QUEST Seminar on Responsible Research

Drawing from implementation science from bench to bedside to practice

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Overview and objectives

1. What is implementation science and why is it important
2. How we study implementation: foundational concepts and key steps
3. New frontiers in applying to tools of implementation science, earlier

Implementation Science in Ottawa:
Centre for Implementation Research

13 faculty and their teams focused on **advancing research into developing and applying Implementation Science** in health settings to improve health-care and health

Multidisciplinary Fields

- Cognitive psychology
- Epidemiology
- Health economics
- Health psychology
- Health services research
- Knowledge translation science
- Medical sociology
- Medicine
- Nursing
- Population health
- Statistics
- Other health and behavioural sciences

Expertise

- Audit and feedback
- Decision aids & shared decision making
- Clinical practice guideline development/evaluation
- Evidence synthesis
- Health care professional behaviour change
- Health economic evaluation
- Qualitative, survey, and consensus methods
- Barriers/enablers assessment
- Intervention co-development
- Trials and cluster trials

What is Implementation Science?

Have you ever heard of this field?
What does Implementation Science mean, to you?

Why is implementation important?

- 100s of billions of $ per year invested in biomedical and health research
- “One of the most consistent findings from clinical and health services research is the failure to translate research in practice or policy”[1]

“All breakthrough, no follow through”[2]

[1]Grimshaw et al (2012); [2]Woolf (2006)

Why is implementation important?

Gaps between research evidence and routine clinical care

30-40%

of people do not receive care according to current scientific evidence[1,3]

14-25%

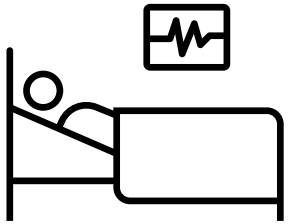
of healthcare provided is not needed[3]

[1]Schuster, McGlynn, & Brook (1998); [2]Grol (2001); [3]Squires et al (2022)

Why is implementation important?

Great basic science and pre-clinical research happening…

…But it is not necessarily optimally reaching the bedside…



… and what is reaching the bedside may be over or under used

What is implementation *science*?

"**scientific** study of methods to promote the **systematic uptake of research findings** and other evidence-based practices **into routine practice**"[1]

Goal: develop a ***generalizable empirical basis*** to optimize implementation activities to improve the healthcare provided to patients and the public

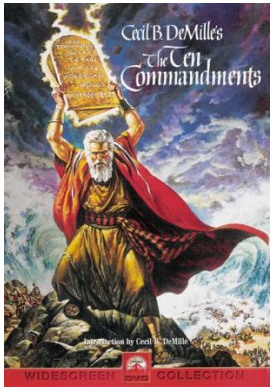
The **science** of the bridge between discovery and impact

[1]Eccles and Mittman (2006) *Implementation Science*

How do health care organisations typically approach implementation?

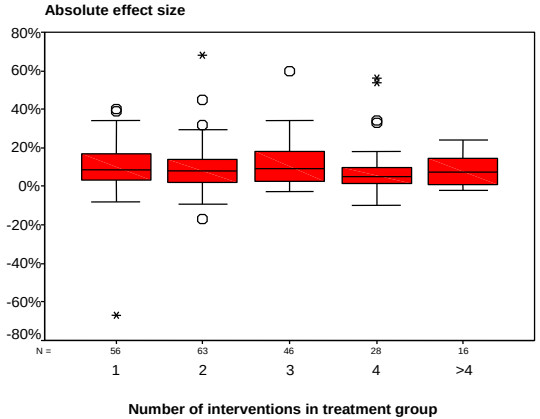
Some typical approaches to implementation

Develop & issue guidelines



They do not self-implement

Throw everything at the issue and see what sticks



Grimshaw et al (2004) *Health Technology Assessment*

More ≠ better

Choose a favorite solution

May not be fit for purpose

Deliver training/CPD

Is content including strategies to address barriers to change?

Develop an app

What about change techniques? What about use?

Develop own internal solutions

Martin Eccles

Jill Francis

Most frequently used approach to implementation in the literature:

ISLAGIATT

(It Seemed Like A Good Idea At The Time)

An expensive version of trial and error

- **Inefficient:** Does not build on what we already know
- **Insufficient:** May miss important factors
- **Unscientific:** Based on implicit ideas of what drives change in practice, undermining scale, spread, and evidence accumulation

Beyond ISLAGIATT

Jump to the solution (ISLAGIATT)

- Set a meeting
- Brainstorm solutions
- Someone decides on a solution
- Implement solution
- Hope it works

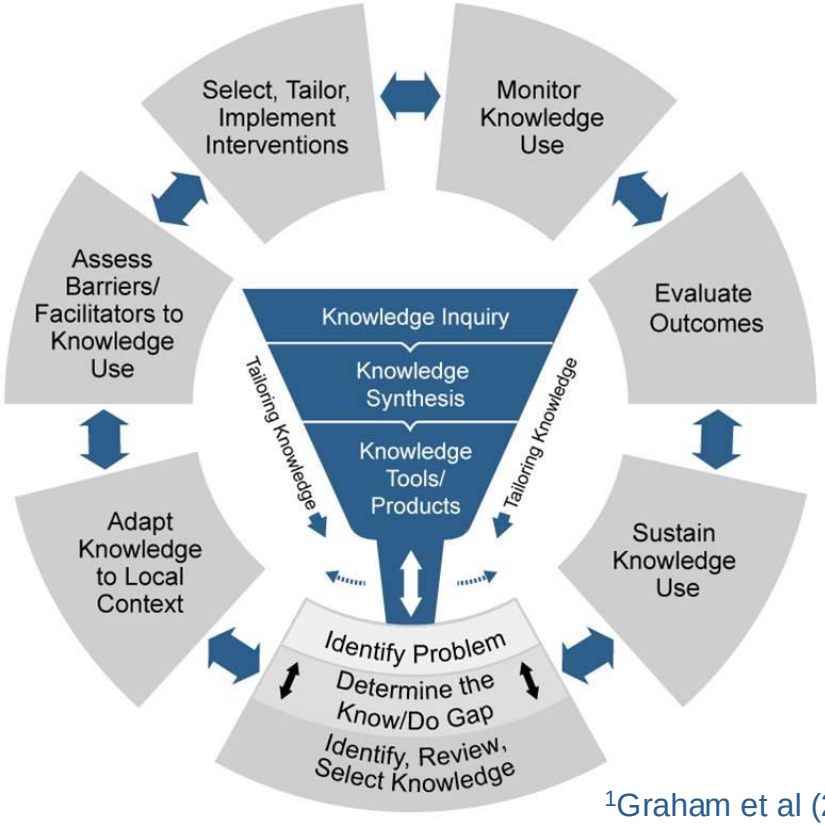
ImplSci approach

✓ Before going to solutions *understand what might get in the way or support change* in more depth to increase likelihood that the solution fits the situation

