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REVIEW

A systematic review of the effectiveness of mass media campaigns for the management of low back pain

Arnela Suman^{a*} , Susan Armijo-Olivo^{a‡} , Sameer Deshpande^b , Janelle Marietta-Vasquez^c, Liz Dennett^d , Maxi Miciak^a , Michiel Reneman^e , Erik L. Werner^f , Sebastian Straube^g , Rachelle Buchbinder^h and Douglas P. Gross^a

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ABSTRACT

Purpose: To synthesize evidence on the effectiveness of mass media campaigns for the management of LBP on beliefs of the general public and health care providers, LBP-related disability, health utilization, and LBP clinical outcomes.

Materials and Methods: Five electronic databases were searched from inception to December 17, 2019. Any studies evaluating the effectiveness of mass media campaigns for LBP were eligible. Primary outcome was general public LBP beliefs, while secondary outcomes included health care provider beliefs as well as LBP-related disability, health utilization, and clinical outcomes.

Results: The search resulted in 4,164 unique records, of which 18 studies were included. These 18 studies predominantly used quasi-experimental methods to evaluate seven LBP mass media campaigns conducted in seven countries. All studies evaluating LBP beliefs in the general public detected positive effects. Health care provider beliefs also consistently improved. Results for behavioural outcomes (disability behaviour and health utilization) were mixed and appeared dependent on campaign characteristics and local context.

Conclusions: Mass media campaigns for LBP appear effective for improving beliefs of the general public and health care providers.

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Disability; low back pain; public health; education; mass media; health promotion

► IMPLICATIONS FOR REHABILITATION

- Mass media campaigns about low back pain (LBP) appear effective for improving beliefs of the general public and health care providers, aligning beliefs with current evidence and self-management principles.
- Rehabilitation professionals should be aware of and seek to support public education initiatives in their communities related to LBP and other disabling health conditions.
- Rehabilitation professionals can highlight and reinforce campaign messages when providing education and reassurance to individual patients.
- Several campaign resources (i.e., posters, pamphlets, electronic resources, etc.) are available for rehabilitation professionals to use in their efforts to reduce disability related to LBP.

Introduction

Low back pain (LBP) is one of the most common and disabling health conditions worldwide, leading to substantial personal, social, and economic burden [1,2]. Clinical practice guidelines have recommended a shift away from medical, surgical, and pharmacological treatment towards helping people stay active

and avoid disability [3–6]. Recommended first-line interventions for LBP now include education about the condition, providing reassurance (i.e., strategies aimed at changing patient behaviour, understanding, or thoughts to reduce fear, doubt and worry [7,8]), advice to stay active, as well as exercise to reduce disability in those with persistent LBP [9]. However, surveys of the general public conducted in several parts of the world consistently

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indicate a mismatch between current evidence and prevailing beliefs about managing LBP [10–13]. A sizeable segment of the population, especially those with LBP, still reports believing rest or protection of the back is needed, along with comprehensive medical investigation and treatment [14–16]. Pessimistic LBP beliefs are common across countries and populations, and are associated with pain, disability, and increased health care utilization [17–19].

Due to the large burden of LBP-related disability, a recent “Call for Action” was issued to address widespread misconceptions in the population and among health professionals about the causes, prognosis, and effectiveness of different treatments for LBP [1,9,20]. A key recommendation was to adopt the concept of positive health (i.e., “the ability to adapt and self-manage in the face of social, physical, and emotional challenges”) as a strategic approach to prevent long-term disability from LBP [20,21]. Positive health places greater emphasis on self-management and requires changed expectations among patients and the general public so they are less likely to expect complete cure for their pain. This adjustment requires initiatives to change widespread and inaccurate beliefs about LBP, and avoidance of often counterproductive behaviours such as prolonged rest, activity avoidance, or staying away from work [20].

Many LBP population-level initiatives have taken the form of mass media campaigns aimed at changing public beliefs, overcoming misconceptions, and promoting improved self-management behaviour of people experiencing LBP [22–25]. A review and workshop summary was published over a decade ago that synthesized evidence regarding the effectiveness of LBP mass media campaigns and provided recommendations for planning and evaluation of future campaigns [26]. Additional campaigns have been evaluated and a more comprehensive synthesis of LBP-related mass media campaigns and their effectiveness is needed.

This systematic review aims to describe, summarize, and synthesize the evidence from studies evaluating the effectiveness of mass media campaigns for the management of LBP.

Materials and methods

Protocol and registration

The protocol for this systematic review was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on December 6, 2018 (CRD42018116797). The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines were followed.

Intervention description

Mass media campaigns were defined as campaigns utilizing any channel of communication, such as television, radio, newspapers, billboards, posters, leaflets, booklets, and websites or social media intended to reach large numbers of people and that are not necessarily dependent on person-to-person contact [27]. Campaigns of interest provided information about management of LBP [1]. Downloadable computer or smartphone applications providing information about LBP were not considered mass media.

Eligibility criteria

This systematic review included studies evaluating mass media campaigns for LBP. Relevant study groups included the general

population, or subsets of the general population with or without LBP. Studies evaluating interventions for patients with cancer, rheumatic conditions, infections, fractures, surgeries, and psychiatric illnesses were excluded.

Studies were considered eligible for inclusion if they were randomized controlled trials (RCTs), controlled trials (CTs), interrupted time series studies, before and after studies, or any other quasi-experimental or observational design investigating the effectiveness of mass media campaigns for LBP. Commentaries, systematic reviews, clinical practice guidelines, theses, reviews, editorials, and studies published in languages other than English were excluded. Studies of all lengths of follow-up were considered.

Information sources and search

An extensive literature search was conducted by a health sciences librarian (LD) and included Ovid MEDLINE(R) and Epub Ahead of Print, In-Process & Other Non-Indexed Citations and Daily 1946 to December 16, 2019, OVID EMBASE (1974-Dec 17, 2019), Wiley Cochrane Central Register of Controlled Trials (CENTRAL) (1991-Dec 17, 2019), SCOPUS (Dec 17, 2019) and EBSCOHost CINAHL Plus with Full Text (1937-Dec 17, 2019). The search combined the 3 concepts of 1) LBP; 2) campaigns or educational interventions; and 3) media, technologies, or formats used to deliver the information. An extensive list of key words and subject headings were used for each concept in a broad search, but only articles evaluating LBP mass media campaigns were deemed relevant for this study. No date or language limits were used in the search but only studies including the adult population were included. The full electronic search strategy is provided in [Supplementary Appendix 1](#). Reference lists of included studies were manually searched, publications of key authors in the area were searched, experts in the area were consulted about relevant papers, and a forward citation search was performed to identify any additional potentially relevant studies.

Study selection

Two reviewers working independently selected from the study team screened the titles and, if available, the abstracts of publications retrieved from the electronic searches. If either reviewer believed that a published article potentially met the inclusion criteria, or if there was inadequate information to determine eligibility, a full-text copy of the article was obtained. Two independent reviewers assessed articles selected for full-text review for eligibility. If discrepancies occurred between reviewers at any stage of the screening process, the disagreements were resolved by consensus and consulting a third reviewer (SAO or DPG).

Data collection process and data items

Relevant data from the included studies were extracted and entered directly into a standardized data extraction form in Microsoft Word by one investigator (AS). A second reviewer (DPG) reviewed all data extraction forms, and disagreements were resolved by consensus. Data were extracted on study identification (i.e., author, title, year), study objectives, campaign characteristics (years of implementation, setting, components of the campaign, targeted population, and other key campaign elements useful for understanding campaign effects [26]), study design (i.e., RCT, CT, interrupted time series studies, before and after studies, other), participants, primary and secondary outcomes and

instruments used to measure outcomes, data measured and data reported, key findings, and effect estimates when available (summary measures such as effect sizes, means and SD) of the outcomes of interest.

Outcomes of interest were extracted and classified based on the Hornik and Yanovitzky's Model of Communication Campaign's Influence [28]. This model indicates that public health communication campaigns act either directly or indirectly to modify public beliefs related to the health behaviour. Improved beliefs potentially lead to behaviour changes and subsequently improved health outcomes. Public beliefs about LBP were thus considered our primary outcome due to the direct effect of campaign influence. LBP-related behaviour changes and clinical outcomes were considered secondary outcomes due to the mediating effect of LBP beliefs and potential moderating effect of external constraints and incentives on behaviour. Outcome measures were classified as follows:

Primary outcome

General Public LBP Beliefs: These were defined as concepts related to LBP that individuals find to be probable or likely to be true [29]. Specifically, evaluations of LBP-related beliefs among the general public regarding the inevitable consequences of future life with LBP as well as beliefs about how to manage and cope with LBP were investigated. This included beliefs about the prognosis or likely outcome of an episode of LBP, importance of bed rest versus staying active, how physical activity and work affect LBP, and other beliefs [30].

Secondary outcomes

Health Care Provider Beliefs: These were defined as the beliefs of health care providers who treat patients with LBP. This category included all self-reported responses of health care providers to belief surveys representing their beliefs, opinions, attitudes, and knowledge of LBP and its management.

Disability behaviours: These were defined as actions and habits conducted by individuals that relate to health maintenance, restoration, and/or improvement of LBP [31]. This included physical activity or its avoidance during a LBP episode as well as all measures of work disability (i.e., work and sickness absence, workers' compensation claims or time loss benefits, or insurance claims or time loss benefits for LBP).

Health utilization behaviours: These were defined as actions and habits conducted by individuals that relate to the choice of seeking care for an episode of LBP, the choice of health care provider, number of health care visits for an episode, among other behaviours. This category included type of health provider selected to treat LBP, number of visits to that provider, use of surgery for LBP, and use of or referrals to diagnostic imaging (i.e., computed tomography (CT), radiography (X-Ray), and/or magnetic resonance imaging (MRI)). This category also included the behaviours and recommendations of health care providers treating patients with LBP, including treatments provided, referrals for diagnostic imaging, surgical consultations, etc.

LBP-related clinical outcomes: These were defined as changes in the actual health or clinical status of the population under investigation [32]. This included reported LBP prevalence within the general population, reported LBP intensity, or any other indicator of LBP-related health outcomes.

Quality assessment of individual studies

Quality assessment of the individual studies was completed by two reviewers working independently (AS and DPG) and overseen by a third reviewer (SAO) to help resolve disagreements. All included studies were appraised using the Effective Public Health Practice Project (EPHPP) Quality Assessment Tool for Quantitative Studies [33]. The EPHPP tool is a generic tool developed to evaluate different public health intervention study designs such as RCTs and CTs, interrupted time series studies, before-and-after designs, and case-control studies. The tool assesses six domains: 1) selection bias, 2) study design, 3) confounders, 4) blinding, 5) data collection method, and 6) withdrawals/dropouts. Each domain is rated as strong, moderate, or weak using set guidelines. The tool does not evaluate the quality of the mass media campaign, only the quality of the campaign evaluation reported in each manuscript. EPHPP scoring guidelines indicate that a study is judged to be of strong quality if there are no weak ratings, of moderate quality if there are no more than two weak ratings, and of weak quality if more than two weak ratings.

