁵²

Framing a simple but powerful message is crucial to address audiences. Participants emphasized the use of clearly worded, concise, and comprehensible messages and based on experts' recommendations on approaches and tools for disseminating to nonresearch audiences and engaging communication initiatives.^{15,53–56} A previous study provides examples on how the dissemination frameworks can be operationalized using 10 rules—(1) audience mapping, message framing, and dissemination plan; (2) media visibility; (3) collaboration; (4) open science: open access, preprints, and open data; (5) nontraditional outputs: lay summaries, press-releases, blogs, and visual/video abstracts; (6) in-person dissemination; (7) art or multimedia dissemination; (8) inclusive dissemination; (9) innovative dissemination tools; and (10) assess dissemination and impact—for novel dissemination of research that allowed making science more widely available and getting the public involved.^{57,58} It is not enough to rely on a communications office to do the dissemination of findings, and the research community as a whole has to step out of its comfort zone, educate in effective research communication techniques, and engage in the political aspects of public health and advocacy that can impact PA policy and practice.⁵⁹

Strengths and Limitations

This study has a number of strengths: (1) The use of a sequential explanatory design allowed inclusion of the views and opinions of the first authors of the most visible publications (highest citations or altmetrics counts) in the PA and public health field and (2) the inclusion of a holistic perspective on the impact of PA and health publications by conducting an assessment that included both a traditional academic metric (citations) and alternative multimedia dissemination (altmetrics). Study limitations include the potential of missing information from the participants that did not answer to the study invitation.

Conclusions

For PA research publications to have real-world impact on PA policy and practice, it is not enough to publish the results

in scientific journals and engage in attempts to disseminate the findings to the media. It is critical to lead co-creation, co-dissemination, and advocacy efforts to effectively engage policymakers and communities in appropriating the evidence, and there should be a long-term commitment to assess the extent to which these findings affect policy and practice outcomes and, ultimately, contribute to increased population PA prevalence.

A significant recommendation for funders of PA research is to consciously direct funding toward project activities that not only exhibit high-quality research but also emphasize extensive reach and dissemination while engaging a broader audience beyond academic circles. Prioritizing efforts that have the potential to create a substantial impact on policy and practice is crucial. To facilitate this, it is important to allocate adequate resources for training. Also, embedding and safeguarding these endeavors within researchers' activities and recognizing their contributions in these domains should be fundamental for career advancement. Embracing this comprehensive approach will significantly contribute to the effective translation of research findings into tangible enhancements in PA policy and practice.

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