Foundational concepts in ImplSci

Knowledge to Action Framework[1]

Outlines key phases in moving research evidence into routine clinical practice



[1]Graham et al (2006)

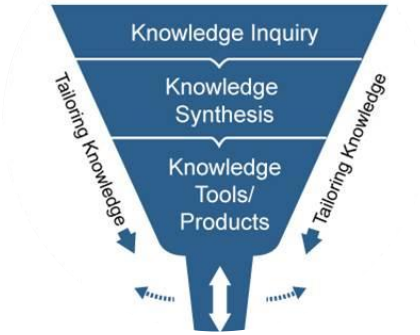
Producing, synthesizing and disseminating evidence: Necessary but usually not sufficient

Knowledge inquiry: Individual studies (rarely sufficient to warrant practice or policy change)

Knowledge synthesis: Systematic reviews of clinical studies

Knowledge tools/products
- Clinical practice guidelines
- Decision Aids
- Policy briefs

Knowledge creation funnel

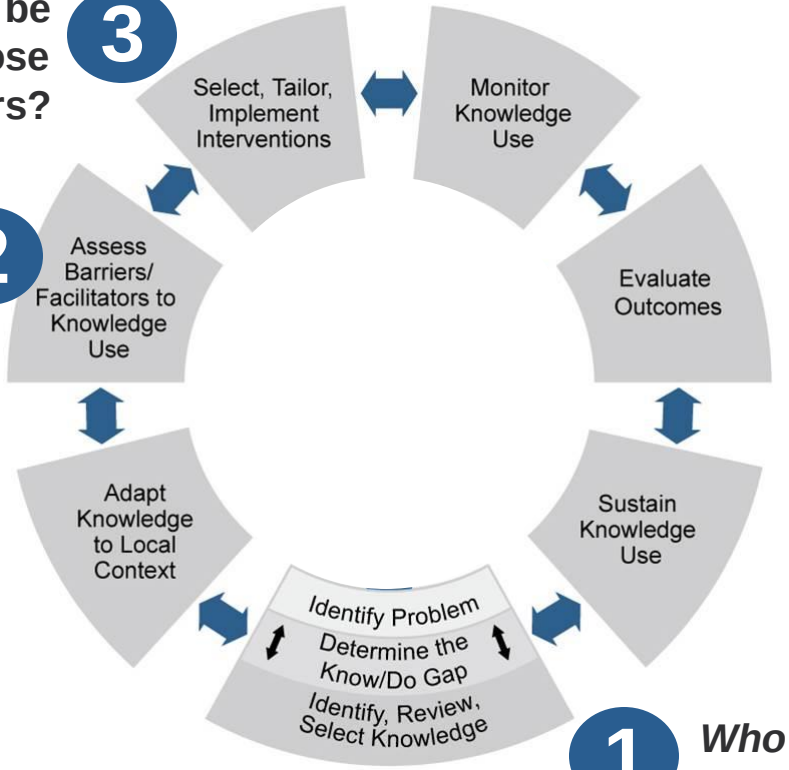


BUT… while producing, publishing and disseminating is important, doing so **does not guarantee implementation**

From knowledge to action: 3 key questions

Which strategies can be effectively used to target those factors? **3**

Which factors determine what they do or don't do? **2**



1 ***Who* needs to do *what*, *differently, when and where*?**

1

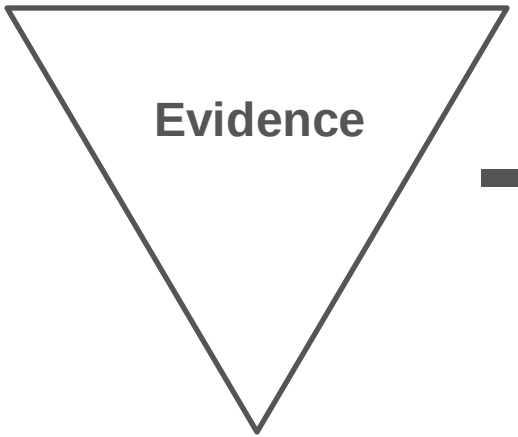
Who needs to do what, differently, where and when?

Take homes: Identify evidence-practice gaps and be as specific as possible

1

Who needs to do what, differently, where and when?

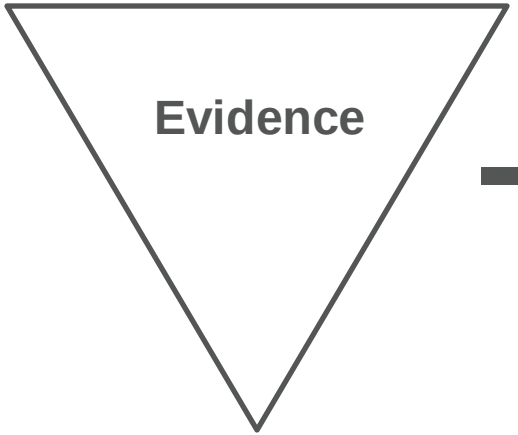
Identifying the problem: evidence-practice gaps



Identify the problem

Any discrepancy between what evidence suggest and what is currently done?

1 Who needs to do what, differently, where and when?



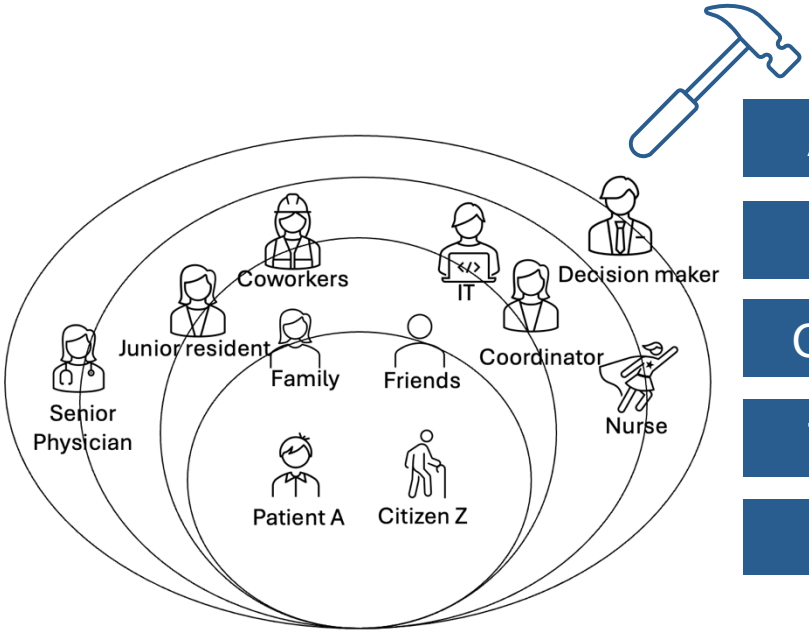
Identify the problem

Potential sources of data on current performance

- National/international organisations
- Research papers seeking to quantify the gaps in particular settings or jurisdictions,
- Local audits, observations, case notes

1 Who needs to do what, differently, where and when?

Someone, at some level, will need to change what they are doing (usually more than one person, at more than one level)



Action	Behaviour(s) that needs to change
Actor	Person/people that do/could do the Action
Context	Physical location or social setting of Action
Target	Person/people for whom Action is performed
Time	When the Action is performed (time/date/freq)

Presseau et al, 2019

From knowledge to action: into the action cycle

Which strategies can be effectively used to target those factors?