The validity of the EPHPP has not been formally evaluated, but it has been recommended by the Canadian National Collaborating Centre for Methods and Tools for use in systematic reviews of public health interventions [34]. The EPHPP has been found to have *fair* inter-rater agreement for individual domains and *excellent* agreement for the final grade [35]. Our inter-rater reliability for quality assessment of individual studies using the EPHPP tool was determined to be poor (Kappa <0.6) before consensus was achieved. Therefore, all articles were reviewed by both reviewers and final decisions were reached through consensus.

Synthesis of results

A quantitative meta-analysis was planned; however, the included studies were very heterogeneous in terms of campaign characteristics, study designs, outcomes measured, and the way they were reported, which did not allow for meaningful data pooling. A meta-analysis was therefore not deemed appropriate. Additionally, in most cases the same mass media campaign was evaluated in multiple published studies (i.e., evaluating different outcomes or different follow-up times). We, therefore, limited our synthesis to narrative descriptions and summaries of the campaigns and their associated evaluations using decision rules for strength of evidence as defined below. We developed a table describing the various mass media campaign's characteristics based on elements that have previously been deemed important for understanding the effect of mass media campaigns [26]. We also developed descriptive tables for each individual study, study quality appraisals, and strength of evidence for each outcome evaluated.

In order to make decisions regarding the strength of evidence and direction of effects of the LBP mass media campaigns, decision rules for outcomes were created as outlined below. The following decision rules were used:

1. **Positive effect:** The result for the outcome is deemed a relevant improvement (i.e., detectable improvement compared to baseline values or to a control group) and is consistent across multiple campaigns or studies;
2. **Promising effect:** The result for the outcome is deemed a relevant improvement (i.e., detectable improvement compared to baseline values or to a control group) in at least one campaign or study;

- 3. **Negative effect:** The result for the outcome is deemed a relevant deterioration and is consistent across multiple campaigns or studies;
- 4. **No effect:** The result for that outcome is deemed irrelevant (i.e., no detectable improvement compared to baseline values or to a control group) across campaigns or studies. The campaign did not significantly improve or deteriorate the outcome of interest;
- 5. **Mixed or Unclear Findings:** There is no clear pattern of positive, negative, or neutral results and/or the outcome has conflicting results across campaigns or studies.

Results

Study selection

The electronic search identified 6,670 records. After removal of duplicates, the titles and abstracts of 4,164 individual studies were screened for eligibility. For 227 records the full-text article was obtained and reviewed for eligibility. Sixteen studies from the electronic search were included in this review (noting that where relevant each publication was included as a separate study for ease of description) [22–25,36–47]. Review of the reference lists of the included studies resulted in inclusion of 2 more studies [48,49]. Thus, the total number of studies included was 18 [22–25,36–49]. Figure 1 shows the PRISMA flow diagram for the selection of studies.

Campaign characteristics

Table 1 provides a detailed description of the characteristics of the campaigns evaluated in the 18 studies. Overall, seven LBP mass media campaigns have been conducted in seven countries, and these have been evaluated by 18 published studies. The mass media campaigns took place in Australia [22,36–39] (*Back Pain – Don’t Take it Lying Down* campaign); Japan [47–49] (*COMMUNITY-wide Campaign To promote Exercise campaign – COMMUNICATE*); Canada [25,40] (*Back Pain – Don’t Take it Lying Down* campaign); Scotland [23] (*Working Backs Scotland* campaign); Norway [24,42,43] (*Active Back* campaign); Ireland [41] (*St Vincent’s Working Backs* campaign); and the United States of America (USA) [44–46] (*Choosing Wisely* campaign).

The campaigns varied substantially in terms of the nature of the mass media components used, communication strategies and messaging provided, and overall intensity. However, the campaigns consistently aimed to overcome prevailing myths about LBP, and promote self-management and activity behaviours during LBP episodes. The primary message provided was about the importance of staying active in 4 campaigns (Scotland, Canada, Ireland, Japan) and avoiding diagnostic imaging in the absence of red flags in one campaign (USA), while two campaigns had a variety of messages including the importance of staying active, avoiding diagnostic imaging in the absence of red flags, and that surgery may not always be indicated (Australia and Norway). The Australian and Norwegian campaigns provided explicit messaging about the importance of staying at work despite LBP. Several

Figure 1. PRISMA 2009 Flow Diagram.

Table 1. Campaign characteristics.

Setting	"Back pain, don't take it lying down"	"Back pain, don't take it lying down"	"Active Back"	Working Backs - Scotland	Working Backs Project - Ireland	Choosing Wisely	COMMUNI-CATE study
Population	State of Victoria, Australia ~4.3 million	Province of Alberta, Canada ~3.3 million	Vestfold and Aust-Agder counties, Norway ~325 000	Scotland (national campaign) ~5.1 million	St Vincent's University Hospital (SVUH), Dublin Hospital had a staff of 2,237	USA (national campaign) ~314 million	City of Unnan, Shimane Prefecture, Japan ~45 364
Health care provision for the general population	Dual system of universal health care (Medicare) and private health insurance	Dual system of universal health care and private health insurance	Medicare covers all inhabitants. A small fee comes in addition for each visit to a health practitioner.	Universal health care provided by NHS Health Scotland	Dual system of universal health care and private health insurance provided by the Health Service Executive	Variety of private health insurance schemes	Universal health insurance system, where participants are free to choose health care facilities
Health care provision for injured workers	State-based work cover insurance paid for by employers, managed by VWA for the state government, provided by several insurance companies.	Province-based Workers' Compensation Board legally mandated to provide care for injured workers. Administration is paid through employer premiums	Employers cover full salary the first 16 days of sickness, Medicare thereafter, for the employees	Universal health care provided by NHS Health Scotland	Universal health care provided by Health Service Executive, with some additional medical services provided under the Occupational Injuries Scheme	Variety of private insurance and workers' compensation schemes	National workers' accident compensation insurance, a government insurance program, covers health care costs for injured workers
Period of campaign	1997 – 1999	2005– 2019 (ongoing)	2002 – 2005	2000–2004	2004	2012–2019 (ongoing)	2009–2014
Who performed the campaign?	Victorian WorkCover Authority	Multiple funding partners including: Alberta Government, WCB-Alberta, local industrial safety associations.	The Hospital of Rehabilitation, Stavem and The Norwegian Back Pain Network, The Communication Unit	NHS Health Scotland, Health & Safety Executive	SVUH multidisciplinary management team	Piloted in 2009 by the National Physicians Alliance, then funded by the American Board of Internal Medicine Foundation and expanded in 2012	Unnan City Hall public health project. Head office is in the Physical Education and Medicine Research Center UNNAN
Rationale for campaign	Rising cost of back pain claims; recognition that educational interventions directed at general practice likely to be ineffective without concomitant education of the public and employers; and recognition of importance of attitudes and beliefs in development of disability from back pain	Rising costs associated with back pain. Perceived need for public education about the condition.	Rising cost of disability and use of health care due to low back pain; great confusion and divergence of beliefs about management amongst the public and amongst different health professionals; multidisciplinary guidelines for acute back pain launched April 2002.	Reversal in the management of back pain. Strong evidence that staying active leads to faster recovery and lower risk of chronic pain and disability, but still considerable uncertainty about effective methods of implementing this change in practice	UK Faculty of Occupational Medicine Guidelines for the Management of Low Back Pain in the Workplace were published in 2000. Efforts were needed to facilitate implementation of evidence based care at the workplace. Campaign was done to promote guideline messages	Low back pain is the fifth most common reason for all physician visits. Imaging of the lower spine before 6 weeks does not improve outcomes but increases costs. Choosing Wisely aimed to reduce low back pain imaging for patients without red-flag conditions	In Japan, musculoskeletal pain has been the most reported subjective symptom and a potential barrier to physical activity, especially in older people. Physical activity is recommended for good health and to reduce pain from musculoskeletal conditions.
Who had input into content?	Consulted widely with international and local experts, multidisciplinary committee composed of representatives from national or state professional organizations with an interest in back pain, medical defense	Organizing committee composed of representatives from the funding organizations. Consulted widely with local and international experts.	Steering committee composed of the owners of the campaign, and reflecting all health professional groups	National partnership including all health professionals who treat back pain in primary care and occupational health, employers, unions, and patients' organizations	Multidisciplinary Working Backs Project management team	Physician-driven effort, recommendation for low back pain imaging was produced by the American Academy of Family Physicians	Physical Education and Medicine Research Center UNNAN and Collaborators. Social marketing planning process was followed including: 1) Situational analysis; 2) Market segmentation and targeting using the TARPARE model; 3)

(continued)

Table 1. Continued.

	"Back pain, don't take it lying down" organization, employer and employee groups.	"Back pain, don't take it lying down"	"Active Back"	Working Backs - Scotland	Working Backs Project - Ireland	Choosing Wisely	COMMUNI-CATE study
Endorsements	Widespread endorsement from relevant national or state professional medical bodies (ind. general practice, orthopaedic surgery, rheumatology, rehabilitation, physiotherapy, chiropractic, osteopathy, sports and occupational medicine).	Widespread endorsement from local health associations (physicians, surgeons, physiotherapy, and chiropractic).	The National Medical Association, The Norwegian Physiotherapist Association, The Norwegian Chiropractic Association, The Directorate for Health and Social Affairs	"Badged" under NHS Health Scotland and Health & Safety Executive, both of which have strong and positive public images	None reported	American Academy of Family Physicians	Setting objective using SMART goals; 4) Marketing strategy development using "4 Ps" (Product, Price, Place, Promotion) Endorsement from local health providers and public officials
Primary Medium	Television commercials aired during prime time	Radio ads	Print media including 4 issues of a 16-page information paper to all households, local TV, radio and cinema commercials, specific web page for the campaign	Radio ads	"Health promotion campaign" to managers, staff, and clinicians – media used and other details not reported	Website material directed toward patients (https://www.choosingwisely.org)	Print media including flyers, leaflets; community newsletters, posters, and banners. Also local audio broadcasts
Overall cost	~USD 7.6 million over 3 years	~USD 1.8 million over 12 years	~USD 1.1 million over 3 years; USD 531,000 in direct costs of the media campaign	Full cost not reported, but described as 'low budget'	Not reported	Not reported	Not reported, but the campaign used existing cost-free public resources (such as city and community newsletters and local audio broadcasts)
Intensity and frequency if known	Intense campaign for 12 months, followed by less intense period for 12 months and then final intense campaign for 3 months. 'Top-up' low intensity yearly ads were planned but never implemented	Radio ads during peak listening months only, continuous website	4 one-month campaign periods, continuous website	177715-second advertisements broadcast on all 15 commercial radio stations in Scotland during a 4-week period in 2000. Short "booster" radio campaigns were transmitted in February and October 2001 and 2002 and February 2003	Not reported	Continuous website	Leaflets and flyers distributed to all 4036 households at least twice; posters were hung at 276 sites, including small assembly houses and downtown shops; banners were placed in all community centers; and 60 – 90 second audio messages were broadcast directly to each household 12 times using a cable network
Penetration (% of population exposed to campaign)	86%	49%	39%	60%	57% of staff 85% of managers	Not reported	62%

(continued)

Table 1. Continued.

