



## A bibliographic review of sustainability research output and investment in 10 leading public health journals across three time periods

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### ABSTRACT

**Objectives:** Long-term delivery, or sustainability, of evidence-based interventions is necessary for public health benefits to be realised. However, sustainment of effective interventions is poor. Understanding the evidence-base and identifying potential gaps is necessary to inform where future research efforts are most warranted.

**Study design:** We undertook a repeat cross-sectional bibliographic review of research published in 10 public health journals across three time periods (2010, 2015 and 2020/2021).

**Methods:** Studies were eligible if they were a data-based study or review article. Studies were assessed as to whether they focused on sustainability. The percentage of public health research studies assessing sustainability overall and by the three time periods was calculated. The association between time period and the proportion of sustainability articles was assessed using logistic regression. Descriptive statistics were used to summarise study characteristics overall and by time period.

**Results:** 10,588 data-based articles were identified, of which 1.3 % (n = 136) focused on sustainability. There was a statistically significant association between time period and the proportion of sustainability research, with a slight increase across the three time periods: 0.3 % (95 % CI: 0.1 %, 0.7 %) in 2010, 1.4 % (95 % CI: 1.0 %, 1.9 %) in 2015 and 1.6 % (95 % CI: 1.3 %, 1.9 %) in 2020/2021. Most research was descriptive/epidemiological (n = 69, 51 %), few focused on measurement (n = 2, 1.5 %) and none on cost effectiveness. Only one intervention study assessed the effect of specific sustainability strategies.

**Conclusions:** This bibliographic review highlights the need for more public health research on sustainability, particularly in the areas of measurement, sustainability interventions, and cost effectiveness.

### 1. Introduction

Governments internationally make considerable investment in the development and delivery of public health programs, although expenditure for public health is often less than other areas [1–6]. While investment in public health interventions has significant potential to positively influence health and economic outcomes, the potential benefits of such programs can only be realised if they are implemented at a population level [6]. Accordingly, funding schemes have been developed to facilitate translational research and build an evidence base in this area [6]. Such investments have improved the production of

implementation research, with implementation science output in the field of public health having more than tripled in the decade to 2017 [7]. The focus of such research has begun to transition from studies describing implementation models, frameworks, and determinants, to those developing and testing the effect of implementation strategies on implementation indicators like adoption, fidelity, and cost [8].

To date, implementation research has predominantly focused on initial implementation of evidence-based interventions (EBI) [9–11]. Sustainability is an emerging but important phase of the implementation process [12–14]. It has been defined as “*after a defined period of time, a program, clinical intervention, and/or implementation strategies continue to*

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be delivered and/or individual behaviour change (i.e., clinician, patient) is maintained; the program and individual behaviour change may evolve or adapt while continuing to produce benefits for individuals/systems" [15]. Despite the importance of sustained delivery of effective EBIs, the impacts of many EBIs cease or are reduced over time, particularly once active implementation support is removed [16–18]. For example, a comprehensive review of 125 empirical studies of public health and clinical interventions reported that less than half of EBIs were sustained to high levels of fidelity at least two years following initial implementation [16]. Furthermore, whilst limited to the school setting, a more recent review by Herlitz et al., in 2020 found that none of the 18 school-based interventions included in the review were sustained in their entirety [17].

To maximise the potential benefits to the community from investment in program implementation, public health policy makers and practitioners need a strong evidence base on which to inform their decisions to support the sustained delivery of EBIs. For example understanding what factors may impact sustainability or what strategies are effective in supporting sustainability, will help public health policy makers and practitioners to better plan for and support long term delivery of EBIs. Encouragingly there are examples of such informative work having recently been undertaken [17,19–22]. To progress the field, a number of priority- and agenda-setting publications have called for the conduct of empirical research which will advance the science of sustainability, including its conceptual development as well as the development of robust measures of key constructs and outcomes, and strategies to improve program sustainability [10,11,16,23–25]. Despite repeated calls for action, it is unclear whether public health research (or funders) have prioritised this field and what type of sustainability research is being produced.

Bibliographic reviews examine the quantity and type of publications in a specific field over a defined time period [26]. Such reviews help describe research activity, characterise the evidence-base, identify potential gaps in the literature, and inform where future research efforts may be warranted [27–29]. Researchers have undertaken bibliographic reviews to describe research activity in specific public health content areas such as tobacco smoking, alcohol use, falls prevention and physical activity [27–31], as well as public health research more broadly [32]. However, we are not aware of any published bibliographic reviews that have described the research on sustainability in public health.