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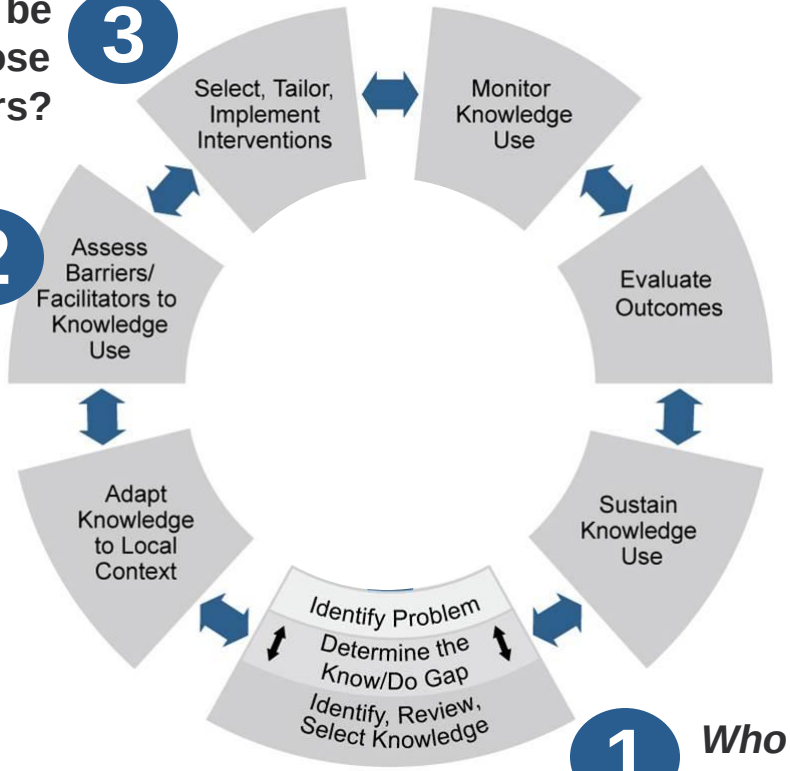
Which factors determine what they do or don't do?

2



1

***Who* needs to do *what*, *differently, when and where*?**

2 Theoretical Domains Framework

TDF Domains
Knowledge
Skills
Memory, attention and decision processes
Behavioural regulation
Environmental context and resources
Social Influences
Beliefs about capabilities
Intention
Goals
Social/professional role and identity
Beliefs about consequences
Reinforcement
Emotion
Optimism

- Synthesizes what we know about practice change into 14 domains
- Used for understanding **barriers** and **enablers** to change in patients, healthcare professionals and policymakers
  - ✓ Interviews or focus groups
  - ✓ Questionnaires
  - ✓ Systematic reviews/meta-syntheses
- ✓ Links directly to selecting strategies designed to address each domain

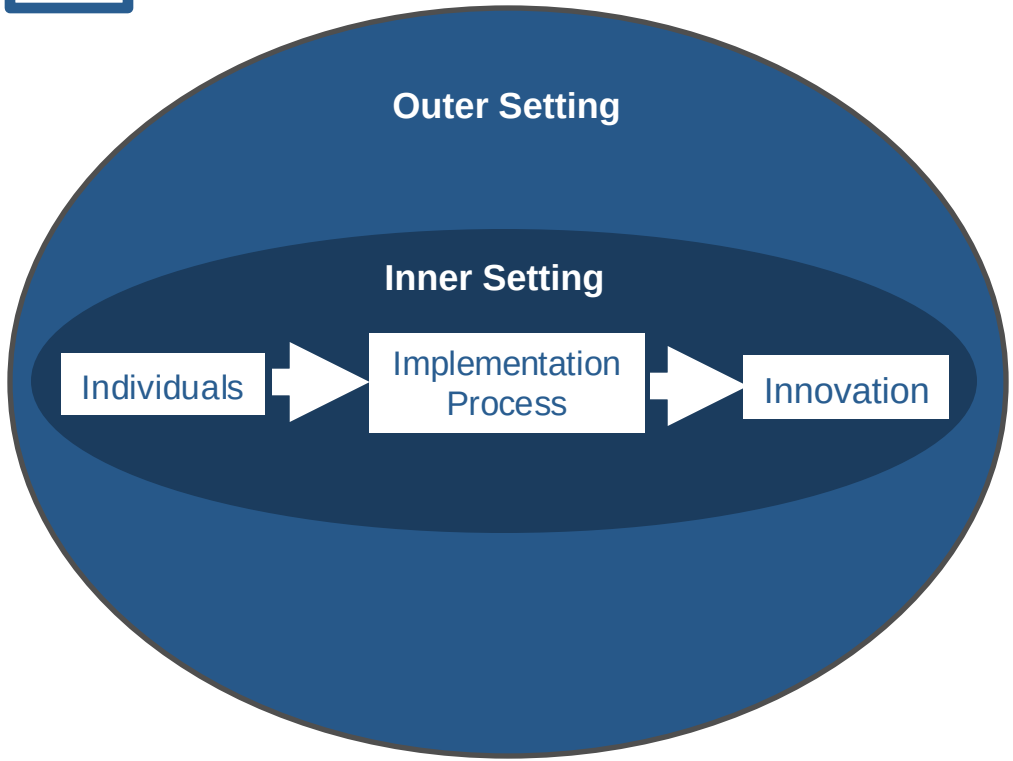
Methodology | Open access | Published: 21 June 2017

A guide to using the Theoretical Domains Framework of behaviour change to investigate implementation problems

Lou Atkins, Jill Francis, Rafat Islam, Denise O'Connor, Andrea Patey, Noah Ivers, Robbie Foy, Eilidh M. Duncan, Heather Colquhoun, Jeremy M. Grimshaw, Rebecca Lawton & Susan Michie

