REVIEWS

Improvement Science and Implementation Science in Cancer Care: Identifying Areas of Synergy and Opportunities for Further Integration

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Efforts to improve cancer care primarily come from two fields: improvement science and implementation science. The two fields have developed independently, yet they have potential for synergy. Leveraging that synergy to enhance alignment could both reduce duplication and, more importantly, enhance the potential of both fields to improve care. To better understand potential for alignment, we examined 20 highly cited cancer-related improvement science and implementation science studies published in the past 5 years, characterizing and comparing their objectives, methods, and approaches to practice change. We categorized studies as improvement science or implementation science based on authors' descriptions when possible; otherwise, we categorized studies as improvement science if they evaluated efforts to improve the quality, value, or safety of care, or implementation science if they evaluated efforts to promote the implementation of evidence-based interventions into practice. All implementation studies (10/10) and most improvement science studies (6/10) sought to improve uptake of evidence-based interventions. Improvement science and implementation science studies employed similar approaches to change practice. For example, training was employed in 8/10 implementation science studies and 4/10 improvement science studies. However, improvement science and implementation science studies used different terminology to describe similar concepts and emphasized different methodological aspects in reporting. Only 4/20 studies (2 from each category) described using a formal theory or conceptual framework to guide program development. Most studies were multi-site (10/10 implementation

science and 6/10 improvement science) and a minority (2 from each category) used a randomized design. Based on our review, cancer-related improvement science and implementation science studies use different terminology and emphasize different methodological aspects in reporting but share similarities in purpose, scope, and methods, and are at similar levels of scientific development. The fields are well-positioned for alignment. We propose that next steps include harmonizing language and cross-fertilizing methods of program development and evaluation.

KEY WORDS: implementation science; improvement science; quality improvement; cancer.

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INTRODUCTION

In cancer prevention and control, the adoption of evidence into practice remains slow and uneven across regions and care delivery settings, leading to unwarranted variation in cancer care delivery and deficits in quality and safety. In 2013, the National Academy of Medicine (formerly the Institute of Medicine) described cancer care in the USA as a “system in crisis,” calling for efforts to improve accessibility, coordination, and patient centeredness and to better integrate research evidence into oncology practice.¹ Similar concerns have been raised globally, particularly in low- and middle-income countries.²

Efforts to improve cancer care delivery in the USA and abroad are driven primarily by two fields: improvement

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science and implementation science. Broadly, improvement science refers to systems-level efforts to improve the quality, value, and safety of health care.³ Implementation science refers to efforts to promote the systematic uptake of evidence-based interventions into practice and policy.⁴ Although their goals are complementary, the two fields have developed independently from different philosophical underpinnings: Improvement science from industry, takes a more pragmatic approach to the reduction of poor performance in health,⁵ whereas implementation science from behavioral science focuses on a need to change behavior across multiple levels of influence to adopt and sustain new evidence in practice.⁶ The fields interact sporadically and remain relatively isolated from one another with respect to terminology, methodology, and integration within health care delivery systems.⁴

Due to their relative isolation, implementation and improvement science have not realized potential synergies to drive positive change in cancer care delivery. As a result, gaps and inequities in the delivery of high-quality, evidence-based cancer care persist across the continuum of care from prevention to treatment to survivorship and end-of-life care. We hypothesize that each discipline has qualities the other could benefit from, and that aligning and cross-fertilizing the fields could reduce silos and duplication, expand the range of methodologies available to those working to improve cancer care delivery, and potentially accelerate the process of improvement. To better understand how implementation science and improvement science are currently being applied to advance cancer care delivery, and to characterize commonalities and differences in the scope and methodology of the two fields, we conducted a review of highly cited improvement science and implementation science studies in cancer care. Specifically, we considered similarities and differences in their objectives, methods, and approaches to practice change. Our objective was to generate preliminary data to inform future efforts to enhance alignment and cross fertilization between the two fields. Our long-term goal is to promote knowledge sharing across the fields to accelerate improvements in cancer care delivery.

