The Australian Prevention Partnership Centre

CERI
Collaboration for Enhanced Research Impact

Implementing policies and programs in chronic disease prevention

Synthesis of knowledge from the Prevention Centre and CERI

March 2024

For improved implementation

1. **Form research-policy partnerships**
2. **Find an evidence-based intervention**
3. **Assess potential scalability and sustainability**
4. **Identify implementation strategies**
5. **Reflect and adjust**

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Disclaimer: The evidence and knowledge included in this synthesis has been selectively drawn from Prevention Centre and CERI member CRE research programs. This evidence review does not claim to be nor is it meant to be a review of all available evidence.

Contents

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CERI Implementation Research Working Group

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Abbreviations

CERI   Collaboration for Enhanced Research Impact. A joint initiative between the Prevention Centre and 11 NHMRC Centres of Research Excellence

CRE   Centre of Research Excellence. A National Health and Medical Research Centre (NHMRC) funding scheme supporting research teams in collaborative research and capacity building

PFI   Centre of Research Excellence in Prevention of Falls Injuries

EPOCH-Translate Centre of Research Excellence in Translating Early Prevention of Obesity in Childhood

HiPP   Centre of Research Excellence in Health in Preconception & Pregnancy

HNEPH   Hunter New England Population Health (a department of Hunter New England Local Health District, NSW)

NCOIS   National Centre of Implementation Science (CRE in Implementation Science)

Prevention Centre The Australian Prevention Partnership Centre

RE-FRESH   Centre of Research Excellence in Food Retail Environments for Health

Tobacco Endgame Centre of Research Excellence on Achieving the Tobacco Endgame

Glossary

Adaptation	Intentional and targeted changes made to the design or delivery of an effective intervention with the aim of improving its fit or effectiveness in a given context.
Adoption	A decision to make full use of an innovation, intervention or program. Also defined as the decision of an organisation or community to commit to and initiate an evidence-based intervention, and the practice of doing so.
Core/non-core components	Core components are those aspects of an evidence-based intervention that are essential to deliver to ensure effectiveness (also known as essential ingredients). Non-core components are aspects of the evidence-based intervention that can be modified or adapted to local context and potentially improve outcomes like adoption.
De-implementation	Reducing or stopping the use of a guideline, practice, intervention or policy in health care or public health settings.
Determinants	Factors that can influence effectiveness or implementation of an intervention, including enablers (factors that facilitate) or barriers (factors that inhibit).
Dissemination	The targeted distribution of information and intervention materials to a specific health audience.
Effectiveness trials	Trials that aim to determine the results of an intervention when tested under 'real-world', pragmatic conditions that are similar to everyday practice.
Efficacy trials	Trials that aim to determine the results of an intervention when tested under 'ideal' conditions in a well-controlled environment. Usually a precursor to effectiveness trials.
Evidence-based intervention (EBI)	A health-focused intervention, practice, program or guideline with evidence demonstrating the ability of the intervention to change a health-related behaviour or outcome.
Fidelity	Degree to which an intervention or program is implemented as intended by the developers and as prescribed in the original protocol.
Implementation outcomes	The effects of deliberate and purposive actions to implement new programs, practices and services. Implementation outcomes may include acceptability, feasibility, adoption, penetration, appropriateness, cost, fidelity and sustainability.
Implementation science	The study of methods to promote the adoption and integration of evidence-based practices, interventions and policies into routine health care and public health settings to improve the impact on population health.
Implementation strategies	Methods or techniques designed to enhance the adoption, implementation and sustainability of a program or practice.
Knowledge translation	The process of converting scientific and technically complex research into everyday language and applicable actionable concepts in the practice setting.

Logic model	A graphic depiction or roadmap that presents the shared relationships among the resources, activities, outputs, outcomes and impact for an effective intervention; it depicts the relationships among an intervention's activities and its intended effects.
Reach	The absolute number, proportion and representativeness of individuals who participate in a given initiative or receive a specific intervention.
Scale up	Deliberate efforts to increase the spread and impact of interventions successfully tested in pilot or experimental projects to benefit more people and to foster policy and program development. Scale up is often incremental, and can include the process of piloting scale up strategies.
Sustainability	The continued use of an evidence-based intervention over a defined period of time, whereby the intervention continues to effect and/or maintain the desired behaviour change/health outcomes. The intervention and/or health outcomes may evolve or adapt over time as needed, but continue to lead to benefits for individuals/systems.

Adapted from:

U.S. Department of Health & Human Services & National Institutes of Health (2019). Implementation Science at a Glance. Available at: https://cancercontrol.cancer.gov/sites/default/files/2020-07/NCI-ISaaG-Workbook.pdf

Goodrich DE, Miake-Lye I, Braganza MZ, Wawrin N, Kilbourne AM. Quality Enhancement Research Initiative. (2020). QUERI Roadmap for Implementation and Quality Improvement. United States Department of Veterans Affairs Veterans Health Administration Office of Research and Development Health Services Research and Development. Available at: https://www.queri.research.va.gov/tools/roadmap/

Summary of findings

How we deliver policies and programs matters. Too many evidence-based interventions fail to realise their potential due to poor implementation.

Implementation research is a scientific inquiry that seeks to understand how interventions, programs or policies are adopted, implemented and sustained in real-world settings.

This document synthesises the implementation research findings of the Prevention Centre and members of the Collaboration for Enhanced Research Impact (CERI) in relation to four questions developed in conjunction with policy and practice partners.

It provides evidence and tools to support implementation. Our research can provide significant value to prevention policy makers and practitioners through support to:

- select a policy or program most likely to be effective

- think about the best ways of delivering policies and programs to realise their true potential

- scale up and adapt policies and programs to different contexts to improve reach and equity

- sustain policies and programs so they don't slip over time.

Advice for policy and practice

What are some useful workforce and partnership approaches to improve the use of research to enhance the implementation of prevention programs and their impact?

Our evidence consistently shows that prevention programs that arise out of partnerships between researchers and policy agencies lead to improvement in implementation and greater impact on chronic disease.

- One of the most important ways of improving implementation is through the establishment of effective **research-policy-practice partnerships**.

- Partnerships between academia and policy agencies exist on a continuum. **Implementation is most effective when co-creation or policy-led approaches are used**. Refer to page 19 for different types of research-policy-practice partnerships and their value for implementation.

- **A wide variety of strategies are available to build capacity for agency involvement in implementation partnerships**, and hence the generation and use of evidence to inform implementation. Refer to page 24 for different strategies you can use.

- **Consider the role of other organisations** such as NGOs or other agencies as partners in implementation and implementation research.

How can scaled up programs be adapted to local contexts and priority populations and retain their beneficial effects on individuals and communities?

- Our findings suggest that assessing scalability from the start is critical in enhancing implementation success.

- Key steps to support the scale up of evidence-based programs and adaptations to local context and priority populations:

    1. **Assess the evidence base**: Always start with an evidence-based intervention or practice that demonstrates an impact on the behaviour of interest.

    2. **Determine scalability:** Use a scalability assessment tool such as the Intervention Scalability Assessment Tool (ISAT).

    3. **Choose a framework**: Use a scale up framework such as WHO's Expandnet or Milat et al.'s scale up guide.

    4. **Understand core and non-core components**: What is essential for the program to function as designed? Which components could be adapted?

    5. **What are you adapting and why?** Are you trying to improve the fit, enhance effectiveness, reduce costs?

    6. **Understand local barriers and facilitators**: What strategies do you need to tailor to the local context?

    7. **Monitor, learn and adjust as necessary**: Evaluate the reach and adoption of the scaled up program.

How can implementation research help to ensure the impacts of prevention programs can be sustained?

Like scalability, intervention sustainability should be assessed early in the intervention planning phase.

- Plan for sustainability from the start. **Conduct a sustainability assessment** so you understand the multi-level factors that may impact on the sustained delivery of the intervention.

- **Employ a sustainability theory or framework**. Consider your capacity and intentions to provide ongoing support for the intervention.

- **Consider the costs** of sustainability approaches and strategies.

- Establish processes to **monitor the implementation and outcomes of the intervention** – to identify whether it starts to slip and help guide decisions about what support and resources are needed to contribute to the long-term success of the program.

What information should be captured at different phases of a program lifecycle and how should it be used to inform the improvement of prevention programs and their implementation?

It is necessary to gather evidence at each stage of the program lifecycle, on factors such as intervention effectiveness, potential for scalability and sustainability, implementation enablers and barriers, and implementation outcomes and effects.

- **Consider the evidence for interventions** that address the health problem – is an effective intervention available that is also potentially implementable? Systematic reviews can assist here.

- **Assess the intervention for suitability to be implemented at scale** in the desired context. Collect information from a variety of sources, for example, environmental scans, barriers and facilitators assessment, use of tools such as scalability tools to determine potential.

- **Identify potential implementation strategies** using systematic reviews or frameworks, apply these strategies and monitor effects such as reach, acceptability and adoption.

- Implementation is an ongoing process. **Reflect on determinants of the success (or failure) of implementation strategies and adjust as needed**. Consider which strategies should be strengthened, which should be adapted, and which can be dropped. Consider broader impact on measures such as economic outcomes.

Introduction

The Australian Prevention Partnership Centre (Prevention Centre) is a national collaboration of researchers, policy makers and practitioners who are invested in improving the evidence base surrounding chronic disease prevention, and translating that evidence so that it can be implemented effectively by decision makers and stakeholders in order to improve the health and wellbeing of communities.

The Collaboration for Enhanced Research Impact (CERI) is a joint initiative between the Prevention Centre and National Health and Medical Research Council (NHMRC) Centres of Research Excellence (11 at the time of report publication). CERI aims to facilitate collaboration between prevention researchers in order to produce knowledge products and syntheses that meet the needs of policy and practice partners, as well as enhance knowledge mobilisation and support capacity building.

The focus of this report is to synthesise the knowledge that has been generated by the Prevention Centre and CERI CREs in relation to implementation research for prevention. Implementation research is a common theme across research conducted by all CERI members, and CREs are expected to achieve impact through facilitating implementation of their research findings.

The specific research questions answered below were developed in conjunction with policy and practice partners (hereafter referred to as policy partners or agencies), ensuring this synthesis is relevant and applicable to our key stakeholders. Furthermore, we anticipate the information contained in this synthesis will assist with advocating to senior leadership for greater capacity building opportunities within policy and practice agencies where possible, in order to support implementation research and the potential benefits on health outcomes.

This synthesis differs from traditional systematic or scoping reviews in that evidence is primarily drawn from Prevention Centre projects and work undertaken by relevant CERI member CREs. Where appropriate, research findings from non-CERI researchers are incorporated to provide context. This synthesis does not provide an exhaustive review on all evidence in relation to the research questions, but rather provides a summary of highly relevant work conducted nationally by members of CERI that can help to address the evidence needs and priorities reported by policy agencies in Australia.

Background

Why is implementation important for prevention?

The burden of chronic diseases is increasing worldwide and poses a significant challenge for healthcare systems, economies and communities. Prevention approaches aim to prevent the onset or development of chronic diseases by addressing the underlying determinants such as unhealthy diets, physical inactivity, tobacco use and harmful alcohol consumption, among others. They can include health promotion campaigns, regulatory and policy interventions, and community-based programs that aim to improve health literacy, create supportive environments, and increase access to healthy food, physical activity and other resources.

When well implemented, investment in primary prevention can result in significant health, social and economic benefits and is a crucial strategy for improving population health and wellbeing. However, the potential benefits of prevention efforts are often impeded by implementation challenges, for example, a lack of resources, inadequate delivery infrastructure, and limited workforce capacity. Additionally, a lack of community support and low public awareness can hinder successful program implementation. Just one third of tested prevention programs are implemented at scale.[1]

Addressing these challenges by considering implementation across the phases of policy (or program) development and delivery can help in adapting programs to local contexts with sufficient fidelity to improve community health. Indeed, improved public health outcomes will only materialise when effective programs (interventions) are effectively implemented (Figure 1.)

Figure 1. Both effective programs and effective implementation are required to improve health outcomes

> **Effective program**
> "**The thing** you want to implement"

+

> **Effective implementation**
> "How to best put **the thing** into practice"

=

> **Improved patient or public health outcomes**

What is implementation research?

Implementation research is a scientific inquiry that seeks to understand how interventions, programs or policies are adopted, implemented and sustained in real-world settings.[2] The goal of implementation research is to identify and address the factors that influence the success or failure of an intervention, and to develop strategies to optimise its implementation and impact, such as implementation strategies (Figure 2.).[3]

This type of research aims to bridge the gap between research and practice by generating evidence that can be used to improve the delivery and effectiveness of interventions in real-world settings. Implementation research can help address many of the challenges that prevent effective prevention policy and program implementation and ensure that they are having the intended beneficial impact to individuals, communities and populations.

Figure 2. Implementation research provides a lens in which to study and enhance implementation, using implementation strategies to improve health outcomes

Implementation research

Implementation strategies

Effective program

"**The thing** you want to implement"

+

Effective implementation

"How to best put **the thing** into practice"

=

Improved patient or public health outcomes
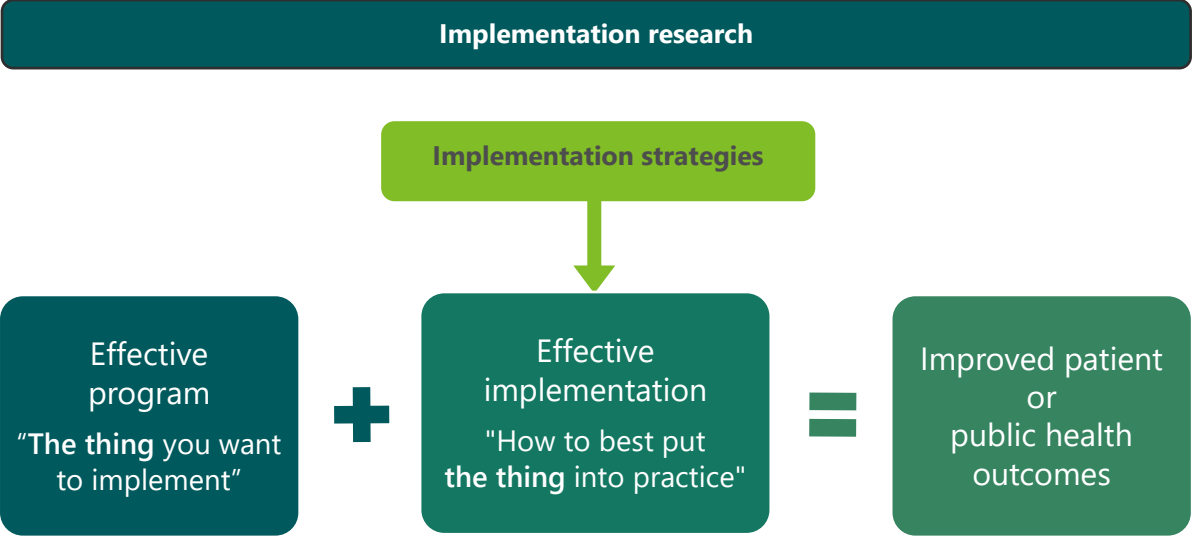
Methods

The purpose of this knowledge synthesis is to provide a narrative review of implementation work conducted by the Prevention Centre and CERI CREs that is relevant to the priority questions developed as part of the policy dialogue process (described below). Unlike a systematic review, which aims to capture all the relevant evidence on a particular topic through a highly structured search, screening and data extraction process, this knowledge synthesis primarily profiles Prevention Centre and CRE research projects and outputs. This synthesis is not an exhaustive review of all implementation research conducted by the Prevention Centre and CREs, but rather a selective overview of work that directly relates to the specific areas of implementation (such as capacity building and scale up) highlighted in the knowledge synthesis research questions.

Figure 3. The knowledge synthesis process

1. Commissioning of knowledge synthesis
2. Establishment of working group
3. Development of content for policy dialogue #1
4. Policy dialogue #1
5. Development of research questions
6. Evidence gathering and synthesis
7. Policy dialogue #2
8. Finalisation of synthesis and dissemination

Commissioning of knowledge synthesis and establishment of working group

As part of a growing series of knowledge syntheses commissioned by the Prevention Centre,[4-6] members of the NCOIS were invited to lead a knowledge synthesis of work conducted by the Prevention Centre and CERI CREs on implementation research. NCOIS members formed a working group to conduct the knowledge synthesis together with Prevention Centre representatives as well as interested representatives from the CERI Implementation Research Working Group.

Policy dialogue 1

Broad scoping questions were drafted to elucidate needs and challenges faced by attendees in relation to implementation. Before the dialogue, invitees were sent pre-reading that provided context to the policy dialogue, including a definition of implementation research, why it is important (especially in the context of health policy) and a list of some seminal publications in the field.

The first policy dialogue was held on 26 April 2023 via a 90-minute virtual meeting. The dialogue was attended by five Prevention Centre representatives, four NCOIS representatives, 12 policy partners representing Wellbeing SA, Health and Wellbeing Qld, NSW Ministry of Health, VicHealth, WA Dept of Health, ACT Government, Hunter New England Local Health District and Mid North Coast Local Health District, and three CRE/CERI representatives. Discussion covered issues such as challenges faced when supporting implementation of a health policy, program or intervention, challenges surrounding measurement of program implementation and knowledge, and resource gaps in how to best support implementation.