Implementation Science **12**, Article number: 77 (2017) | Cite this article

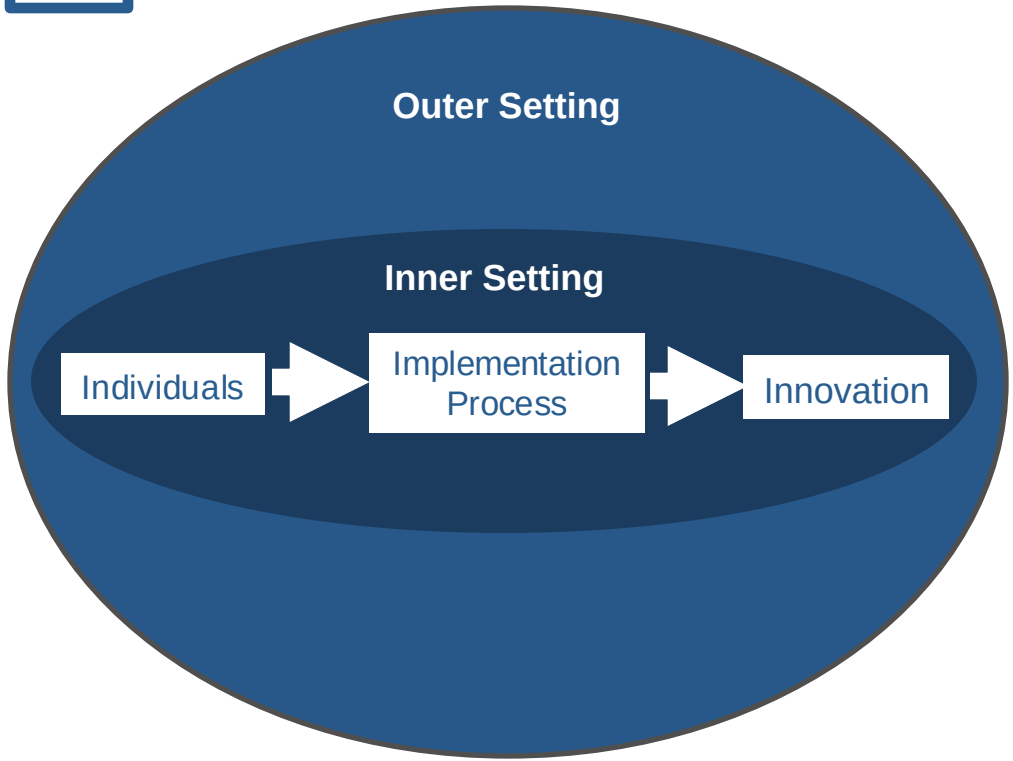
2 Consolidated Framework for Implementation Research (CFIR)



- Synthesizes ‘common constructs from published implementation theories’ from 19 specific MTFs
- Resulting framework –CFIR – has been enormously influential to the field of implementation science
- Can be used to surface barriers/enablers using qualitative, survey or review methods

Damschroder et al. 2022

2 Consolidated Framework for Implementation Research (CFIR)

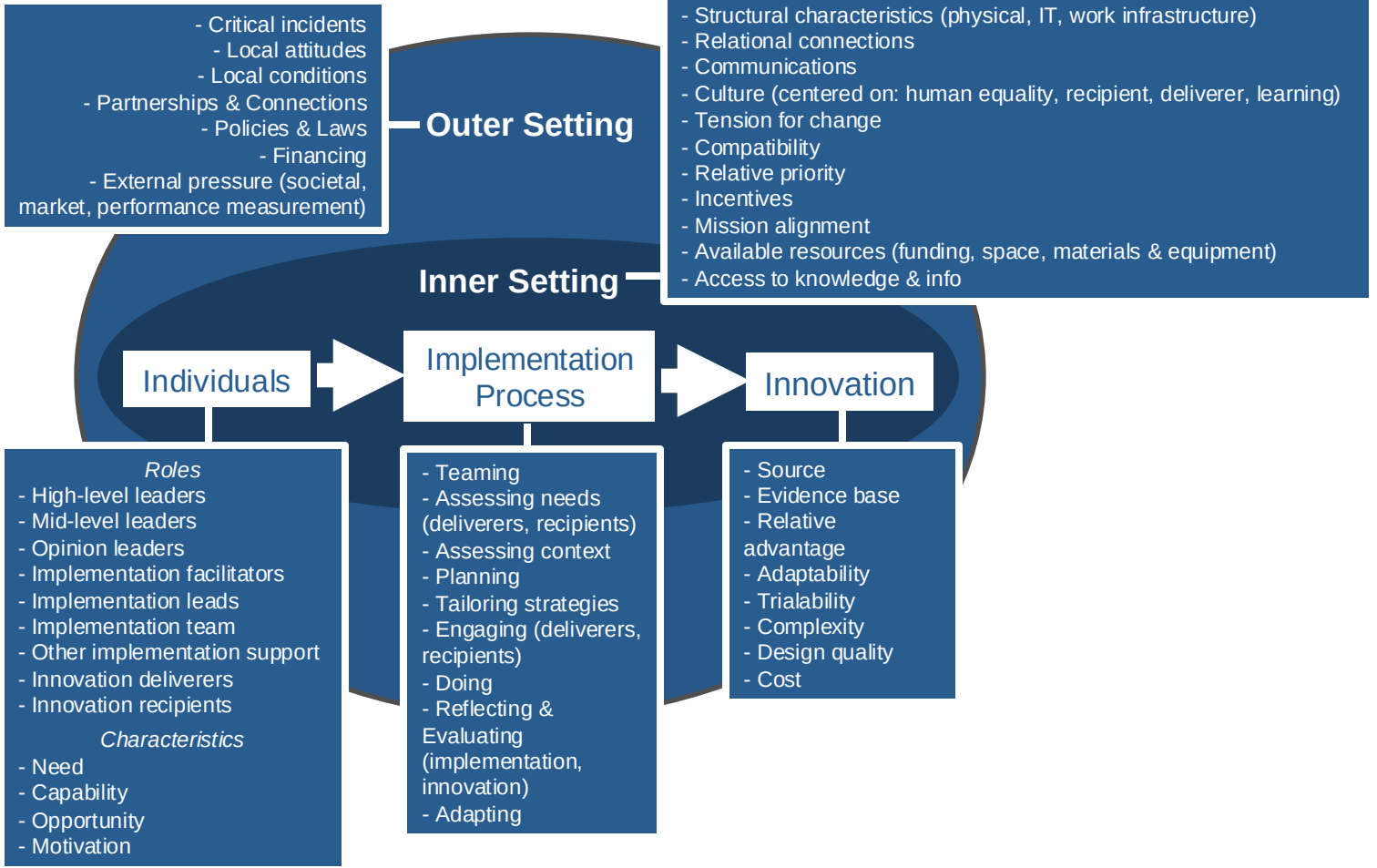


5 Overarching Domains

- **Innovation**: The “thing” being implemented (treatment, program, pathway, service)
- **Inner setting:** Where the innovation is implemented (hospital, clinic, emerg)
- **Outer setting**: the wider setting in which the inner setting is based (hospital system, province, country)
- **Individuals**: the roles and characteristics of those in the setting
- **Implementation process**: activities and strategies used to implement the innovation