METHODS

With support from a medical librarian (SJK), we searched PubMed for articles published between January 1, 2014, and March 1, 2019, that included terms related to “cancer” and “implementation” or “improvement” in their titles and/or abstracts. We limited our search to 17 peer-reviewed journals commonly accessed by the research team that regularly publish implementation science and/or improvement science studies in the area of cancer care (Table 1). PubMed indexes all 17 of these journals, so it was possible to search all 17 using only PubMed. Details of our PubMed search strategy are presented in Table 2.

Table 1 Peer-Reviewed Journals Included in the PubMed Search

Journal	PubMed abbreviation	Impact factor
Journal of Nursing Care Quality	J Nurs Care Qual	1.191
Research Nursing in Health	Res Nurs Health	1.678
International Journal for Quality in Healthcare	Int J Qual Health Care	1.829
BMC Health Services Research*	BMC Health Serv Res	1.932
Clinical and Translational Science	Clin Transl Sci	1.954
Journal of Clinical and Translation Science	J Clin Transl Sci	1.954
Journal of Advanced Nursing	J Adv Nurs	2.267
Journal of Oncology Practice*	J Oncol Pract	2.509
Journal of the American Board of Family Medicine*	J Am Board Fam Med	2.515
Translational Behavioral Medicine*	Transl Behav Med	2.521
Medical Care*	Med Care	3.081
American Journal of Public Health*	Am J Public Health	4.138
Implementation science*	Implement Sci	4.345
American Journal of Preventive Medicine*	Am J Prev Med	4.527
Journal of General Internal Medicine*	J Gen Intern Med	4.606
BMJ Quality and Safety	BMJ Qual Saf	7.226
Annual Review of Public Health	Annu Rev Public Health	9.491

*Published one or more studies included in the final review and analysis

Using the Rayyan screening tool,⁷ two authors (DKC and LLZ) reviewed the titles and abstracts of all articles returned by the PubMed search, to make decisions about inclusion. First, we developed a coding structure for inclusion and exclusion criteria by independently reviewing the titles and abstracts of the same 50 articles, then meeting to resolve discrepancies and clarify decision rules (e.g., to allow for inclusion of de-implementation studies). Next, we each reviewed half of the remaining articles for inclusion, noting articles that required further discussion. Decisions about the inclusion and categorization of these articles were reached through consensus-based discussion, with a third author (BK) providing adjudication. Finally, within each category (implementation science or improvement science), we ordered included articles by number of citations, using the Web of Science Citation Index. We selected the 10 most highly cited articles from each category for inclusion in the analysis, using number of citations as an indicator of study impact.^{8, 9}

When reviewing, we considered articles eligible for inclusion if they evaluated interventions or strategies aimed at improving cancer care delivery and related to implementation science or improvement science. Specifically, articles were included if their titles and/or abstracts made specific reference to implementation science (e.g., implementation strategy or evidence-based intervention) or improvement science (e.g., quality improvement or process improvement), or if they met commonly used definitions of either discipline. Based on these definitions, implementation science studies evaluated efforts to promote the adoption and implementation of evidence-based interventions into practice,⁴ and improvement science studies evaluated efforts to improve the quality, value, or