Following the policy dialogue, the knowledge synthesis working group developed a list of themes, grouped into four priority meta-themes, which were the focus of the evidence synthesis:

1. **Workforce and partnership:** Exploring models of workforce capacity building and partnership with other agencies (where relevant) to improve program implementation impact, evaluation and improvement. This includes the need to build the capacity of the prevention workforce to support learning approaches to prevention implementation, scale up and sustainment, the challenges of doing so in devolved health systems, and the implementation actions that policy agencies can take within the prevention system.

2. **Equitable impacts at scale:** Exploring how prevention programs can best improve population health outcomes through implementation at scale, while also addressing health inequities. This includes exploration of local tailoring, form versus function, and the fidelity/adaptation tension.

3. **Sustainment:** Understanding processes to maximise the likelihood that investment in prevention (for example, programs and policies) has a sustained and ongoing impact. This includes issues such as project close-out and de-implementation.

4. **Evaluation and improvement:** Insight into what and how implementation processes and impacts can be measured across project phases and how this data can be used for learning and ongoing improvement for prevention. This theme also includes the commonalities and differences between program evaluation and implementation research, and what additional value implementation research provides.

Based on the four meta-themes described above, the knowledge synthesis working group developed the following research questions to consider in this knowledge synthesis:

Question 1: What are some useful workforce and partnership approaches to improve the use of research to enhance the implementation of prevention programs and their impact?

Question 2: How can scaled up programs be adapted to local contexts and priority populations and retain their beneficial effects on individuals and communities?

Question 3: How can implementation research help to ensure the impacts of prevention programs can be sustained?

Question 4: What information should be captured at different phases of a program lifecycle and how should it be used to inform the improvement of prevention programs and their implementation?

The meta-themes and research questions were circulated to policy dialogue attendees for feedback and minor alterations were made to improve clarity.

Evidence gathering and synthesis

Once the research questions were confirmed, several methods were used to collect relevant literature from the Prevention Centre and CRE members of CERI.

Knowledge synthesis working group members conducted a search of the websites for each CRE to locate potentially relevant projects and publications. Each CRE was also contacted via email through their nominated representative on the CERI Coordinating Group and the CERI Implementation Research Working Group, and requested to provide examples of CRE work related to any of the four research questions.

A member of the Prevention Centre team conducted a search of the Prevention Centre's EndNote library and online Resource Hub to identify additional outputs.

Members of the knowledge synthesis working group then reviewed all information provided. They mapped this information to the broad research questions distilled from the dialogue. They included research that most directly addressed the research questions and provided case studies from across the Prevention Centre and CERI member CREs.

Policy dialogue 2

The second policy dialogue was held on 17 August 2023, via a 90-minute virtual meeting. The dialogue was attended by seven Prevention Centre representatives, five NCOIS representatives, 16 policy partners representing Wellbeing SA, Health and Wellbeing Qld, NSW Ministry of Health, Cancer Council NSW, VicHealth, WA Dept of Health, and Mid North Coast Local Health District, and three CRE/CERI representatives. The key findings relating to each research question were presented, and attendees provided feedback and their perceived implications of the findings for their policy agency or practice organisation. Attendees were also invited to provide suggestions for how best to disseminate the knowledge synthesis findings.

Findings

Workforce and partnerships

Question 1: What are some useful workforce and partnership approaches to improve the use of research to enhance the implementation of prevention programs and their impact?

Key findings and implications

- One of the most important ways of improving implementation is through establishing effective research-policy-practice partnerships.

- Partnerships between academia and policy agencies exist on a continuum, with implementation occurring best when co-creation or policy-led approaches are used. The most appropriate model of partnership will be determined by several factors, including the preferences, skills and resources of the policy agency, as well as the type of implementation strategy or research to be undertaken.

- A wide variety of strategies are available to build capacity for agency involvement in implementation partnerships, for the generation and use of evidence to inform implementation.

- Other organisations (such as NGOs through contractual agreements, or other agencies such as education departments) can also serve as partners in implementation and implementation research. Consider the role they can play, what approaches are needed to support these partnerships and the strategies that can be used to support implementation efforts.

Background

There are many factors on many levels that can impede implementation. A range of organisations in the prevention system can impact implementation, and different organisations need to work together to maximise the likelihood of successful implementation. It is necessary to identify organisations that may be most influential to the implementation activity of the specific setting in which you are trying to implement a policy or program, such as a hospital, clinic, school or sporting club.

Forming research-policy-practice partnerships is a core aspect of prevention practice. Research suggests that partnerships lead to better prevention services, for example, by facilitating a range of views and perspectives to improve service development and through leveraging the capacity and infrastructure of partners to improve reach and implementation. Academic partnerships are one form of partnership that can support 'evidence-based' prevention. Partnerships with academics who have expertise in implementation research can ensure relevant implementation research is identified, generated and used to support implementation-related decisions of policy agencies. Policy partners identified several needs in relation to exploring models of workforce capacity building and partnership with other agencies (where relevant) to improve program implementation impact, evaluation and improvement.

Fostering effective research partnerships for implementation

The Prevention Centre and CERI members have generated evidence to suggest research partnerships improve the translation of prevention research into health policy and practice. An international study of trials of prevention interventions undertaken by the NCOIS found a significant positive association between greater engagement between researchers and practitioners and the impacts of studies on health policy and practice.[7] Similarly, qualitative studies of Australian academics and policy makers

have suggested partnering in research is an important contributor to improving evidence use.[8] The Prevention Centre has undertaken a program of work on research partnerships for prevention and identified a range of features associated with success (Box A).

Nonetheless, such partnerships can carry material risk (as well as benefit) for partnering policy agencies. If not managed well, such research can be unnecessarily disruptive to the provision of prevention services or compromise key stakeholder relationships. Fostering strong, trusted partnerships requires significant commitment and skills by all partners, and an understanding of each other's needs, expectations, and values.

Box A. Description of work undertaken by the Prevention Centre to characterise contributors to successful research partnerships

The Prevention Centre has undertaken a program of work to study its research partnerships and partnerships with policy agencies. This included interviews with key researchers, partners and funders in the collaboration, as well as surveys, feedback from workshop participants and collection of routine process data. While not explicitly related to implementation research, their findings remain relevant to the establishment of successful research partnerships to support program implementation and improvement.

They found features that lead to the successful functioning of the partnership centre include:[9,10]

- engagement (including time commitment and active participation)

- partnership among diverse stakeholders

- co-production processes between research and decision makers

- knowledge integration processes (working on bringing together disparate pieces of work to make a bigger impact)

- processes to support adaptive learning and improvement (reflective practice and continuous improvement).

Research partnerships

Partnerships between policy and practice organisations and researchers enhance the use of research for health policy and practice decision-making.[10] The nature of partnerships can be characterised by the level of engagement between researchers and policymakers/practitioners.

We have adapted a model by Martin (2010)[11] to describe different types of partnerships that may exist in public health (Table 1). The appropriate partnership for a particular situation will depend on a range of factors, including the desired level of control (power) of a partner and their capability, expertise, and resources to undertake, interpret and (for policy agencies) apply the research findings. A single policy agency may have different partnership models for different projects depending on these factors.

Table 1. Continuum of research engagement and partnership between researchers and policy makers/practitioners, adapted from Martin 2010[11]

	Partnerships				
	Academic-controlled	**Academic-led**	**Co-creation[12]**	**Policy-led**	**Policy-controlled**
Relevance and potential impact on implementation	Limited	Low	High	High	Very high
Definition[13]	Research designed and undertaken by researchers primarily focused on generating new knowledge to advance scientific understanding.	Research primarily designed/undertaken by researchers with the input of policy makers, to generate new knowledge on a policy-relevant issue, as well as commissioned program evaluations.	Research where engagement between researchers and policy makers occurs across all research stages. Ensures research addresses a specific policy issue and/or generates new knowledge.	Research conceived and primarily designed by policy makers to address a specific policy issue with the input of researchers.	Research designed and undertaken by policy agencies to address a specific policy issue.
Role of policy agencies	No role of policy makers in design, funding or interpretation. Policy makers may be recipients of research findings when study is complete.	Requires consultation with policy makers and their agreement to contribute to the research. May require access to partners expertise, resource, data or infrastructure. May include commissioned research.	Requires engagement of both researchers and policy makers across all phases of the study.	Policy agency research leadership, engaging researchers as required. May be undertaken internally by policy agency staff, and/or commissioning elements of the research or the input of experts (e.g. statistical support).	No role of external researchers in the design, funding, execution or interpretation of findings.

	Partnerships				
	Academic-controlled	**Academic-led**	**Co-creation**[12]	**Policy-led**	**Policy-controlled**
Suitability for policy agencies	If research independent of policy engagement is desirable. For generation of new ideas or innovations unconstrainted by policy contexts or current realities. On issues of political or organisational sensitivity. No or limited resources, infrastructure or capacity for research or research engagement within the policy agency.	Research is in an area of interest and the findings may be of future relevance to policy agency. No need for control over key research features by the policy agency. Limited capacity of the policy agency to undertake or engage in the research.	A clear evidence need of the policy agency. Experience forming and managing complex stakeholder partnerships. Limited research expertise and capacity. Investment in partnership with a research group may be of longer-term strategic interest.	A clear and immediate evidence need of the policy agency. Need for control over key features or timelines of the study. Sufficient research capacity, expertise, leadership and infrastructure within the policy agency.	A clear and immediate evidence need of the policy agency. Suitable research partners (expertise, trust) are not available. Need for control over key features or timelines of the study. Required expertise, infrastructure is available within the policy agency.

Academic-controlled research requires little or no engagement of policy agencies and is not defined here as a model of partnership. In this form, policy agencies may be a recipient of health research. Its impact on policy implementation is, therefore, limited.

On the other end of the continuum is policy/practice-controlled research, where policy agencies have the necessary capacity, expertise and resources to undertake research to provide for their own evidence needs. Research is therefore conducted by and for the agency. It may include quality improvement research, or analysis of data sets collected and held by the agency. Some policy agencies may have dedicated research and evaluation units to undertake this role. We have not defined this as a form of research partnership. Nonetheless, it is recognised as a potent model for improving program implementation, impact, evaluation and improvement. NCOIS published a case study describing the conduct of policy/practice-controlled implementation research by a health promotion unit in NSW (Hunter New England Population Health) which is summarised in Box B.[14]

> **Box B. An embedded model of policy and practice-controlled implementation research in the Hunter New England region of NSW**
>
> Hunter New England Population Health (HNEPH) is responsible for supporting the provision of prevention services by community and clinical services in the Hunter New England region of NSW. HNEPH undertakes research to improve the implementation of prevention interventions in these settings. Senior leaders within the unit hold both health service and academic positions under an integrated governance structure that oversees both service delivery and research initiatives. All research undertaken by HNEPH is aligned and seeks to improve the provision of prevention services.
>
> HNEPH has invested in a range of research infrastructure to support the integration of research and practice, including dedicated statistical and data collection and management personnel and equipment. This model ensures that research is relevant and undertaken in the context of the health service, and that evidence generated is available in real time for decision-making and can be continuously applied.
>
> The model has been credited with significant improvements in health system performance and has been identified as an exemplar model for the translation of research to practice.

Academic-led, co-creation or policy-led research partnerships

Research partnerships are particularly important to support implementation by policy agencies. This is because successful implementation requires:

i.   tacit and contextual knowledge of implementation context (usually held by policy agencies responsible for implementation and their end users)

ii.   implementation and behavioural science expertise to collect, interpret and help apply research findings for improvement (usually held by research institutions).

Furthermore, implementation research seeks to improve the delivery (implementation) of prevention services by clinical and community organisations. This requires policy agencies to enable access to organisations and services and staff responsible for implementation, for example, to investigate barriers or attitudes towards proposed changes in preventive health care provision or test the impact of different strategies to improve the implementation of health programs.

Academic-led partnerships

Academic-led partnerships require few resources and may come with less risk to policy agencies. They may be particularly beneficial for policy agencies with limited research capacity or expertise, but with a broad interest in the research and its findings. Policy input may involve the contribution of funding or in-kind to the project, the provision of letters of support for grant applications, or participation in an advisory group. As research projects may not be designed to address an immediate policy need, and as key research methods, outcomes or timelines have not been curated to do so, policy makers may be less likely to use them to improve the implementation of health policies or programs, particularly in the short term.

Co-creation partnerships

Co-creation partnerships leverage the knowledge and expertise of both research and policy agencies, use joint decision-making processes, and can maximise both the scientific quality and policy relevance of research. While they require greater investment of policy makers' time and resources, and can be more complicated forms of partnership, they enable evidence to be generated to address an important evidence need.

Research partnerships using co-creation are common among Prevention Centre and CRE related projects.[15-18] The RE-FRESH CRE has published a perspective piece exploring the key attributes of co-creation (as well as co-design and co-production) partnerships.[19] The RE-FRESH and HiPP CREs have also undertaken partnership-driven projects, as described in Box C.

Box C. Example of co-creation partnerships from RE-FRESH AND HiPP

Researchers from RE-FRESH CRE successfully collaborated with local government, non-government organisations and supermarket retail partners to test a series of marketing interventions which aimed to improve consumer purchasing of healthy foods.

As part of the 'Eat Well @ IGA' program, the partners worked together by finding joint priorities between the researchers and the retailer (such as sales of fresh foods, which confer both health benefits and are associated with high profit margins). They also designed and tested strategies that would be feasible and scalable in a working supermarket environment (such as shelf tags and trolley signage).

In addition to increased sales of some healthy foods targeted by the intervention, the program showed high levels of acceptability with customers and staff, with no reported impact on retail profit (which was of key concern for the retail partner).

Learnings from this program of work are now being applied to other supermarkets and settings, and efforts to scale the intervention beyond a research study to an embedded program are underway.[20, 21]

HiPP CRE has undertaken a series of priority setting activities, including consultation and consensus processes with consumers and experts to ensure the needs and perspectives of stakeholders (including policy makers, practitioners and consumers) are central to their work in addressing maternal health.[22, 23]

Policy agencies interested in establishing co-creation partnerships may wish to engage with bodies such as the Prevention Centre or a CRE to explore opportunities and interests. Actions such as bringing researchers and policy agencies together as active and equal partners, valuing all knowledge, and using innovative approaches to conduct health research have been argued to be important for co-creation partnerships to be successful.[20]

Policy-led partnerships

Policy-led partnerships may occur in contexts where there is an immediate evidence need by a policy agency that has sufficient research capacity to lead key aspects of the study drawing on specialist skills or selected expertise from researchers (for example, data collection, statistics or health economics). It requires policy agencies to identify the expertise that is required, solicit the input of researchers, and develop governance structures and decision-making processes to support the successful operation of the partnership.

Strategies to build capacity and/or facilitate research engagement

Increasing the capability of the policy agency workforce can improve the likelihood that successful research partnerships will be cultivated to improve the implementation of health policies and programs. It may also increase their capacity to undertake research to address their own implementation evidence needs.[21] (Refer to Box D and Table 2).

Box D. Example of work from the NCOIS of strategies that support research engagement by policy agencies

A scoping review undertaken by the NCOIS systematically catalogued strategies recommended to support research engagement by health services and other agencies.[25] We have adapted this and classified strategies identified in the review according to the research engagement and partnership models defined previously (such as academic-controlled through to policy-controlled). (Refer to Table 2.

The capacity building needs of policy agencies will depend on the ways in which they want to engage with implementation research and the research partnership they are seeking.

Academic-controlled research will require limited workforce development strategies in policy agencies, such as training in accessing and critically appraising literature, and access to basic academic infrastructure, such as bibliographic databases, so that policy makers can identify, interpret and apply implementation research they find to address specific implementation evidence needs.

Models that involve co-creation will require organisational incentives and dedicated leadership to ensure purposeful involvement of the policy agency in the partnership.

Policy-led and policy-controlled partnerships require the highest levels of capacity building and support within the organisation, including the availability of essential research resources (such as statistical support, material resources and funding for data collection and dissemination of findings), dedicated research-practice roles, dedicated research time, as well as systems to facilitate networking and ongoing educational opportunities.