	"Back pain, don't take it lying down"	"Back pain, don't take it lying down"	"Active Back"	Working Backs - Scotland	Working Backs Project - Ireland	Choosing Wisely	COMMUNI-CATE study
Other media	Radio, billboard and print advertisements, posters, seminars, visits by well-known personalities to workplaces, publicity articles and publications.	Website (http://www.backactive.ca) Posters, pamphlets, bus and billboard advertisements, informational articles in public and industry publications. Some television public service announcements	Website (no longer active) Posters with the messages of the campaign at health care clinics	Website (no longer active) Support from a well-known Scottish sports personality produced extensive free press and television news coverage	Distribution of Working Backs Project booklet to key stakeholders	Eleven consumer groups (including Consumer Reports and American Association of Retired Persons) maintained ongoing public advocacy efforts to disseminate recommendations to consumers	Videotapes and DVDs on flexibility and muscle-strengthening activities
Additional interventions	The Back Book was made widely available with translations in 16 languages, and all Victorian doctors were sent evidence-based guidelines for the management of employees with compensable low back pain	Specific focus on employers and health care providers to distribute posters and pamphlets.	All primary care doctors, physiotherapists and chiropractors were sent copy of guidelines, and invited to specific courses. In addition, a specific intervention was conducted in 6 co-operating workplaces	35 000 information packs were distributed to all health providers. This included leaflets, The Back Book, a booklet on Managing Back Pain in the Workplace, and a poster.	Included a tailored study intervention package, which utilized a 'health promotion in the workplace' framework. Organizational database and management pathway with early reporting and guideline-based clinical management	Recommendations have been incorporated into clinical ordering processes at some health systems	Outreach health education by professionals during medical check-ups and various community events (including sports events and festivals). Residents were provided with pedometers and reflective material for walking safety. Peer-support provided through community social networks and word-of-mouth buzz marketing
Basis of campaign	Simple evidence-based messages derived from The Back Book	Simple evidence-based messages derived from The Back Book	5 specific evidence-based statements based on the Norwegian Guidelines	Campaign focused on staying active, with no overt comment about work (thought any shift toward "staying active" would automatically include work)	Based on UK Faculty of Occupational Medicine Guidelines for the Management of Low Back Pain in the Workplace	Physician-driven, grassroots initiative to reduce "low-value" care including imaging for low back pain for patients without red-flag conditions	Physical activity is generally recommended for older people, and specifically for people with musculoskeletal disorders
Intended Audience	General population, health care providers (particularly general practitioners), employers	General population, general practitioners, employers and employees	General population, health care providers in primary care, employers and employees	General population, health care providers (particularly general practitioners), employers	All staff and employees of SVUH	General population, general practitioners	All middle-aged and elderly (40–79 years) residents living in the Unnan communities
Main messages	Back pain is not a serious problem; positive attitudes are important and it is up to you; continue usual activities, don't rest for prolonged periods, continue exercising and remain at work if possible; X-rays are	Back pain: Don't take it lying down; The key to feeling better sooner is to stay active	Low back pain is not dangerous; X-ray is not useful; activity makes improvement; surgery is rarely necessary	Stay active; Try simple pain relief; and if you need it, get advice. Secondary messages were: 1) Don't take back pain lying down; 2) There's a lot you can do to help yourself; and 3)	Most people fully recover from low back pain; LBP is common, often recurrent but is rarely due to any serious disease; In most acute episodes of back pain the worker should try to remain as active as	Do not do imaging for low back pain within the first 6 weeks, unless red flags are present	"Be active to cure your low back and knee pain" (originally in Japanese). The 3 study groups received different activity promotion messages: 1) Walking; 2) Stretching; 3) Walking, stretching,
							(continued)

(continued)

Table 1. Continued.

	"Back pain, don't take it lying down"	"Back pain, don't take it lying down"	"Active Back"	Working Backs - Scotland	Working Backs Project - Ireland	Choosing Wisely	COMMUNI-CATE study
Specific behavioural messages	not useful; surgery may not be the answer; keep employees at work. Stay active Stay at work Avoid X-rays and surgery	Stay active	Stay active Avoid X-rays and surgery	Stay active	Stay active	Avoid X-rays	Stay active
Messengers	International back pain experts, sports personalities who had successfully managed back pain, actors, comedians, health care professionals, Minister for Health	Well-known Canadian Olympic Gold Medalist, local health care professionals and organizations	Animation figure (humorous)	Well-known Scottish sports personality, Local health care professionals and organizations	Not reported	American Academy of Family Physicians, eleven consumer groups, including Consumer Reports and American Association of Retired Persons	Mainly done by a core team of 5 physical activity professionals, peer-support provided by community leaders and lay health workers, Cooperative relationships developed with education and sports organizations, the regional development departments of Unnan City Hall, the Unnan Police Department, each community's self-administered organization, Senior Citizens' Club, schools, and clinics.
Marketing Evaluation	Focus groups and surveys to measure community awareness, public opinion	Awareness measured on an annual basis	Consulted at halfway to determine general awareness	Pre-campaign focus groups to inform messaging	Surveys to measure staff awareness	Not reported	Detailed pre-campaign preparation using a social marketing approach, implementation assessed with process evaluation
Scientific evaluation	Independent evaluation funded by Victorian WorkCover Authority	Independent evaluation funded by Alberta Heritage Foundation for Medical Research	Conducted by one of the founders of the campaign, but was replaced on the steering committee halfway; funded by the project and its owner	No opportunity, time, or funding for a proper scientific study so pragmatic observational study conducted by the organizers	Pre- and post-intervention staff and manager's surveys. Also evaluated sick leave among staff before and after	Multiple retrospective analyses of health care claims from various health care insurance plans or clinics from across the USA	Cluster-randomized trial of the 32 communities within Unnan, Independent evaluation funded by the Ministry of Health, Labour and Welfare of Japan, the Ministry of Education, Culture, Sports, Science and Technology of Japan, and Japan Society for the Promotion of Science.

Table is a modified and expanded version of Table 1 from: Buchbinder et al. [26].

Table 2. Detailed description of included studies.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Buchbinder et al. [22]	Australian campaign evaluations Population based intervention to change back pain beliefs and disability: three part evaluation	Back Pain: Don't take it lying down, Victoria, Australia 1997-1999	1. Direct marketing 2. TV 3. Radio 4. Print 5. Outdoor and out-of-home 6. Digital media	The campaign comprised television commercials that were aired in prime-time slots starting in September 1997. The intensity of the campaign varied: • Concentrated campaign for three months initially • Followed by low key maintenance campaign until September 1998. • Three-month concentrated television campaign started in September 1999, with no further commercials being aired before completion of the evaluation. The commercials included: • Dialogue by recognised (international medical experts as well as Australian sporting and television personalities who had successfully managed their back pain. • All advertisements concluded with a statement of endorsement by the relevant national professional bodies. The television campaign was supported by radio and printed advertisements, outdoor billboards, posters, seminars, workplace visits, and publicity articles. <i>The Back Book</i> was made widely available, with translations in 16 languages, and all doctors in Victoria received evidence based guidelines for the management of employees with low back pain who were eligible for compensation.	Public health and primary care. Random samples of the general population and General Practitioners in Victoria and New South Wales 1. (excluding borders) $n = 4730$ 2. $n = 2556$ general population practitioners	Quasi-experimental before-after study. Campaign in the state of Victoria, with the state of New South Wales as control.	1. Population beliefs about back pain 2. General practitioner beliefs about low back pain 3. General practitioner attitudes about low back pain 4. Workers' compensation claims	1. Back Beliefs Questionnaire 2. Agreement with statements/ modified Ontario questionnaire (5-point Likert scale) 3. Agreement with statements/ modified Ontario questionnaire (5-point Likert scale) 4. Administrative data count (5-point Likert scale)	1. Survey 1: August 1997 2. Survey 2: August 1999 3. Survey 3: February 2000	1. Beliefs about back pain: Significant improvements in population beliefs in Victoria between successive surveys, while there was no change in general population beliefs in New South Wales (mean improvement in questionnaire score 1.9 (95% confidence interval (CI) 1.3 to 2.5), $p < 0.001$ and 3.2 (2.6 to 3.9), $p < 0.001$, between baseline and the second and third survey, respectively). 2. General practitioner beliefs about low back pain: Significant improvements in beliefs regarding avoidance of imaging (odds ratio 1.6 (95% CI 1.2 to 2.3) and complete bed rest (odds ratio 2.9 (95% CI 1.6 to 5.2) and encouraging early return to work (odds ratio 3.6 (95% CI 2.4 to 5.6) in Victoria compared to New South Wales. 3. General practitioner attitudes about low back pain: Significant improvements in Victoria compared to New South Wales in terms of attitudes to imaging and investigations (odds ratios ranged from 1.5 to 3.6, 95% CI ranged from 1.1 to 5.6). 4. Workers' compensation claims: Clear decline in number of claims	A population-based strategy of provision of positive messages about back pain improves population and general practitioner beliefs about back pain, seems to influence medical management, and reduce disability and workers' compensation costs related to back pain.