Table 2 PubMed Search Strategy

Search #	Query
1—Journals (ISSN)	1353-4505 OR 2044-5415 OR 1057-3631 OR 0309-2402 OR 1748-5908 OR 1613-9860 OR 0025-7079 OR 0163-7525 OR 0160-6891 OR 1554-7477 OR 1752-8054 OR 0090-0036 OR 0749-3797 OR 1557-2625 OR 0884-8734 OR 1472-6963 OR 2059-8661
2—Terms related to “Cancer”	Neoplasms[Mesh] OR neoplasms[tiab] OR cancer[tiab] OR cancers[tiab] OR cancerous[tiab] OR tumor[tiab] OR tumour[tiab] OR tumors[tiab] OR tumours[tiab] OR carcinoma[tiab] OR carcinomas[tiab]
3—Terms related to “Improve” OR “Implement”	(implement[tw] OR implementing[tw] OR implemented[tw] OR implements[tw] OR adoption[tw] OR adopt[tw] OR adopted[tw] OR adopts[tw] OR uptake[tw] OR use[tw] OR dissemination[tw] OR disseminating[tw] OR disseminated[tw] OR “knowledge transfer”[tw] OR “knowledge translation”[tw]) OR (improvement[tw] OR improve[tw] OR improved[tw] OR improves[tw] OR improving[tw] OR increase[tw] OR increasing[tw] OR increases[tw] OR increased[tw] OR reduce[tw] OR reducing[tw] OR reduces[tw] OR reduced[tw] OR decrease[tw] OR decreased[tw] OR decreasing[tw] OR decreases[tw])
4	1 AND 2 AND 3
5—Dates	Published between January 1 st , 2014 and March 1 st , 2019
TOTAL SEARCH BLOCK	((1353-4505 OR 2044-5415 OR 1057-3631 OR 0309-2402 OR 1748-5908 OR 1613-9860 OR 0025-7079 OR 0163-7525 OR 0160-6891 OR 1554-7477 OR 1752-8054 OR 0090-0036 OR 0749-3797 OR 1557-2625 OR 0884-8734 OR 1472-6963 OR 2059-8661)) AND (Neoplasms[Mesh] OR neoplasms[tiab] OR cancer[tiab] OR cancers[tiab] OR cancerous[tiab] OR tumor[tiab] OR tumour[tiab] OR tumors[tiab] OR tumours[tiab] OR carcinoma[tiab] OR carcinomas[tiab])) AND ((implement[tw] OR implementing[tw] OR implemented[tw] OR implements[tw] OR adoption[tw] OR adopt[tw] OR adopted[tw] OR adopts[tw] OR uptake[tw] OR use[tw] OR dissemination[tw] OR disseminating[tw] OR disseminated[tw] OR “knowledge transfer”[tw] OR “knowledge translation”[tw]) OR (improvement[tw] OR improve[tw] OR improved[tw] OR improves[tw] OR improving[tw] OR increase[tw] OR increasing[tw] OR increases[tw] OR increased[tw] OR reduce[tw] OR reducing[tw] OR reduces[tw] OR reduced[tw] OR decrease[tw] OR decreased[tw] OR decreasing[tw] OR decreases[tw]))

Search conducted on March 1, 2019

safety of care.³ Included studies were categorized as implementation science or improvement science according to authors’ descriptions where possible, or else according to these definitions.

Studies could address any aspect of cancer care, from prevention, to treatment, to end-of-life care. We excluded commentaries, reviews, case reports, and practice guidelines; studies that did not relate to cancer prevention or control; and cancer prevention or control studies focused on clinical effectiveness.

Four authors (DKC, LLZ, MD, BK) developed an abstraction form based on improvement science and implementation science concepts previously described by members of our team⁴ in addition to the Standards for Reporting Implementation Studies (StaRI)¹⁰ and Standards for Quality Improvement Reporting Excellence (SQUIRE) 2.0³ guidelines. These standards were established in 2015 and 2017, respectively. The SQUIRE 2.0 guidelines are intended to guide research using any method to improve healthcare. The StaRI guidelines apply more specifically to studies that aim to improve the implementation and scaling up of effective healthcare interventions (or discontinuation of ineffective or harmful interventions).

We conducted a pilot test of the abstraction form in which four authors (DKC, LLZ, MD, BK) abstracted data from five common articles, to refine the data abstraction process and ensure consistency. Each of the four authors then independently abstracted a subset of the 20 articles (10 implementation science and 10 improvement science). One author (DKC) reviewed all abstracted information for accuracy. The final set of 10 implementation science and 10 improvement science studies were then characterized and compared with respect to their objectives, methods, and approaches to practice change.