Table 2. Strategies to support policy agency organisational capacity to engage in implementation research and implementation research partnerships

Strategy	Examples	Academic-controlled	Academic-led	Co-creation	Policy-led	Policy-controlled
Research-trained and skilled staff within policy agency	Research-trained staff embedded/ integrated within policy agencies and governance positions				X	X
	Research-practice roles				X	X
	Funded/guaranteed research time			X	X	X
	Secondments/joint position in policy and research institution				X	X
	Co-location of staff and exchange of staff time			X	X	X
Provision of resources and infrastructure dedicated for research activity	Provision of, or access to, journal subscriptions	X	X	X	X	X
	Available research space (desk, computer, software)				X	X
	Statistical support				X	X
	Data collection, management and infrastructure				X	X
	Funding for research and dissemination of findings (conferences, open access publications)			X	X	X
Organisational incentives and rewards for undertaking research	Career advancement/promotion opportunities			X	X	X
	Scholarships and paid research placements			X	X	X
	PhD tuition support and scholarships			X	X	X
	Awards, honours, public recognition of research excellence			X	X	X
Leadership commitment, involvement and accountability for research	Formal endorsement of research		X	X	X	X
	Research leadership in position descriptions			X	X	X
	Strategic plan with commitment to research activity/capacity			X	X	X
	Building research questioning and evidence-based practice into service's culture			X	X	X

Strategy	Examples	Academic-controlled	Academic-led	Co-creation	Policy-led	Policy-controlled
Research training and capacity building	Online training, seminars, workshops, professional development, conferences	X	X	X	X	X
	Local research champions/mentoring		X	X	X	X
	Engagement in research projects, knowledge exchange, placements in research groups		X	X	X	X
	Support to obtain formal qualifications/training		X	X	X	X
	Observe-Act-Plan-Reflect used to encourage practitioners to initiate and lead research projects in their areas of interest				X	X
Networks and communication	Forums/conferences/multidisciplinary workshops and seminars aimed at building relationships and collaboration	X	X	X	X	X
	Communities of practice			X	X	
	Joint PhD/student supervision between practice and academic institutions			X	X	
	Projects and technologies shared between collaborators		X	X	X	
A formal research-practice entity and partnerships structures	Formal structures to enhance partnerships between universities and policy agencies to facilitate policy-led research (e.g. the Prevention Centre)		X	X	X	
	Contracting of research entities to provide research expertise, input and to undertake evaluations		X	X	X	
	Funding schemes aimed at supporting research partnerships (NHMRC Partnership Grants/CREs)		X	X	X	

Interaction between implementation partnerships and strategies

Figure 4 provides a simple generic schematic of common implementation partnerships important to policy-led implementation activity (such as in a Department of Health). The dark green lines (extending from the lead agency to potential partner organisations) represent partnerships the lead agency may consider forming to support implementation. The light green lines (extending from potential partner organisations to the implementing setting/organisation) represent the strategies that could be provided by such organisations to support implementation of a policy or program in a setting. These may include cross-sectoral partnerships with other policy agencies (for example, Department of Education) who may influence implementation activity of the setting, and contractual (or other) relationships with enabling organisations such as NGOs, local health districts (LHD) or professional associations who can provide specific implementation support to the setting.

Policy agencies can influence implementation through:

- selecting 'implementable or scalable' interventions
- forming supportive health policy
- communicating standards of care
- providing funding
- regulation and enforcement.

Enabling organisations will typically take on specialist activities to support implementation, such as providing technical support, training or facilitation. The role of a lead policy agency is to ensure that they identify, select and partner with other agencies that can deliver the implementation support required to improve implementation. This will require an understanding of the barriers (determinants of implementation) of the target setting that need to be addressed, and the management of relationships and partnerships to ensure that they deliver the required strategies. The successful execution of a coordinated approach to implementation support across partners can be supported by:

- the use of formal agreements (contracts)
- specifying roles and responsibilities and performance expectations of each partner
- monitoring systems
- mechanisms of accountability.

Figure 4. Common implementation partnerships and associated implementation strategies
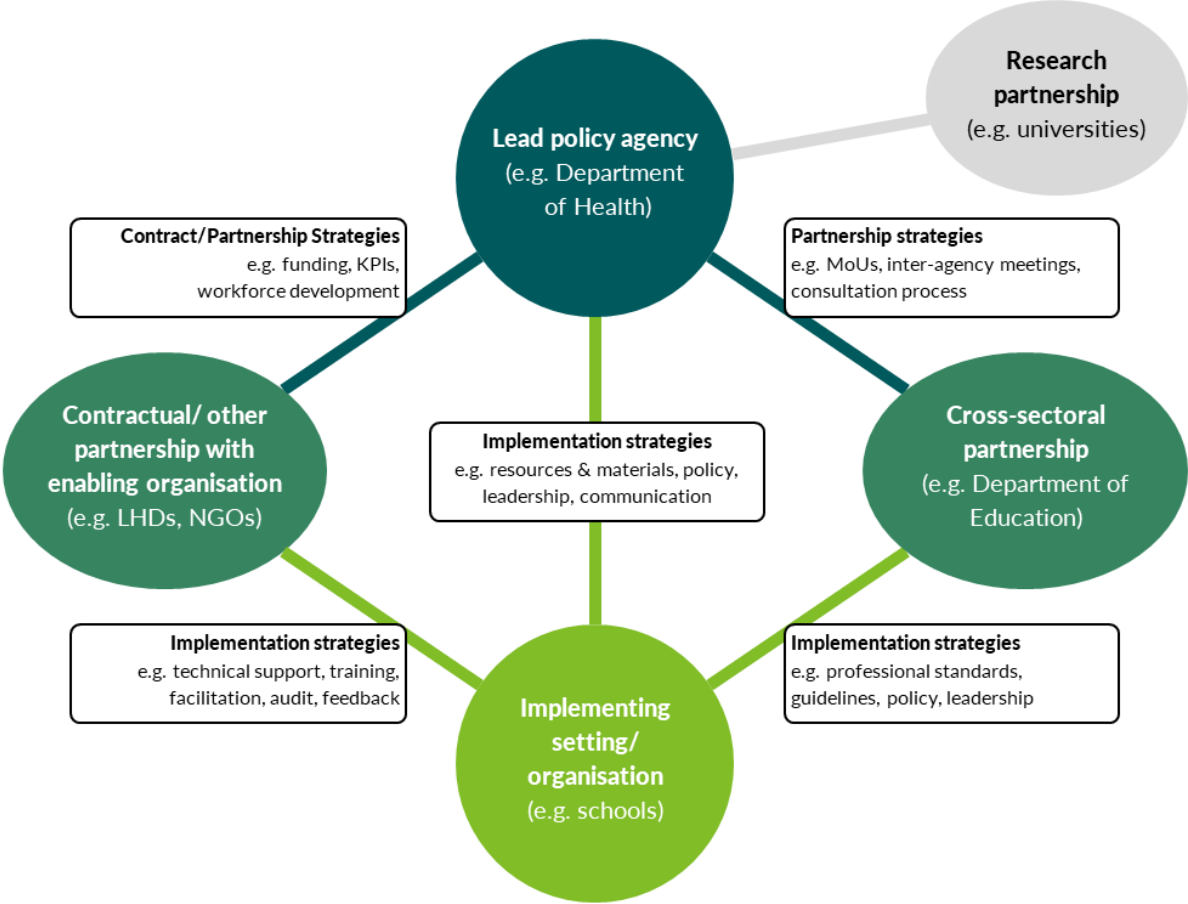
Equitable impacts at scale

Question 2: How can scaled up programs be adapted to local contexts and priority populations and retain their beneficial effects on individuals and communities?

Key findings and implications

- Assess scalability when reviewing the evidence base. There are numerous tools and frameworks available to assist in both assessing potential for scale up and developing a scale up plan.

- Consider core and non-core components. This is essential when determining what potential adaptations can be made to the intervention and what the effect of these adaptations may be. Adaptations are also an important medium through which the different needs of priorities populations can be met, to try to ensure equity.

- Consider implementation barriers and facilitators and recognise these may vary in different contexts and for different population groups. Assessing determinants at the local level is critical to ensure any tailoring of the intervention is appropriate to local context.

- Monitor the effects of adaptations and tailoring and refine as necessary. Intervention effectiveness often decreases when scaled up, so develop an approach to monitoring implementation and outcomes.

Figure 5. Key steps to support the scale up of evidence-based programs and adaptations to local context and priority populations

Assess the evidence base	Determine scalability [1]	Use a framework [2]	Understand core/non-core components [3]	What are you adapting and why [4]	Understand local barriers and facilitators	Monitor, learn and adjust as necessary
• Identify a range of evidence-based policies, programs or practices that can impact on the key behaviours within the population group of interest.	• In partnership with stakeholders and end users, assess the scalability of the identified evidence-based policies, programs or practices. • Scalability tools have been developed to consider a range of domains and intervention attributes that require considerations.	• To maximise the potential benefits of adapting public health programs, numerous frameworks have been developed to provide guidance for both practitioners and researchers on how to systematically approach adaptation of public health programs into new settings or for scale up. • Scale-up frameworks and guides have also been developed to support a planned and deliberate process to scaling up.	• Identify core components and the logic model or theory of how those components are intended to bring about the desired outcome. • Also referred to as the active ingredients, essential elements, or mechanisms of change, core components are those variables that are essential if a program is to function as designed. This makes it possible to then adapt non-essential (non-core) elements to meet local needs and preferences.	• Consider why any adaptations are needed - is it to improve the intervention fit (generally achieved via modifying the non-core components), to enhance the effectiveness (achieved via strengthening the core components) or to reduce costs or increase cost-effectiveness on scale up?	• The approach to scale up can be adapted by understanding local barriers and facilitators and tailoring scale up, and implementation strategies, to the local context.	• Monitor the reach and adoption of the scaled up program, including the program adoption within population subgroups to ensure equal uptake. • Provides opportunity to review and adjust approaches to adaptation and scale up to support implementation in priority groups as needed, and hence to increase impact. • The formation of a Community of Practice provides a mechanism to continue to share ideas, learn and embed these methods into ongoing scale-up opportunities.

Refer to notes section on the following page.

Figure 5 notes:

1. Milat A, Lee K, Grunseit A, Conte K, Wolfenden L, Bauman A. (2019) The Intervention Scalability Assessment Tool A guide for assessing the scalability of health interventions. The Australian Prevention Partnership Centre.

2. Scale up framework:

- Centre for Epidemiology and Evidence. Milat AJ, Newson R and King L. Increasing the scale of population health interventions: A guide. Evidence and Evaluation Guidance Series, Population and Public Health Division. Sydney: NSW Ministry of Health, 2014

- World Health Organization. (2010) Nine steps for developing a scaling-up strategy. ExpandNET. WHO Library Cataloguing-in-Publication Data. Geneva, Switzerland

3. Understanding Core and Noncore components. Aarons GA, Sklar M, Mustanski B, Benbow N, Brown CH. "Scaling-out" evidence-based interventions to new populations or new health care delivery systems. Implement Sci. 2017 Sep 6;12(1):111.

4. Adaptation Framework: Kirk MA, Moore JE, Wiltsey Stirman S, Birken SA. Towards a comprehensive model for understanding adaptations' impact: the model for adaptation design and impact (MADI). Implement Sci. 2020 Jul 20;15(1):56.

FRAME Framework: Wiltsey Stirman S, Baumann AA, Miller CJ. The FRAME: an expanded framework for reporting adaptations and modifications to evidence-based interventions. Implement Sci. 2019 Jun 6;14(1):58.

Background

Stakeholders in the policy dialogues said they were keen to explore implementation research relevant to how prevention programs can best improve population health outcomes and contribute to addressing health inequities, and explore issues such as local tailoring, form versus function and the fidelity/adaptation tension.

Effectively scaling up programs to retain impact, and secondly adapting them to fit the needs of local context and priority populations to retain beneficial health outcomes, requires considered planning, purposeful implementation and ongoing monitoring to ensure multiple goals are being achieved. There are several considerations that can be taken into account early in the scale up planning phase, in partnership with multiple key stakeholders and end users.

To achieve improvements in population health outcomes, effective programs need to be scaled up and adopted by a large proportion of the population to ensure universal access. Interventions known to be effective but delivered only to a small proportion of the population constitutes a health inequity, as others are deprived of the intervention's proven health benefits. Scaling up is a process that has been defined as a 'deliberate effort to increase the impact of a successfully tested intervention, to benefit a greater number of people to foster policy and programs on a lasting basis'.[22] This process may be incremental, and include initial piloting of the potential benefit of scale up strategies.

The process should always aim to start with an evidence-based intervention or practice that demonstrates an impact on the behaviour of interest. Achieving population-level health outcomes requires maximum reach, adoption and implementation together with equitable uptake of the chosen intervention or program. However, as shown in Box E, scaling up and achieving population health impacts is a considerable challenge.

Box E. Findings of reviews demonstrating drops in intervention effect with scaling up

A series of systematic reviews undertaken by the NCOIS, including physical activity, nutrition and obesity prevention interventions, found the effectiveness of interventions is reduced by 25-50% when they are scaled up, compared with prior trials that had been undertaken to establish their effects. In many cases, the effects of the scaled up interventions were no longer statistically significant.[23-25] This reduction in effect size is known as voltage drop. In the process of scaling up, all of the interventions required adaptations. Any adaptations made without careful consideration have the potential to unintentionally reduce the effectiveness of the chosen intervention.

For scaled up programs to retain their beneficial effects and achieve equitable health outcomes for individuals and communities, the policy, program or practice chosen needs to:

- have shown beneficial effects on the population of interest - be **evidence-based**

- be able to reach and be adopted by large proportions of the population (that is, the program needs to be **scalable**)

- have a beneficial impact on individuals and communities equally - are any **adaptations** to the program necessary to improve its fit with different priority populations, which components can be adapted to ensure the effectiveness of the program (non-core components) and which components need to be retained (core components)?

- be adopted and implemented by all population groups - what **barriers and enablers** to adoption and implementation do communities face? Can the strategies used to scale up the program be selected or tailored to meet these needs?

How to plan for scale up to achieve equitable uptake, adoption and population health benefits

Using a framework or guide to support a planned approach

Drawing on the definition of scale up being 'a deliberate effort to increase impact', a systematic planned approach to scale up and adaptation may increase the likelihood that interventions can be delivered at a population level, adopted equally by a significant proportion of the population of interest (including by priority population groups), and retain their effectiveness to benefit individuals and communities. That is, the strategies and effort to guide scale up, where possible, should draw on evidence and/or use a deliberate process to guide strategy selection and consider the necessity of, rationale for, and potential impact of any adaptations.

Given the number of considerations that need to occur to successfully scale up an intervention, the Prevention Centre has published a guide to scaling up public health interventions.[26] Evidence reviews[27] have also identified a number of other guides and frameworks that have been published[28, 29] including the World Health Organization's ExpandNet framework.[22] While there is variation in the number and actions outlined in these frameworks, broadly such frameworks include phases related to:

- formative work to assess the scalability of interventions and prepare for scale up. This includes identifying **core** and **non-core components**, undertaking a documented process to consider necessary adaptations, and identifying systems and infrastructure to monitor scale up efforts

- executing a scale up plan, implementing an intervention at scale, and monitoring scale up actions, uptake and outcomes

- sustaining scale up.

Assessing scalability and preparing for scale up

In this phase, policy agencies assess the 'scalability' of interventions being considered, to ensure that they are **amenable for scale up** and have potential for **equitable impact across a range of priority groups**.

Scalability is "the ability of a health intervention shown to be efficacious on a small scale and or under controlled conditions to be expanded under real-world conditions to reach a greater proportion of the eligible population, while retaining effectiveness".[30]

Assessing scalability is a critical initial activity, as the evaluation of interventions by university researchers usually occurs under optimal research conditions and with resources beyond those readily available in the 'real world'.[31] As a result, many evidence-based interventions are not considered realistic candidates for investment in large-scale delivery. For example, they may be too complex or not aligned to end-user strategic goals, or they may not fit within available infrastructure and may be too costly or premature to implement (for example, a suitable implementation model may not have been evaluated).

Undertaking a scalability assessment also helps identify **core** and **non-core** intervention components, which is considered essential to support decisions on what can be adapted and what should be retained within the intervention to maintain its effect. Core components (also known as intervention functions) are those that are necessary to be delivered with high fidelity to result in the desired behaviour change or health outcome of interest. Scalability assessments are vital to help prevent implementation failure and minimise voltage drop. Scalability assessment tools have been developed and piloted by Prevention Centre researchers to support this step (Box F).

Scalability assessments, however, can often be impeded by a lack of implementation research evidence of the scalability attributes of interventions.

Box F. The Intervention Scalability Assessment Tool

The Intervention Scalability Assessment Tool (ISAT)[36] was developed by the Prevention Centre to aid research end users to assess the potential scalability of an existing intervention, consider the relevant context that may aid or impede scale up, and aid in the design and development of interventions with a goal of future scale up.

The ISAT encourages users to pull evidence from a range of sources, such as published scientific literature, expert opinion and practice data in order to score the intervention across a range of relevant domains. There are five domains capturing factors relevant to the public health problem, the intervention and context, including:

- the nature and impact of the problem
- intervention characteristics
- strategic and political context
- effectiveness
- costs and benefits.

Four domains capture implementation barriers and facilitators, such as fidelity and adaptation, reach and acceptability, delivery settings and workforce, and implementation infrastructure.

The final domain captures sustainability.

The ISAT has been used successfully across a range of interventions.[37]

NCOIS reviews demonstrate information critical to assessing the scalability of different interventions (that is, evidence on indicators of implementation success such as acceptability, cost, feasibility and sustainment or the effectiveness of strategies to support implementation) is often not reported.[32] To address this, and support the selection of prevention interventions amenable to implementation at scale, the NCOIS is currently undertaking national surveys of school principals and childcare directors, and surveys of public health policy agencies, to assess scalability attributes of a range of effective nutrition and physical activity interventions in these settings. These data will be available in 2024.

Where there is limited implementation research to draw on, scalability assessments should be undertaken collaboratively with key partners and stakeholders such as researchers, policy or end user agencies and practitioners. Ensuring the assessment draws on research, practice and policy evidence is critical to ensuring the success of the intervention at scale.

