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LEADING ARTICLE

Implementing Exercise in Healthcare Settings: The Potential of Implementation Science

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Abstract

Exercise is an efficacious therapy for many chronic diseases. Integrating efficacious evidence-based interventions (EBIs), such as exercise, into daily healthcare practice is a slow and complex pursuit. Implementation science seeks to understand and address this phenomenon by conducting studies about the methods used to promote the routine uptake of EBIs. The purpose of this article is to explore implementation science and a common conceptual framework in the discipline, the Consolidated Framework for Implementation Research (CFIR), as it applies to exercise EBI. We conclude by offering recommendations for future research that leverage implementation science priorities to highlight the potential of this research field for advancing the implementation of exercise EBI.

Key Points

There is a large evidence base supporting the role of exercise to effectively contribute to the management of many chronic diseases.

The Consolidated Framework for Implementation Research (CFIR) is a comprehensive implementation framework that provides an overarching view of implementation and the determinants that can influence implementation of exercise in healthcare settings.

This article provides recommendations for future research that draw from implementation science priorities to improve the implementation of exercise in routine healthcare.

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1 Introduction

Translating research findings into daily healthcare practice is a slow and, in many cases, complex and challenging pursuit. It takes an average of 17 years to turn a small percentage of research into practice that benefits patient outcomes [1]. Studies from the USA [2] and many other countries including Australia [3] suggest that patients receive evidence-based care less than 60% of the time. While numerous studies document the development and scientific testing of evidence-based interventions (EBIs) (defined as interventions with proven efficacy and effectiveness designed to improve healthcare outcomes [4]), most of these are not successfully implemented into practice [5]. Therefore, research efforts are often wasted [6] and communities may fail to derive the purported benefits of these EBIs. This common phenomenon is described as the research-to-practice gap [7].

Addressing the research-to-practice gap has garnered attention across many research fields [8–10] including public health [11] where understanding implementation of physical activity interventions in practice is the focus of many studies [12–15]. Exercise is a sub-set of physical activity [16] and in this article we explore the research-to-practice gap in exercise EBIs. We focus on exercise EBIs that are prescribed by practitioners within an individualised approach [17] to treat established chronic diseases.

2 Reasons for the Research-to-Practice Gap

There are many reasons for the research-to-practice gap [18–20]. Healthcare workers may lack knowledge about the EBI, fail to see a need for introducing the EBI, or find the EBI is not feasible to integrate within their existing routines [19, 21]. These are notwithstanding the practical aspects of implementation that demand organisations allocate sufficient expertise, funding and time to support uptake and continued use of the EBI [19, 21]. A lack of studies that focus on, and funding for, translational and implementation research has further impeded progress. That is, far more efficacy studies are funded and conducted [6] compared to implementation-focused research [4].

In exercise EBIs, factors that contribute to the research-to-practice gap include: research studies that use exercise protocols that are impractical to replicate in real-world healthcare settings [22], lack of data about the optimal 'dose' of exercise EBIs required to produce clinically meaningful outcomes [23], a lack of knowledge about the benefits of exercise EBIs [24] and technical expertise to prescribe exercise EBIs [25] within the multidisciplinary healthcare team, the travel distance between the exercise EBI in proximity to a patient's home [26] and limited resourcing (e.g. funding that subsidises patient participation costs and carving out dedicated time within clinical encounters to facilitate uptake of exercise EBIs) [27, 28]. Further, there is a suggestion that non-pharmacological interventions, including exercise, are poorly described in research studies and lack adequate marketing and regulation compared to pharmacology interventions [29].

3 Introducing Implementation Science

Implementation is "the process of putting to use or integrating evidence-based interventions within a setting" [4] to address the research-to-practice gap. Implementation science is defined as "the scientific study of *methods* to promote the systematic uptake of research findings and other evidence-based practices into routine practice" [30, p1]. The outputs from implementation science are designed to be relevant in real-world healthcare practice. As such, implementation science uses a wide range of study designs [31, 32] that better engage stakeholders and can create generalisable knowledge [4]. The designs selected are informed by the research question and typically focus on the health service (team or organisation) or health system level rather than the individual patient [33]. Mixed method designs that collect both quantitative and qualitative data are also encouraged [34, 35], because they enable a richer description of the possible determinants known to influence implementation.

Identifying the determinants, or barriers and enablers that are known to influence implementation of EBIs [36], is an early step in the implementation process [21]. That is, once an assessment of the determinants is conducted, implementation strategies which are the "methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical programme or practice" [37, p1] can be planned, designed and enacted to mitigate barriers and activate enablers to support successful implementation [21]. The determinants that influence implementation typically exist across multiple levels—at the level of the EBI, the individual, the organisation and the system level [18–20]. These determinants have been documented within multiple implementation theories, models and frameworks [38], as such researchers are encouraged to select and apply an appropriate theoretical approach within their studies [36, 39].

