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REVIEW

HEALTH CARE SCIENCE

Implementation science: A critical but undervalued part of the healthcare innovation ecosystem

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Abstract

Healthcare systems face many competing demands and insufficient resources. Service innovations to improve efficiency are important to address this challenge. Innovations can range from new pharmaceuticals, alternate models of care, novel devices, and the use other technologies. Suboptimal implementation can mean lost benefits. This review article aims to highlight the role of implementation science, summarize how settings have leveraged this methodology to promote translation of innovation into practice, and describe our own experience of embedding implementation science into an academic medical center in Singapore. Implementation science offers a range of methods to promote systematic uptake of research findings about innovations and is gaining recognition worldwide as an important discipline for health services researchers. Health systems around the world have tried to promote implementation research in their settings by establishing (1) dedicated centers/programs, (2) offering funding, and (3) building knowledge and capacity among staff. Implementation science is a critical piece in the translational pathway of "evidence to innovation". The three efforts we describe should be strengthened to integrate implementation science into the innovation ecosystem around the world.

KEYWORDS
evidence translation, implementation research, intervention

1 | INTRODUCTION

All health care systems face increased demands from aging populations and growing rates of chronic disease. They also have to deal with a pipeline of new diagnostics, therapeutics and models of care, some of which have high additional costs for only a modest improvement in outcomes [1]. Traditionally, countries have responded to these pressures by increasing the proportion of gross domestic product (GDP) they allocate to health services. However this may not be a sustainable solution. Once more than 10% of GDP is used for health services, policy makers have tended to draw a line, and apply a policy of cost containment [2]. This may require decision makers to assemble evidence that shows a new innovation is indeed cost-effective in the context of their current

Abbreviation: GDP, gross domestic product.

services [3]. Solutions that allow patients to be managed at lower cost are increasingly popular, and high-cost services that provide low value to patients are now scrutinized more carefully than before [4].

Given the economic challenges to health services, there is scope and need for innovations, which can be broadly thought of as turning good ideas into a practical solution [5]. A salient example is a deep learning system in ophthalmology for mass screening of eye diseases such as diabetic retinopathy, where early detection and management would result in better health outcomes for patients and significant cost-savings for the healthcare system [6–8]. New models of care may involve patient activation, role-substitution and extended scopes of practice for healthcare workers in a bid to enlarge the pool of appropriately skilled staff while responsibly devolving care to optimize manpower cost. They hold promise for increasing value in healthcare [9, 10]. In addition, clinical pathways that leverage telehealth, tele-monitoring, mHealth, and the internet of things are increasingly necessary for meeting the challenges of timely and equitable access to healthcare, amidst the current pandemic and future global crises [11, 12]. While these examples suggest innovations are fancy new inventions, they can in fact also be simple evidence-based interventions, for example, adopting a cholesterol-lowering drug shown to lower the risk of major cardiac adverse events.

We are currently not fully reaping the benefits of these evidence-based healthcare innovations due to a lack of implementation [13]. The time lag between research evidence and clinical practice has been estimated to be about 17 years [14, 15], an expensive opportunity cost which merits focussed efforts into translation and implementation [16]. This estimate was derived from studies conducted between 1968 and 1997 and there might have been improvements since. However, considering studies up to 2005 measuring the time from [17] publication to guideline, the lag is still significant at a mean of 9 and 13 years for mental health and cardiovascular diseases, respectively [17]. The reasons for this time lag are manifold and include both the lack of ring-fenced funding for implementation as well as the need for more agile implementation research methods [18]. In low-resource countries, we must also acknowledge and address on-the-ground realities such as scarcity of support and resources [19].

This review article aims to highlight the role of implementation science, summarize how settings have leveraged this methodology to promote translation of innovation into practice, and describe our own experience of embedding implementation science into an academic medical center in Singapore.

2 | ROLE OF IMPLEMENTATION SCIENCE

Implementation science is a multidisciplinary and emerging field that investigates how best to put an innovation into practice and sustain it, after efficacy has been demonstrated. It can be defined as the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice and, hence, to improve the quality and effectiveness of health services [20]. There are several good introductory articles on implementation science readers can refer to [21–23]. The goal of implementation science is primarily to systematically understand the processes, barriers and facilitators across multiple contextual levels that affect implementation success, and to develop and test implementation strategies to increase uptake of the innovation by overcoming the barriers and/or enhancing the facilitators [22].