### 1.1. Aims

This bibliographic review assesses sustainability-related research in the area of public health across three time-periods (2010, 2015, 2020/2021). The specific aims were to:

- 1) Describe the proportion of data-based public health research articles that focus on sustainability, that have been published in 10 leading public health journals across the three time-periods;
- 2) Assess whether the proportion of public health research articles focused on sustainability has changed over time; and
- 3) Describe the characteristics of public health research articles focused on sustainability across the three time-periods.

## 2. Methods

### 2.1. Study design and sample

A repeat cross-sectional bibliographic review was undertaken of public health research published within a purposive sample of leading public health journals across three time periods that is the years: 2010, 2015 and 2020/2021 (up to August/September 2021 when the search was completed).

The 2020 SCImago Journal & Country Rank [33] was used to produce a comprehensive sample of top-tiered public health journals. A list

of journals indexed in the top 25 % (i.e., Q1) from the category of "Public, Environmental and Occupational Health" was created and reviewed by three experts in public health (NN, TM and AH). From the list of 73 available Q1 journals, the 10 top ranked journals (according to their Q1 rating), and which were considered the most relevant to public health based on assessment of the journals scope by the three experts, were selected for inclusion in this study. See Table 1 for an overview of included journals. Any article published in these selected journals was considered to be public health related.

### 2.2. Study identification and eligibility

All articles published in the 10 public health journals from each of the three selected time-periods were downloaded and assessed independently by one review author (BM, DL or KA) for eligibility. As a quality control measure, a random 10 % of all articles were independently assessed for eligibility by a second author (CG). All included

**Table 1**  
Characteristics of journals used in sampling frame.

Journal name	Impact factor <sup>a</sup>	Impact factor year	First year of publication	Number of eligible articles
American Journal of Preventive Medicine	6.604 [51]	2021	1985	2010: 259 2015: 300 2020/2021: 452 Total: 1011
American Journal of Public Health	9.308 [52]	2020	1911	2010: 364 2015: 525 2020/2021: 299 Total: 1188
Annual Review of Public Health	21.870 [53]	2021	1980	2010: 28 2015: 28 2020/2021: 53 Total: 109
BMC Public Health	4.135 [54]	2021	2001	2010: 786 2015: 1246 2020/2021: 3359 Total: 5391
European Journal of Public Health	4.424 [55]	2021	1991	2010: 105 2015: 221 2020/2021: 351 Total: 677
Implementation Science	7.327 [56]	2021	2006	2010: 95 2015: 209 2020/2021: 158 Total: 462
International Journal of Public Health	5.1 [57]	2021	1974	2010: 77 2015: 102 2020/2021: 154 Total: 333
Lancet Public Health	72.427 [58]	2021	2016	2010: NA 2015: NA 2020/2021: 96 Total: 96
Prevention Science	3.931 [59]	2021	2000	2010: 36 2015: 106 2020/2021: 165 Total: 307
Preventive Medicine	4.637 [60]	2021	1972	2010: 167 2015: 294 2020/2021: 553 Total: 1014

<sup>a</sup> Impact factor sourced from journal website.

studies were checked for eligibility by a second author (AH, NN or CG). Individual studies were considered eligible if they were a data-based study or review article and published in 2010, 2015 or 2020/2021 (up to August/September 2021 when the search was completed). We selected 2010 as the first time-period as this was five years after publication of an original agenda-setting paper for sustainability [34], and thus allowed time for research in this area to begin to accrue. Similar to other bibliographic reviews, studies were excluded if they did not detail data-based research (e.g., editorials, letters with no new data, corrections, conference abstracts and protocol papers) [28].