Models, frameworks and theories are summarised in a taxonomy by Nilsen [36] and include process models, determinant frameworks and evaluation frameworks, as well as classic and implementation theories. These frameworks serve three different purposes in studies [36, 40]. First, process models describe the steps involved in translating research into practice. Second, are frameworks that provide details about contextual factors that influence implementation success. This includes determinant frameworks, such as the Consolidated Framework for Implementation Research (CFIR) [18] (see Sect. 4) and the Theoretical Domains Framework (TDF) [41], a common framework applied in exercise EBI studies. Many implementation science studies use more than one framework to address different aspects of implementation, which explains the combined use of the TDF and CFIR in implementation studies [42], despite being of similar theoretical purpose. Third, are evaluation frameworks that evaluate the outcomes of implementation. The Reach Effectiveness Adoption Implementation and Maintenance (RE-AIM) [42] is a popular evaluation framework used in exercise EBI studies.

4 The Consolidated Framework for Implementation Research (CFIR)

The CFIR is one of the most common [39] determinant frameworks in implementation science. It is described as a meta-theoretical framework that provides an overarching view of implementation [18]. The CFIR was developed through the compilation of 19 previously published theories, models and frameworks in implementation science [18]. The CFIR identifies 39 separate determinant constructs that are categorised within five domains, representing the multi-level influences on implementation. The five domains are: (1) *Characteristics of the intervention* that describe the attributes of the EBI that influence implementation; (2)

Characteristics of the inner setting that describe the factors that influence implementation and are attributable to the host site (i.e. the organisation) where implementation is planned; (3) *Characteristics of the outer setting* is a broad construct that refers to factors outside the immediate organisation that can influence implementation within the organisation; (4) *Characteristics of the individual* describe the attributes of the individuals involved with implementation (i.e. healthcare providers, patients) that influence implementation processes and outcomes; and (5) the *Process of implementation* illuminates the common steps involved in moving an EBI into routine practice (See: https://cfirguide.org/constructs/). The CFIR provides a standardised list of determinants known to influence implementation outcomes and success [43]. Applying the CFIR (and thus its standardised architecture) to implementation research can also facilitate the cumulation of generalisable knowledge across studies and support replication of EBIs at different sites [43].

The CFIR has been used for many different purposes in implementation science [43]. Damschroder et al. [44] applied the CFIR to help explain the variations in successful implementation of a weight management programme at five different sites [44]. Similarly, the CFIR has also been used to identify the determinants that are important for successful implementation in telemedicine [45] and telephone-based lifestyle coaching [46]. To the best of our knowledge, the CFIR has not been applied extensively within the exercise EBI literature. Given it provides an overarching view of implementation, greater attention to the CFIR as a valuable framework for better understanding implementation of exercise EBIs is warranted. In the following sections, we discuss and provide examples of how the determinants that influence implementation can be applied to exercise EBIs. We adopt an exploratory approach and conducted a global search that aimed to illustrate the breadth of factors that influence implementation through providing examples for every determinant construct of the CFIR. Recognising that identification of determinants is an early step in the implementation process, we conclude by providing recommendations that draw from identified priorities in implementation science that could augment exercise EBI studies to improve translation and real-world implementation.

4.1 CFIR Domain: Characteristics of the Intervention

The determinant constructs listed within this domain include [18]: (1) the relative advantage; (2) the level of complexity; (3) adaptability; (4) trialability; (5) intervention source; (6) evidence strength and quality; (7) design and packaging of the intervention; and 8) cost. To illustrate, the relative advantage of implementing exercise as part of routine care for people with mental illness is justified because of the contribution exercise EBIs make to reducing the life expectancy gap (approximately 15 years) in people with serious mental illness. The life expectancy gap is a critical issue within the sector, as such positioning exercise EBIs as a possible solution to this issue may enhance stakeholder perceptions about the value of implementing exercise EBIs. Table 1 provides examples of how other determinants within the Characteristics of the Intervention may apply to exercise EBIs.

4.2 CFIR Domain: Characteristics of the Inner Setting

The determinant constructs within this domain include [18]: (1) structural characteristics; (2) networks and communication; (3) culture; (4) implementation climate (that includes tension for change, compatibility, relative priority, organisational incentives and rewards, goals and feedback and learning climate); (5) readiness for implementation (that includes leadership engagement, available resources, access to knowledge and skills). For example, workplace cultures that are not inclusive of exercise are a reported barrier to referral rates and education provided to patients in cancer care [57]. Evidence suggests that alignment is needed between organisational cultures and individual constructs (such as knowledge and beliefs) to enable implementation [62]. As such, if an organisational culture is not inclusive of exercise, training staff to improve referrals or their technical competencies to prescribe exercise EBIs may be ineffective. Table 2 provides examples of how the Characteristics of the Inner Setting may apply to exercise EBIs.