The implementation questions that would be relevant differ, depending on the stage of implementation and/or any specific implementation challenge faced. Importantly, key stakeholders should be involved early, and the research goals agreed amongst them. Although implementation science focuses on the later stage of the translation pathway, bringing it in earlier in the developmental process, where effectiveness is still being assessed, is possible and in fact beneficial. Effectiveness-implementation hybrid designs assess varying degrees of implementation outcomes alongside effectiveness and can allow researchers to gain useful information to design more effective implementation strategies and thus reduce the translation timeline [24]. Similarly, even quality improvement initiatives, where many innovations tend to arise from, can also benefit from the application of implementation science tools and methods [25]. In essence, implementation research is real-world, real-time research that addresses real implementation challenges [26].

The importance of implementation science has been gaining traction worldwide. There have been recommendations for prospective research on implementation and sustainability, and even advocacy for reporting of implementation factors in evidence syntheses [27, 28]. However, implementation science is still not leveraged effectively in many places [29]. This could partly be attributed to the lack of implementation science expertize and basic understanding of implementation science among healthcare staff, who are often important stakeholders in the implementation of many innovations.

3 | PROMOTION OF IMPLEMENTATION RESEARCH AROUND THE WORLD

There were three detailed reports from different settings on how implementation science was embedded to promote innovation translation [29–31]. From these reports, we observed three main approaches to promote the use of implementation research: dedicated centers/programs, dedicated funding, and capacity-building.

3.1 | Dedicated centers/programs

Many settings in recent years have focused efforts to incorporate implementation science formally into innovation ecosystems and to build the capacity for it. Innovation centers are an increasingly common setup within health systems, but they vary in their aims, areas of focus and structures [32]. One example of an innovation center with a mission to use implementation science is The Indiana University Center for Healthcare Innovation and Implementation Science (IU-CHIIS), which successfully scaled up two innovations, created the first Certificate in Innovation and Implementation Science in the United States and secured federal research funding within its first two years [30].

Other settings may not have a dedicated center but have programs specifically to leverage implementation science to promote innovation translation. The University of Kentucky Value of Innovation to Implementation Program (VI^2P) offers awards for pilot projects where including an implementation framework is required and implementation outcomes are encouraged [29], and the Veterans Health Administration (VHA) Office of Research and Development (ORD) also funds implementation science as part of the Research Lifecycle, a framework specifying the pathway from discovery to implementation of innovations, to enhance the Learning Health System [31].

3.2 | Dedicated funding

Providing funding for implementation research is another common strategy to encourage implementation research. This is given in the University of Kentucky VI^2P, which generated much enthusiasm and resulted in upskilling of clinicians in implementation science and collaborations for implementation science projects [29]. In addition, the Research Lifecycle by the VHA ORD, created new funding opportunities for implementation science not otherwise available from federal research funders [31]. Increasingly, some funders such as the Canadian Institute of Health Research, are also requiring an implementation plan as part of the project proposal [33].

3.3 | Capacity building

Teaching and training initiatives for implementation science is another key pillar for encouraging implementation research. This is also embedded in efforts in dedicated centers/programs. For example, in the University of Kentucky VI^2P, principal investigators who were new to conducting implementation studies also had to attend a 2h training workshop and could consult experts [29]. A recent systematic review found 41 distinct capacity building initiatives across eight countries but primarily in the United States, with varying target professions, delivery formats, durations, structures, and contents [34]. Though participants generally found the initiatives helpful in increasing their knowledge and encouraging them to engage in implementation research, substantial gaps remain in implementation science training. Training is still relatively infrequent and inaccessible due to strict eligibility criteria, lack of institutional support, lack of awareness and/or competing demands [34]. More strikingly, training initiatives are still lacking in many parts of the world, especially in low and middle-income countries. This is evident in a recent systematic review of evidence-based practice implementation in China which revealed suboptimal use of implementation frameworks, weak research designs, nonsystematic development of implementation strategies, and inconsistent and inadequate reporting of implementation strategies [35]. Recognizing this gap, the World Health Organization has also developed training tools and activities, such as the Implementation Research Toolkit and Massive Open Online Course developed by the Special Program for Research and Training in Tropical Diseases, to enable implementation research for solving local pressing health problems with existing evidence-based practices in low and middle-income countries [36].