(continued)

Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Buchbinder et al. [36]	2001 Volvo Award Winner in clinical studies; effects of a media campaign on back pain beliefs and its potential influence on management of low back pain in general practice	See above	See above	See above	See above	See above	1. Population beliefs about back pain 2. Fear avoidance beliefs for physical activity and work among respondents who reported back pain in the preceding year 3. General practitioner management of acute and subacute low back pain	1. Back Beliefs Questionnaire (BBQ) 2. Fear Avoidance Beliefs Questionnaire (physical activity subscale; modified work activity subscale) 3. Modified Ontario questionnaire/Agreement with statements about investigation, consultation management, and referrals for 2 patient scenarios: acute and subacute low back pain	See above	1. All nine individual items of the BBQ improved significantly over time in Victoria compared with no significant change for any item in New South Wales. The improvements in BBQ score observed in Victoria after the campaign occurred uniformly irrespective of self-reported low back pain history. Mean improvement in BBQ was 1.9 (95% CI 1.3 to 2.5) between baseline and Survey 2 and Survey 2 ($p < 0.001$), and mean improvement was 3.2 (95% CI 2.6 to 3.9) between baseline and Survey 3 ($p < 0.001$). 2. Among those with self-reported low back pain in the preceding year, there were significant improvements ($p < 0.001$) in fear avoidance beliefs relating to physical activity (mean improvements of -1.5 between baseline and Survey 2, and -2.4 between baseline and Survey 3) but not beliefs	The strategy improved the beliefs of the general population and general practitioners about back pain and appears to influence medical management.

(continued)

Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Buchbinder et al. [37]	Population based intervention to change back pain beliefs: three year follow up population survey	See above	See above	See above	Public health: n = 6230 participants from general population (1500 completed the 4th survey, 900 in Victoria and 600 in New South Wales)	See above	1. Population beliefs about back pain	1. Back Beliefs Questionnaire	1. Survey 1: August 1997 2. Survey 2: August 1999 3. Survey 3: February 2000 4. Survey 4: December 2002	about work in Victoria compared with New South Wales. A significant improvement in mean response was observed in Victoria for all four individual FABphys items, and this differed consistently (but not significantly) from the change in NSW. No difference was observed between states in the change of individual FABwork items. 3. Significant improvements in stated management of both acute and subacute low back pain relating to investigation, management and referral to X-ray were observed in Victoria over time compared with New South Wales. GPs in Victoria were 2.51 times as likely not to order tests for acute low back pain and 0.40 times as likely to order lumbosacral radiographs. They also were 0.48 times as likely to prescribe bed rest and 1.65 times as likely to advise work modification.	Population beliefs about back pain remain more positive in Victoria three years after the end of the LBP media campaign. Some decay was observed in effects, suggesting top-up reminders or other strategies may be necessary to maintain

(continued)

Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Buchbinder et al. [38]	Effects of a media campaign on back beliefs is sustained 3 years after its cessation	See above	See above	See above	Public health: $n = 6230$ participants from general population (1500 completed the 4th survey, 900 in Victoria and 600 in New South Wales)	See above	1. Population beliefs about back pain 2. Fear avoidance beliefs for physical activity and work among respondents who reported back pain in the preceding year	1. Back Beliefs Questionnaire 2. Fear Avoidance Beliefs Questionnaire (physical activity subscale; modified work activity subscale)	See above	1. Consistent improvements in population beliefs about back pain in Victoria were seen irrespective of baseline belief status, and regardless of age, gender, rural or metropolitan residence, education level, country of birth, employment status, type of work, previous back pain experience and awareness of back pain advertising (Mean improvement in BBQ score was 2.3 (95% CI 1.8 to 2.8) between baseline and survey 4 ($P = 0.001$)). 2. Among those with self-reported low back pain in the preceding year, there were still significant improvements ($p < 0.05$) in fear avoidance beliefs relating to physical activity in Victoria although there were less positive beliefs about avoiding physical activity compared with surveys 3. There was no difference in mean FABphys scores in NSW (control group) at survey 4 compared to survey 1. Increase in fear avoidance beliefs (modified work activity subscale) from baseline at survey 4 was observed in both states.	Improvements over time. Significant sustained improvements in population beliefs about back pain were observed 3 years after cessation of the media campaign, providing evidence that a primary preventive strategy of altering population beliefs about back pain may be a highly effective way for reducing back-related disability. However, some dilution of the observed effects was seen, suggesting the need for top-up reminders or other strategies.
Buchbinder et al. [39]	Improvements in general	See above	See above	See above	Primary care: $n = 3702$ general	See above	1. Agreement with statements/	1. Survey 1: August 1997	1. Sustained improvements,	Media campaign has a sustained effect on	(continued)

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
	practitioner beliefs and stated management of back pain persist 4.5 years after the cessation of a public health media campaign				practitioners (1,146 general practitioners completed the 3 rd survey)		<ol style="list-style-type: none"> General practitioner beliefs about low back pain General practitioner attitudes about low back pain General practitioner stated management of acute and subacute low back pain 	modified Ontario questionnaire (5-point Likert scale) Agreement with statements/ modified Ontario questionnaire (5-point Likert scale) Modified Ontario questionnaire/ Agreement with statements about investigation, consultation management, and referrals for 2 patient scenarios: acute and subacute low back pain	Survey 2: February 2000 Survey 3: May 2004	some dilution, over time in Victorian general practitioners' beliefs about back pain (odds ratios ranged from 1.6 (95% CI 1.2 to 2.3) to 3.6 (95% CI 2.4 to 5.6)). 2. Sustained improvements, some dilution, over time in Victorian general practitioners' attitudes about back pain (odds ratios ranged from 1.4 (95% CI 1.0 to 1.9) to 1.7 (95% CI 1.2 to 2.6)). 3. Sustained improvements over time in Victorian general practitioners' stated management for acute and subacute low back pain. At Survey 3, compared with baseline, Victorian physicians were 2.0 (95% CI 1.3 to 3.0) times as likely as their NSW counterparts to know that patients with low back pain need not wait to be almost pain free to return to work, 1.78 (95% CI 1.27 to 2.49) times as likely not to order tests for acute low back pain and 0.47 (95% CI 0.33 to 0.69) times as likely to order lumbosacral radiographs. They were also 0.49 (95% CI 0.34 to 0.73) times as likely to prescribe bed rest and 1.62 (95% CI 1.19 to 2.22) times as likely to advise work modification.	general practitioner beliefs and stated behavior 4.5 years after its cessation.

Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Suman et al. [40]	Evaluation of a Canadian back pain mass media campaign	Back Pain: Don't take it lying down Canada 2005-2008	2. TV 3. Print 4. Radio 5. Outdoor and out-of-home 6. Digital media	Mass media campaign undertaken by the Workers' Compensation Board of Alberta and partners, with the primary objective of education adult Albertans about back pain and the advantages of staying active. Practical advice was provided using various communication tactics to educate on how best to manage or treat back pain, and focused largely on modifying existing beliefs that back pain requires rest. Key messages included: • Activity is good for your back; • Even when you feel pain, you can participate in low-impact exercise without further straining your back; • The sooner you get moving the sooner you will feel better; • Health care professionals believe with regular activity and proper body mechanics you will feel better within a few weeks; • Get your back in motion. Over 3 years, the core theme of the campaign was used in a variety of media formats including: • Radio; • Bus ads; • Bill boards; • Posters; • Promotional materials; • Public service announcement television spots. Radio ads ran in major frequencies in 11 regions throughout Alberta and on a variety of station formats. Ads were aired in bursts during high listening months. Medical and health care associations endorsed the advertisements to increase credibility. The campaign reflected a balance of paid and free initiatives. See ID #716.	Public health: $n = 8566$ randomly selected participants from general populations of Alberta and Saskatchewan	Quasi-experimental before-after and interrupted time-series with campaign provided in the province of Alberta, and neighbouring province of Saskatchewan used as control	1. Beliefs about back pain 2. Health care utilization 3. Work-related disability	1. BBQ and level of agreement with 4 statements related to management of back pain 2. Data from public health care funding agency in Alberta and Workers' Compensation Board of Alberta 3. Administrative database data from the Workers' Compensation Boards of Alberta and Saskatchewan	1. Survey 2: 2006 2. Survey 2: 2006 3. Survey 3: 2007 4. Survey 4: 2008	1. Agreeing with survey item: If you have back pain you should try to stay active increased from 55.5% to 63.4% in Alberta but decreased from 59.7% to 58.3% in Saskatchewan (Interaction between province and time found adjusted OR = 0.91 (95% CI 0.84 to 0.98), $p = 0.018$. 2. BBQ scores were consistent across years in Alberta and between provinces with no significant differences observed across years or provinces on the Back Beliefs Questionnaire scores (the interaction between province and time was found not to be statistically significant ($P = 0.13$). 3. No effects on any of the publicly funded health utilization outcomes in Alberta or on any of the workers' compensation health utilization outcomes. 4. No effects on any of the workers' compensation claims outcomes, including first time back claims.	The campaign appears to have had a small impact on public beliefs specifically related to campaign messaging to stay active, without impact on health utilization or work disability outcomes.
		Back Pain: Don't take it lying down Canada 2010-2015	See above	The core theme of the campaign continued to be used in a variety of media formats, including: • Radio; • Bus ads; • Bill boards; • Posters; • Promotional materials; • Public service announcement television spots. Radio ads ran in major frequencies in 11 regions throughout Alberta and on a variety of station formats. Ads were aired in bursts during high listening months. Medical and health care associations endorsed the advertisements to increase credibility. The campaign reflected a balance of paid and free initiatives. See ID #716.	Public health: $n = 11\ 637$ participants from general population	Quasi-experimental time series using repeated cross-sectional population	1. Beliefs about back pain	1. Agreement with statement related to management of back pain (staying active)	1. Survey 1: 2010 2. Survey 2: 2011 3. Survey 3: 2012 4. Survey 4: 2013 5. Survey 5: 2014	1. Significant increase in agreement with stay active statement over time between years 2010 and 2014 with a proportion of	Ongoing back pain mass media campaign resulted in increase in the proportion of

(continued)

Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Werner et al. [24]	Norwegian campaign evaluations Low back pain media campaign: no effect on sickness behaviour	Active Back, Norway 2002-2005	1. Direct marketing	Media campaign towards the general public advertised five statements, which were:	Primary care and public health, $n = 4538$ participants from general population	Quasi-experimental before-after study with the campaign provided in two counties in southern Norway (Vestfold and Aust-Agder), and a third county (Telemark) acting as control	1. Population beliefs about back pain and usefulness of imaging for LBP	1. Agreement with statements (5-point Likert scale)	1. Survey 1: 2002	plateau of about 72% (95% CI 69.6 to 75.7) agreement between 2012 and 2014 ($p = 0.001$).	respondents agreeing that they should stay active when experiencing back pain.
			2. TV			2. Total and back pain related sick leave	2. Administrative data from Norwegian National Insurance Administration and 4. Administrative data from all official and private institutes for imaging and orthopedic departments	2. Survey 2: 2004	improvement in beliefs about low back pain in the general public was observed following a limited, small-scale low-budget media campaign, the study did not demonstrate any corresponding change in sickness behaviour.		
			3. Radio				3. Imaging for LBP			3. Survey 3: 2005	
			4. Print				4. Surgery for LBP				
			5. Outdoor and out-of-home	any dangerous illness; X-rays rarely reveal the cause of back pain							
			6. Digital media	A back in motion improves faster							
				Work with your back! One recovers faster by returning to work as soon as possible, even if the back is still hurting;							
				Only a few people with back pain need surgery.							
				The campaign also included special information directed at primary care doctors, physiotherapists, and chiropractors. The written material included a short and full version of guidelines, information about the projects, posters for waiting rooms, and handouts for patients.							
				Channels for the mass media campaign were:							
				A web site (available continuously through the campaign);							
				Posters for waiting rooms (available continuously throughout the campaign);							
				16 pages pamphlet delivered to all households (spring and fall 2003, spring 2004, spring 2005);							
				Local paper ads (spring and fall 2003, spring 2004, spring 2005);							
				Local cinema ads (fall 2002, spring 2003, spring 2004, spring 2005);							