RESULTS

Search Results

The PubMed search returned 1,381 unique articles. After title and abstract review, 90 studies categorized as implementation or improvement science remained. Reasons for the exclusion of articles are shown in Figure 1. From these 90 studies, we retained the 10 most highly cited studies from each category for inclusion in the analysis, for a total of 20 studies. Included studies were cited an average of 8 times (mean: 11 for improvement science and 6 for implementation science).

Basic Study Characteristics

Most articles (14/20) reported on studies conducted in the USA. Studies addressed cancer prevention (2/20),^{11, 12} screening (8/20),^{13–20} diagnosis (1/20),²¹ treatment (5/20),^{22–26} and supportive, palliative, or psychosocial care (4/20).^{27–30} Implementation science studies (8/10) typically focused on cancer prevention or screening, while improvement science studies were more distributed across the cancer care continuum. Studies had been published in nine of the 17 searched journals, including one cancer-specific journal (Table 3).

Study Objectives, Setting, and Design

Of the 10 studies categorized as implementation science, 9 sought to improve uptake of an evidence-based practice (e.g., cervical cancer screening) or program (e.g., a skin cancer prevention program). The final implementation science study focused on discontinuation of a practice lacking evidence of benefit, namely PSA screening for men aged 75 years or older.¹⁶

Figure 1 Reasons for exclusion of studies.

Among the studies categorized as improvement science, 6/10 aimed to improve uptake of evidence-based and/or guideline-recommended practices, including, for example, cancer screening, emotional distress screening, radiation treatment peer review, and timely antibiotic administration for febrile neutropenia.^{19, 20, 22, 24, 26, 29} The remaining improvement science studies sought to improve clinical or utilization outcomes such as unplanned readmissions, reducing costs, and/or addressing logistical issues in care delivery.

All (10/10) studies categorized as implementation science and 6/10 studies categorized as improvement science^{19–23, 29} were conducted across multiple sites (e.g., clinics, hospitals, schools). For most (7/10) multi-site implementation science studies, and all (6/6) multi-site improvement science studies, the multiple study sites were part of the same health system or network.

Table 3 shows that implementation and improvement science studies typically used basic observational study designs, such as a single group pre-test post-test design (4/10 implementation science and 6/10 improvement science).^{12–15, 23–26, 29} Only 4/20 studies (2/10 implementation science and 2/10 improvement science)^{11, 20, 21, 28} used a randomized controlled trial (RCT) design to evaluate the program of interest.

Development and Components of the Program Under Study

Implementation science studies (6/10) referred to programs designed to promote practice change as “strategies” or as a

collective “strategy”^{11, 13, 15, 17, 27, 28} while improvement science studies (6/10) used the term “intervention.”^{19–21, 26, 29, 30} The remaining improvement science studies (4/10) used a more specific term to describe the program under study, for example, “care pathway,” or referred to a broad approach, such as “change management initiative.”

Across all 20 studies, only 4 (2 from each category) described a theoretical or conceptual basis for development of the program (Table 3). Both implementation science studies^{11, 18} applied the Diffusion of Innovations Theory in developing the program under study; one of these studies also used Social Cognitive Theory.¹¹ One of the improvement science studies described a specific “conceptual model of primary care delivery” as the basis for their program,¹⁹ and another used the Community Health Advisors Network Model.²⁴

Studies categorized as improvement science generally provided more information about the context in which care delivery gaps were identified and prioritized, and solutions developed. For example, 4/10 improvement science studies described conducting a current state analysis to identify or better understand the problem;^{22, 25, 26, 29} 3/10 described convening a group of local stakeholders to address the problem;^{22, 23, 29} and 2/10 described conducting a barriers assessment to inform program development.^{22, 29} Descriptions of the context surrounding program development in implementation science studies generally contained less detail; 4/10 studies in this category provided baseline data to