### 2.3. Data extraction and statistical analyses

One author (DL, BM, or KA) independently classified whether each eligible article focused on sustainability or not. Due to variation and inconsistencies in how sustainability has been defined [15], we employed a broad definition of whether a study focused on sustainability to ensure all relevant articles were included. We included all studies where the authors indicated a focus on sustainability, or used related terms to describe their objectives or results (i.e., maintenance, institutionalisation, routinisation, continued implementation, or long-term follow-up). The following characteristics were then extracted from these studies: type of research, study design, setting, and content area. Type of research articles were classified based on definitions used in previous bibliographic reviews [28,30,32], including: descriptive/epidemiological (i.e., focus on prevalence, pattern or predictors), measurement (i.e., development or psychometric evaluation of data collection instruments), intervention (i.e., testing the effect of interventions), or review. Study designs were classified according to categories used in previous bibliographic reviews [32]: systematic review/meta-analysis, non-systematic review, randomised controlled trial, non-randomised controlled trial, cohort study, cross-sectional study, cost effectiveness, qualitative, mixed methods or other. Each respective study aim was used to classify the research type and design. Data extracted from all eligible sustainability studies were checked by a second author (CG or AH).

All analyses were conducted in SAS version 9.3. Descriptive statistics were used to summarise the characteristics of included studies. The proportion and 95 % confidence interval (CI) of articles focusing on sustainability out of all eligible articles was calculated for each of the three time periods. A logistic regression was used to assess whether there

was an association between time period and the proportion of sustainability research published. Due to the small number of eligible articles, assessment of the statistical differences between article characteristics (e.g., study design and type) was not feasible.

## 3. Results

A total of 12,526 articles were published across the three time-points and 10 public health journals, of which 10,588 were data-based articles eligible for inclusion in this study. The number of data-based articles published in each journal across the three years is presented in Table 1. Of the 10,588 data-based articles, 136 (1.3 %) focused on sustainability (see Fig. 1).

### 3.1. Aim 1: Proportion of data-based research articles focused on sustainability

The percentage of original research articles that focused on sustainability was 0.3 % (95 % CI: 0.1 %, 0.7 %) in 2010, 1.4 % (95 % CI: 1.0 %, 1.9 %) in 2015 and 1.6 % (95 % CI: 1.3 %, 1.9 %) in 2020/2021.

### 3.2. Aim 2: Proportion of data-based research articles focused on sustainability over time

Compared to the earliest publication year of 2010, we observed a small increase in the proportion of data-based research articles focusing on sustainability in the more recent publication years (i.e., 0.3 % in 2010 vs. 1.4 % in 2015 and 1.6 % in 2020/2021); while we saw a similar proportion of articles focusing on sustainability in 2015 and 2020/2021 (1.4 % vs. 1.6 %). Logistic regression results indicated a statistically significant association between year of publication and whether data-based articles focused on sustainability ( $p = 0.0007$ ). Specifically, compared to 2010 the odds of a sustainability study being published were approximately five times higher in both 2015 (odds ratio (OR): 4.5; 95 % CI: 1.9, 10.5) and 2020/2021 (OR: 5.0; 95 % CI: 2.2, 11.6).

### 3.3. Aim 3: Characteristics of sustainability research

Across all time periods the majority of sustainability articles were descriptive/epidemiological ( $n = 69$ , 51 %), followed by intervention ( $n = 46$ , 34 %) and literature reviews ( $n = 16$ , 12 %). Few articles focused

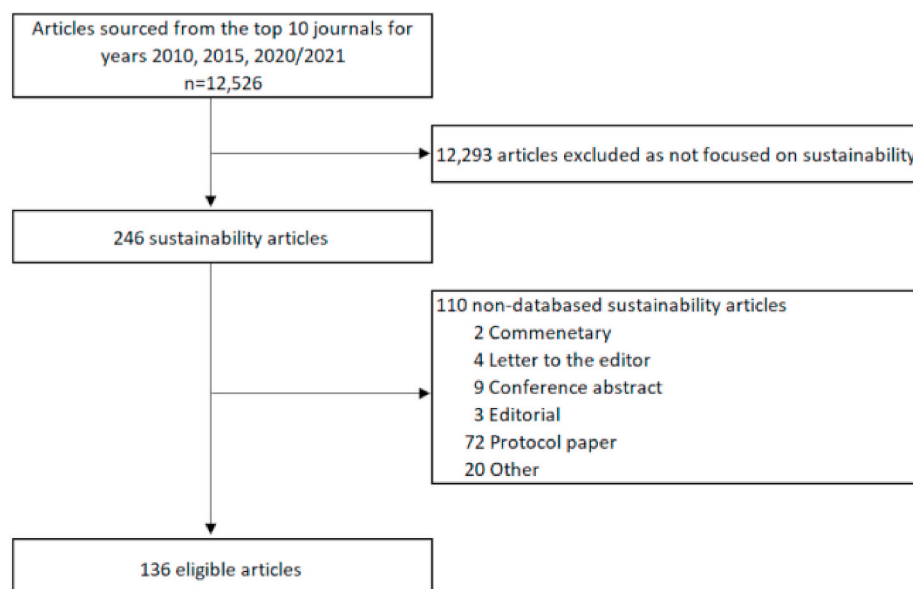


Fig. 1. Flow diagram illustrating study selection.