4 | EFFORTS TO PROMOTE IMPLEMENTATION RESEARCH IN SINGAPORE

A common and key enabler across the three main thrusts to promote the use of implementation science is leadership support and funding [29, 31], There is a positive trend in these aspects in recent years in Singapore. On the national level, implementation science

has become one of the strategic areas for the prestigious Singapore Translational Research Investigator Award and the newly revamped Population Health Research Grant from the National Medical Research Council [37].

SingHealth, the largest healthcare cluster in Singapore, also offers implementation science support through the Health Services Research and Analytics Technologies for SingHealth grant to encourage collaboration between clinicians and academics to improve performance in health services [38]. Within the SingHealth Duke-NUS academic medical centre, implementation science has been explicitly included as one of the research methods in a growing number of research entities such as the Health Services Research Centre, Centre for Population Health Research and Implementation, and the Health Services and Systems Research program in Duke-NUS [39–41]. In parallel, there has been capacity building efforts in the form of implementation science workshops, and a 5-day module as part of the Graduate Certificate in Health Services Innovation launched in 2021 [41, 42]. All these were possible only with leadership support at various levels. First, support from senior management paves the way for access to resources for setting up of these institutional initiatives and lends credibility to them. Second, the successful execution of these initiatives require leadership from those managing them, who should not only believe in the value of implementation science but have a certain level of proficiency in it.

5 | RECOMMENDATIONS FOR INTEGRATING IMPLEMENTATION SCIENCE INTO THE INNOVATION ECOSYSTEM

Current efforts to incorporate implementation science into the innovation ecosystem should continue to be expanded and strengthened.

First, capacity building should target different audiences in appropriate ways. At the very least, awareness of implementation science and its importance should be raised in a broad spectrum of healthcare staff, especially those who tend to be key stakeholders in implementation of innovations. This might be done through various strategies such as seminars, local conferences, publicity of case studies through websites, newsletters and other channels to reach intended audiences. Layering on this, short courses can be offered to interested staff to gain more knowledge and skills to enable them to engage in implementation research. Finally, a core team of implementation researchers can be nurtured through postgraduate studies and mentoring.

Second, innovation grant calls should make implementation science a required component and/or consider the strength of the implementation science component of a proposal an evaluation criterion. This not only signals the importance of implementation science, but it could also increase the chance of success for the innovation by requiring research teams to think about implementation early. As research teams build their experience and confidence in implementation science this could have a positive rollover effect on other projects and grants that may not explicitly require it.

Third, more implementation research can only be made possible with dedicated funding. The bright side is that implementation science is meant to be pragmatic and therefore relatively less resource intensive than efficacy studies. Furthermore, the COVID-19 pandemic has also presented a new set of circumstances that calls for new perspectives and approaches to implementation science, such as innovative ways to collect and use real world data [18]. In some instances, it is even possible to perform implementation research in the absence of funding, as exemplified by a retrospective analysis of factors that enabled zero transmission of COVID-19 to staff during the implementation of community care facilities in the early phase of the pandemic in Singapore [43].

In conclusion, the value of implementation science is being recognized increasingly in healthcare and is worth investing in through institutional commitment, funding and training to in turn reap the returns on investments in innovation development.

AUTHOR CONTRIBUTIONS

Sze Ling Chan: Conceptualization (lead); data curation (lead); writing – original draft (lead); writing – review and editing (equal). **Elaine Lum**: Conceptualization (supporting); writing – review and editing (equal). **Marcus E. H. Ong**: writing – review and editing (equal). **Nicholas Graves**: Conceptualization (equal); writing – review and editing (equal).

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

There is no data for this review.

ETHICS STATEMENT

None.

INFORMED CONSENT

None.

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