Damschroder et al. 2022

CFIR



Damschroder et al. 2022

From knowledge to action: into the action cycle

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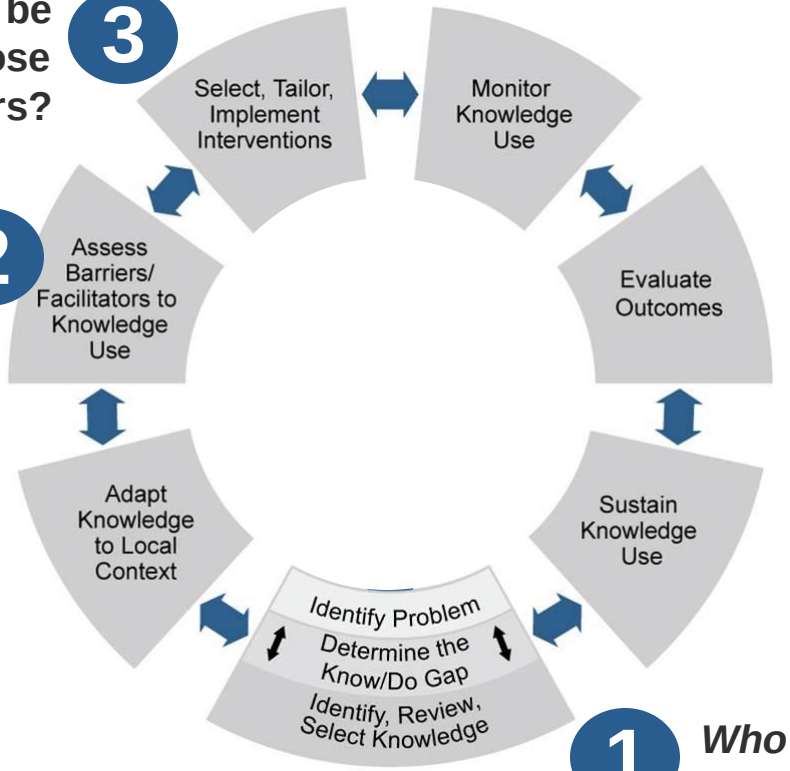


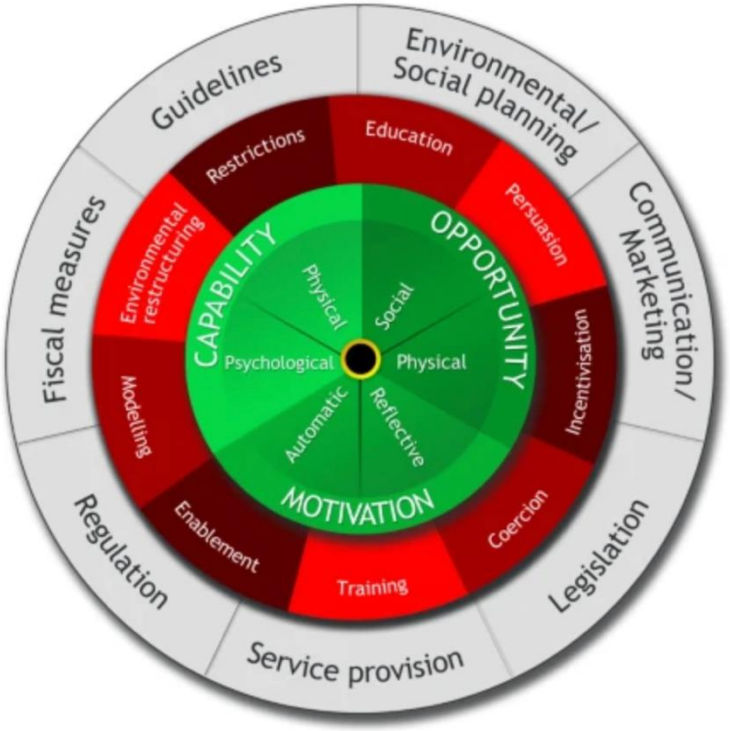
1

***Who* needs to do *what*, *differently, when and where*?**

3 What strategies can address those barriers/enablers?

Behaviour Change Wheel

- Framework linking behaviour change to barriers/enablers to interventions and policy
- Useful to policy-makers, service planners and intervention designers
- Provide guidance for ‘mapping’ barriers to interventions and supportive policies



Michie, van Stralen, West (2011); Michie, Atkins, West (2014); Ojo et al (2019)

RESEARCH Open Access

A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project

Byron J Powell[1*], Thomas J Waltz[2], Matthew J Chinman[3,4], Laura J Damschroder[5], Jeffrey L Smith[6], Monica M Matthieu[6,7], Enola K Proctor[8] and JoAnn E Kirchner[6,9]

Use evaluative and iterative strategies (10)	Develop stakeholder interrelationships (17)	Change infrastructure (8)
Provide interactive assistance (4)	Train and educate stakeholders (11)	Utilize financial strategies (9)
Adapt and tailor to context (4)	Support clinicians (5)	Engage consumers (5)

Powell et al 2015; Waltz et al 2015

Use evaluative and iterative strategies

- Assess for readiness change and identify barriers and facilitators
- Audit and provide feedback
- Purposefully reexamine the implementation
- Develop and implement tools for quality monitoring
- Develop and organize quality monitoring systems
- Develop a formal implementation blueprint
- Conduct local need assessment
- Stage implementation scale up
- Obtain and use patients/consumers and family feedback
- Conduct cyclical small tests of change

Provide interactive assistance

- Facilitation
- Provide local technical assistance
- Provide clinical supervision
- Centralize technical assistance

Adapt and tailor to context

- Tailor strategies
- Promote adaptability
- Use data experts
- Use data warehousing techniques

Change infrastructure

- Mandate change
- Change record systems
- Change physical structure and equipment
- Create or change credentialing and/or licensure standards
- Change service sites
- Change accreditation or membership requirements
- Start a dissemination organization
- Change liability laws