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Werner et al. [42]	Healthcare provider back pain beliefs unaffected by a media campaign	See above	See above	See ID #1794 The educational initiative was aimed at primary care doctors, physiotherapists, and chiropractors. It consisted of written material mailed to clinics, and provision of posters and patient handouts to be distributed at the clinics. The written material was in addition to the short and full version of guidelines. Information on the campaign and overall project were also provided.	Primary care, $n = 239$ doctors, physiotherapists, and chiropractors	See above	1. Healthcare providers' beliefs about back pain and usefulness of imaging for LBP	1. Agreement with 7 statements (5-point Likert scale)	See above	in MRI imaging (152% intervention and 596% control increases) 4. Increase in surgical procedures in intervention (33%) and control (20%) counties	The mass media campaign with educational initiatives aimed at healthcare providers did not result in important improvements in healthcare providers' beliefs about low back pain.
Werner et al. [43]	The effects of a media campaign on beliefs and utilization of imaging examinations in Norwegian patients with low back pain	See above	See above	See above	Primary care and public health, $n =$ not reported	See above	1. Imaging examinations for low back pain 2. Population and healthcare providers' beliefs about back pain and usefulness of imaging for LBP 3. Healthcare providers' recommendations for diagnostic imaging for low back pain	1. Administrative data from six private and public radiology departments 2. Agreement with 11 statements (5-point Likert scale) 3. 4-item likelihood scale	See above	Despite slightly improved population and healthcare providers' beliefs about the usefulness of diagnostic imaging examinations for low back pain, an overall increase in utilization of imaging modalities was observed, with a trend away from the use of X-ray towards the use of MRI.	

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Scottish campaign evaluation Waddell et al. [23]	Working Backs Scotland: a public and professional health education campaign for back pain	1. Print 2. Radio 3. TV 4. Digital media	For the general public: Simple messages and informational material. Main messages were: • Stay active; • Try simple pain relief; • If you need it, get advice. Secondary messages were: • Don't take back pain lying down; • There's a lot you can do to help yourself; • The prognosis should be good. Informational material included: • Leaflets presenting information and advice on a single A4 page, with parallel versions for people with back pain, employers, general practitioners, therapists, and pharmacists; • Clinical guidelines; • The Back Book for patients; • A booklet 'Managing back pain in the workplace'; • A poster. Channels for the mass media campaign were: • The primary medium was radio, with 177 715-second advertisements broadcast on all 15 commercial radio	Simple messages and informational material. Main messages were: • Stay active; • Try simple pain relief; • If you need it, get advice. Secondary messages were: • Don't take back pain lying down; • There's a lot you can do to help yourself; • The prognosis should be good. Informational material included: • Leaflets presenting information and advice on a single A4 page, with parallel versions for people with back pain, employers, general practitioners, therapists, and pharmacists; • Clinical guidelines; • The Back Book for patients; • A booklet 'Managing back pain in the workplace'; • A poster. Channels for the mass media campaign were: • The primary medium was radio, with 177 715-second advertisements broadcast on all 15 commercial radio	Primary care, public health, and workplace, $n = 27\,000$ participants from general population	Quasi-experimental before-after study	1. Population beliefs about the management of back pain 2. Professional advice received (stay active, rest/avoid activity, stay off work) and social benefits 3. Sickness absence	1. Agreement with statements related to management of back pain (5-point Likert scale) 2. Not reported 3. Administrative data for sickness absence (Royal Mail) and new awards of social security incapacity benefits for back disorders (Department for Work and pensions)	1. Two months before launch of the campaign 2. Repeated monthly measurement over the following 3 years	2. Increased skepticism about X-rays was observed in the intervention group but not the control group (mean difference between groups in percent disagreeing was 5.5%, $p < 0.001$) 3. Among health care providers a tendency was observed towards less trust in the usefulness of X-rays in all counties. The results were statistically significant in the intervention group ($p < 0.001$), but not in the control group ($p = 0.124$).	Major shift in public beliefs and clinical practice occurred and was maintained, although diminishing progressively over 3 years. Changed beliefs about staying active and changed clinical management did not translate to work-related beliefs or behavior.

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Cunningham et al. [41]	Irish campaign evaluation Working Backs Project: implementing low back pain guidelines	Working Backs Project, Ireland 2004	1. Direct marketing 2. Print 3. Digital media	The campaign encompassed a tailored intervention package, which utilized a 'health promotion in the workplace' framework. This included: • Guideline-based line manager, staff, and back clinician health promotion campaign; • Distribution of the 'Working Backs Project' booklet to key stakeholders; • Establishment of an organizational LBP database and a clear LBP management pathway with early reporting and guideline-based clinical management. The Working Backs Project campaign was launched in June 2004.	Workplace: 1. Line managers: $n = 59$ before, $n = 58$ after 2. Staff: $n = 246$ before, $n = 228$ after	Before-after study	1. Number of staff on LBP-related sick leave and associated number of sick leave days in the previous year 2. Staff and manager attitudes and beliefs about back pain 3. Intended management of choice for LBP 4. Choice of health practitioner for LBP	1. Not reported 2. Back Beliefs Questionnaire (staff), Agreement with guideline-based statements (managers) 3. Level of agreement with guideline-based statements 4. Questionnaire	1. Before campaign: 2004 2. After campaign: 2006	1. Proportion of staff on LBP-related sick leave in the previous year showed a non-significant decrease from 9% ($n = 21$) to 7% ($n = 16$) (95% CI 0.03 to 0.06). 2. Among staff, a mean improvement of 1.8 (95% CI -3.0 to -0.66) on the BBQ score, with more staff (36%) reporting they would try to stay active ($p < 0.05$) with LBP. More positive, evidence-based attitude in managers towards back pain, 5 out of 8 statements improved significantly. 3. 3% (95% CI 4% to 10%) fewer staff reported they would resort to bed rest. 13% (95% CI 2% to 19%) fewer reported they would seek treatment. 14% (95% CI 6% to 22%) increase in staff reporting they would try to stay active. 4. 15% increase (95% CI 6% to 23%) in staff choosing	Staff and manager attitudes and beliefs towards back pain and its management are more consistent with guidelines, although back pain related sickness absence did not decrease significantly.

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Japanese campaign evaluations Kamada et al. [48]	A community-wide campaign to promote physical activity in middle-aged and elderly people: a cluster randomized controlled trial	COMMUNI-CATE study Japan 2009–2014	1. Direct marketing 2. Radio 3. Print 4. Outdoor and out-of-home	A community wide campaign to promote physical activity for middle-aged and elderly residents. The campaign included: • Information delivery: flyers, leaflets, community newsletters, posters, banners, and local audio broadcasts; • Education delivery: outreach health education program and mass- and individual encouragement by professionals during medical check-ups and various community events, including sports events and festivals. Mass-encouragement included the delivery of a motivating talk and demonstration of physical activity, individual encouragement, including short face-to-face promotion and counseling on physical activity while waiting for medical check-ups; • Support delivery: development of social (peer) support, i.e. promoting encouragement by community leaders and lay health workers; material support, i.e. arranging for residents to obtain lightweight reflective material for walking safety, pedometers, and videotapes and DVDs on flexibility and muscle-strengthening activities at the community center; and professional support, i.e. establishing a call center for questions about physical activity and requests for outreach programs.	Public health $n = 4414$ respondents to baseline survey	Cluster randomized controlled trial	1. Regular physical activity (mean number of minutes walking time) 2. Chronic low back pain intensity 3. Low back pain intensity	1. Questionnaire 2. Questionnaire 3. Visual analog scale [from 0 mm (no pain) to 100 mm (most intense pain)]	1. Baseline: October 2009 2. 1-year follow up: October 2010 3. 3-year follow up: October 2012	1. Small decrease in physical activity, (adjusted OR: 0.97, 95% CI 0.84 to 1.14). 2. Small increase in chronic low back pain from 14.0% to 14.5% 3. Median (interquartile range) change in low back pain 0 (95% CI -10 to 4).	inCommunity wide campaign did not improve physical activity, chronic low back pain or low back pain intensity in middle-aged and elderly people 1 year after the campaign.
Kamada et al. [49]	Community-wide promotion of physical activity in middle-aged and older Japanese: a 3-year evaluation of a cluster randomized trial	See above	See above	See above	See above	See above	1. Regular physical activity (mean number of minutes walking time) 2. Chronic low back pain intensity 3. Low back pain intensity	1. Questionnaire 2. Questionnaire 3. Visual analog scale [from 0 mm (no pain) to 100 mm (most intense pain)]	1. Baseline: October 2009 2. 1-year follow up: October 2010 3. 3-year follow up: October 2012	1. No significant increase in the proportion of adults who reached recommended levels of aerobic flexibility, and/or muscle-strengthening activities (adjusted change difference	The 3-year community wide intervention did not achieve a significant increase in the proportion of adults who reached recommended levels of aerobic flexibility, and/or muscle-strengthening activities (adjusted change difference

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Kamada et al. [47]	Community-wide intervention and population-level physical activity: a 5-year cluster randomized trial	See above	See above	See above	See above	See above	1. Regular physical activity (mean number of minutes walking time) 2. Chronic low back pain 3. Low back pain intensity	1. Questionnaire 2. Questionnaire 3. Visual analog scale [from 0 mm (no pain) to 100 mm (most intense pain)]	1. Baseline: October 2009 2. 1-year follow up: October 2010 3. 3-year follow up: October 2012 4. 5-year follow up: October 2014	1. Compared with control communities, adults achieving recommended levels of physical activity increased significantly in intervention communities [adjusted change difference: 4.6 percentage points (95% CI 0.4 to 8.8)]. The intervention was effective for promoting all types of recommended PAs, i.e. aerobic (walking, 6.4%), flexibility (6.1%) and muscle-strengthening activities (5.7%). 2. Small increase in chronic low back pain from 14.0% to 15.2% 3. Median (interquartile range) change in low back pain from 8 (95% CI 0 to 36) to 36) at baseline to 5 (95% CI 0 to 28).	The 5-year community wide intervention increased the population-level of physical activity, with an accompanying small decrease in low back pain intensity (but little difference between intervention and control groups).
USA campaign evaluations Hong et al. [45]	Small decline in low-value back imaging associated with the 'Choosing Wisely' campaign 2012–2014	1. Direct marketing 2. Print 3. TV 4. Outdoor and out-of-home 5. Social and digital media	Choosing Wisely by the American Board of Internal Medicine in 2012 as a patient- and clinician-targeted campaign to reduce potentially unnecessary "low value" medical services. Choosing Wisely recommendations release was accompanied by widespread media attention,	Primary care: $n = 1\,547\,870$ patients with 1 862 397 back pain visits without red-flag diagnoses	Quasi-experimental, interrupted-time series	1. Low-value back imaging in acute back pain visits (visits without red-flag diagnoses)	1. Medical claims data from a commercial health insurer 2. Two years after the launch of the campaign (2012–2014)	1. Two years prior to the launch of the campaign (2010–2012)	1. Low value imaging rate was 4.76 percent (95% CI 3.80 to 5.73) lower 2.5 years after the start of the campaign. reduction in low-value back imaging. In contrast, no change was seen in high-value back	Choosing Wisely was associated with a very small but statistically significant relative reduction in low-value back imaging. In contrast, no change was seen in high-value back	

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Table 2. Continued.