4.3 CFIR Domain: Characteristics of the Outer Setting

The determinant constructs listed within this domain include [18]: (1) cosmopolitanism; (2) external polices and incentives; (3) patient needs and resourcing; and (4) peer pressure. In the UK, the National Institute for Health and Care Excellence (NICE) provides quality standards that can be included in healthcare audits to support the provision of high-quality, evidence-based care. The quality standards for Type 2 diabetes include the provision of structured education programmes (that include physical activity) at diagnosis [72]. External policies and incentives can be leveraged through the implementation process to guide implementation of exercise EBIs and audit compliance with evidence-based care standards. Table 3 provides examples of how the Characteristics of the Outer Setting may apply to exercise EBIs.

4.4 CFIR Domain: Characteristics of the Individuals

The determinant constructs listed within this domain include [18]: (1) individual knowledge and beliefs about the intervention; (2) self-efficacy of the individual; (3) individual

Table 1 The CFIR domain of Characteristics of the Intervention: determinant constructs and descriptive examples from the exercise literature

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Relative advantage Stakeholders' perception of the advantage of implementing the intervention versus an alternative solution*	In diabetes care, nurses suggested that patients perceive little benefit in engaging in exercise EBIs because they are on medication that will have a similar effect. This suggests the *relative advantage* of adopting an exercise EBI is not evident [48] to stakeholders McIntosh et al. [49] reported that patients had other conditions that "took priority" (p e1760) over participation in cardiac rehabilitation. This suggests the *relative advantage* of participation was not sufficient to support a shift in behaviour This barrier may be connected to the *evidence strength and quality* (for example, the development and dissemination of the Exercise is Medicine® message). That is, how the exercise EBI is framed may not resonate with all stakeholders which impacts on the *relative advantage* of changing practice [50]
The level of complexity Perceived difficulty of implementation, reflected by duration, scope, radicalness, disruptiveness, centrality, and intricacy and number of steps required to implement*	Implementing an exercise EBI may require multiple steps, completed by multiple people, including initial screening, completing referral forms and initiating referral to an appropriate service, follow-up with the patient to confirm attendance, arranging transportation if required and coordinating the exercise EBI within the broader suite of treatments that a person may be receiving. To optimise implementation, the EBI should be simplified where possible The inclusion of a care co-ordinator to manage the referral process and patient flow through programmes is an implementation strategy that has been employed and can address *the level of complexity* [51]
Adaptability The degree to which an intervention can be adapted, tailored, refined or reinvented to meet local needs*	During implementation a tension exists between maintaining the fidelity of an EBI and adapting the EBI to improve the fit with the host implementation site [52] Beidas et al. [51] reported three adaptions were made to a breast cancer exercise EBI to address barriers that arose during the implementation process. These included: (1) working with the staff to individualise the exercise programme; (2) hiring a new staff member to optimise the referral process; and (3) adding a follow-up phone call after the initial referral to increase participation in the programme In exercise EBI for mental illness [53], the reported adaptions included: (1) changing the pacing of the EBI and duration of the sessions; (2) expanding the sessions to add individualised appointments; (3) adding support from peer support workers or mental health counsellors; and (4) including pharmacy education to advise on psychotropic-induced weight gain The components of an exercise EBI that produce individual behaviour change and are suggested to be maintained (and *not adapted)* throughout implementation (for cancer care) include: (1) setting clear goals; (2) ability to transfer the programme from a supervised setting to an unsupervised setting; and (3) support to help patients self-manage
Trialability The ability to test the intervention on a small scale in the organisation, and to be able to reverse course (undo implementation) if warranted*	In Australia, university students such as exercise physiologists or physiotherapists have been used to *trial* new exercise EBIs within existing mental health settings [54]. This allowed individuals and organisations to work with the new practice before making a bigger commitment, such as hiring staff or changing operating policies and procedures to accommodate the new way of delivering services
Intervention source Perception of key stakeholders about whether the intervention is externally or internally developed*	Matthews et al. [55] have proposed an adapted framework for experience-based co-design (i.e. a method of design that is participatory and creates shared ownership and power with the people that will use the product or service) in exercise EBIs and mental healthcare to improve adherence to exercise EBIs. Facilitated co-design of an exercise EBI may improve the perception of *internally developed intervention source*

Table 1 (continued)