Work collaboratively with key stakeholders to assess suitability of interventions for scale up

In addition to scalability assessments, broader formative evaluations should be undertaken to provide a comprehensive assessment of the potential for an intervention to be delivered at scale while retaining effectiveness. These may include consultation and qualitative research with the target audience, and/or situational and environmental analysis of the systems to identify the availability of infrastructure to support implementation at scale.[33]

Engaging stakeholders and partners that are key to scale up in 'co-production' processes can help:

- guide the development of the scale up strategy

- identify barriers and facilitators of scale up

- provide opportunities to modify or adapt an intervention or delivery systems to better facilitate scale up

- challenge misperceptions and help secure ongoing commitment and advocacy for scale up and ongoing sustainability.[28,34]

Nguyen[28] suggests four broad stakeholder groups whose input is important to solicit and respond to in making decisions about whether to scale up and the development of a scale up plan:

i)   implementers

ii)   receivers/adopters

iii)   supporters

iv)   opponents.

In this phase, potential barriers and facilitators to implementation at scale are identified via processes of stakeholder engagement (or other methods such as quantitative surveys), and implementation/ scale up strategies to address them are identified and developed. Several theories and frameworks can be used to assist with matching strategies to overcome barriers or leverage an identified facilitator.[35-37]

Selecting effective strategies to support scale up

> **Box G. Findings of reviews demonstrating a gap in implementation strategies being tested at scale**
>
> Systematic reviews undertaken by the NCOIS across a number of community and clinical settings and risk factors have identified a range of effective strategies to support implementation in these settings, though few have been tested at scale (defined as >50 organisational units such as schools or workplaces).[38-40]

Where possible, data from a range of sources (for example, published data, surveys with end users, observations) should be used to support the selection of scale up and implementation strategies in order to target identified barriers and facilitators.

It is recommended to use theories or frameworks to support the selection of scale up strategies, to avoid 'ISLAGIATT' (*It Seemed Like a Good Idea At The Time*). Using such theories and frameworks to select implementation strategies produces a multi-component approach to scale up involving a variety of strategies targeting system, organisational or personal factors (for example, training, prompts and reminders, and audit and feedback), that target identified barriers and leverage facilitators to support implementation.

Broadly, the more barriers targeted, the more likely it is that the intervention will be implemented with sufficient fidelity to achieve the desired benefit. Reviews undertaken by the NCOIS have demonstrated the more comprehensive the implementation approach, the greater the adoption of the evidence-based intervention, where a dose response relationship is demonstrated between the number of implementation strategies employed and the level of implementation achieved.

For example, this was exemplified in three studies,[41-43] all targeting implementation of the NSW healthy canteen policy, where schools were supported to ensure healthy ('green') items comprised at

least 50% of all items sold. In the study where seven implementation support strategies were employed, 81.5% of schools implemented the new guidelines;[43] when five strategies were employed, implementation occurred in 59.3% of schools;[41] and when two strategies were used, guideline implementation was achieved in 44.8% of schools.[42,44]

Executing a scale up plan and implementing at scale

Scale up occurs using a scale up plan as a guide. It involves:

- coordinating and training an implementation workforce (if required)

- executing the implementation support strategies embedded within established governance structures

- establishing monitoring systems to track progress, uptake and implementation and to monitor accountability.

Prevention Centre qualitative research of Australian policy makers involved in the scale up of prevention programs found successful scale up was supported by good governance, clear leadership, adequate resourcing and expertise, as well as accountability structures and a high level of acceptability among the general or target population.[45] Such findings suggest that these elements may be particularly important to incorporate as part of planned scale up strategies.

It should also be acknowledged that the process of scale up is dynamic. Notwithstanding the importance of formative evaluation and preparatory work, barriers to scale up will change, and new barriers will arise as the process unfolds in ways that may be difficult or indeed impossible to anticipate. In addition, while some barriers and facilitators may be universal across the population, barriers to adoption and implementation may also differ across the population and may therefore require a tailored approach to scale up to achieve equitable population health impacts[46] (Box H).

> **Box H. Importance of considering barriers unique to subgroups and how this can be addressed in scale up**
>
> A study funded by the Prevention Centre found barriers to the implementation of nutrition programs across Australian childcare services changed markedly over time. Similarly, while some barriers to adoption of a school nutrition program were consistent across schools, some barriers also differed between priority population groups. Without systems that can monitor and respond to such changes, large-scale and equitable improvements in program adoption and implementation are challenging and may be unlikely, potentially exacerbating inequities. Such phenomena also underscore the criticality of data monitoring systems to support adaptive and equity driven approaches that scale up, facilitate implementation and ensure accountability of actors.

Sustaining scale up

While scale up is a deliberate effort to increase the impact of a successfully tested intervention, to benefit a greater number of people, often the decision of when to scale up occurs via a window of opportunity where both political context and evidence identified by senior policy makers and practitioners align.[45] When planning for scale up, identifying what is required to sustain ongoing implementation and embedding key strategies into longer-term planning is considered best practice, however this can be a challenge when many factors may be unknown. Evidence suggests sustainability of scaled up programs is heavily influenced by ongoing funding, evidence of impact as well as good acceptability among the general or target population.[45] This underscores the need for monitoring systems and evaluation activities to capture evidence of impact and implementation success such as acceptability, and cost effectiveness.

Adapting scale up to local contexts and priority populations to ensure equitable uptake, adoption and implementation

Why are adaptations necessary?

As policies and programs are scaled up, the diversity of the population, the infrastructure available and the determinants (barriers and facilitators) to uptake, adoption and implementation may differ from the original tested intervention. Barriers to implementation are unlikely to be static and may also change over time. This necessitates ongoing monitoring and changes to the evidence-based intervention or the implementation approach to match the local context including the provider and target audience characteristics, capabilities, capacity, and resources[47] (Box I). The process of modifying or changing evidence-based interventions and/or implementation strategies prior to or during the course of scaling up is known as 'adaptation'.[48]

> **Box I. Role of adaptations in scale up**
>
> Research undertaken by the NCOIS of evidence-based interventions that have been scaled up from an efficacy trial (that is, an intervention tested under ideal conditions) demonstrated that adaptations are ubiquitous to enable scale up in diverse settings. In a series of papers evaluating the impact of the scale up process on a program's effect size, 100% of the scaled up interventions required adaptations to account for delivery to different populations, contextual differences and varying infrastructure.[23-25]
>
> Most often, these adaptations occurred to the delivery mechanism (for example, from face-to-face to online) to allow scale up to larger population groups. Corresponding to these adaptations, NCOIS research also demonstrated that when evidence-based programs are scaled up, there is 25-50% reduction in the effect size of the intervention (that is, voltage drop).[23-25]

Adaptations are commonly made to improve the 'fit' of an intervention (for example, changing language or delivery mode). While adaptations are increasingly recognised as an important process to facilitate large-scale implementation into new or more diverse settings, they should be undertaken with caution and via a deliberate process. Without careful planning, adaptations that have been made to improve intervention fit, acceptability, cost and resources could inadvertently reduce the effectiveness of an intervention, resulting in voltage drop or exacerbating health inequities. For example, poorly planned adaptations could be made to an intervention's core components (that is, the functions – or the intervention components responsible for driving the impact), such as intervention dose, mechanisms (underlying theory), and content of the intervention.[24]

Further, as the broad aim of scale up is increasing the reach of programs to achieve population health improvements (horizontal scale up), there is potential that, in the act of increasing reach, adaptations may also unintentionally exacerbate inequities if equitable uptake, adoption and implementation is not achieved. This can result when the focus of scale up is solely on reach as an outcome, without considering 'who' is adopting or not adopting the intervention and why. Strategies that target early adopters may not impact on harder-to-reach groups or priority populations, those in most need and those requiring additional support. As such, without careful planning, adaptations may in fact result in very little or no population health gains. While scale up has been perceived as an approach that may exacerbate inequities, well planned approaches to scale up may in fact reduce population-level health inequities by ensuring equitable access to and uptake of evidence-based interventions.[49]

How to adapt prevention programs to local context and priority population when scaling up

Well planned approaches to scale up have potential to improve population health outcomes while also addressing the needs of priority populations.[49] However, this is likely to only be achieved via working in partnership with stakeholders, implementers and end users in selecting an intervention that impacts the population of interest, understanding the intervention core and non-core components, identifying the barriers and facilitators to implementation and whether they differ across priority population groups, and by developing monitoring systems and adjusting implementation strategies as necessary.[50, 51]

Identifying core and non-core intervention components and implementation strategies

It is critical to identify core (function) and non-core components (form) when adapting an evidence-based intervention to the local context as part of the scale up process.[52] It is essential to retain and preserve core components that are responsible for driving the intervention. Core and non-core components can be identified via a variety of methods such as quantitative, qualitative or stakeholder driven processes. For example, research designs such as factorial or comparative effectiveness studies can be undertaken to evaluate the effectiveness of individual or a combination of intervention components. Alternatively, qualitative methods can be undertaken with end users, implementers and/or stakeholders to identify the contribution, value and acceptability of intervention components or implementation strategies.

In reality, processes to identify core and non-core components can be challenging, but are highly critical to the outcome. Undertaking this process in partnership with academic partners, stakeholders and end users is recommended if core and non-core components have not been identified through a research-led process. It is a process that warrants careful consideration prior to making decisions on what to scale up and how, and a key step outlined in the Prevention Centre Scale up Guide.[26]

Identifying the purpose of the adaptation

Before making any adaptations, it is important to consider the purpose of an adaptation. For example, the purpose of making adaptations could be to improve their 'fit' (and hence the reach and adoption across priority groups) or to improve their 'effect' (or cost effectiveness) prior to an evidence-based intervention being scaled up. Once the core and non-core components of the evidence-based intervention or the implementation approach have been identified, informed decisions can be made regarding what to adapt and why.

Adaptations aimed at improving the 'fit' of the evidence-based intervention or implementation approach to the local context or to be more suitable to priority populations should seek to only modify non-core components. A common example is improving a program's 'cultural fit'. An example of such an adaptation to improve the fit of an evidence-based intervention to different priority population groups has been undertaken for the Healthy Beginnings program to improve the fit for Chinese and Arabic mothers. A description of this adaptation process is included in Box J.

Box J. Description of the adaptation process undertaken by Healthy Beginnings to improve fit for Arabic and Chinese mothers

The EPOCH/EPOCH-Translate CRE leads several obesity prevention programs in early childhood, including the Healthy Beginnings program in NSW. As part of the scale up process, the team has conducted work to adapt the Healthy Beginnings program for two cultural/language groups: Arabic and Chinese Mandarin.

The core components of the program aim to improve parental self-efficacy and behaviours to support healthy infant growth and dietary and physical activity behaviours aligned to national guidelines. The research team undertook a number of focus groups with both Arabic and Chinese-speaking mothers, as well as interviews with health professionals who work with Arabic/Chinese-speaking families.[53]

The purpose of this work was to provide insights into the unique experiences of these groups to inform the adaptation process. Core components that were retained included key information on infant feeding, active play and sleep, use of behavioural change techniques such as feedback, and social support. Non-core components were adapted based on information gathered. For example, recruitment changed from flyers to face-to-face methods with bi-cultural members of the research team at antenatal groups. Resources were translated and updated to include culturally relevant images, with additional focus on concepts that may have been less familiar in these cultures, such as 'tummy time'.[54] The cultural adaptation has been shown to be feasible and acceptable.[55]

To improve the scalability of an intervention, adaptations can also be made to identify and then retain or strengthen the effect of core components or to retain the effect while reducing intervention or implementation cost or improving cost effectiveness (Box K).

Box K. Description of the adaptation process undertaken by SWAP IT healthy lunchbox program to identify core components and cost effectiveness to enhance scalability prior to state and national scale up

NCOIS leads a number of implementation trials to optimise the effectiveness of chronic disease prevention programs implemented in community settings. SWAP IT is an effective mHealth (mobile health) lunchbox intervention supporting parents to SWAP OUT discretionary lunchbox foods and SWAP IN everyday foods aligned with dietary guidelines. Over multiple randomised controlled trials, SWAP IT demonstrated an effect on improving a child's weight status,[56] total lunchbox energy, and energy from discretionary foods packed and consumed while at school,[57, 58] while achieving high levels of acceptability[59] and feasibility from a school and parent perspective. SWAP IT consists of four strategies designed to overcome parental barriers to packing healthier lunchboxes including:

1. school nutrition policy
2. curriculum resources
3. ten theoretically designed electronic messages delivered directly to parents' mobile phones via the existing digital communication infrastructure of the school
4. parent resources (clear drink bottles, ice-brick and a resource booklet).

Given the effectiveness of SWAP IT, prior to scale up, a further study was conducted to identify core intervention components by comparing the effectiveness and cost effectiveness of the full SWAP IT program (four intervention strategies), with a modified scalable version of the program consisting solely of the electronic messages.[60]

A cluster RCT was undertaken with 10 primary schools in New South Wales, Australia. Schools were randomised to receive the full SWAP IT program (four strategies) or a modified version consisting of the most scalable program components including the electronic parent messages. Mean energy (kilojoules (kJ)) content of discretionary lunchbox foods and drinks packed in lunchboxes was measured at baseline and six-month follow-up. Results of the study identified there was no significant difference between groups that received all components and those receiving text messages only in the mean discretionary energy packed in the lunchbox (-20.7kJ, p=0.81), mean energy from everyday foods (30.2kJ, p=0.67), or total energy packed in the lunchbox (9.9kJ, p=0.91). However, the mean cost per student were $6.02 for the full intervention and $0.07 for the modified version.[60]

Given there was no differential outcome between groups, the theoretically designed text messages to support parents to overcome barriers to packing healthier lunchboxes was identified as the core intervention component (function), and provides a highly scalable and cost-efficient alternative to the full SWAP IT program model.

Understanding local barriers and facilitators to tailor scale up and implementation strategies to match the local context

It is also important to understand the barriers and facilitators to effective uptake, adoption and implementation and whether they differ according to local context. Barriers and facilitators may differ by context and across priority population groups and may continue to change over time[50] (Box L). As a result, scale up should be thought of as a dynamic process and the scale up plan and implementation strategies will need to be adapted to respond to the emerging determinants. Understanding these determinants across the population and within priority groups is essential to developing a scale up plan and corresponding implementation strategies. Using a framework such as The Health Equity Implementation Framework[46] can help identify how determinants may differ for priority population

groups, via considering culturally relevant factors, service provider and client interaction and the social context.

While barriers and facilitators can be identified at a range of levels, they are rarely consistent across all population groups. As a result, a tiered or tailored approach to implementation may be necessary. Core implementation strategies delivered universally can then be supplemented with locally and contextually tailored strategies to overcome barriers identified in priority populations (Box L).

Box L. Description of how barriers and facilitators can be used to inform tailored scale up

An applied approach to identifying barriers and facilitators specific to the context, currently being undertaken by the NCOIS, is the conduct of a quantitative formative evaluation survey with end users and stakeholders to inform scale up of an evidence-based school nutrition program (SWAP IT healthy lunchbox program). These formative surveys have been used to identify whether barriers/facilitators in priority population groups differed to those more generally across the population of interest, allowing for an informed approach to tailoring scale up strategies and implementation support.

Key barriers that were universally identified by end users included knowledge and awareness of effective programs, workload and competing demands, role of the school and perceived parental support. Additional barriers for priority groups included concerns of food insecurity and culture-related barriers and enablers including support from parents and carers, evidence the program works, and endorsement from other local schools. Scale up plans have been adapted based on local context and identified barriers and facilitators and an evaluation is currently occurring.[50, 61]

Monitoring systems designed to drive universal and equitable adoption, implementation and sustainment

Monitoring of barriers and facilitators that differ across population groups or change over time is necessary to ensure an equitable approach to scale up. Further, monitoring also allows adjustments to the implementation approach over time as the context changes within and across groups. While ideal, this monitoring is often challenging and requires well planned infrastructure to enable ongoing assessment of barriers and facilitators and monitoring of intervention adoption and implementation. A call for such investment in prevention data systems has been suggested by the Prevention Centre, implementation researchers and policy makers to transform prevention systems and impact on population health.[62] Demonstrating impact is a key driver to determine ongoing funding and sustainability of scale up efforts, thus emphasising the need for monitoring of scale up efforts and reporting of outcomes.

An important aspect of any monitoring system is the use of valid and reliable measures. Other important features include the collection of data routinely in a cost-effective, efficient, timely manner, which is acceptable to participants and easily accessible to policy agencies to support decision-making.[63, 64] For this reason, monitoring of chronic disease prevention initiatives in public health is challenging due to a lack of systems capable of routinely and easily collecting and organising data.

Sustaining policies and programs

Question 3: How can implementation research help to ensure the impacts of prevention programs can be sustained?

Key findings and implications

- Plan for sustainability from the start. To maximise our impact on public health and make the most efficient use of public health resources, it is imperative to invest in interventions that are not only effective but also cost-effective and sustainable. To achieve this, proactive planning including gaining a comprehensive understanding of the multi-level factors that may impact on the sustained delivery of the intervention is needed. It is recommended that a sustainability assessment should be an integral part of the initial planning phase.