Author, year	Title	Campaign	Campaign components	Campaign provision	Setting and participants	Study design	Outcomes	Measurement instruments	Time points measured	Results	Authors' conclusions
Kost et al. [46]	Clinical decisions made in primary care clinics before and after Choosing Wisely	Choosing Wisely United States 2012	1. Direct marketing 2. Print 3. TV 4. Outdoor and out-of-home 5. Social and digital media	1. Direct marketing by the American Board of Internal Medicine in 2012 as a patient- and clinician-targeted campaign to reduce potentially unnecessary "low value" medical services. Choosing Wisely recommendations release was accompanied by widespread media attention, and the campaign partnered with 11 consumer groups to disseminate the recommendation to both doctors and patients. Choosing Wisely recommendations have also been incorporated into clinical ordering processes at some health systems.	Primary care, $n = 1089$ patient charts from 3 primary care residency clinics	Quasi-experimental before-after study	1. Appropriate imaging orders for back pain	1. Chart review	1. A 6-month period before the launch of the campaign 2. A 6-month period after the launch of the campaign	No change in appropriate imaging orders for back pain (consistently 87.8% before and after intervention, $P = 0.99$)	Adherence to imaging orders for back pain recommendations was unexpectedly high at baseline, limiting the opportunity for change.
Rosenberg et al. [44]	Early trends among seven recommendations from the Choosing Wisely campaign	Choosing Wisely United States 2012	1. Direct marketing 2. Print 3. TV 4. Outdoor and out-of-home 5. Social and digital media	Choosing Wisely was launched by the American Board of Internal Medicine in 2012 as a patient- and clinician-targeted campaign to reduce potentially unnecessary "low value" medical services. Choosing Wisely recommendations release was accompanied by widespread media attention, and the campaign partnered with 11 consumer groups to disseminate the recommendation to both doctors and patients. Choosing Wisely recommendations have also been incorporated into clinical ordering processes at some health systems. Additionally an intervention was provided, consisting of either a 1-hour, in-person seminar or an online webinar reviewing Choosing Wisely recommendations and a stepwise approach to communicating to patients a plan of care based on the recommendations.	Primary care, $n = 14\ 727$ patients with low back pain and 7865 claims for low back pain	Quasi-experimental retrospective analysis of claims data	1. Inappropriate imaging for low back pain	1. Medical and pharmacy claims data from nationwide healthcare plans	1. Quarterly assessment from 2010 through 2013	1. No statistically significant change in inappropriate imaging orders for low back pain (53.7% utilization throughout study; $P = 0.71$)	No change in low back pain imaging in the absence of red-flag conditions.

campaigns also included supplemental activities aimed at educating health care providers, such as dissemination of clinical practice guidelines or distribution of booklets through the providers.

The primary campaign medium varied across the campaigns with prime-time television commercials used in the Australian campaign, radio advertisements in Scotland and Canada, a combination of radio and print in Norway and Japan, and an online website in the USA. The Irish campaign did not report many details of the media used, describing it only as a health promotion campaign with distribution of a booklet. Television advertisements were also used in Canada, Scotland, and Norway, although this was mainly limited to complimentary Public Service Announcements (in Australia paid television advertisements formed the bulk of the media budget). All campaigns used some form of print medium. The Japanese campaign described using a social marketing process when planning and implementing campaign activities (see Table 1 for more details on the planning process used).

Intensity varied across the campaigns, with the highest reported awareness of campaign messaging reported in Australia (86% awareness in Australia as compared to 39–62% elsewhere, see Table 1). Among those campaigns where budgets were detailed, the budget for the Australian campaign was the largest at USD \$7.6 million over 3 years with the bulk of the budget spent on television advertisements, while all other published budgets were more modest. The Canadian campaign has had a budget of ~USD \$1.8 million over 12 years while the Norwegian campaign had an overall budget of USD \$1.1 million over 3 years [26]. Budgets for the Scottish and Japanese campaigns were not reported, yet described as low cost. The budget of the *Choosing Wisely* campaign in the USA was not exactly known or published but is considered low cost as it relied heavily on in-kind contributions from professional associations and mainly used low cost social media (i.e., websites and Twitter feed). The budget for the Irish campaign was not described.

Description of individual studies

Table 2 provides a detailed description of the 18 studies evaluating the seven LBP mass media campaigns. The majority of campaigns were evaluated using quasi-experimental before-and-after or time series designs (Australia 5 studies, Norway 3 studies, Canada 2 studies, Scotland 1 study, Ireland 1 study). The Japanese campaign was evaluated using a cluster RCT with 3 separate follow-up times (1, 3, and 5 years). The Japanese studies did not evaluate general public beliefs about LBP, but evaluated physical activity levels and LBP-related clinical outcomes (prevalence and intensity of chronic LBP). The studies from the USA used quasi-experimental methods to evaluate use of and referrals for diagnostic imaging for LBP.

Quality assessment of individual studies

Table 3 shows the quality assessment of the included studies. Only three studies [47–49] (16.7%) were rated as strong quality based on the overall rating from the EPHPP tool. These evaluated the Japanese campaign using cluster RCT methodology. The majority of studies ($n=11$ [22,24,25,36–40,43–46], 61.1%) were rated as moderate quality, followed by four papers [23,41,42,44] (22.2%) that were rated as weak. The EPHPP tool item related to selection bias was the domain most commonly rated as weak ($n=9$, 50%). The domains related to study design and blinding were rated as moderate in the majority of the studies ($n=14$,

77.8% and $n=10$, 55.6% respectively). Most studies were rated as strong quality on the domain confounding ($n=13$ studies, 72.2%). Due to the nature of the population-based campaigns, the domain related to “withdrawals and drop-outs” was not applicable for most studies, except for the studies reporting on a cluster RCT.

Synthesis of results

A detailed synthesis for each evaluated primary and secondary outcome is provided in Table 4 and discussed in detail below.

Primary Outcome - General public beliefs

General public LBP beliefs were evaluated through two broader categories: general “LBP beliefs” and “fear avoidance beliefs” about physical activity and work. To evaluate general “LBP beliefs”, researchers used either the Back Beliefs Questionnaire (BBQ) or level of agreement with individual belief statements that were relevant to each campaign (29 different statements). Fear avoidance beliefs were evaluated among those with a self-reported history of low back pain in the preceding year using the Fear-Avoidance Beliefs Questionnaire (FABQ) physical activity and work subscales.

Back Beliefs Questionnaire: LBP beliefs were measured by the BBQ in six studies [22,25,36–38,41], evaluating the Australian, Canadian, and Irish campaigns. Five studies [22,36–38,41] reported positive effects of the campaigns, with no accompanying effect in a control population. The positive effect observed in Australia was also evaluated in a longer-term follow-up 3 years after the cessation of the campaign, with beliefs remaining significantly more positive overall and on individual belief statements [37,38]. The Canadian campaign [25] reported neutral effects (mean change of 0), however, its messaging was limited to stay active while the BBQ addresses LBP beliefs more broadly.

Individual Belief Statements: Four individual LBP belief statements were used across multiple studies. Three studies [23,25,40] evaluating the Canadian and Scottish campaigns examined respondent agreement with the statement: “If you have back pain you should try to stay active”. Consistent positive effects of the Canadian and Scottish campaigns were observed on this belief statement (16.5% and 23.0% improvement respectively). Similar results were reported by two [23,25] studies evaluating agreement with the statement: “If you have back pain, you should rest until it gets better” (Canada 4.5% improvement, and Scotland 24.0% improvement). Each statement was directly and explicitly related to campaign messaging. The Canadian campaign has continued and a long-term follow-up indicates that the improved beliefs have been sustained for 10 years, especially among respondents reporting exposure to campaign messaging [40]. Agreement with individual statements related to going to work and use of “simple painkillers” did not significantly change in either campaign (but were also not key messages of the campaigns).

Other beliefs statements were investigated within individual studies of general public beliefs. Evaluation of the Norwegian campaign used seven individual LBP belief statements based on the main messages of the campaign and addressing common myths about LBP [24]. Evaluation detected a statistically significant improvement in general public LBP beliefs over time compared to a control population (mean sum-score change of 1.5 out of 35 versus 0.3 in the control group, $p < 0.001$).

A separate study of the Norwegian campaign reported on 2 additional belief statements about the usefulness of diagnostic

Table 3. Quality assessment of included studies.