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Evidence strength and quality Stakeholders' perceptions of the quality and validity of evidence supporting the belief that the intervention will have desired outcomes*	Avery et al. [56] reported that general practitioners (GPs) viewed prescribing medication as a more appealing and effective option than prescribing exercise EBIs for patients with diabetes. This suggests GPs may not value the exercise EBI evidence as highly as pharmacological evidence Granger et al. [57] suggested that a lack of evidence in lung cancer and exercise EBIs resulted in poor buy-in from medical staff and a lack of dedicated resources and funding for their services How the evidence is tailored for dissemination may influence implementation (i.e. Segar et al. [58] suggested that the Exercise is Medicine® message, an initiative designed to encourage more health practitioners to prescribe exercise, is a health-focused message that is useful for clinicians but may not translate favourably for patients)
Design and packaging of the intervention Perceived excellence in how the intervention is bundled, presented and assembled*	EX-MED Cancer [59] has been developed through extensive research and is a best-practice exercise programme for people with cancer. Investment has been made in designing the entire process. For example, the programme is packaged with a consistent visual style (i.e. fonts, colouring, language used in information materials), a central hub has been established to coordinate referrals and uniform training is provided to all healthcare professionals delivering the programme to ensure consistency in evidence-based delivery [60]
Cost Costs of the intervention and costs associated with implementing the intervention including investment, supply and opportunity costs*	Dennett et al. [27] reported a range of issues associated with a lack of funding that impacted on the delivery of exercise EBIs in cancer rehabilitation. These included lack of funding for exercise equipment, marketing the programme, patient access to therapists and navigating the patient's private health insurance policies Stoutenberg et al. [61] provided a detailed breakdown of the costs that should be considered as part of implementing exercise EBIs (costs associated with staffing, training, technology requirements). Further they suggested that tracking costs which may be offset by implementing exercise EBIs (changes in healthcare utilisation, medication expenditure) would be useful to demonstrate the effectiveness that had pragmatic application

CFIR Consolidated Framework for Implementation Research, *EBI* evidence-based intervention, *SMI* serious mental illness

*Definitions as supplied by the CFIR companion website https://cfirguide.org/constructs/

stages of change; (4) individual identification with the organisation; and (5) other personal attributes. Individual identification with the organisation is a broad construct that describes how an individual perceives the organisation, the alignment with their own personal values and their commitment to the organisation. For example, in some organisations doctors and nurses may perceive the provision of exercise EBI as within their normal scope of practice, whereas individuals in other organisations may not. Whilst many organisations have developed resources and tools to support provision of EBIs [79], if the individual perceives that the task allocation has not occurred in a fair and just manner, they may continue to resist change. Table 4 provides examples of how the Characteristics of the Individuals may apply to exercise EBIs.

4.5 CFIR Domain: The Process of Implementation

The determinant constructs listed within this domain include [18]: (1) planning; (2) engaging (that includes opinion leader, formally appointed internal implementation leaders, champion, external change agents); (3) executing; and (4) reflecting and evaluating. Planning for implementation generally involves identifying the barriers and enablers to implementation, designing and enacting implementation strategies to address barriers and leverage enablers. This may also involve some form of iteration or evaluation to optimise implementation [21]. The 'Together in Movement and Exercise' [85] planned for the expansion of a community-based exercise programme for people with neurological conditions prior to implementation. The planning process matched specific implementation strategies to each identified barrier. This approach to planning offers

Table 2 The CFIR domain of Characteristics of the Inner Setting: determinants and descriptive examples from the exercise literature