on measurement ( $n = 2$ , 1.5 %). All but one of the 46 intervention studies assessed the longer-term outcomes of an intervention, including the sustained benefit ( $n = 22$ , 48 %), sustained delivery ( $n = 19$ , 41 %) or both sustained benefit and delivery of an EBI ( $n = 5$ , 11 %). Only one intervention study assessed the effect of specific strategies designed to sustain the delivery of an EBI. The most frequently used study design was mixed methods ( $n = 31$ , 23 %), followed by qualitative ( $n = 29$ , 21 %). No studies explored cost-effectiveness (see Table 2).

Differences in the type of research conducted between the three time periods were difficult to examine due to the small number of articles published in 2010 ( $n = 5$ ). However, descriptively the type of study designs appeared similar for the later time-periods of 2015 and 2020/2021, with the largest proportion of studies being descriptive/epidemiological (64 % vs. 47 %) and the fewest focusing on measurement (0 % vs. 2 %). Similarly, the research designs employed by studies in 2015 and 2020/2021 were similar, with mixed methods (21 % vs. 24 %) and qualitative (21 % vs. 23 %) the most frequently used at both time periods. Although a larger number of cross-sectional studies were published in the most recent time period (0 % vs. 8 %) (see Table 2).

Across all time periods the country where research had most commonly been conducted was the United States (30 %), followed by the United Kingdom (8 %). Collectively, most studies were conducted in community-based settings (e.g., sporting clubs, churches, and community pharmacies) (46 %), followed by educational (25 %) and clinical settings (22 %). Few studies were conducted in a workplace setting (4 %). The most common public health focus addressed were: physical activity (22 %), child/youth health and wellbeing (21 %) and nutrition (18 %). Less than 10 % of studies focused on each public health topic area of: smoking (9 %), women's health (7 %), overweight or obesity (outside of physical activity and nutrition) (5 %), other substance use (4 %), and alcohol use (3 %). Again, it was difficult to compare differences in the setting and public health focus across the three time periods, due to the small number of sustainability articles published in 2010. However, the proportion of articles published in the more recent time periods (e.g., 2015 and 2020/2021) were similar for most topics, with the exception of a larger percentage of studies published in 2020/2021 vs 2015 for the areas of nutrition (14 % vs. 22 %), non-communicable disease (14 % vs 2 %), women's health (10 % vs 0 %) and overweight and obesity (8 % vs. 0 %) (see Table 2).

#### 4. Discussion

Despite repeated calls for research to be more focused on the sustainability of health-related interventions [10,23,24,34], we found that the proportion of public health research in this area is low, making up just over 1 % of database research articles across the three time periods assessed. Despite an observed increase in the proportion of public health articles focusing on sustainability from 2010 (0.3 %) to more recent years of 2015 (1.4 %) and 2020/2021 (1.3 %), the absolute change in the proportion was small and remained critically low even at its peak. Such output is not of a volume sufficient to rapidly advance the field.

We found that the majority of research studies were descriptive, a finding which is consistently reported by other bibliographic reviews [27,28,30,32]. Specifically, over half of the studies identified were descriptive (51 %), which is just outside previous bibliographic reviews reporting estimates of 52 %–87 % [27,30]. As an emerging area of research, it is not surprising that the majority of work has focused on describing the phenomenon of sustainability. It also aligns with previous calls for action to identify and understand the factors that affect sustainability [10]. Unexpectedly, we found that just over one third (34 %) of all studies examined an intervention. This is higher than several other bibliographic reviews in fields of research with a more mature evidence-base that have reported less than 20 % of research output as intervention-focused [27,32]. However, only one of the intervention studies identified specifically assessed the effect of strategies designed to support EBI sustainability; with all others focused on assessing the