- Employ a sustainability theory or framework to help identify determinants that may influence intervention sustainment and to help select sustainability strategies. When selecting sustainment approaches and strategies, first consider your capacity and intentions for ongoing support of the intervention. This may influence which intervention is selected and the strategies you may need to use during the implementation phase to embed the intervention into routine practice.

- The effectiveness and cost effectiveness of sustainability approaches and strategies is still yet to be established. Be consistent in describing approaches and strategies used and the costs to implement these. This will enable the field to understand how best to sustain interventions and the economic implications of program sustainability.

- Establish processes to monitor the implementation and its outcomes using valid and reliable tools. Monitoring and evaluation will help identify whether implementation starts to slip and help guide decisions about what support and resources are needed to contribute to the long-term success of the program.

Background

Why is sustainability important?

Despite the significant investment in the development and implementation of evidence-based chronic disease prevention initiatives, systematic reviews suggest that only 23% of public health and clinical interventions are sustained two years after initial implementation.[65] For example, a review by Herlitz et al. of school-based health promotion interventions found that of the 18 included programs, none were sustained in their entirety following the cessation of external implementation support.[66] Given the latency period between an individual's exposure to an intervention and health improvement, a failure to sustain effective chronic disease prevention programs means that the potential public health impact will be lost or severely diminished. (See Figure 6). Further, lack of sustainment wastes the billions of dollars spent each year in the design and implementation of chronic disease prevention programs and reduces stakeholder trust and willingness to engage in future initiatives.[67] Accordingly, sustainability research has been identified as a priority area within implementation science,[68] and was also identified by policy partners as an area where they would like greater understanding of the processes to maximise the likelihood that investment in prevention (for example, programs and policies) has a sustained and ongoing impact. This includes issues such as project close-out and de-implementation.

Figure 6. Public health impact begins when programs are sustained (developed by the NCOIS)
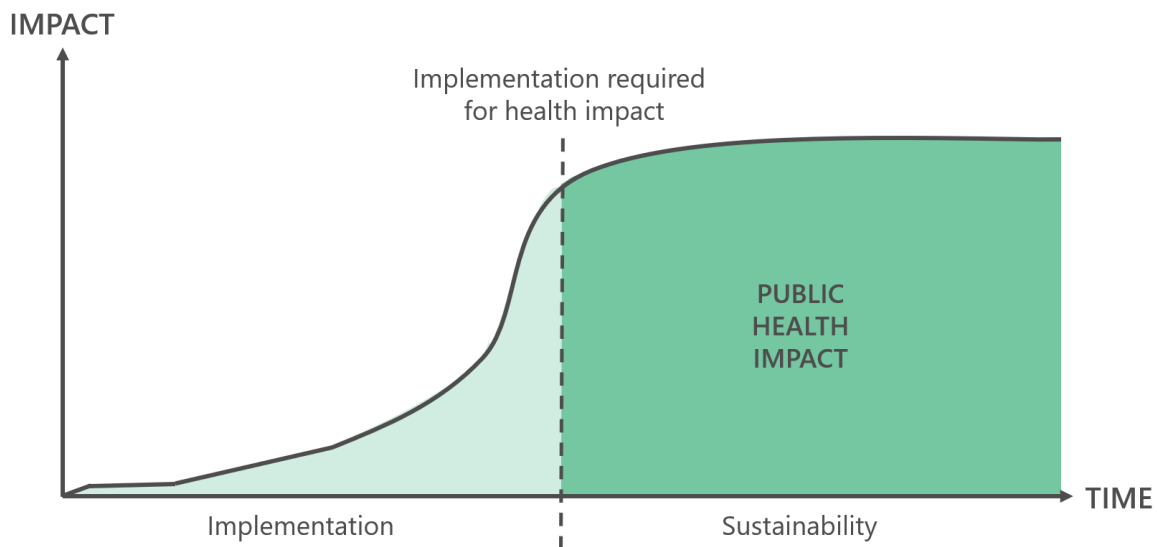
Defining sustainability

Within the implementation science field, there have been changing concepts, definitions and phrases used to describe sustainability, making it difficult for those looking for advice about what the focus of their efforts should be. For example, sustainability was often thought to be the 'routinisation' or 'institutionalisation' into practice of a policy or program, established during implementation. However, more contemporary perspectives recognise that this definition does not encompass the complexities and adaptability required for sustained delivery of evidence-based interventions in various policy contexts. Nor does it address the tension between the ongoing delivery of a program and the continued benefit to individuals on their health and wellbeing. As a result, more emphasis has been placed on definitions of sustainability that recognise it as an ongoing process rather than a fixed end goal.

A recent definition by Moore et al[69] bridges the gap between previously divergent views on sustainability, acknowledging the dynamic context within which evidence-based interventions are implemented. Specifically, it defines sustainability as: [69]

> '(1) after a defined period of time, (2) the program, clinical intervention, and/or implementation strategies continue to be delivered and/or (3) individual behaviour change (i.e. clinician, patient) is maintained; (4) the program and individual behaviour change may evolve or adapt while (5) continuing to produce benefits for individuals/systems'.

This definition enables those working in the field to pinpoint the exact elements they are interested in such as the program itself, its associated health benefits, the necessary infrastructure and capacity for program delivery, the implementation strategies employed, or a combination of these factors.

Once specified, it is then possible to apply implementation science to identify the

- key determinants that influence sustainability
- strategies to support sustainability
- systems and measures to monitor sustainability.

Key determinants that influence sustainability

Systematic reviews of barriers to sustaining evidence-based interventions in clinical and community settings have identified several factors that impact on their sustainability. These are: staff turnover, executive or leadership support, and access to training and resources.[66, 67, 70, 71] For example, a review led by the NCOIS of the barriers and facilitators impacting the long-term success of chronic disease prevention interventions in schools and childcare services found that from the 31 included studies, the leading determinants were: leadership and organisational support, stakeholder involvement, intervention adaptation, and the availability of resources.[71] Evidence from empirical studies conducted by other collaborating CREs provides additional confirmation of these findings. For example, in exploring the barriers and enablers to sustained implementation of the INFANT program, Love et al. found that inner setting factors (organisational climate, readiness, and management support) and outer setting elements (community need and partnerships) had the greatest influence on program sustainment.[72] A study by Crane et al. took a systems approach to understanding the sustainment of population prevention programs and found that they were impacted by such things as short term political and funding cycles, competing demands for funding and resources, and programs which could not be adapted to changes in context.[73]

To gain a comprehensive understanding of the multi-level factors that may impact on the sustained delivery of an evidence-based intervention, it is recommended that a sustainability assessment be undertaken. Using an established conceptual framework can serve as a valuable starting point to guide this assessment. The Integrated Sustainability Framework[67] is a commonly used empirically informed framework that identifies multi-level factors associated with sustainability across different settings, contexts and populations. Broadly speaking, this framework identifies the dynamic interactions between:

- outer contextual factors (such as sociopolitical context, funding or external leadership support)

- inner contextual or organisational-level factors (such as availability of facilities/equipment, executive/leadership support, staff turnover)

- implementation processes (such as partnerships, training, program data and evaluation)

- characteristics of the evidence-based interventions (such as program flexibility and adaptability, perceived benefit and need)

- characteristics of implementers (such as staff motivation, skills and expertise).

Planning for sustainability

Sustainability is often conceptualised as the final phase in a sequential phase of implementation. However, as noted above, there are several factors that may influence the sustainability of an evidence-based intervention, including attributes of the innovation (intervention) itself and the context in which it is being implemented. These factors need to be taken into account during the design or selection of both the intervention and the strategies aimed at facilitating its adoption, implementation and long-term maintenance.

There are several useful sustainability planning guides or tools that can be used to help identify factors that may impact on the sustainability of a program and current capacity for sustainability. A key feature of these tools is their emphasis on collaborative assessment with key partners and decision makers to enable the identification of end user priorities and needs at an early stage during the planning process. Some commonly used tools include:

- **The National Health Service (NHS) Sustainability Model**,[74] a user-friendly diagnostic tool that may be used by practitioners to brainstorm factors impacting program sustainability. This model comprises 10 key factors related to process, staff and organisational issues, and was

identified by NHS staff and stakeholders as vital for sustaining change in clinical settings. Practitioners score each factor against set criteria, enabling them to pinpoint critical areas requiring attention for project sustainability. The NHS Sustainability Guide that accompanies the model offers practical advice to enhance the likelihood of sustainability within individual contexts.

- **The Clinical Sustainability Assessment Tool (CSAT),**[75] and the **Program Sustainability Assessment Tool (PSAT).**[76] These tools consist of a comprehensive set of questions (35 items for CSAT and 40 items for PSAT) that guide delivery agencies, funders, or stakeholders in evaluating the sustainability capacity of a program. These tools offer a step-by-step approach for assessing sustainability and provide access to resources and support for creating an action plan to strengthen program sustainability.

Although the reliability and validity of these tools is still being established, they offer a valuable starting point in the process of identifying strategies that can effectively address areas at risk. By using these tools, practitioners can gain insights into potential sustainability interventions and actions that may help mitigate sustainability challenges and enhance the overall success of the program.

Strategies to support sustainability

Approaches to sustainability

Despite its importance, there is little evidence on how agencies should best support the sustained implementation of interventions.[77] Surveys conducted by the NCOIS with Australian policy makers have identified this as a priority, and the NCOIS is currently leading a consortium of international experts in sustainability and implementation science to identify and describe common approaches used to sustain interventions. Through the development of a typology, it is hoped that a common language of approaches will be established that will assist policy makers and practitioners to identify if and when different approaches are needed, in what conditions and what capacity is required from them in an ongoing way. The initial typology has, to date, identified three possible approaches which include self-sustaining (where no ongoing support is provided), static support (where constant and unchanging type and level of support is provided) and dynamic support (where support evolves over time to respond to changes in the environment, organisation, or the intervention itself).[78] Empirically testing this typology will be a priority to help inform different policy approaches.

Effectiveness of strategies

Similarly, the effectiveness of strategies to sustain the implementation of an intervention is another under-researched area. A review by Greenhalgh et al. concluded there is a "near absence of studies focusing primarily on the sustainability of complex service innovations".[79] A recent bibliographic review by Hall et al. of over 10,000 papers found only 1% focused on sustainability.[80] A 2019 review by Hailemariam et al. of strategies employed in community-based settings to sustain public health interventions identified that the most frequently employed strategies were: ongoing funding, booster training and supervision and feedback.[81] Less commonly employed approaches involved modifying the evidence-based interventions to enhance its ongoing alignment within the organisation, seeking additional financial resources to support sustainment, garnering leadership and stakeholder support to ensure the continued use of the evidence-based interventions, and continually monitoring the effectiveness of the evidence-based interventions. However, the effectiveness of these strategies has largely not been tested and so we must currently rely on findings from a few individual studies. For example, a randomised controlled trial, conducted in 188 Australian community football clubs, tested the effectiveness of: audit and feedback, prompts and reminders, tools and resources, recognition and awards to sustain the implementation of evidence-based alcohol management practices in sporting

venues.[82] However, the study found that the delivery of these strategies had no significant impact on community football clubs' sustained delivery of safe alcohol management practices.
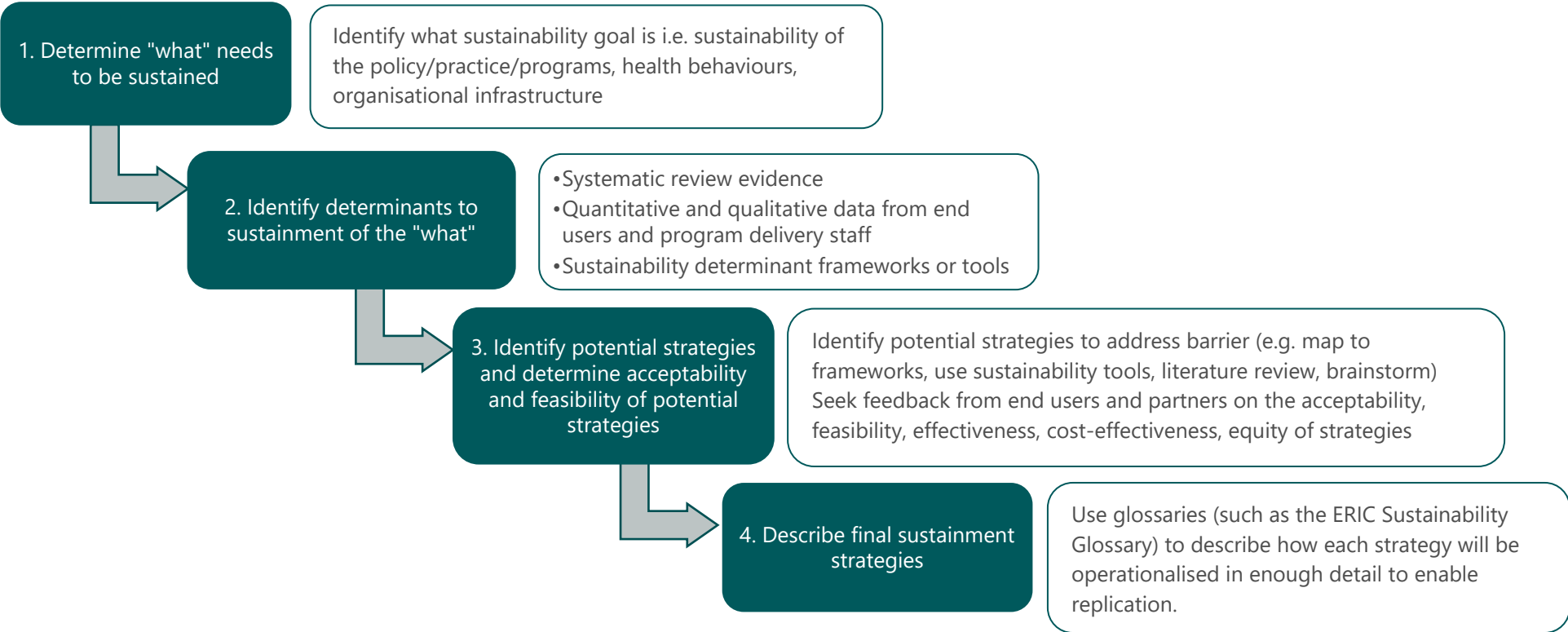
While more robust trials are needed, there are considerable challenges in undertaking such research. For example, these studies typically require large sample sizes with lengthy follow-up periods, often beyond the range of grant funding periods. Scoping of registered trials and published protocols suggests that there are several randomised controlled studies currently planned or being implemented which will add to the body of evidence. Until the findings of these studies are available, evidence from observational studies or non-controlled studies may be helpful. For example, there have been several naturalistic studies conducted in low and middle-income countries which have used strategies such as train-the-trainer, quality assurance checks with feedback as well as capacity building and community empowerment strategies. Furthermore, embedding sustainability strategies within implementation trials may be an efficient approach. For example, a study by Doherty et al. uses a stepped-wedge trial design to evaluate the effectiveness of an implementation and sustainability support package consisting of action plans, reviewing implementation and ongoing training to enhance and sustain the routine provision of antenatal care addressing alcohol consumption within public maternity services.[83]

Selecting sustainability strategies

In the absence of any definitive guidance on how to select sustainability strategies, we recommend that researchers and practitioners apply processes used to develop implementation strategies.[84, 85] Figure 7 below outlines a process that could be used to identify, select, and describe strategies used to sustain its delivery.

- Determine what aspect of sustainability is the focus, that is, sustained delivery of the evidence-based intervention, implementation strategies or individual health behaviours or outcomes.

- Identify the main determinants impacting on the sustainability of the aspect of sustainability of interest, from above.

- Identify potential strategies to address these key determinants using some established criteria, such as the Acceptability, Practicability, Effectiveness, Affordability, Side effects, and Equity (APEASE)[(86)] criteria to ensure that no strategy will create or exacerbate inequities.

- Describe strategies consistently and in enough detail to enable replication. A sustainment-explicit glossary adapted from the Expert Recommendations for Implementing Change (ERIC)[(87)] has been developed by Nathan et al[88] from the NCOIS to help with consistency in the description of sustainability strategies. This glossary also identifies when each of the strategies may need to be operationalised according to the Exploration, Preparation, Implementation and Sustainment (EPIS) Framework.[89] The use of frameworks such as the Action, Actor, Context, Target, Time (AACTT) framework by Presseau et al[90] will also help the field by describing each strategy in terms of 'what', 'who', 'when', 'where' and 'how', so that each strategy can be sufficiently understood.