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Structural characteristics The social architecture, age, maturity and size of an organisation*	Whilst many of the structural factors are fixed, organisations that view other organisations as similar to them in size, structure, operations and values are more likely to provide a realistic example that can be modelled [63]
Networks and communications The nature and quality of webs of social networks and the nature and quality of formal and informal communications within an organisation*	The referral process between oncology providers and physical therapists was a noted barrier in Beidas et al. [51] study in cancer care Lederman et al. [54] report that all members of the multidisciplinary team, including nurses, allied health and medical staff, need to be involved in the promotion of exercise EBIs Stoutenberg et al. [61] reported that a main step in the development of an exercise EBI is a network that consists of "programs, places and professionals" (p3) to support referrals In cardiac rehabilitation pre-approved referrals have been identified as an effective strategy to address referral barriers [64]
Culture Norms, values, and basic assumptions of a given organisation*	Lederman et al. [54] identified "culture and empowerment" (p4) as an enabling factor that supported staff to integrate exercise EBIs in mental healthcare services Further, Fibbins et al. [65] suggested that staff-focused exercise programmes present a possible mechanism to address workplace cultures that impede patient access to exercise EBIs
Implementation climate The absorptive capacity for change, shared receptivity of involved individuals to an intervention and the extent to which use of that intervention will be rewarded, supported and expected within their organisation*	Chor et al. [66] suggested that organisations with poor organisational climate are less likely to see value in adopting EBIs. Poor climate presents as staff who are emotionally exhausted, have poorly defined roles and operate in depersonalised environments [66]. Conversely, organisations that are viewed as having a good climate may present as having leaders who lead by example and demonstrate the expected behaviours [67]
Readiness for implementation Tangible and immediate indicators of organisational commitment to its decision to implement an intervention*	Furness et al. [68] quoted management as taking the opportunity of a "new and expanded" (p122) mental health facility, to add resources to an existing service that better addressed the physical health issues of patients by hiring an exercise physiologist. Through this process, management also prepared existing clinical staff for the new exercise EBI by providing online resources that detailed how the exercise physiology role may operate within the existing service Miller et al. [69] described many barriers to implementing exercise EBIs in people with heart failure, including: (1) insufficient funding or staff to support the programme; (2) competition—a similar service being offered in close proximity; and (3) a lack of clinical resources Granger et al. [57] reported that a lack of exercise EBI services and time were the main barriers to implementation in cancer care. This included a lack of dedicated referral pathways that could support patients to traverse the health system Young et al. [70] noted that staff perceptions about: (1) impacts on workload; (2) available time; and (3) whether implementing exercise EBIs was part of their job role, were barriers to implementation of an intradialytic exercise programme Demark-Wahnefried et al. [71] identified competing demands in clinical encounters made it challenging for healthcare staff to adequately discuss exercise. A similar finding was observed by Dalzell et al. [28] (in cancer care), where competing time pressures of staff resulted in referral delays to the exercise EBI

CFIR Consolidated Framework for Implementation Research, *EBI* evidence-based intervention

*Definitions as supplied by the CFIR companion website https://cfirguide.org/constructs/

a sound model for other exercise EBIs to replicate, as tailoring implementation strategies to specific barriers is an identified need of implementation research [86]. Table 5 provides examples of how the Process of Implementation may apply to exercise EBIs.

Table 3 The CFIR domain of Characteristics of the Outer Setting: determinant constructs and descriptive examples from the exercise literature

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Cosmopolitanism The degree to which an organisation is networked with other external organisations*	The relationship between the hospital and community-based organisation was reported as vital to moving people towards self-managed exercise programmes in cancer care [25] Lederman et al. [54] reported collaborations were required in mental healthcare to support strong referral pathways. A similar observation was reported by Leach et al. [73] in cancer care The lack of structured pathways between services (in cancer care) was noted as a referral barrier by Demark-Wahnefried et al. [74]
External policies and incentives A broad construct that includes external strategies to spread interventions, including policy and regulations (governmental or other central entity), external mandates, recommendations and guidelines, pay-for-performance, collaboratives, and public or benchmark reporting*	In Australia, the state of New South Wales has a policy on physical health care within mental health services that mandates certain activities be undertaken by the mental health service [75]. The Mental Health Commission in that state has also developed an evidence guide for the physical and mental health of people with mental illness [76]. Further, Australia is one of the few countries that subsidises access to healthcare providers skilled in exercise prescription through the tax payer-funded Medicare system. Taken together, one could argue that these external policy directives, resources and funding opportunities create an environment that is conducive to establishing and integrating exercise EBIs in mental health care In the UK the National Institute for Health and Care Excellence (NICE) guidelines [77] provide minimum level standards for the care of people with serious mental illness. The recommendation that physical health risk factors should be "audited as part of (a) team report" (p170), and to support compliance with the guidelines, included in "board-level" (p170) performance indicators creates a regulatory environment that is conducive to introducing new EBIs, such as exercise
Patient need and resourcing The extent to which patient needs, as well as barriers and facilitators to meet those needs, are accurately known and prioritised by the organisation*	Furness et al. [68] highlighted an organisational change coupled with *patient need* as the driving force behind introducing a new exercise EBI in mental healthcare. Sources quoted through the study suggested that a health promoting environment was lacking for patients and existing staff did not have the required skills to provide this service. The addition of a new staff member offered patients an opportunity to access exercise EBIs, as opposed to spending their time in hospital "lay(ing) around" (p123). The experience-based co-design method referred to in Table 1 (*Intervention source*), presents a possible strategy to develop programmes that address patient need Murgitroyd et al. [78] described designing an exercise EBI to ensure patient need was addressed. This included classes available at a wide range of locations and times, providing written information at the point of referral and follow-up phone calls to engage patients *Patient need* has been described in cardiac rehabilitation and includes having classes at different times, group classes that encourage social support, having telemetry equipment to monitor patients and also offering hybrid classes that included home and clinic-based activities to accommodate travel distance [49] Table 1 (*Intervention source*) presents a possible strategy to develop programmes that address patient need
Peer pressure Mimetic or competitive pressure to implement an intervention; typically because most or other key peer or competing organisations have already implemented or are in a bid for a competitive edge*	The competitive environment or demand for a service/product may also be a catalyst for organisational change [18]. Most entities do not want to lag behind or fail to offer the most effective treatment for a given illness or condition