**Table 2**  
Characteristics of eligible articles focusing on sustainability.

Characteristic	Year			Total (n = 136)
	2010 n = 6	2015 n = 42	2020/2021 n = 88	
	Number (%)	Number (%)	Number (%)	Number (%)
<b>Country<sup>a</sup></b>				
Australia	0	2 (6 %)	6 (7 %)	8 (6 %)
Canada	0	1 (3 %)	6 (7 %)	7 (6 %)
United States	3 (60 %)	14 (39 %)	21 (25 %)	38 (30 %)
United Kingdom	0	5 (14 %)	5 (6 %)	10 (8 %)
Multiple	0	3 (8 %)	5 (6 %)	8 (6 %)
Other <sup>b</sup>	2 (40 %)	11 (31 %)	41 (49 %)	54 (43 %)
<b>Type of research</b>				
Descriptive/epidemiological	1 (17 %)	27 (64 %)	41 (47 %)	69 (51 %)
Measurement	0	0	2 (2 %)	2 (1 %)
Intervention <sup>c</sup>	4 (67 %)	9 (21 %)	33 (38 %)	46 (34 %)
Review	1 (17 %)	6 (14 %)	9 (10 %)	16 (12 %)
Other	0	0	3 (3 %)	3 (2 %)
<b>Research design</b>				
Systematic review/meta-analysis	0	4 (10 %)	6 (7 %)	10 (7 %)
Non-systematic review	0	2 (5 %)	4 (5 %)	6 (4 %)
Randomised controlled trial	3 (50 %)	6 (14 %)	13 (15 %)	22 (16 %)
Non-randomised controlled trial	1 (17 %)	1 (2 %)	2 (2 %)	4 (3 %)
Cohort study	1 (17 %)	9 (21 %)	12 (14 %)	22 (16 %)
Cross-sectional study	0	0	7 (8 %)	7 (5 %)
Cost effectiveness	0	0	0	0
Mixed methods	1 (17 %)	9 (21 %)	21 (24 %)	31 (23 %)
Qualitative	0	9 (21 %)	20 (23 %)	29 (21 %)
Other	0	2 (5 %)	3 (3 %)	5 (4 %)
<b>Setting</b>				
Educational	2 (33 %)	14 (33 %)	18 (20 %)	34 (25 %)
Workplace	0	1 (2 %)	4 (5 %)	5 (4 %)
Community (e.g., sporting clubs, churches, and community pharmacies)	2 (33 %)	18 (43 %)	43 (49 %)	63 (46 %)
Clinical	2 (33 %)	7 (17 %)	21 (24 %)	30 (22 %)
Other	1 (17 %)	2 (5 %)	1 (1 %)	17 (14 %)
<b>Public Health focus</b>				
Smoking	0	3 (7 %)	9 (10 %)	12 (9 %)
Alcohol	0	2 (5 %)	2 (2 %)	4 (3 %)
Nutrition	0	6 (14 %)	19 (22 %)	25 (18 %)
Mental health	2 (33 %)	6 (14 %)	7 (8 %)	15 (11 %)
Physical activity	1 (17 %)	11 (26 %)	18 (20 %)	30 (22 %)
Substance use	1 (17 %)	2 (5 %)	2 (2 %)	5 (4 %)
Non-communicable disease	0	1 (2 %)	12 (14 %)	13 (10 %)
Child/youth health and wellbeing	0	8 (19 %)	20 (23 %)	28 (21 %)
Overweight and obesity	0	0	7 (8 %)	7 (5 %)
Women's health	0	0	9 (10 %)	9 (7 %)
Communicable diseases	0	4 (10 %)	11 (13 %)	15 (11 %)
Other	3 (50 %)	10 (24 %)	33 (38 %)	46 (34 %)

<sup>a</sup> Cell sizes do not match total sample as some studies, especially reviews, were not conducted or focused on a specific country.

<sup>b</sup> Other includes countries where less than a total of 5 studies were conducted in an individual country across all time periods. In most instances only one study was conducted in each individual country.

<sup>c</sup> Only one intervention study assessed the effect of specific strategies designed to sustain the delivery of an intervention.

longer term benefits and/or delivery of an EBI. There is a need for studies which adequately describe and test the effectiveness of specific strategies focused on improving the sustainability of EBIs [18,25].