Figure 7. Proposed process to identify, select and describe sustainability strategies

```
┌──────────────────────┐   ┌──────────────────────────────────────────┐
│ 1. Determine "what"  │   │ Identify what sustainability goal is i.e.  │
│    needs to be       │   │ sustainability of the policy/practice/     │
│    sustained         │   │ programs, health behaviours, organisational│
└──────────────────────┘   │ infrastructure                             │
         │                 └──────────────────────────────────────────┘
         ▼
   ┌──────────────────────┐   ┌──────────────────────────────────────────┐
   │ 2. Identify          │   │ •Systematic review evidence                │
   │ determinants to      │   │ •Quantitative and qualitative data from end│
   │ sustainment of the   │   │  users and program delivery staff          │
   │ "what"               │   │ •Sustainability determinant frameworks or  │
   └──────────────────────┘   │  tools                                     │
            │                 └──────────────────────────────────────────┘
            ▼
      ┌──────────────────────┐   ┌────────────────────────────────────────────┐
      │ 3. Identify potential │   │ Identify potential strategies to address     │
      │ strategies and        │   │ barrier (e.g. map to frameworks, use         │
      │ determine             │   │ sustainability tools, literature review,     │
      │ acceptability and     │   │ brainstorm)                                  │
      │ feasibility of        │   │ Seek feedback from end users and partners on │
      │ potential strategies  │   │ the acceptability, feasibility,              │
      └──────────────────────┘   │ effectiveness, cost-effectiveness, equity of │
               │                 │ strategies                                   │
               ▼                 └────────────────────────────────────────────┘
         ┌──────────────────────┐   ┌────────────────────────────────────────┐
         │ 4. Describe final     │   │ Use glossaries (such as the ERIC         │
         │ sustainment strategies│   │ Sustainability Glossary) to describe how │
         └──────────────────────┘   │ each strategy will be operationalised in │
                                     │ enough detail to enable replication.     │
                                     └────────────────────────────────────────┘
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Monitoring sustainability

Monitoring the implementation of evidence-based interventions is essential to identify whether prevention program implementation or program effectiveness is being sustained.[91] It can also provide an opportunity to understand how best to sustain interventions.[92] While we know intervention implementation will typically decline over time, little is known as to when or how quickly this occurs. Monitoring enables the timely identification of any issues that may arise during implementation, in turn helping to identify if and when additional support is needed to maintain intervention effectiveness and prevent potential slippage.[84] Monitoring systems, therefore, should be viewed as core infrastructure to support ongoing sustainment of prevention programs.

Evaluation and improvement

> **Question 4:** What information should be captured at different phases of a program lifecycle and how should it be used to inform the improvement of prevention programs and their implementation?

Key findings and implications

- Consider the evidence for previously tested interventions that address the health problem – is an effective intervention available that is also potentially implementable? Systematic reviews can assist here.

- Assess the intervention for suitability to be implemented at scale in the desired context. This could include collecting information from a variety of sources, such as environmental scans, barriers and facilitators assessment, use of tools such as scalability tools to determine potential, or undertaking a local pilot.

- Identify potential implementation strategies using systematic reviews or frameworks, apply these strategies and monitor effects such as reach, acceptability and adoption.

- Implementation is an ongoing process. Reflect on determinants of the success (or failure) of implementation strategies and adjust as needed. Consider which strategies should be strengthened, which should be adapted, and which can be dropped. Consider broader impact on measures such as economic outcomes.
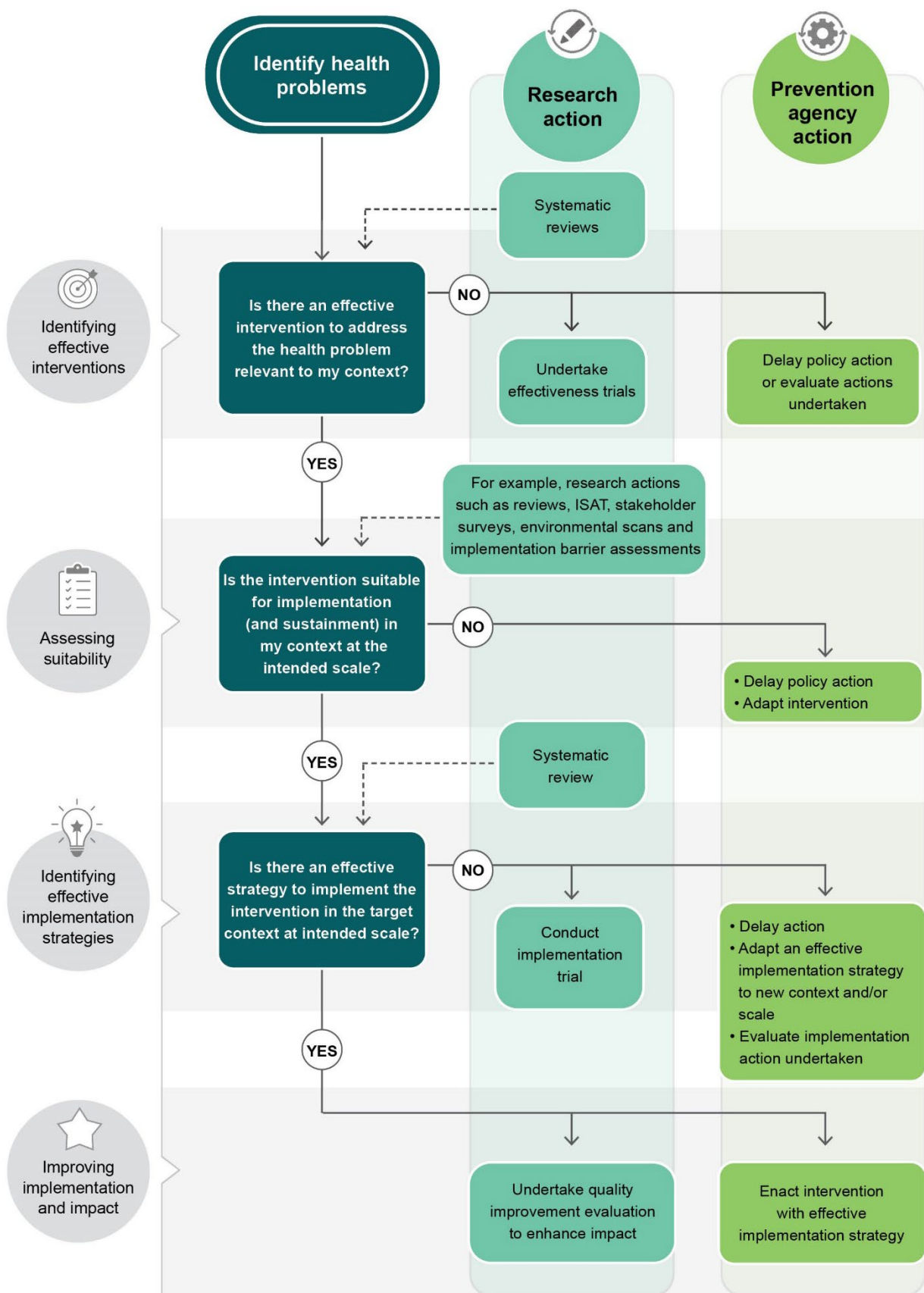
Background

The process of implementation occurs across a number of stages that broadly map onto conventional stages of research translation. The use of data and research in each phase is important to improve the implementation and impact of evidence-based interventions. During the policy dialogues, policy partners were keen to gain insight into what and how implementation processes and impacts can be measured across project phases and how this data can be used for improvement. In addition, there was interest in examining commonalities and differences between program evaluation and implementation research, and what additional value implementation research provides. Figure 8 provides an overview of the phases to be covered in this section. It is an adaptation of an earlier version of a decision tree, published by the NCOIS, to characterise this process and the key research inputs and potential policy agency actions across each phase.

Phase 1: Identifying effective interventions

Health policies and programs must be effective if they are to improve patient or population health. We determine what is effective based on evidence of its efficacy (how well an intervention produces the desired health outcome under ideal conditions) and, more importantly, its effectiveness in achieving these outcomes in real-world conditions. Many interventions have been proven to be effective in various population settings. Systematic reviews can assist practitioners in finding effective interventions that they may consider in their context. Systematic reviews seek to appraise all relevant evidence of the effects of interventions and are recommended as the basis for identifying potential intervention options for health policy makers and practitioners. Searching for or identifying effective interventions from local evaluations of health policies or programs can also be useful to supplement the findings of systematic reviews given the contextual relevance of these evaluations. In the absence of evidence of effective interventions, policy agencies may delay policy action until sufficient evidence is available, invest in its production (such as randomised efficacy or effectiveness trials), or conduct evaluations of the effectiveness of policy or practice activities (interventions).

Figure 8. Decision tree illustrating the evidence to implementation pathway

Identify health problems

Research action

Prevention agency action

Identifying effective interventions

Systematic reviews

Is there an effective intervention to address the health problem relevant to my context?

NO → Undertake effectiveness trials

NO → Delay policy action or evaluate actions undertaken

YES

For example, research actions such as reviews, ISAT, stakeholder surveys, environmental scans and implementation barrier assessments

Assessing suitability

Is the intervention suitable for implementation (and sustainment) in my context at the intended scale?

NO → • Delay policy action
• Adapt intervention

YES

Systematic review

Identifying effective implementation strategies

Is there an effective strategy to implement the intervention in the target context at intended scale?

NO → Conduct implementation trial

NO → • Delay action
• Adapt an effective implementation strategy to new context and/or scale
• Evaluate implementation action undertaken

YES

Improving implementation and impact

Undertake quality improvement evaluation to enhance impact

Enact intervention with effective implementation strategy

Phase 2: Assessing the suitability of effective interventions for implementation

Research undertaken by the NCOIS reports the effects of interventions often attenuate, and may no longer be effective when delivered at scale in the real world.[23-25] This has been attributed, in part, to the poor fit between the interventions selected and the context in which they are being delivered. As interventions that are poorly suited to their contexts are not well implemented,[23-25, 93] appraising the suitability of effective interventions is critical. Such appraisal will typically require the following.

i. Assessment of the characteristics of the intervention such as measures of its level of complexity, the cost of the program and its delivery, the expertise required to deliver it and its acceptability among those receiving it. This information can be used to identify opportunities to adapt the intervention to improve its 'implementability', 'scalability', and/or 'sustainability'.

ii. Assessment of modifiable determinants (barriers) and facilitators of implementation of the intervention, such its acceptability to the organisations that are to deliver it; their organisational capacity, resources and readiness to do so; alignment with existing routines and processes; and the knowledge, skills and attitudes of staff or other barriers (or facilitators) to implementation. Such assessments inform the design of implementation strategies by identifying what they need to do to improve implementation.

iii. Assessment of the context in which it is to be implemented, such as whether the policy, practice or intervention is already widely implemented, its broader policy alignment and political support, the existence of supportive delivery infrastructure or other environmental factors that may influence the likelihood of successful implementation. These assessments help to determine whether the prevailing, and largely unmodifiable, contextual factors are sufficiently supportive for an implementation effort.

A range of research methods can be used to generate such evidence. These include information gathered via systematic reviews of research studies assessing implementation barriers and contexts.[70, 71, 94] It is also necessary to gather information from process evaluations that explore how the intervention is implemented. This information should also be assessed as part of any trials testing the effectiveness of interventions, or of strategies to support their implementation – see hybrid trial designs.[95, 96] Rich data to appraise the amenability of interventions for implementation, however, will likely require a range of quantitative and qualitative research designs engaging key stakeholders that may be involved in or affected by the implementation.

Phase 3: Identifying effective implementation strategies

Interventions must be implemented with sufficient fidelity of the core elements of the program if they are to provide the benefits we expect them to achieve for patients or populations. Policy agencies must couple effective interventions with effective strategies to support their implementation. Designing effective implementation strategies requires an understanding of the barriers (determinants) of implementing a proposed intervention among those required to implement it (for example, school staff, healthcare workers). Formative evaluation to understand implementation barriers for a selected intervention (from Phase 2) is critical to support the selection of appropriate implementation strategies to address them.

Systematic reviews can help identify effective implementation strategies (Box M). For many prevention interventions, however, it is unlikely that reliable evidence is available on the effectiveness of strategies to support implementation at the desired scale, that are suitable to the local context (culture, environment, available resource etc). As such, undertaking trials testing implementation strategies, or evaluating implementation efforts undertaken by policy agencies as they occur, will be required to establish their effectiveness. This may involve the development of an implementation strategy using information collected

about the characteristics of the intervention, implementation determinants and contexts; or the adaptation of a strategy that has been used for a similar intervention or context. A range of theoretical frameworks can help with the selection of strategies to address implementation barriers (or act on determinants).[36, 37]

Box M. Identifying effective implementation strategies

NCOIS has undertaken systematic reviews of the effects of implementation strategies for prevention interventions across a range of key settings including schools, childcare, sporting clubs and workplaces.[38-40, 97] Cochrane's Effective Practice and Organisation of Care group provides a comprehensive database of reviews of implementation and practice change strategies.[98-100]

NCOIS has published guidance on the methods and measures to be used when testing or evaluating implementation strategies.[96, 101, 102] Primarily, such research should include an assessment of the extent to which the intervention was implemented as intended (process evaluation). Such measures will need to be developed to suit the specifics of the intervention being implemented but are typically an assessment of the quality or completeness of delivery of prescribed intervention components. They may also incorporate other dimensions, such as measures of adoption, reach and sustainability.

Measures may also be included to assess effects on the targeted health behaviour (physical activity, nutrition), or health condition or other outcomes valued by patients or populations (quality of life). This is important to confirm whether the level of implementation achieved was sufficient to achieve the targeted beneficial patient and public health outcomes, particularly when this implementation threshold is not known. In addition, the inclusion of measures of implementation determinants and contexts are important to understand how and why an implementation strategy had (or did not have) the desired effect.

Phase 4: Improving implementation and impact

Supporting ongoing, iterative improvement in prevention policies and programs is important to optimise their impact. A 2019 international consensus process led by the NCOIS defined optimisation as a "deliberate, iterative and data-driven process to improve a health intervention and/or its implementation to meet stakeholder-defined public health impacts within resource constraints".[103] Such improvement processes required good quality data, ideally as part of monitoring systems, and resources to analyse and evaluate program implementation and outcomes.

Data collection from trials of implementation strategies, or evaluation of implementation actions of policy agencies, can inform opportunities to improve the implementation and hence the impact of health interventions. Measures particularly important for improvement include:

i.   Measures of implementation success. That is, did the strategy improve the measures of program implementation that it sought to change, for example, brief smoking cessation advice consistent with guidelines, or the delivery of all components of a school-based nutrition program? This will provide information regarding whether the strategy 'worked'. Additionally, other data and measures that would typically be collected as part of comprehensive program evaluations, including reach, adoption, impacts on health behaviours or conditions, cost effectiveness, satisfaction and acceptability, would be helpful when interpreting 'success'. These could be quantitative or qualitative measures.

ii.   Measures of any changes in implementation determinants (barriers) and context, to enable 'testing' of implementation logic or theory (how it worked). That is, did the implementation strategy reduce the barriers to implementation that it targeted? Were there (new) barriers that were not addressed that may be important? These could be quantitative or qualitative measures.

iii. Measures of key resource constraints (usually cost and available resources or economic data) that limit any improvement decisions that can be made.

Improving the impact of an implementation strategy requires a clear implementation theory (or the development of one), outlining how the implementation strategy is expected to influence the determinants of implementation, and how it will drive improvements in implementation - in other words, its mechanisms of action. The collection of evaluation data (described above) can then be used to refine this program theory and modify the implementation strategy to improve its impact. Modifications to improve impact could include:

- removing strategies that do not influence implementation

- strengthening strategies to further enhance implementation; and/or

- adding strategies to address additional determinants of implementation.

Table 3 provides a case study of how this has been applied to rapidly improve the implementation of prevention programs.[104]

Table 3. Example implementation theory illustrating the relationship between implementation strategies, determinants, improved implementation and modifications to implementation strategies and outcomes

Implementation strategies		Implementation determinants		Implementation impact	Recommendation for improvement
Communication of standards and guidelines	→	Knowledge and awareness	→		Retain
Small financial incentive	X	Motivation	→		Modify/Strengthen
Interactive training workshop	→	Skills	→	Improved implementation	Retain
Opinion leaders	X	Social influences	X		Remove strategy
Electronic decision support systems	→	Enabling environmental resources	X		Remove strategy
Prompts and reminders (not delivered)	?	Attention and decision making	?		Add strategy

In the generic example of an implementation theory above, data is used from implementation research program evaluation to examine whether the implementation strategies deployed influenced the determinant, and whether this in turn influenced the implementation of the program. Such assessments could occur using factorial designs, quantitative statistical approaches such as mediation analyses, and/or be based on qualitative evaluations of observational data.

In the example above, communication of standards and guidelines and an interactive training workshop would be strategies that should be retained as they influenced the determinant (knowledge, awareness, and skills), and this in turn contributed to improved implementation. In this example, the use of small financial incentives did not appear to be effective for this program in improving motivation for implementation. However, based on broader literature and evidence reviews, motivation was associated with the implementation outcome, indicating that new and/or modified strategies to improve motivation seem warranted and would be likely to further enhance implementation.

The use of opinion leaders and electronic decision support systems can be removed as they target determinants of implementation that are not associated with improved implementation. Finally, in this example, there is some suggestion from other sources that prompts and reminders may be successful in targeting a determinant that may influence implementation of this program. This implementation strategy could therefore be considered as an additional strategy that could be included to strengthen implementation.

Discussion

This knowledge synthesis reports on the broad scope of implementation research work undertaken by the Prevention Centre and CREs in CERI that has implications for partners and end users in the prevention space. Across two policy dialogues, we elicited the key challenges and needs of policy agencies in relation to the implementation of programs related to chronic disease prevention. We then drew upon the work by the Prevention Centre and CERI CREs to highlight implementation research relevant to these needs, a summary of which is described below.

Workforce and partnership approaches to improve implementation of prevention programs

Across the body of work examined, evidence consistently showed that prevention programs that arise out of partnerships between researchers and policy agencies led to improvement in implementation and greater impact on chronic disease.[7-10] The relative input of academics or policymaker/practitioners in the partnerships varied and were influenced by several factors including the type of implementation project and the resources and expertise required. Opportunities and evidence-based approaches for policy agencies who wish to build workforce capacity for implementation were discussed.[105]