Study	Global rating	Selection bias	Study design	Confounders	Blinding	Data collection methods	Withdrawals and dropouts
Buchbinder et al. (BMJ) [22]	Moderate	Weak	Moderate	Strong	Strong	Strong	N/A
Buchbinder et al. 2001 (Spine) [36]	Moderate	Weak	Moderate	Strong	Strong	Strong	N/A
Buchbinder and Jolley [37]	Moderate	Weak	Moderate	Strong	Strong	Strong	N/A
Buchbinder and Jolley [38]	Moderate	Weak	Moderate	Strong	Strong	Strong	N/A
Buchbinder and Jolley [39]	Moderate	Weak	Moderate	Moderate	Moderate	Moderate	N/A
Cunningham et al. [41]	Weak	Weak	Moderate	Weak	Weak	Strong	N/A
Gross et al. [25]	Moderate	Moderate	Moderate	Strong	Moderate	Weak	N/A
Hong et al. [45]	Moderate	Strong	Moderate	Strong	Weak	Moderate	N/A
Kamada et al. [48]	Strong	Moderate	Strong	Strong	Moderate	Strong	Moderate
Kamada et al. [49]	Strong	Moderate	Strong	Strong	Moderate	Strong	Moderate
Kamada et al. [47]	Strong	Moderate	Strong	Strong	Moderate	Strong	Moderate
Kost et al. [46]	Moderate	Moderate	Moderate	Weak	Moderate	Moderate	N/A
Rosenberg et al. [44]	Weak	Strong	Weak	Weak	Moderate	Moderate	N/A
Suman et al. [40]	Moderate	Moderate	Moderate	Strong	Moderate	Weak	N/A
Waddell et al. [23]	Weak	Moderate	Moderate	Weak	Strong	Weak	N/A
Werner et al. (SJPHC) [42]	Weak	Weak	Moderate	Strong	Weak	Moderate	Weak
Werner et al. (PEC) [24]	Moderate	Weak	Moderate	Strong	Moderate	Moderate	N/A
Werner et al. [43]	Moderate	Weak	Moderate	Strong	Moderate	Moderate	N/A

imaging for LBP [43]. Increased skepticism about X-rays was observed in the intervention group but not the control county (mean difference between groups of 5.5%, $p < 0.001$) [24]. The Irish campaign was evaluated through 9 belief statements about the choice of management for acute LBP [41]. More respondents agreed they should stay active (14% improvement, $p = 0.001$), more disagreed they should seek treatment (13% improvement, $p = 0.006$) or avoid strenuous activity (14% improvement, $p = 0.004$). The other 6 belief statements related to bed rest, medications, taking time off work, modifying work activities, exercising, or using heat/cold were not significantly improved.

Fear-Avoidance Belief Questionnaire: Fear avoidance beliefs among those who reported low back pain in the preceding year were evaluated in two studies using the physical activity subscale and a work subscale of the FABQ modified to remove questions that might potentially unblind participants to the purpose of the survey [36,38]. In these studies, positive effects of the Australian campaign were found on the FABQ physical activity subscale (mean change of 2.4 out of 24, $p < 0.001$), with no corresponding improvement in the control population. No significant change was found on the FABQ work subscale as expected by the study team as the items were not relevant to the main campaign messages.

Overall, consistent statistically significant positive effects in general public LBP beliefs were observed in all studies evaluating general public beliefs. The size of the effect varied from modest to large, depending on the setting and belief measured. The positive effects appeared related to explicit campaign messaging and may persist long term (i.e., up to 10 years in the case of the ongoing Canadian campaign).

Secondary outcomes

Health care provider beliefs

Health care provider beliefs about LBP were investigated by two studies of the Australian campaign [22,39]. These studies measured the effects of the campaign on health care providers' agreement with 8 individual statements about management of LBP and their intended behaviour regarding what they would do when seeing patients with LBP. General practitioner beliefs about LBP improved significantly on the majority of belief statements in the intervention group, with no corresponding improvement in the

control population. At a 4.5-year follow-up, the odds ratio for general practitioners in the intervention group was 2.0 (95% confidence interval [CI], 1.3–3.0) when compared to the control population for believing that patients with LBP need not wait to be almost pain free to return to work; 1.78 (95% CI, 1.27–2.49) times as likely not to order imaging for acute LBP, and 0.47 (95% CI, 0.33–0.69) times as likely to order lumbosacral radiographs [39]. They were also 0.49 (95% CI, 0.34–0.73) times as likely to prescribe bed rest and 1.62 (95% CI, 1.19–2.22) times as likely to advise work modification.

A study evaluating the Norwegian campaign detected statistically significant improvements in health care provider beliefs about the usefulness of imaging examinations [43]. The proportion of health care providers disagreeing with the statement "X-rays and newer imaging tests can always find the cause of pain" was higher in the intervention as compared with the control counties (30% versus 12% disagreement respectively, $p < 0.001$). A second study evaluating the Norwegian campaign investigated 7 statements related to main messages of the campaign and common LBP myths [42]. Small, statistically non-significant differences were observed between health care providers exposed and unexposed to campaign messaging. However, providers in both the control and experimental groups held beliefs that were more in line with evidence-based guidelines after the campaign.

The study evaluating the Scottish campaign [23] examined LBP-related advice that would be given by health care providers. The study explored this outcome through reported agreement with 3 statements about advice given to patients regarding the importance of staying active, resting or avoid activity, and staying off work. Statistically significant improvements were observed on the statements related to staying active (14.0% improvement) and resting/avoid activity (10.0% improvement), while the statement related to staying at work did not change significantly after the campaign.

Overall, consistent statistically significant positive effects in health care provider LBP beliefs were observed in all of the campaigns evaluating this outcome. The size of the effect varied from modest to large, depending on the setting and belief measured. The positive effect appears to be related to explicit campaign messaging and may persist long term (i.e., up to 4.5 years after cessation of the Australian campaign).

Table 4. Detailed synthesis of outcomes

Outcome	Measurement Instruments	Positive Effect in Multiple Campaigns	Promising Effect in One Campaign	Negative Effect in Multiple Campaigns or Studies	No Relevant Effect Detected	Mixed or Unclear Findings
General Public Beliefs						
Beliefs about low back pain	<ul style="list-style-type: none">• Back Beliefs Questionnaire• Individual belief statements	✓				
Fear Avoidance beliefs about physical activity	<ul style="list-style-type: none">• Fear-Avoidance Beliefs Questionnaire (physical activity)	✓				
Fear Avoidance beliefs about work	<ul style="list-style-type: none">• Fear-Avoidance Beliefs Questionnaire (modified work)				✓	
Healthcare Provider Beliefs						
Health care provider beliefs about low back pain	<ul style="list-style-type: none">• Individual belief statements• Beliefs about intended management of LBP	✓				
Disability Behaviours						
Regular Physical Activity	<ul style="list-style-type: none">• Walking 150 minutes/week		✓			✓
Workers' compensation/ Sick leave Absence	<ul style="list-style-type: none">• Compensation claims for LBP• Days compensated for LBP• Corporation administrative data					
Health Utilization Behaviours						
Visits to health care providers	<ul style="list-style-type: none">• Workers' compensation medical payments for low back pain					✓
Choice of provider for low back pain	<ul style="list-style-type: none">• Individual preference statements		✓			
Imaging for low back pain (X-ray, CT, or MRI)	<ul style="list-style-type: none">• Administrative data				✓	
LBP-Related Clinical Outcomes						
Proportion experiencing chronic low back pain	<ul style="list-style-type: none">• Questionnaire				✓	
Intensity of low back pain	<ul style="list-style-type: none">• Pain Intensity Visual Analogue Scale				✓	

Disability behaviours

Physical Activity: Three high quality studies of the Japanese campaign [47–49] investigated the effects on reported “regular physical activity” as measured by reports of engaging in 150 min/week or more of walking, daily flexibility activities, or muscle strengthening activities two or more days per week. No statistically significant improvement in physical activity was observed in the first two follow-up periods (1- and 3-year) [48,49]. However, at 5-year follow-up, a statistically significant positive effect was observed in the proportion of residents meeting the physical activity recommendation of walking 150 min/week [47]. The treatment communities saw a 4.6% improvement (95% CI 0.4%, 8.8%) compared with control communities. A linear dose–response relationship between campaign awareness and changes in physical activity was also reported. This was the only campaign in which reported physical activity was evaluated.

Work Disability (i.e., Workers’ Compensation Claims/Social Security Claims/Sickness Absence): Five studies [22–25,41] evaluating the Australian, Canadian, Norwegian, Scottish, and Irish campaigns investigated administrative data to determine whether the campaigns reduced work disability due to LBP. One study [22] from the Australian campaign (with explicit messaging regarding the importance of staying at work) reported a decline in number of claims for back problems of 15% over the duration of the campaign, as well as back claims as a proportion of all claims, and the duration of claims measured by rate of days compensated. Work-related disability (back claims as a proportion of all claims, proportion of first time back claims, duration of time loss wage replacement benefits for LBP, and recurrence of benefits) and Social Security Incapacity Benefits were investigated by individual studies evaluating the Canadian [25] and Scottish [23] campaigns respectively. Neither study detected relevant changes due to the campaigns.

Waddell et al. [23] investigated whether the Scottish campaign improved sickness absence using administrative data from the United Kingdom Royal Mail. Werner et al. [24] investigated whether the Norwegian campaign improved total sick leave and LBP-related sick leave days. Cunningham et al. [41], investigated whether the Irish campaign improved LPB-related sick leave and associated number of sick leave days in the previous year. Consistently, no statistically significant or relevant effects were detected in sickness absence outcomes as a result of the Irish [41], Scottish [23], or Norwegian [24] campaigns.

Overall, mixed findings were observed of the effect of mass media campaigns on work disability behaviours. Sizeable improvements in work disability measures were detected in the Australian study, which was also the only campaign with explicit messaging regarding the importance of staying at work. Promising effects were observed on general physical activity in the Japanese campaign at 5-year follow-up.

Health utilization behaviours

Visits to Health Care Providers: One study evaluating the Australian campaign used administrative claims data from a workers’ compensation database to evaluate health utilization behaviours as measured by medical payments for all continuing claims [22]. A statistically significant reduction in medical costs of 20% per claim was observed. Another study evaluating the Canadian campaign, which did not contain messaging specific to use of health care, did not detect statistically significant effects on any publicly funded or workers’ compensation health utilization outcome [25].

Choice of Health Care Provider: The study of the Irish campaign [41] investigated the choice of health care provider for treating LBP through agreement with nine individual preference statements. Only one statement significantly changed after the campaign, with respondents more likely to state they intended to visit an occupational health provider when they experienced LBP (15% more likely, $p=0.001$). The other 8 health utilization preference statements related to general practitioner, physiotherapist, hospital consultant, non-consultant hospital doctor, emergency, osteopath, and chiropractor were not significantly changed after the campaign.

Imaging for LBP: Evaluations of the Norwegian, Canadian, and USA campaigns did not detect statistically significant changes in use of diagnostic imaging for LBP (i.e., CT, X-Ray, and/or MRI) [24,25,43–46]. In Norway, reductions in both the intervention and control groups were observed for CT and X-Ray, however, substantial increases were observed in capacity and use of MRI (152% in the intervention group and 596% in the control) [24]. Two evaluations of the USA campaign report no change in the use of low value imaging [44,46]. While another study detected a small, statistically significant reduction (4% relative reduction) in a dataset with very large sample size ($n=1,547,870$) [45]. Evaluation of the Canadian campaign detected non-significant changes in proportion of claimants undergoing diagnostic imaging for LBP (radiograph, CT, and MRI) [25].