Develop stakeholder interrelationships

- Identify and prepare champions
- Organize clinician implementation team meetings
- Recruit, designate, and train for leadership
- Inform local opinion leaders
- Build a coalition
- Obtain formal commitments
- Identify early adopters
- Conduct local consensus discussions
- Capture and share local knowledge
- Use advisory boards and workgroups
- Use an implementation advisor
- Model and simulate change
- Visit other sites
- Involve executive boards
- Develop an implementation glossary
- Develop academic partnerships
- Promote network weaving

Train and educate stakeholders

- Conduct ongoing training
- Provide ongoing consultation
- Develop educational materials
- Make training dynamic
- Distribute educational materials
- Use train-the-trainer strategies
- Conduct educational meetings
- Conduct educational outreach visits
- Create a learning collaborative
- Shadow other experts
- Work with educational institutions

Support clinicians

- Facilitate relay of clinical data to providers
- Remind clinicians
- Develop resource sharing agreements
- Revise professional roles
- Create new clinical teams

Engage consumers

- Involve patients/consumers and family members
- Intervene with patients/consumers to enhance uptake and adherence
- Prepare patients/consumers to be active participants
- Increase demand
- Use mass media

Utilize financial strategies

- Fund and contract for the clinical innovation
- Access new funding
- Place innovation on fee for service lists/formularies
- Alter incentive/allowance structures
- Make billing easier
- Alter patient/consumer fees
- Use other payment schemes
- Develop disincentives
- Use capitated payments

Powell et al 2015

Newer frontiers of implementation science methods application

- **Implementation science is typically a downstream field**: focus is on how to improve the care provided to patients/the public through increased use of new evidenced treatments and approaches and/or reducing low value existing care

- **BUT**: the methods applied to understand how to move evidence into practice can be **leveraged to improve the generation of evidence** too, to optimize its later implementability

Using ImplSci to enhance our breakthroughs

Examples of upstream application of ImplSci tools and methods

Enhancing recruitment to early phase trials

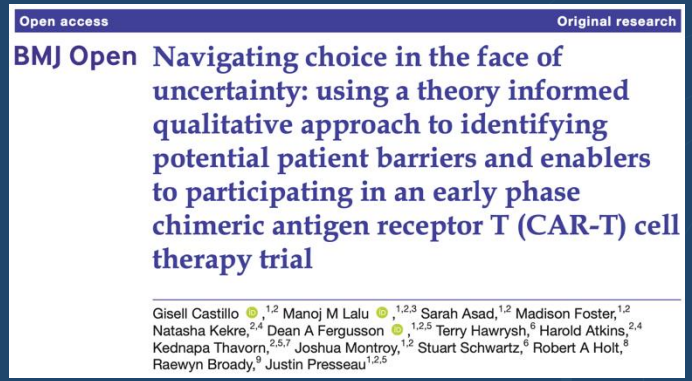
Castillo et al. Trials (2021) 22:230
https://doi.org/10.1186/s13063-021-05121-y

Trials

RESEARCH Open Access

Hematologists' barriers and enablers to screening and recruiting patients to a chimeric antigen receptor (CAR) T cell therapy trial: a theory-informed interview study

Gisell Castillo[1,2], Manoj Lalu[1,2,3], Sarah Asad[1,2], Madison Foster[1,2], Natasha Kekre[1,4], Dean Fergusson[1,2,5], Terry Hawrysh[6], Harold Atkins[1,4], Kednapa Thavorn[1,5,7], Joshua Montroy[1,2], Stuart Schwartz[6], Robert Holt[8], Raewyn Broady[9], Justin Presseau[1,2,5*] and on behalf of the GO CART team

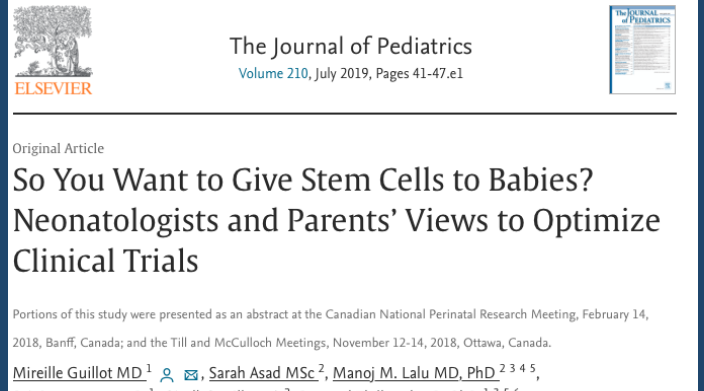


Open access Original research

BMJ Open

Navigating choice in the face of uncertainty: using a theory informed qualitative approach to identifying potential patient barriers and enablers to participating in an early phase chimeric antigen receptor T (CAR-T) cell therapy trial

Gisell Castillo,[1,2] Manoj M Lalu,[1,2,3] Sarah Asad,[1,2] Madison Foster,[1,2] Natasha Kekre,[2,4] Dean A Fergusson,[1,2,5] Terry Hawrysh,[6] Harold Atkins,[2,4] Kednapa Thavorn,[2,5,7] Joshua Montroy,[1,2] Stuart Schwartz,[6] Robert A Holt,[8] Raewyn Broady,[9] Justin Presseau[1,2,5]



ELSEVIER

The Journal of Pediatrics

Volume 210, July 2019, Pages 41-47.e1

Original Article

So You Want to Give Stem Cells to Babies? Neonatologists and Parents' Views to Optimize Clinical Trials

Portions of this study were presented as an abstract at the Canadian National Perinatal Research Meeting, February 14, 2018, Banff, Canada; and the Till and McCulloch Meetings, November 12-14, 2018, Ottawa, Canada.

Mireille Guillot MD[1], Sarah Asad MSc[2], Manoj M. Lalu MD, PhD[2 3 4 5],

TDF Domains
Knowledge
Skills
Memory, attention and decision processes
Behavioural regulation
Environmental context and resources
Social Influences
Beliefs about capabilities
Intention
Goals
Social/professional role and identity
Beliefs about consequences
Reinforcement
Emotion
Optimism