CFIR Consolidated Framework for Implementation Research, *EBI* evidence-based intervention, *UK* United Kingdom

*Definitions as supplied by the CFIR companion website https://cfirguide.org/constructs/

5 Recommendations

Recently, the research-to-practice gap in non-pharmacological EBIs (such as exercise EBIs) has been identified as an explicit opportunity to capitalise on research outputs [29], the justification being that non-pharmacological EBIs can be just as effective as their pharmacological equivalents [29]. However, as demonstrated throughout this article,

Table 4 The CFIR domain of Characteristics of the Individual: determinant constructs and descriptive examples from the exercise literature

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Individual knowledge and beliefs about the intervention Individuals' attitudes towards and value placed on the intervention as well as familiarity with facts, truths and principles related to the intervention*	Santa Mina et al. [25] suggested the reasons for poor uptake of exercise EBIs in cancer care include provider-level barriers such as a lack of exercise prescription skills in clinicians and a perception that exercise may cause injury and increase fatigue and other symptoms in cancer patients. A similar challenge, that is reduced knowledge about the positive benefits of exercise EBIs in cancer was noted by Dennett et al. [27], Demark-Wahnefried et al. [71, 74] and a more recent study by Santa Mina et al. [80] Demark-Wahnefried et al. [71] suggested oncologists have a critical role in engaging people in lifestyle intervention, because a cancer diagnosis presents a "teachable moment" (p179) whereby patients maybe more receptive to behaviour change. This contrasts with evidence from cardiac rehabilitation that suggests the proximity to diagnosis may be an inappropriate time to discuss exercise EBIs—"a lot of people in white coats arrived and told me things. And I had no paper to take notes" [81, p5] Granger et al. [57] suggested that engaging the multidisciplinary team early in the implementation process (in lung cancer) would facilitate improved knowledge and practice change. Likewise, Dalzell et al. [28] reported programme success (in cancer care) relied the on the multidisciplinary team's awareness and advocacy for the exercise EBI Avery et al. [56] reported similar findings in diabetes (i.e. GPs lacked knowledge about the type, duration and frequency of exercise EBIs) and subsequently developed a tailored training programme to address this gap The 'Physical Activity and Exercise Toolkit' [82] is a resource that has been developed and implemented across Canada to address *provider knowledge and beliefs* to support provision of exercise EBIs in diabetes care
Self-efficacy of the individual Individual belief in their own capabilities to execute courses of action to achieve implementation goals*	Clark et al. [83] reported that as patients presented with multiple co-morbidities, specialists and nurse practitioners (providing care for people with osteoporosis) experienced "guideline overload" (p1957) and lacked self-efficacy (and knowledge) to effectively navigate the multiple disease-specific exercise guidelines to confidently prescribe exercise EBIs Self-efficacy is an identified barrier to exercise engagement and an established correlate of adult physical activity levels [84]. As such, addressing self-efficacy is suggested to be a core component of exercise EBIs (both within exercise EBI as an intervention to promote patient behaviour change and for healthcare providers to support referrals processes etc.)
Individual stages of change Characterisation of the phase an individual is in, as he or she progresses towards skilled, enthusiastic, and sustained use of the intervention*	The American College of Sports Medicine provides comprehensive recommendations for delivering exercise EBIs as part of the treatment for chronic diseases that includes the use of individual behavioural techniques. This determinant could equally be applied to health professionals to determine their readiness to engage with the exercise EBI
Individual identification with the organisation A broad construct related to how individuals perceive the organisation, and their relationship and degree of commitment with that organisation*	Furness et al. [68] highlighted the issue of a misalignment between the organisation's values and that of individual staff. The study, which focused on adding an exercise physiologist to an existing mental health care service, quoted management as saying they had a direction for the service that was about "health promotion"(p122); however a senior staff member noted "people are going well why are we spending money on that role as opposed to more nurses?"(p124)
Other personal attributes A broad construct to include other personal traits such as tolerance of ambiguity, intellectual ability, motivation, values, competence, capacity, and learning style*	*Other personal attributes* is a broad construct that includes a range of personal factors known to influence implementation, such as motivational levels, learning style, personal values [18]. Young et al. [70] noted that staff perceptions about their professional role and identity may influence implementation of exercise EBIs in diabetes care; however, more broadly this is an area of little research [47]

CFIR Consolidated Framework for Implementation Research, *EBI* evidence-based intervention, *GPs* general practitioners

*Definitions as supplied by the CFIR companion website https://cfirguide.org/constructs/

successfully implementing interventions that demonstrate efficacy is challenging and complex, with multiple determinants acting as potential barriers to the implementation process.