Overall, a mixed effect was observed of mass media campaigns on health utilization behaviours. The Australian campaign, which included explicit messaging regarding health utilization, led to a sizeable reduction (20%) in medical costs from visits to health care providers. Additionally, changes in advice provided by health care providers in Scotland were only related to specific campaign messaging related to staying active (advice regarding staying at work was unchanged and not mentioned in the campaign). A promising effect was also observed from the Irish campaign, which increased respondents' choices regarding seeing occupational physicians who were highlighted in the campaign. However, no relevant effect on use of diagnostic imaging was detected from any of the campaigns.

LBP-Related clinical outcomes

LBP-related clinical outcomes were investigated by three studies evaluating the Japanese campaign at three follow-up times (1-, 3-, and 5-year follow up) [47–49]. These studies examined the prevalence of chronic LBP measured by a questionnaire and LBP intensity measured through a 100 millimetre (mm) Visual Analogue Scale (VAS) from 0 mm (no pain) to 100 mm (most intense pain). The studies consistently found that neither the prevalence of reported chronic low LBP (~0.5% higher prevalence of chronic LBP in the intervention group after 5 years) or LBP intensity (mean change of ~4mm out of 100 mm after 5 years with small, non-significant differences between the intervention and control groups) changed significantly after the campaign. Disability due to chronic LBP was not measured in the Japanese evaluation. Overall, no relevant effect was seen in LBP-related health outcomes following the Japanese campaign.

Discussion

Mass media campaigns have been recommended to help overcome widely held misconceptions and erroneous beliefs about LBP among the general public and reduce the burden of disability from the condition [9,50]. However, such campaigns can be costly

and no systematic review of previous research in this area has been conducted. The results of the current systematic review indicate that while evidence is moderate due to the challenges inherent to evaluating population-level interventions, mass media campaigns appear to positively shift general public beliefs about LBP. The size of the effects varied from modest to large, but was largest in the case of beliefs most closely related to campaign messaging and large campaign penetration/awareness. Accurate knowledge and beliefs that are supported by current evidence are a fundamental component of positive health, which promotes the ability to adapt and self-manage in the face of social, physical, and emotional challenges, such as LBP [20]. Consistently, mass media campaigns led to a higher proportion of the general public agreeing with the importance of self-management strategies, including staying active despite LBP.

Improvements in public LBP beliefs following mass media campaigns appear to persist for a long duration [38–40]. Evaluation of a Canadian campaign ongoing for over a decade has detected slow, sustained improvements over the course of 11 years [40]. Effects of the Australian campaign persisted for at least 4.5 years after its cessation, although with some decay likely due to absence of reminders [37,39]. A recent Danish campaign to improve beliefs about musculoskeletal pain and work also showed significant improvements in these beliefs in the long term (3 years after the campaign) [51]. These observations are consistent with the slow, steady improvements from ongoing mass media campaigns related to cigarette smoking and tobacco use, sedentary behaviour, and sexual health-related behaviours [52]. Each of these topics has required sustained and intensive public education efforts involving the mass media along with other supplemental activities such as regulatory changes before substantial improvements in beliefs and behaviours were seen. LBP appears similar, and ongoing, long-term, and intensive efforts to change LBP beliefs of the general public are recommended.

Our results also indicated consistently improved LBP-related beliefs of health care providers, indicating the beliefs of providers treating patients with LBP such as physicians, physical therapists, and chiropractors may also be amenable to change. Interestingly, evaluators of the Australian campaign compared beliefs of physicians with and without a special interest in LBP and found that physicians with a special interest were significantly more likely to believe that complete bed rest and avoidance of work is appropriate for acute LBP and lumbar spine radiographs are useful [53]. This has important implications for any future mass media campaigns or knowledge translation initiatives to health care providers, particularly relating to the influence of those that may have vested interests.

It is less clear whether changes in LBP beliefs are accompanied by changes in long-term disability behaviour, health utilization, or actual LBP clinical outcomes. Promising results were observed in reported physical activity only 5 years after the Japanese campaign, which took an intensive social marketing approach to planning and implementation. However, increased physical activity was not accompanied by improvements in the prevalence or intensity of chronic LBP. Disability due to chronic LBP (or physical activity levels despite LBP) was not evaluated and may be more likely to improve due to this type of intervention. Reduced work disability was seen following the Australian campaign where explicit messages were presented about the importance of staying at work. As part of the Australian mass media strategy, the state of Victoria also had supportive policy and legislation in place to support workers' and employers' efforts to stay at work despite LBP [54]. Several other key differences existed between the Australian

and subsequent campaigns including intensity and penetration of campaign messaging (86% awareness of messaging in Australia), primary medium used, as well as overall budget. Since the Australian campaign also had the largest effect on health behaviours, replication would be worthwhile, although challenging given the changes that have occurred in the media landscape. In most countries there is now much more online, video-on-demand, and social media content rather than traditional television advertising. Additionally, conflicting messages by those with vested interests in LBP are often presented through the media and via direct-to-consumer advertising.

Messaging in future campaigns should build on current results related to staying active and avoiding rest, and also emphasize more specific, targeted messages about behaviours such as the importance of staying at work, avoiding ineffective, low value, and potentially harmful treatments, and avoiding unnecessary diagnostic imaging. These evidence-based messages would be in competition with the promise of much health care marketing offering cures or significant pain relief with low-value care. The latter differ in terms of fundamental beliefs and conceptualizations of pain by offering quick fixes through non-evidence based, low-value care in comparison with offering strategies for long-term adaptation and self-management. Self-management implies accepting that pain will be part of life, which in turn opens the door to re-engaging in valued life activities. While self-management is likely a more realistic message, consistent with third wave psychological approaches, it is also much less easy to 'sell' than the promise of a simple quick fix. Competing marketing messages are confusing for the public, may explain limited effect sizes observed in some campaigns, and may also hinder closing the beliefs-behaviour gap.

Creative social marketing and a large up-front budget would likely be required to run a campaign that presents these messages and overcomes obstacles. Given the enormous economic and social burden of LBP, such an investment may be worthwhile, but should be accompanied by a rigorous evaluation of effectiveness and economic benefit. Additionally, in line with banning of tobacco advertisements, regulation of health care marketing, as well as careful consideration of regulatory context should also be considered to avoid conflicting messages and enable campaign delivery.

Changing LBP-related health behaviours and actual clinical outcomes is unlikely to be done merely through educational interventions alone [54]. Models of the influence of communication campaigns [28] as well as behavioural change more generally [55,56] indicate that external constraints or incentives often facilitate or impede uptake of desired behaviours. The Behaviour Change Wheel and Theoretical Domains Framework are useful behavioural change theories that could inform future campaign development [55,56]. Both theories highlight the importance of foundational beliefs about health conditions and their associated behaviours, but also indicate that intrinsic and extrinsic factors such as motivation, capability, and opportunity are critical elements in behavioural change [57]. Changing behaviour of the general public and health care providers is difficult and will require complex interventions designed using a systems approach to overcome identified obstacles [58]. Designers of future campaigns will need to carefully consider how such external factors may influence the success of their campaign. Future campaigns and related theoretically-informed interventions should be carefully evaluated to determine their effectiveness for changing public beliefs and behaviours. Campaigns' developers ideally should work collaboratively with policy makers and other stakeholders to

implement specific intervention components such as supportive regulatory and policy changes aimed at changing behaviours of the population. For example, the Norwegian campaign was supplemented with a separate peer-support intervention in six workplaces in the area exposed to the campaign [59]. This initiative led to a 27% reduction in total work absence and a 49% reduction in LBP-related work absence.

A wide variety of tools have been developed to critically appraise studies evaluating clinical interventions in different health areas [60,61]. However, there is no agreement regarding the optimal tool to critically appraise quality of studies evaluating population-based interventions using quasi-experimental or observational designs. Many quality appraisal tools have not been developed using scientifically rigorous methods and have not been validated [60]. For this systematic review, the EPHPP tool was used to evaluate study quality. This tool has been judged suitable for use in systematic reviews of effectiveness, has been reported to have adequate content and construct validity, and has been used in other reviews evaluating the effectiveness of mass media campaigns [62–64]. However, the reliability was low and the tool was unable to distinguish between high or low-quality quasi-experimental studies, resulting in the majority of included studies being rated as weak to moderate. While well-done randomized controlled trials evaluating mass media campaigns would be beneficial, these types of studies may be impossible to conduct due to the nature of these interventions. Population-level interventions such as mass media campaigns are inherently difficult to evaluate due to their large-scale nature, challenges with regard to blinding, low response rates to population surveys, and difficulty in implementing randomization. Research is needed to develop reliable and valid quality appraisal tools for population-based trials that often rely on quasi-experimental designs with low response rates to population-based surveys. Additionally, the tool does not necessarily reflect the quality or content of the actual mass media campaign, as the assessment is based on the reporting of corresponding publications. Potentially the framework outlined here (Table 1) could inform development of a tool to evaluate the quality of mass media campaigns.

Strengths and weaknesses

This is the first systematic review assessing the effectiveness of mass media campaigns for LBP, providing an evidence base for informed decision-making regarding the development and implementation of future mass media and population-based interventions for LBP. We conducted a very broad search due to the complex nature of these interventions. We initially searched for any type of educational intervention, then excluded any that did not involve a mass media component. This led to a large number of records being excluded with the main reasons being: 1) study was not related to back pain; 2) no mass media campaign was evaluated, and 3) no quantitative evaluation or protocol only. A detailed description and synthesis of the mass media campaigns, and their evaluations has been provided. Due to the large heterogeneity between the studies in terms of study design, outcome measures and measurement tools used, a meta-analysis of the results was not deemed appropriate and the conclusions are drawn based on a narrative synthesis using decision rules. The inclusion of studies published only in English and indexed in electronic databases may have introduced language and publication bias; although we believe the included studies are representative of the available evidence. Lastly, most campaigns were conducted

in a different media landscape than the current digital and social media environment, potentially limiting the generalizability of results to the current context.

Conclusion

Mass media campaigns for LBP appear effective for improving beliefs of the general public and health care providers, making beliefs more in line with current evidence and self-management principles. Converting beliefs into behaviours is, however, more complex. As highlighted by the preparation undertaken for the successful Australian campaign, developers of future campaigns will need to carefully consider complex cultural and regulatory contexts and design interventions that overcome identified barriers to behavioural change.

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Declaration of interest

The authors report no conflicts of interest.

Data sharing

Relevant data are available from the corresponding author upon reasonable request.

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