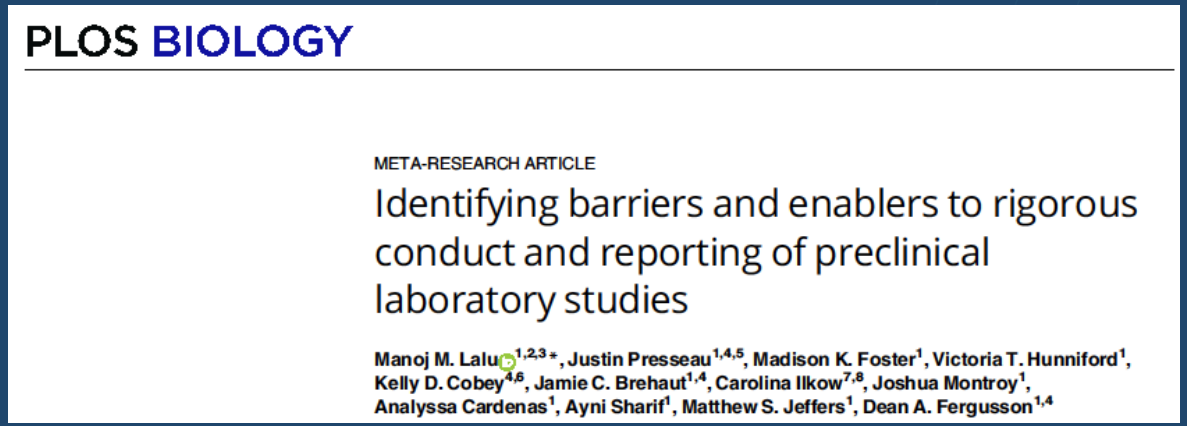
Leveraging methods from ImplSci to structure an approach to assessing barriers/enablers to **recruiting to and participating in an early phase trial** can:

- ✓ Cover factors that may not otherwise be raised
- ✓ Highlight potentially unanticipated barriers that may undermine the trial at its earliest evaluation phases
- ✓ Identify modifiable factors that can be linked that can inform trial protocol enhancements

What about preclinical research?

What about preclinical research?

Example : Barriers/Enablers to rigorous preclinical lab studies



PLOS BIOLOGY

META-RESEARCH ARTICLE

Identifying barriers and enablers to rigorous conduct and reporting of preclinical laboratory studies

Manoj M. Lalu[1,2,3]*, Justin Presseau[1,4,5], Madison K. Foster[1], Victoria T. Hunniford[1], Kelly D. Cobey[4,6], Jamie C. Brehaut[1,4], Carolina Ilkow[7,8], Joshua Montroy[1], Analyssa Cardenas[1], Ayni Sharif[1], Matthew S. Jeffers[1], Dean A. Fergusson[1,4]

Reporting Guidelines for preclinical research

NIH Principles and Guidelines for Reporting Preclinical Research

- Standards
- Replicates
- Statistics
- Randomization
- Blinding
- Sample Size Estimation
- Inclusion & Exclusion Criteria


PLOS BIOLOGY

OPEN ACCESS

COMMUNITY PAGE

Reporting animal research: Explanation and elaboration for the ARRIVE guidelines 2.0

Nathalie Percie du Sert, Amrita Ahluwalia, Sabina Alam, Marc T. Avey, Monya Baker, William J. Browne, Alejandra Clark, Innes C. Cuthill, Ulrich Dirnagl, Michael Emerson, Paul Garner, Stephen T. Holgate, David W. Howells, [...], Hanno Würbel

Uptake relatively poor[1,2], despite:

- Similar guidelines developed by others[3]
- Incorporating evaluation in grant applications[4]
- Multiple targeted educational programs[5,6]

In short: ISLAGIATT does not seem to have worked

[1]Moher et al 2015; [2]Hair et al 2019; [3]Percie du Sert et al 2020; [4]NIH 2019; [5]NIH; [6]Enhancing Quality in Preclinical Data Summer School

Objective:

To systematically identify **barriers** and **enablers** **to implementing and reporting** the NIH principles & guidelines for preclinical research

Lalu et al 2024 *PLOS Biology*

Methods:

- Qualitative 1:1 interviews with preclinical PIs/Investigators and highly qualified personnel from two national cancer and cardiovascular Canadian networks in Fall 2018
- Interview topics and coding/analysis guided by the Theoretical Domains Framework
- Mapping of barriers/enablers to solutions using Behaviour Change Wheel and ERIC taxonomy

TDF Domains
Knowledge
Skills
Memory, attention and decision processes
Behavioural regulation
Environmental context and resources
Social Influences
Beliefs about capabilities
Intention
Goals
Social/professional role and identity
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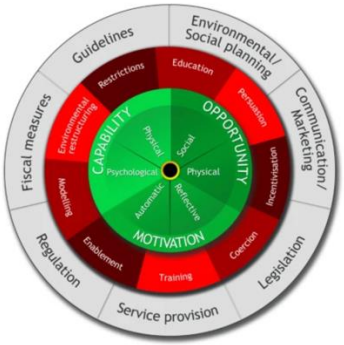

RESEARCH Open Access

A refined compilation of implementation strategies: results from the Expert Recommendations for Implementing Change (ERIC) project

Byron J Powell[1*], Thomas J Waltz[2], Matthew J Chinman[3,4], Laura J Damschroder[5], Jeffrey L Smith[6], Monica M Matthieu[6,7], Enola K Proctor[8] and JoAnn E Kirchner[6,9]

Demographics

Table 1. Participant characteristics.

Characteristic	Frequency or median (*N* = 30)
Median age (range) in years	42 (27–66)
Gender	
Male	19
Female	11
Career level	
Investigators	17
Highly qualified personnel*	13
Primary area of research	
Cancer	15
Cardiovascular	15
Median experience conducting preclinical in vivo work (range) in years	13 (1–42)
Median length of interview (range) in minutes	42 (26–69)

Lalu et al 2024 *PLOS Biology*

Global Themes – Barriers

Barrier Theme 1: Variability in awareness and current practices TDF: Knowledge, Skills	• Varied awareness of guidelines and current practices • Varied training (formal/informal) • Varied current practices (least experience with inclusion/exclusion criteria, sample size estimation, reporting standards)

"...we do have inclusion and exclusion criteria, but they tend to be, post analysis, not, we don't normally decide them, before the start of the experiment because all of the stuff we do is kind of new and sometimes we don't really know what to expect, right, we cross the bridge when we get there. So it's, I would say inclusion/exclusion criteria might be, might be something that we could improve..."—Participant 18

"...so we don't necessarily calculate in advance the sample size, doing power analysis, you know this is not something, we probably should do it, I don't see any barrier for doing it except the knowledge barrier..."—Participant 17

"...we haven't randomized. I mean the randomization we do is whatever animal is available ...we don't actually flip a coin and do mutant first, wild type, it's just, it's kind of random in a way that whatever's available we perform the experiment. ...the labs that I've worked with we've never randomized our samples."—Participant 19

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Global Themes – Barriers

Barrier Theme 2: Costs and challenges of implementing the guidelines TDF: Beliefs about Consequences, Beliefs about Capabilities, Environmental Context and Resources, Goals	• Perceived cost and feasibility issues seen as barriers (time, costs, personnel) • Nature of experiment (e.g. model, exploratory research)