Adaptation and scaling up programs

Our findings suggested that assessing scalability from the start is critical in enhancing implementation success. A number of tools have been designed by CREs to aid policy makers in conducting these assessments and to assist with the process of scaling up.[22, 26, 106] As it is likely that some degree of adaptation will be required as part of the scale up process, the synthesis also highlighted the importance of understanding core/non-core intervention components[26] in order to ensure planned adaptations do not adversely affect intervention impact. Similarly, it is critical to understand the unique barriers and facilitators present in the context in which scale up is planned.[46]

Improving sustainability

Like scalability, intervention sustainability should be assessed early in the intervention planning phase. Having a good understanding of sustainability determinants assists with the selection of sustainability strategies. We identified a number of tools that can be used to aid in this process.[74-76] While the evidence base supporting the effectiveness and cost effectiveness of various sustainability strategies is emerging,[77, 92] monitoring implementation of an intervention using recognised tools and outcomes is recommended. Following this approach provides opportunities to detect when sustainment may be dropping, and prompt the use of additional support strategies.

Evaluation across the program lifecycle and improving implementation

The findings of the knowledge synthesis highlighted the types of evidence and information that should be gathered at different points in the program lifecycle to optimise implementation. In the early phases, choosing effective interventions with potential for scalability and sustainability is critical. A wide variety of data sources should be consulted to gather this information prior to undertaking scale up or sustainment.[71, 94] The selection of implementation strategies should be guided by an understanding of barriers and facilitators, and the context in which the intervention is going to be implemented.[37] Methods to measure implementation outcomes as well as intervention effects should also be established[96] to allow for tailoring of implementation strategies as required, in order to maximise the impact of the intervention on population-level outcomes.

Strengths and limitations

One of the strengths of this model of synthesis is that it has been directly informed and is responsive to the needs of policy makers and practitioners working in prevention. The use of policy dialogues to determine themes and specific research questions to be addressed in this synthesis has ensured the research and work captured in this report will be of greatest relevance and assistance to these end users. The diversity of foci of the CREs who contributed to this report is a strength, as it ensures that the research questions have been addressed based on findings from multiple populations, settings and research methodologies.

It should be noted that this is not a systematic review, and therefore does not aim to include all knowledge regarding a particular theme or research question. We have prioritised the inclusion of Prevention Centre and CERI CRE-generated work, but have supplemented this with references to externally generated findings where we believe this is important for additional context.

Future research

In the process of undertaking this synthesis, we have highlighted where knowledge is still developing, and where further work would be valuable in progressing our understanding and providing a more substantial evidence base for recommendations. Through our knowledge gathering approach, we identified a number of pieces of ongoing work by the Prevention Centre and CREs which we expect to contribute to and enhance our knowledge of implementation research in the future. These include:

- A study by the NCOIS (funded by the Prevention Centre) which is applying learning health systems methods in order to understand how barriers to the implementation of chronic disease prevention programs change over time

- A study by RE-FRESH (funded by the Prevention Centre) which is co-creating implementation tools and training to supporting retailers, health promotion practitioners and other stakeholders to improve the healthiness of food retail environments in healthcare settings such as hospital cafeterias at scale.

- A study by the NCOIS (funded by the Prevention Centre) to explore stakeholders' perspectives on the optimal way to translate preventive care guidelines into community-based mental health care.

- HiPP has several implementation projects underway that are focusing on models of care and optimising health outcomes in pregnancy developed in partnership with Monash Health.

- The CRE in Prevention of Falls Injuries (PFI) has capitalised on the clinician-researcher partnership model and has a number of clinician PhD students working within the CRE on implementation projects.

- PFI has also received funding to scale up the "Choose to Move" program, which is an evidence-based program from Canada aimed at increasing physical activity in older adults. The team will also adapt the program for Arabic speakers as a priority population with low physical activity levels and who are currently not well supported by existing services.

- A body of work being led by the NCOIS aiming to develop a consensus-driven framework for how policy and practice bodies can achieve sustainability of evidence-based interventions.

- A NCOIS review of models to guide adaptations of evidence-based interventions to meet the needs of priority populations.

Conclusion

Drawing on the body of work generated by the Prevention Centre and CERI CREs, this knowledge synthesis presents relevant evidence on a number of implementation research topics of importance identified by policy agencies including models of research partnership, intervention adaptation and scale up, intervention sustainability and evaluation of programs and using this data to improve implementation. It is anticipated that key end users, such as policy makers and practitioners will be able to use this knowledge synthesis to assist in their efforts to improve chronic disease prevention across the program lifecycle.

Appendix 1: List of relevant papers

CRE/Group	Title	Author/Year	Research question	Study type/Description
Workforce and Partnerships				
NCOIS	Improving the impact of public health service delivery and research: a decision tree to aid evidence-based public health practice and research	Wolfenden et al. 2020	Workforce and partnerships Evaluation	Editorial Tool to support application of research evidence to public health programs
NCOIS	Embedding researchers in health service organisations improves research translation and health service performance: the Australian Hunter New England Population Health example	Wolfenden et al. 2017	Workforce and partnerships	Commentary Model for embedding academics/researchers in health services and benefits
NCOIS	Describing the evidence-base for research engagement by health care providers and health care organisations: a scoping review	Yoong et al. 2023	Workforce and partnerships	Review Overview of strategies to increase research engagement by health care practitioners and services
NCOIS/ Prevention Centre	A call to action: More collaborative implementation research is needed to prevent chronic disease	Wolfenden et al. 2022	Workforce and partnerships	Commentary Recommendations for actions to improve chronic disease prevention through strategic investment and collaboration
Prevention Centre	Knowledge mobilisation for chronic disease prevention: the case of the Australian Prevention Partnership Centre	Wutzke et al. 2018	Workforce and partnerships	Qualitative Description of academic/ policy and practice partnership and how collaboration contributes to knowledge mobilisation
Prevention Centre	Knowledge mobilisation in practice: an evaluation of the Australian Prevention Partnership Centre	Haynes et al. 2020	Workforce and partnerships	Mixed Methods Evaluation of academic/ policy and practice partnership
Prevention Centre	Partnering to prevent chronic disease: reflections and achievements from The Australian Prevention Partnership Centre	Slaytor et al. 2018	Workforce and partnerships	In Practice Description of Prev Centre establishment, achievements and challenges
Prevention Centre	The case for citizen science in public health policy and practice: a mixed methods study of policymaker and practitioner perspectives and experiences	Marks et al. 2023	Workforce and partnerships	Mixed Methods Use of citizen science in public health policy and practice
Prevention Centre	A scoping review of citizen science approaches in chronic disease prevention	Marks et al. 2022	Workforce and partnerships	Review Role of citizen science approaches in chronic disease prevention research
Prevention Centre	What Can Policy-Makers Get Out of Systems Thinking? Policy Partners' Experiences of a Systems-Focused	Haynes et al. 2020	Workforce and partnerships	Qualitative Policymakers' experiences of systems thinking within a

	Research Collaboration in Preventive Health			national research partnership in prevention
Prevention Centre	Multisectoral Action for Community Health (MACHI): Institutionalising a whole-of-government approach to chronic disease prevention	Professor Stephen Jan and Dr Bindu Patel	Workforce and partnerships	Findings Brief Summary of critical components of effective multisectoral collaboration
HiPP	Setting Preconception Care Priorities in Australia Using a Delphi Technique	Boyle et al. 2022	Workforce and partnerships	Delphi study Priority setting process for preconception care
HiPP	OptimalMe Intervention for Healthy Preconception, Pregnancy, and Postpartum Lifestyles: Protocol for a Randomized Controlled Implementation Effectiveness Feasibility Trial	Harrison et al. 2022	Workforce and partnerships	Protocol Case study of hybrid RCT, underpinned by academic-led research partnership with private health care provider
HiPP	The Health in Planning, Pregnancy and Postpartum (HiPPP) Portal HiPPP Workplace Portal Implementation Guide Using Intervention Mapping to Develop a Workplace Digital Health Intervention for Preconception, Pregnant, and Postpartum Women: The Health in Planning, Pregnancy and Postpartum (HiPPP) Portal	n.a. Blewitt et al. 2022	Workforce and partnerships	Online portal and associated papers/guide Case study of a researcher led partnership to develop a workplace digital health intervention.
HiPP	Co-designing preconception and pregnancy care for healthy maternal lifestyles and obesity prevention	Walker et al. 2020	Workforce and partnerships	Discussion paper Outlines research/practice co-design opportunities and considerations in relation to pregnancy and preconception care
Tobacco Endgame	Building staff capability, opportunity, and motivation to provide smoking cessation to people with cancer in Australian cancer treatment centres: development of an implementation intervention framework for the Care to Quit cluster randomised controlled trial	Ryan et al. 2022	Workforce and partnerships	Commentary Outlines development of an implementation intervention, through an academic-led partnership approach
Tobacco Endgame	How can a coordinated regional smoking cessation initiative be developed and implemented? A programme logic model to evaluate the '10,000 Lives' health promotion initiative in Central Queensland, Australia	Khan et al. 2021	Workforce and partnerships Evaluation	Mixed methods Describes program model and process evaluation of smoking cessation initiative
RE-FRESH	"Eat Well@IGA" study A Successful Intervention Research Collaboration Between a Supermarket Chain, the Local Government, a Non-governmental Organization and Academic Researchers: The Eat Well @ IGA Healthy Supermarket Partnership	Blake et al. 2022	Workforce and partnerships	Case study/RCT Describes a co-designed partnership approach with a range of stakeholders to determine effectiveness of intervention to increase health food sales in a

	The 'Eat Well @ IGA' healthy supermarket randomised controlled trial: process evaluation	Blake et al. 2021		supermarket chain and improve implementation
RE-FRESH	Co-creation Approach in Practice: Naming a Cafe Located within a Rural Health Service Provides Added Value to a Health Strategy	Vargas et al. 2023	Workforce and partnerships	Mixed methods Co-creation approach as a method of achieving additional engagement of stakeholders
Re-FRESH	Implementation of a food retail intervention to reduce purchase of unhealthy food and beverages in remote Australia: mixed-method evaluation using the consolidated framework for implementation research	Brimblecombe et al. 2023	Workforce and partnerships	Mixed methods Study utilised co-design with Aboriginal and Torres Strait Islander managed community store partners in the Healthy Stores 2020 study to improve implementation
RE-FRESH	Implementation and sales impact of a capacity building intervention in Australian sporting facility food outlets: a longitudinal observational study	Blake et al. 2022	Workforce and partnerships	Quantitative research Evaluated fidelity of intervention to increase healthy drinks displayed and sold in sporting facilities and impacts on sales and revenue
RE-FRESH	Co-creation, co-design, co-production for public health – a perspective on definitions and distinctions	Vargas et al. 2022	Workforce and partnerships	Commentary Defines concepts of co-design, co-production and co-creation in relation to public health partnerships
RE-FRESH	CO-Creation and evaluation of food environments to Advance Community Health (COACH)	Whelan et al. 2023	Workforce and partnerships	Methodology Describes a process framework to guide establishment of co-creation research and practice in healthy food retail environments
PFI	BEHAVIOUR Trial Brief Physical Activity Counselling by Physiotherapists (BEHAVIOUR): protocol for an effectiveness-implementation hybrid type II cluster randomised controlled trial Current practice of physical activity counselling within physiotherapy usual care and influences on its use: a cross-sectional survey	Hassett et al. 2022 Zhu et al. 2021	Workforce and Partnerships	This is an ongoing study funded by MRFF and a Translating Research into Practice (TRIP) Fellowship. Physiotherapists will be trained to promote physical activity as part of routine practice. Lead CI has a dual clinician/academic appointment with USYD/ SWSLHD Protocol/Study to inform intervention development
Scale Up				
NCOIS	Reviews examining scale up penalty A systematic review of adaptations and effectiveness of scaled-up nutrition interventions	Sutherland et al. 2022	Scale up	Systematic reviews This is a series of systematic reviews examining to what degree effectiveness seen in the original trial is maintained in the scaled up

	How effective are physical activity interventions when they are scaled-up: a systematic review	Lane et al. 2021		trial for nutrient, physical activity and obesity interventions
	Scaling-up evidence-based obesity interventions: A systematic review assessing intervention adaptations and effectiveness and quantifying the scale up penalty	McCrabb et al. 2019		
NCOIS	Scale up of the PA4E1 trial		Scale up	RCT outcome data These papers report implementation outcomes from the scale up of a physical activity trial in secondary schools
	Scale up of the Physical Activity 4 Everyone (PA4E1) intervention in secondary schools: 12-month implementation outcomes from a cluster randomized controlled trial	Sutherland et al. 2020		
	Scale up of the Physical Activity 4 Everyone (PA4E1) intervention in secondary schools: 24-month implementation and cost outcomes from a cluster randomised controlled trial	Sutherland et al. 2021		
NCOIS	Scale up of the SWAP-IT trial		Scale up	RCT protocol/outcome data These papers report the effectiveness of the scale up of "SWAP-IT" – a digital health intervention designed to increase packing of healthy lunchboxes in childcare centres and primary schools
	Protocol for an effectiveness-implementation hybrid trial to assess the effectiveness and cost-effectiveness of an m-health intervention to decrease the consumption of discretionary foods packed in school lunchboxes: the 'SWAP IT' trial	Sutherland et al. 2019		
	Cluster randomised controlled trial of an m-health intervention in centre-based childcare services to reduce the packing of discretionary foods in children's lunchboxes: study protocol for the ' SWAP IT Childcare' trial	Pond et al. 2019		
	A randomized controlled trial to assess the potential efficacy, feasibility and acceptability of an m-health intervention targeting parents of school aged children to improve the nutritional quality of foods packed in the lunchbox 'SWAP IT'	Sutherland et al. 2019		
	A multicomponent mHealth-based intervention (SWAP IT) to decrease the consumption of discretionary foods packed in school lunchboxes: Type I	Sutherland et al. 2019		

		effectiveness-implementation hybrid cluster randomized controlled trial			
		New models to support parents to pack healthy lunchboxes: Parents acceptability, feasibility, appropriateness, and adoption of the SWAP IT m-Health program	Brown et al. 2023		
NCOIS	PACE study			Scale up Sustainability	RCT protocol/outcome data
	A cluster randomised controlled trial of an intervention to increase the implementation of school physical activity policies and guidelines: study protocol for the physically active children in education (PACE) study	Nathan et al. 2019			These papers report the effectiveness of the scale up of "PACE" – an implementation trial designed to support primary school teachers to adhere to physical activity policies and deliver content according to guidelines
	Multi-strategy intervention increases school implementation and maintenance of a mandatory physical activity policy: outcomes of a cluster randomised controlled trial	Nathan et al. 2022			
	Optimising a multi-strategy implementation intervention to improve the delivery of a school physical activity policy at scale: findings from a randomised noninferiority trial	Lane et al. 2022			
	Identifying essential implementation strategies: a mixed methods process evaluation of a multi-strategy policy implementation intervention for schools	Lane et al. 2022			
	Economic evaluation of a multi-strategy intervention that improves school-based physical activity policy implementation	Lane et al. 2022			
NCOIS	Optimisation: defining and exploring a concept to enhance the impact of public health initiatives	Wolfenden et al. 2019		Scale up	Qualitative Reports findings from a modified Delphi study with international stakeholders to define optimisation in relation to public health, and to consider in which context optimisation is most useful
NCOIS	Adaptation of public health initiatives: expert views on current guidance and opportunities to advance their application and benefit	Yoong et al. 2020		Scale up	Qualitative Reports findings from a World Café/focus group study with international stakeholders to review and critique available adaptive

					frameworks, and to consider opportunities to progress adaptation research and application
NCOIS	Differential effectiveness of a practice change intervention to improve antenatal care addressing alcohol consumption during pregnancy: Exploratory subgroup analyses within a randomised stepped-wedge controlled trial	Doherty et al. 2023	Scale up		Subgroup analysis from RCT

This study explored how the effectiveness of a practice change intervention to increase adherence to alcohol consumption guideline-directed care in antenatal services varied as a result of different sociodemographic variables. This information can be used to adapt future implementation of the intervention to potentially improve effectiveness for specific subgroups |
| NCOIS | Strategies for enhancing the implementation of school-based policies or practices targeting risk factors for chronic disease

Strategies to improve the implementation of healthy eating, physical activity and obesity prevention policies, practices or programmes within childcare services

Strategies to improve the implementation of workplace-based policies or practices targeting tobacco, alcohol, diet, physical activity and obesity | Wolfenden et al. 2022