The authors suggest there is great scope to augment exercise EBI research with identified priorities from implementation science to improve translation into practice [52, 86, 94, 95]. First, researchers are encouraged to embrace research designs that better address the nuances associated with optimising real-world health services [32]. For example, this includes conducting pragmatic trials that assess the effectiveness of exercise EBIs whilst simultaneously offering a rich description of the determinants that influenced implementation. Pragmatic trials need to be accompanied

Table 5 The CFIR domain of the Process of Implementation: determinant constructs and descriptive examples from the exercise literature

Determinant constructs and definitions from CFIR companion website [47]	Descriptive examples from the exercise literature
Planning The degree to which a scheme or method of behaviour and tasks for implementing an intervention is developed in advance, and the quality of those schemes or methods*	In diabetes care, a plan-do-study-act (PDSA) cycle was used to develop a diabetes care programme that included exercise within an existing health service. Multiple iterations of the PDSA cycle were undertaken prior to patients being enrolled in the programme to ensure barriers to successful implementation were addressed [87] Finlayson et al. [88] used the RE-AIM framework to plan and design recommendations for fall prevention programmes in people with multiple sclerosis. They used the framework to develop practical considerations that organisations should consider within their planning to improve the reach, adoption, implementation and maintenance of programmes Koorts et al. [89] have developed a practical guide that is based upon the CFIR (and two other frameworks), which can be used to plan for implementation of exercise EBIs in healthcare settings
Engaging Attracting and involving appropriate individuals in the implementation and use of the intervention through a combined strategy of social marketing, education, role modelling, training, and other similar activities*	Four subsections describe how individuals can be engaged in the implementation process (opinion leader, formally appointed internal implementation leader, champion, external change agent). In cardiac rehabilitation, the cardiologist's role in setting up the initial appointment was viewed as an incentive to participate by patients [49] Kimmel et al. [90] suggested that physicians are the most "powerful influencers" (p154) in getting people with cancer to adopt lifestyle behaviours, including exercise EBIs Granger et al. [57] suggested that due to the value patients placed on medical practitioners' advice, they needed to promote exercise EBIs (in addition to other health workers). Further, the role of the champion in supporting the implementation of exercise EBIs has been identified as important in both mental healthcare [54] and cancer care [80] Beidas et al. [51] reported the role of the champion in exercise oncology was: (1) to encourage buy-in of the programme; (2) adapt the referral and programme protocols; and (3) support other staff through the implementation process. Finally, this same study quoted an oncology provider as saying "Selling this idea is going to have to be done by some external force and all we can do is cooperate and buy in and go along with it. It will be much more efficient I think" (p343). This suggests an external driver (i.e. *external change agent*) of the exercise EBI may have been welcomed by the oncology staff
Executing Carrying out or accomplishing the implementation according to plan*	Hoekstra et al. [91] reported an implementation strategy used to implement an exercise EBI in disability care was to support organisations to write project plans and reporting requirements that were reviewed during execution of implementation Other studies identified implementation strategies that were used to enable implementation but did not advise if these were part of a broader implementation planning and *execution.* For example, Santa Mina et al. [25] reported that implementation strategies used to generate support for the implementation of exercise in cancer care included hosting interprofessional workshops and presentations at clinical rounds and departmental meetings. Mewes et al. [92] reported many implementation strategies were clinically and cost-effective in increasing compliance with exercise guidelines in cancer care
Reflecting and evaluating Quantitative and qualitative feedback about the progress and quality of implementation accompanied with regular personal and team debriefing about progress and experience*	Lederman et al. [54] identified programme evaluation as a central strategy that enabled understanding of "what works in real-world clinical settings" (p4) Gyurcsik and Bittain [93] evaluated the implementation of a community-based exercise EBI for people with arthritis (PACE®). The evaluation found that despite provider support, the programme had poor participation and many organisations ceased offering the programme. At all sites where implementation failed, providers were sent to PACE® training by their employer. This suggests a possible mismatch between PACE® and *patient needs and resourcing, as* local communities' members did not take up the programme Stoutenberg et al. [61] provided an evaluation framework that documents the metrics that could reasonably be collected with routine healthcare systems to evaluate the effectiveness of exercise EBIs

CFIR Consolidated Framework for Implementation Research, *EBI* evidence-base intervention, *RE-AIM* Reach, Effectiveness, Adoption, Implementation, Maintenance framework, *PACE®* people with arthritis can exercise

*Definitions as supplied by the CFIR companion website https://cfirguide.org/constructs/

by research that explores how the organisational culture enables the uptake of exercise EBI (culture), specifies whether incentives or policies existed that were leveraged to advance implementation efforts (policies and incentives) and articulate how stakeholders were engaged through the implementation process and the outcomes of these efforts (engaging).