". . .there needs to be enough flexibility with respect to sample size and replicates. . . If you can't justify 30 animals to animal care, [if] you can't afford to purchase, house, maintain and then conduct experiments on 30 animals then pay the people who have to do it, then I think it could, in theory, set the institution [of] science up for a failure in that they might miss something that is potentially a building block to a large discovery. It has potential to be prohibitive to a not extremely largely staffed, well-funded lab."—Participant 7

"If it's something that's at a sort of mature stage. . .then yes I would say those guidelines are practical and important. For more exploratory experimental studies, where we're just trying to get at a picture of the landscape for everything, we don't really implement those things naturally because we're still trying to sort out technical things or whatnot. And all the data that would come out of it we would still use to guide next steps."—Participant 11

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Global Themes - Enablers

Enabler Theme 1: Benefits and proficiency increase motivation and intentions TDF: Beliefs about consequences, Goals, Beliefs about capabilities, Nature of Behaviour, Intention	• Perceived benefits motivating (e.g. good scientific practice, needed to publish, requirements) • Motivated if felt to be logistically and personally feasible

"The most important thing is we want to do good research that is reproducible, rigorous, and with high translational potential for the health of the population."—Participant 2

"Yes, I mean to the best. . .that we can. And I would certainly go back at this and look at it in a little bit more detail to see how similar or different it is to what we're actually doing in practice right now. Just reading some of these things, I can see that there are things we can improve on and maybe work to implement. But some of these other things, biological and technical replicates, those are things we've always included in our experiment design."—Participant 8

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Global Themes - Enablers

Enabler Theme 2: Need for support, resources and system level changes TDF: Environmental Context & Resources, Behavioural Regulation, Reinforcement, Social Influences, Social, Professional Role & Identity	• General education or training (esp. early in career/trainees) • Work in teams and need additional personnel

"Everyone needs to be on the same page and. . .it would be good if there was someone who sort of had all this knowledge that you could just go to and get help with for designing your study."—Participant 10

"I think especially for the trainees, there needs to be a certain level of formal training along these lines. Because that doesn't exist now, at all. It's left really up to the PIs to do it, and then the PIs biases get involved in it and those biases are driven by funding and other kinds of factors. And so I think that kind of training has to start really early. The early stages of graduate school and so on. This is the gold standard that we have to subscribe to, and we're expected to follow those rules."—Participant 6

"I think really having someone in the lab that's really expert with the guidelines and really know what to do and how to do it would be the best. So then when you arrive in the lab that's doing preclinical research, that person is showing you how to do it so, you learn from then and you learn the best way to do it at the beginning. So, then it becomes routine."—Participant 15

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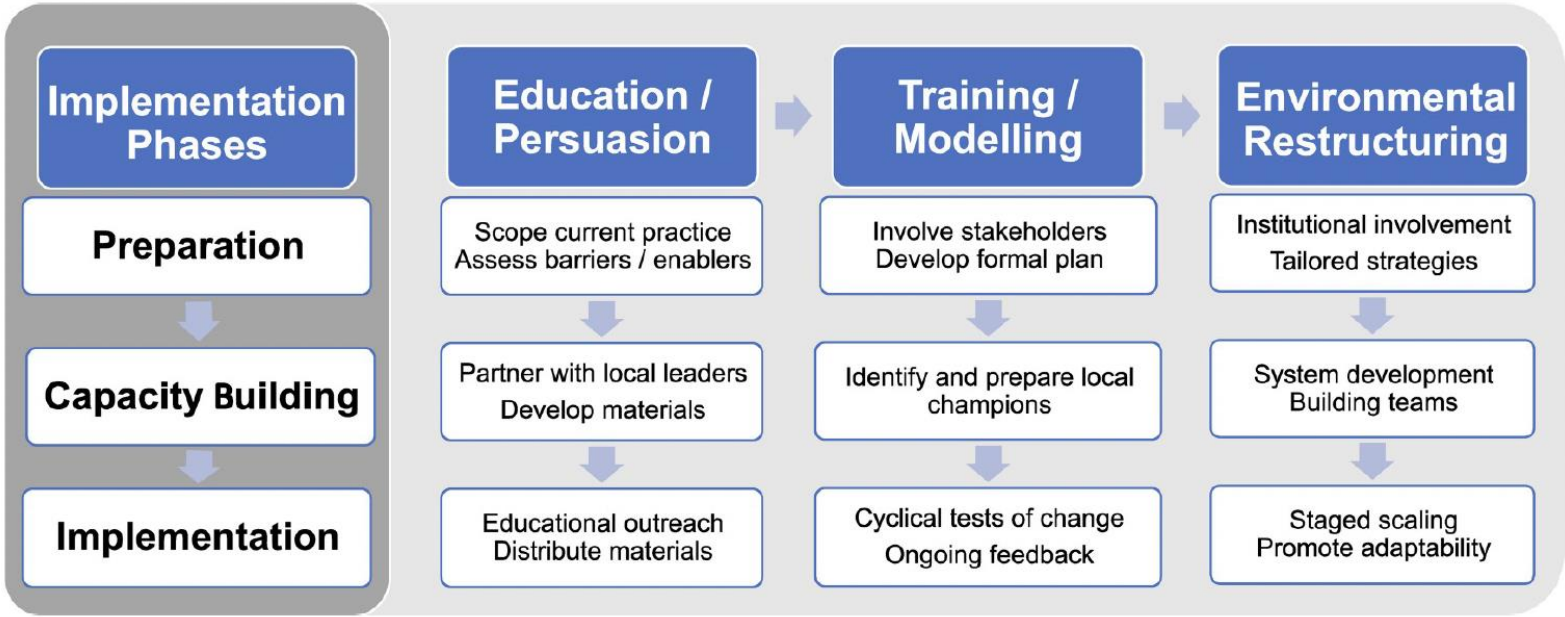
Mapping barriers to solutions using the Behaviour Change Wheel and ERIC



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Take home messages

Overall take home messages

- Implementation ≠ Implementation *Science*
  - Implementation Science = scientific study of the determinants, processes and outcomes of implementing evidence into practice and moving innovations into routine use
  - Fundable, publishable, core research activity
- Don't jump straight to solutions: Developing solutions before understanding the problem risks developing elegant solutions to non-problems, or the wrong solution
- Drawing upon Implementation Science can avoid pitfalls of ISLAGIATT and promote a shared understanding of what works to improve care
- Lots of progress in 20 years: An exciting, vibrant field with potential to contribute novel approaches to improve healthcare
  - Early efforts show the value of applying methods of ImplSci ***earlier*** in the research process: Lots of opportunity and we are keen to collaborate

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