Of concern was the lack of cost-effectiveness studies identified, although it is possible that cost may have been examined separately



from the sustainability work or reported as a secondary outcome within another type of research design (e.g., as part of an intervention study). Nonetheless, one of the most commonly identified determinants of sustainment is funding availability or continued financial support [10]. Given this understanding, the cost implications and long-term cost-effectiveness of an EBI is essential for understanding and supporting sustainability. Such information is also crucial for decision makers who are vested in the ongoing value of investment of public health programs and initiatives. We also identified very few measurement studies (1 %). This is unsurprising given the recognised challenges in defining and measuring sustainability [11,16,35]. Encouragingly, recent reviews of implementation and sustainability measures [35–38] suggest an increase in work being conducted in this area; although the psychometric properties of available measures may still require refinement [35,37,38].

Most of the sustainability research that we identified was conducted in community-based settings. However, only 4 % of sustainability studies were conducted in the workplace. For over 30 years the World Health Organization (WHO) has identified workplaces as a key setting for addressing chronic disease prevention [39]. Furthermore, the number of interventions and reviews that have been conducted on workplace interventions is extensive [40]. Another surprising finding is the relatively few studies (<10 %) we identified that were focused on addressing tobacco and alcohol use. In light of the sizable burden of illness attributable to these health behaviours [41–43], and the number of interventions and policies that have been implemented to prevent uptake and promote cessation [42,43], this is an area where future research may be warranted to ensure the funding used to deliver related policy and practices is not wasted.

## 5. Limitations

This study provides an overview of the proportion of research that has been dedicated to assessing sustainability in 10 leading public health journals, and how this has changed across three time periods. There are several limitations of this work that should be acknowledged. First, despite the inclusion of high-quality journals, the 10 that we included may not be representative of the breadth of public health intervention sustainability research across differing contexts; for example, low- and middle-income contexts. It is also possible that other public health-related journals have published a greater proportion of sustainability-focused research. We also assumed all articles published in the 10 selected journals had a public health focus due to their publication in a public health related journal. It is possible that some articles may not have been strictly public health focused due to the breadth of some of the journals' scope. Second, we only assessed studies published across three time periods. It is possible that the trends in research output may have differed if a greater number of time points of different time periods were examined. Third, the small number of sustainability articles made it difficult to conduct statistical comparisons of the differences in the characteristics of research output between the three time periods. Third, it is possible that we failed to recognise some sustainability-related studies, as the definitions and terminology used to describe these terms is often vague and poorly defined [11,18], with some studies only mentioning their focus on sustainability in passing using or with unconventional terminology. However, we employed an inclusive definition of sustainability to avoid missing relevant articles. On the other hand, our broad inclusion criteria may have resulted in the classification of some studies that may not otherwise be viewed as focusing on sustainability. For example a number of the intervention studies that assessed the longer term health effects of an EBI used relatively short (i. e., <6 months) follow-up periods, yet we included these due to the authors intent of assessing sustainability of their intervention.

## 6. Conclusions

This bibliographic review provides an extensive and in-depth assessment of the research activity made in the area of sustainability in 10 leading public health journals over the last 10 years. The study results suggest that despite multiple calls for research into this area over the last 15+ years, only around 1 % have examined this important topic, with minimal increase over time. Despite examples of effective and cost effective interventions across a variety of settings and targeting a range of population groups [5,44–47], and emerging research regarding methods to achieve initial implementation [48–50], the findings of this study suggests the evidence-base is not sufficiently geared towards informing how best to achieve sustained EBI benefits. The findings from this study should be used to direct future research efforts so that we can address one of the greatest challenges faced by the area of public health.

### Ethics approval and consent to participate

Not applicable.

### Consent for publication

Not applicable.

### Availability of data and materials

Data and materials relating to this review are available from the corresponding author on reasonable request.

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### Author contributions

LW conceived the concept for this review. AH developed the protocol with assistance from LW, NN and TM. AH undertook article screening, data extraction, analysis and led drafting of the manuscript. BM, KA and DCWL sourced all articles, screened for eligibility and completed data extraction. CG, CL and AS also assisted with data extraction. RS and NN provided extensive input and guidance on the content area. All authors contributed to the interpretation of the results, drafting and reviewing of the manuscript.

### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## List of Abbreviations

EBI	Evidence Based Intervention
CI	confidence Interval
Q1	Quartile 1
OR	Odds Ratio

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.puhip.2023.100444>.

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