Improving reporting on determinants also aligns with the UK Medical Research Council guidance for evaluating complex interventions in healthcare. The guidance recommends evaluations consider the contextual factors that affect implementation or the mechanisms by which the EBI works [96].

Second, developing knowledge about how exercise EBIs are adapted during the implementation process is recommended [52]. Whilst poor reporting of exercise EBI protocols is an identified barrier to implementation [97] and standardised reporting guidelines have been developed [98], adaption to standardised protocols is likely to occur during implementation. Identifying those adaptions that are made to the exercise EBIs and evaluating what level of adaption is acceptable [52] without compromising the clinical effectiveness of the EBI are needed. Adaptions may include changes to delivery mode, supervision levels, frequency, duration or intensity of the intervention, or staff from different roles delivering the intervention. A recently published systematic review of obesity interventions that examined quantifying the scale-up penalty (defined as the reduction in effect size that occurs when implementing studies in real-world environments) found that all interventions were adapted prior to implementation and the scaled-up interventions demonstrated less than 75% of the effects that had been previously established in efficacy trials [99]. In some cases, the effects were as low as 25% [99].

The final recommendation where implementation science could improve the translation of exercise EBIs is through evaluating those implementation strategies, or combination of strategies, that are most effective to improve the uptake of exercise EBIs. This includes understanding the mechanisms behind how and why the implementation strategy works [86] and specifying implementation strategies [95]. Particularly useful for exercise EBIs would be testing how different implementation strategies can lead to not only initial implementation but also to ongoing, sustainable change in routine practice. To illustrate, lack of healthcare provider knowledge about the benefits of exercise EBIs is a barrier to implementing exercise EBI. Conversely, healthcare providers were also seen as opinion leaders and champions who could positively influence uptake of exercise EBIs. Useful to a broad range of exercise EBIs would be designing and testing targeted, cost-effective strategies that work across multiple settings and are sustained over time [86].

As most healthcare organisations have finite resources, optimising investment by resourcing those implementation strategies that are shown to be effective for integrating exercise EBIs in routine practice is likely to be appealing. A study by Grace et al. [64] explored the effectiveness of different implementation strategies designed to increase referrals and uptake of cardiac rehabilitation programmes. The results demonstrated that uptake significantly improved with the use of strategies such as booking appointments prior to discharge, implementing automatic referrals and providing patient education shortly after discharge by a two- to fivefold effect. Thus, we recommend that implementation research in the exercise setting needs to examine the transferability of such strategies.

We suggest that researchers defer to existing taxonomies of implementation strategies that are described in sources such as the Expert Recommendations for Implementing Change (ERIC) project (which identified 73 implementation strategies) [37], the Effective Practice and Organisation of Care (EPOC) [100] and Behaviour Change Techniques (BCT) as outlined by Michie et al. [101]. Whilst the BCT has been recommended [102] to support the identification of components of physical activity interventions that are associated with effectiveness, such as social support, self-monitoring, goal setting and feedback, the distinction must be drawn between this and the components of the implementation strategy. That is, what are the effective components of implementation strategies and how do they exert their influence to successfully implement exercise EBI? Powell et al. [103] also provide useful guidance for selecting and tailoring implementation strategies. In sum, we currently have limited understanding of implementation strategies and integrating exercise EBIs in routine practice.

6 Conclusion

By exploring the exercise EBI literature as aligned to the CFIR, we aimed to illustrate the breadth of determinants that influence implementation. There are limitations to this approach including that we did not conduct a systematic review to identify studies that aligned with the CFIR. However, we sought to include a range of EBI literature that best illustrates the 39 determinant constructs. Despite these limitations, by highlighting the inherent relationship between the proximal identification of determinants and the distal outcome of successful implementation, we offer recommendations that leverage current implementation science priorities [52, 86, 94, 95] to help bridge the research-to-practice gap in exercise EBIs. Implementation science offers an opportunity to expand the research agenda, reduce research waste and increase the relevance of exercise EBI research. Without a greater emphasis on implementation research, much of the resources spent proving the efficacy of exercise EBIs will be wasted as we fail to apply this knowledge in real-world settings.

Compliance with Ethical Standards

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