Wolfenden et al. 2020

Wolfenden et al. 2018 | Scale up | | Systematic review/findings brief

Series of Cochrane reviews exploring effectiveness of implementation strategies to scale up prevention trials in schools, workplaces, childcare centres and sporting clubs |
| Prevention Centre | Development of ISAT tool

Intervention Scalability Assessment Tool: A decision support tool for health policy makers and implementers

The Intervention Scalability Assessment Tool: A pilot study assessing five interventions for scalability

Scaling up population health interventions from decision to sustainability - a window of opportunity? A qualitative view from policy-makers | Milat 2020

Lee 2020

Lee 2020 | Scale up | | Methods/Qualitative

Series of papers describing the development and application to the Intervention Scalability Assessment Tool (ISAT), which can be used to assess potential scalability of a program/policy/interventio n |
| Prevention Centre | Towards the implementation of large-scale innovations in complex health | Wutzke et al. 2016 | Scale up | | Review/Qualitative |

	care systems: views of managers and frontline personnel			These studies and the findings brief explore determinants of scaling up programs in public health, and in physical activity specifically
	Pathways for scaling up public health interventions	Indig et al. 2017		
	Tensions and Paradoxes of Scaling Up: A Critical Reflection on Physical Activity Promotion	Koorts 2023		
Prevention Centre	Development and Application of the Scale up Reflection Guide (SRG)	Lee et al. 2023	Scale up	Methods This paper guides stakeholders through a process of considering how projects were scaled up, and how best to document this information to improve future implementation
EPOCH-Translate	Effects of Telephone and Short Message Service Support on Infant Feeding Practices, "Tummy Time," and Screen Time at 6 and 12 Months of Child Age: A 3-Group Randomized Clinical Trial	Wen et al. 2020	Scale up	RCT These papers report the results of a study to scale up the Healthy Beginnings program to prevent obesity in early childhood
	Effects of telephone support or short message service on body mass index, eating and screen time behaviours of children age 2 years: a 3-arm randomized controlled trial	Wen et al. 2022		
	Twelve-month effectiveness of telephone and SMS support to mothers with children aged 2 years in reducing children's BMI: a randomized controlled trial	Wen et al. 2023		
	Economic evaluation of the Communicating Healthy Beginnings Advice by Telephone trial for early childhood obesity prevention	Killedar et al. 2022		
EPOCH-Translate	Navigating infant feeding supports after migration: Perspectives of Arabic and Chinese mothers and health professionals in Australia	Marshall et al. 2021	Scale up	Qualitative/mixed methods A series of papers describing the cultural adaptation of the Healthy Beginnings program, including identification of core/non-core components
	The process of culturally adapting the Healthy Beginnings early obesity prevention program for Arabic and Chinese mothers in Australia	Marshall et al. 2021		
	Feasibility of a culturally adapted early childhood obesity prevention program among migrant mothers in Australia: a mixed methods evaluation	Marshall et al. 2021		

EPOCH-Translate	Factors Influencing Parental Engagement in an Early Childhood Obesity Prevention Program Implemented at Scale: The Infant Program	Love et al. 2018	Scale up	Qualitative/Protocol/RCT A series of papers describing the adaptation and scale up of the INFANT program targeting health eating and active play in the first years of life
	Protocol for an Effectiveness-Implementation Hybrid Trial to Evaluate Scale up of an Evidence-Based Intervention Addressing Lifestyle Behaviours From the Start of Life: INFANT	Laws et al. 2021		
	Mapping intervention components from a randomized controlled trial to scale up of an early life nutrition and movement intervention: The INFANT program	Marshall et al. 2023		
Tobacco Endgame	Smoking cessation interventions and abstinence outcomes for people living in rural, regional, and remote areas of three high-income countries: A systematic review	Trigg et al. 2023	Scale up	Systematic review Suggests some smoking cessation approaches may have variable effectiveness in rural populations, highlighting the need for potential adaptations if scaled up for this population
Tobacco Endgame	Tobacco cessation and screening in culturally and linguistically diverse communities: an Evidence Check rapid review	McEntee et al. 2022	Scale up	Rapid review Found more screening interventions were tailored for CALD populations compared to smoking cessation programs (of which there is minimal evidence). Evidence of effectiveness for screening was variable dependent on language, and more research is needed
RE-FRESH	Factors Influencing Implementation, Sustainability and Scalability of Healthy Food Retail Interventions: A Systematic Review of Reviews	Gupta et al. 2022	Scale Up/ Sustainability	Systematic review Very few reviews have explored the sustainability or scalability of healthy food retail interventions, suggesting more evidence is needed to inform future implementation

PFI	Fall prevention behaviour after participation in the Stepping On program: a pre-post study with 6-month follow-up	Tiedemann et al. 2020	Scale Up	Pre-post
	Scale up of the Stepping On fall prevention program amongst older adults in NSW: Program reach and fall-related health service use	Paul et al. 2020		*Stepping On* is a fall prevention program underpinned by behaviour change and exercise, involving seven weekly group sessions on a variety of fall prevention topics and home exercise. It is targeted at community-dwelling people aged >65 years
	Outcomes associated with scale up of the Stepping On falls prevention program: A case study in redesigning for dissemination	Mahoney et al. 2020		
	"Pisando Fuerte": an evidence-based falls prevention program for Hispanic/Latinos older adults: results of an implementation trial	Pinzon et al. 2019		The program has been scaled up in the USA, and has also be adapted for people with mild cognitive impairment or who have had a stroke, and translated into Spanish. Several example papers are included here
	Stepping On after Stroke falls-prevention programme for community stroke survivors in Singapore: A feasibility study	Xu et al. 2020		

Sustainability				
Prevention Centre/ NCOIS	Understanding the sustainment of population health programmes from a whole-of-system approach	Crane et al. 2022	Sustainability	Qualitative

Interventions with population health policymakers assisted with identifying key barriers to program sustainment |
| Prevention Centre | Evaluation of the Population Health Information Management System (PHIMS) | | Sustainability/ scale up/partnerships | Mixed methods

Series of papers arising from the evaluation of NSW Health's Population Health Information Management System (PHIMS), which is an online monitoring system designed to capture statewide implementation data relevant to the Healthy Children Initiative |
| | Dynamics behind the scale up of evidence-based obesity prevention: protocol for a multi-site case study of an electronic implementation monitoring system in health promotion practice | Conte et al. 2017 | | |
| | Capturing implementation knowledge: applying focused ethnography to study how implementers generate and manage knowledge in the scale up of obesity prevention programs | Conte et al. 2019 | | |

	Can an electronic monitoring system capture implementation of health promotion programs? A focussed ethnographic exploration of the story behind program monitoring data	Conte et al. 2020		
	Will E-Monitoring of Policy and Program Implementation Stifle or Enhance Practice? How Would We Know?	Conte et al. 2018		
	Scale up of prevention programmes: sustained statewide use of programme delivery software is explained by normalised self-organised adoption and non-adoption	Goldberg et al. 2022		
	Key Performance Indicators for program scale up and divergent practice styles: a study from NSW, Australia	Gron et al. 2020		
NCOIS	A Pilot Randomised Controlled Trial to Increase the Sustainment of an Indoor–Outdoor-Free-Play Program in Early Childhood Education and Care Services: A Study Protocol for the Sustaining Play, Sustaining Health (SPSH) Trial	Imad et al. 2023	Sustainability	Protocol This pilot RCT will provide crucial acceptability and feasibility data regarding sustainability strategies designed to increase sustainment of a physical activity program in early childhood settings
NCOIS	Evaluation of measures of sustainability and sustainability determinants for use in community, public health, and clinical settings: a systematic review	Hall et al. 2022	Sustainability	Systematic Review Psychometric review of measures of sustainability and sustainability determinants
NCOIS	Do the Expert Recommendations for Implementing Change (ERIC) strategies adequately address sustainment?	Nathan et al. 2022	Sustainability	Mixed methods Adapts the Expert Recommendations for Implementing Change (ERIC) taxonomy to incorporate implications for sustainment of evidence-based interventions
NCOIS	Adaptation and validation of the Program Sustainability Assessment Tool (PSAT) for use in the elementary school setting	Hall et al. 2021	Sustainability	Psychometrics Describes efforts to adapt and validate the program sustainability tool (PSAT) in primary schools
NCOIS	Two-year follow-up of a randomised controlled trial to assess the sustainability of a school intervention to improve the implementation of a school-based nutrition policy	Wolfenden et al. 2019	Sustainability	RCT Explores sustainment of a primary school canteen intervention even after the conclusion of active implementation support
NCOIS	Barriers and facilitators influencing the sustainment of health behaviour	Shoesmith et al. 2021	Sustainability	Systematic Review

	interventions in schools and childcare services: a systematic review			Identified strategies that address barriers to sustainment of evidence based programs in school and early childcare settings
NCOIS	School-level factors associated with the sustainment of weekly physical activity scheduled in Australian elementary schools: an observational study	Shoesmith et al. 2021	Sustainability	Quantitative study Examined school and teacher level factors and perceptions that predicted sustainment of a physical activity program in primary schools
EPOCH-Translate	Factors contributing to the sustained implementation of an early childhood obesity prevention intervention: The INFANT Program	Love et al. 2022	Sustainability	Qualitative study Study identifies several barriers and facilitators to sustainment of an infant feeding and physical activity program when implemented at scale in the community
RE-FRESH	Adoption, implementation, and sustainability of early childhood feeding, nutrition and active play interventions in real-world settings: a systematic review	Gelman et al. 2023	Sustainability	Systematic Review Found many barriers and facilitators to implementation and subsequent sustainment of interventions targeting nutrition and activity in early childhood when delivered at scale
Tobacco Endgame	Can improvement in delivery of smoking cessation care be sustained in psychiatry inpatient settings through a system change intervention? An analysis of statewide administrative health data	Plever et al. 2023	Sustainability	Quantitative study Explored maintenance of a system change intervention to improve smoking cessation in mental health units and found ongoing high levels of adherence 3 years following active implementation
Evaluation				
NCOIS	Designing and undertaking randomised implementation trials: guide for researchers	Wolfenden et al. 2021	Evaluation	Methods Provides guidance on the key components of randomised trials of implementation strategies, including articulation of trial aims, trial recruitment and retention strategies, randomised design selection, use of implementation science theory and frameworks, measures, sample size calculations, ethical review and trial reporting
NCOIS	Increased use of knowledge translation strategies is associated with greater research impact on public health policy and practice: an analysis of trials of nutrition, physical activity, sexual	Wolfenden et al. 2022	Evaluation	Quantitative Study Study found a relationship between the use of comprehensive knowledge

	health, tobacco, alcohol and substance use interventions			translation strategies and research impact
RE-FRESH	The Public Health 12 framework: interpreting the 'Meadows 12 places to act in a system' for use in public health	Bolton et al. 2022	Evaluation	Methods Translates the Meadows 12 framework into the PH12, which can then be used by stakeholders to implement systems change in community-led public health intervention
Prev Centre	Using natural experiments to improve public health evidence: a review of context and utility for obesity prevention	Crane et al. 2020	Evaluation	Review Highlights the critical role natural experiments can play in contributing to evidence generation for obesity prevention interventions
Prev Centre	Applying pragmatic approaches to complex program evaluation: A case study of implementation of the New South Wales Get Healthy at Work program	Crane et al. 2019	Evaluation	Case Study Describes a pragmatic evaluation approach to evaluate a statewide, complex health promotion initiative
PROJECTS UNDERWAY				
PFI	The 'PROMOTE PA' study evaluates the impact of physical activity promotion by health professionals (including physiotherapists) on the physical activity levels of patients while observing and gathering information to better understand how to implement physical activity promotion in health services	Promotion of evidence-based physical activity for older adults and people with disabilities by health professionals, Sherrington C, Hassett L, Tiedemann A, Harvey L, De Barros Pinheiro M, Howard K, Phongsavan P, Haynes A, National Health and Medical Research Council (NHMRC)/Partnership Projects These papers informed this trial: Purcell, K., et al. (2023). Promotion of physical activity by health professionals in a sample of six public hospitals: A cross sectional study. *Health Promotion Journal of Australia* West, K., et al. (2021). "People Associate Us with Movement so It's an Awesome	Workforce and partnerships	1. • This project aims to mobilise and empower physiotherapists and other health professionals to encourage and support physical activity among patients by specifically targeting local barriers. We have co-designed a multi-faceted implementation strategy including: an online resource hub with training in behaviour change interventions, referral pathways, home exercise prescription, use of activity monitors; local clinical champions; mentors with expertise in different health conditions; links with community physical activity providers; new "transition" programs suitable for patients; and a community of practice to share learnings between sites. • To evaluate our intervention we will undertake a hybrid implementation-effectiveness cluster randomised trial. We will examine intervention priorities, barriers and enablers of physical activity promotion in daily practice,

		Opportunity": Perspectives from Physiotherapists on Promoting Physical Activity, Exercise and Sport. *International Journal of Environmental Research and Public Health*, 18(6), 2963-1-2963-14		user experiences and cost-effectiveness
PFI	This project will assess whether the use of a quality coaching approach enhances implementation and effectiveness of falls prevention initiatives in partner Sydney Local Health District (SLHD).

Stage 1 of the project will involve co-design of a quality coaching approach for falls prevention in wards of partner Sydney Local Health District using data from pilot work in our two partner Health Districts. Stage 2 of the project will involve a stepped wedge trial to test the quality coaching approach | Quality coaching to implement a hospital fall prevention strategy: intervention development and evaluation in a stepped wedge trial, Sherrington et al. National Health and Medical Research Council (NHMRC)/Partnership Projects | Workforce and partnerships | The PhD candidate leading this study is a SLHD physiotherapist. She is being partially funded by the district. This is part of the capacity building model we have in the Institute for Musculoskeletal Health (which is a partnership between SLHD and USyd) |
PFI	This Hybrid Level 1 effectiveness and implementation randomised controlled trial aims to establish the effect on mobility and falls of a telehealth physiotherapy program compared to usual care in older people aged 65+ years receiving aged care services	A physiotherapy-led telehealth and exercise intervention to improve mobility in older people receiving aged care services: an effectiveness and implementation randomised controlled trial (The TOP UP Study) Pinheiro et al. Funding from Dementia Australia and ARIA	Workforce and partnerships	The TOP-UP study was designed in partnership with aged care providers, consumers and clinicians. A key aspect of the program is capacity building and training of clinicians and care staff. Results will be available at the end of the year. The PhD candidate leading this project (Rik Dawson) is an experienced clinician
PFI	Physical activity is crucial for health across the lifespan and is key to healthy ageing. Choose To Move (CTM) was developed by researchers in British Columbia, Canada, in collaboration with older adults and community-based organisations and is effective in supporting older people to increase physical activity. This research will adapt CTM to suit the needs of older Arabic speaking people in Sydney, who are particularly inactive and not well supported by existing physical activity programs	Choose To Move Sydney Tiedemann et al. NHMRC-CIHR Healthy Cities Implementation Science Team Grant	Scale Up	Choose To Move Sydney will culturally adapt a successful physical activity intervention to improve reach and outcomes in a priority population – older Arabic speakers
HiPP	Several implementation projects underway focussing on models of care and optimising health outcomes in pregnancy in conjunction with Monash Health		Partnership	

Appendix 2: Links to key frameworks, models and tools mentioned in the synthesis

Scale up

Milat AJ, Newson R, King L, Rissel C, Wolfenden L, Bauman A, et al. A guide to scaling up population health interventions. Public Health Res Pract. 2016;26(1):e2611604. https://www.phrp.com.au/issues/january-2016-volume-26-issue-1/a-guide-to-scaling-up-population-health-interventions/

The Intervention Scalability Assessment Tool (ISAT): https://preventioncentre.org.au/resources/the-intervention-scalability-assessment-tool/

Sustainability

The Integrated Sustainability Framework: https://www.annualreviews.org/doi/full/10.1146/annurev-publhealth-040617-014731

NHS Sustainability Model: https://www.england.nhs.uk/wp-content/uploads/2021/03/qsir-sustainability-model.pdf

Program Sustainability Assessment Tool and Clinical Sustainability Assessment Tool: https://sustaintool.org/

APEASE criteria: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/875385/PHEBI_Achieving_Behaviour_Change_Local_Government.pdf

Expert Recommendations for Implementation Change (ERIC) Framework: https://implementationscience.biomedcentral.com/articles/10.1186/s13012-015-0209-1

Exploration, Preparation, Implementation and Sustainment (EPIS) Framework: https://episframework.com/

Action, Actor, Context, Target, Time (AACTT) framework: https://implementationscience.biomedcentral.com/articles/10.1186/s13012-019-0951-x

Special Edition of Frontiers in Health Services: https://www.frontiersin.org/research-topics/30962/sustaining-the-implementation-of-evidence-based-interventions-in-clinical-and-community-settings#articles

Highlighted articles

Editorial: https://www.frontiersin.org/articles/10.3389/frhs.2023.1176023/full

ERIC sustainment-explicit glossary (from the NCOIS): https://www.frontiersin.org/articles/10.3389/frhs.2022.905909/full

Sustainment of INFANT program (from EPOCH-Translate):https://www.frontiersin.org/articles/10.3389/frhs.2022.1031628/full

Example use of PSAT tool: https://www.frontiersin.org/articles/10.3389/frhs.2022.1004167/full

Sustainability of Breastfeeding interventions in LMICs: https://www.frontiersin.org/articles/10.3389/frhs.2022.889390/full

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