Table 3 Study Details

Studies categorized as implementation science						
Author, journal, year, country	Title	Objective(s)	Setting	Evaluation design	Use of theory	Approaches to practice change
Arrossi, Implement Sci, 2017, Argentina	Evaluation of scaling-up of HPV self-collection offered by community health workers (CHWs) at home visits to increase screening among socially vulnerable under-screened women in Jujuy Province, Argentina	To (1) evaluate the effectiveness of an evidence-based self-collection strategy on screening uptake among under-screened women when implemented province-wide; (2) evaluate adoption of the strategy by CHWs; and (3) identify implementation barriers	Jujuy province public health system, including 270 primary health care centers and 700 CHW	Single-group pre-test post-test design	None	Education/training
Bharel, Am J Pub Health, 2015, USA	Eliminating Health Disparities: Innovative Methods to Improve Cervical Cancer Screening in a Medically Underserved Population	To improve cervical cancer screening rates among homeless women	Boston Health Care for the Homeless program (Boston, MA), which includes 70 community sites	Single group pre-test post-test design	None	Education/training; decision support; feedback; workflow modification; rapid cycle testing
Glanz, Am J Pub Health, 2015, USA	Randomized Trial of Two Dissemination Strategies for a Skin Cancer Prevention Program in Aquatic Settings	To evaluate the effects of 2 strategies (basic vs. enhanced) for dissemination of the Pool Cool skin cancer prevention program on (1) program implementation, maintenance, and sustainability; (2) improvements in organizational and environmental supports for sun protection at swimming pools; and (3) sun protection habits and sunburns among children	Outdoor swimming pools in 33 metropolitan areas across the USA	Randomized controlled trial (RCT)	Social cognitive theory; diffusion of innovations theory; and theories of organizational change	Education/training; feedback
Mader, Am J Fam Med 2016 USA	A Practice Facilitation and Academic Detailing Intervention Can Improve Cancer Screening Rates in Primary Care Safety Net Clinics	To evaluate the efficacy and feasibility of an academic detailing and practice facilitation strategy to increase screening rates	3 practice-based research networks in Central and Western New York, including 23 federally qualified health centers	Single group pre-test post-test design	None	Education/training; workflow modification
McCarter, Transl Behav Med, 2018, Australia	Effectiveness of clinical practice change strategies in improving dietitian care for head and neck cancer patients according to evidence-based clinical guidelines: a stepped-wedge RCT	To assess the impact of practice change strategies on implementation of clinical practice guidelines for nutritional management of patients with head and neck cancer	Radiotherapy departments in 5 hospitals	Stepped-wedge RCT	None	Education/training; decision support; feedback
Shelton, J Gen Intern Med, 2015, USA	Reducing PSA-Based Prostate Cancer Screening in Men Aged 75 Years and Older with the Use of Highly Specific Computerized Clinical Decision Support	To assess whether implementation of a point-of-care computerized clinical decision support tool resulted in a reduction in inappropriate PSA screening in the elderly	All outpatient clinics in the Veterans Affairs Greater Los Angeles Healthcare System including a hospital-based primary care clinic, two ambulatory care centers, and eight community-based outpatient clinics	Interrupted time series	None	Decision support
Stock, Implementation Science, 2015, Canada	Mailed participant reminders are associated with improved colonoscopy uptake after a positive FOBT result in Ontario's	To assess the effect of two strategies on colonoscopy uptake following positive fecal occult blood (FOBT) screening	Ontario's province-wide ColonCancerCheck program, which provides FOBT kits, distributed by primary care providers to eligible adults (an estimated 3.9 million individuals)	Segmented time series regression	None	Decision support; workflow modification

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Table 3. (continued)

Studies categorized as implementation science						
Author, journal, year, country	Title	Objective(s)	Setting	Evaluation design	Use of theory	Approaches to practice change
Tu, Implement Sci, 2014, USA	ColonCancerCheck program Adaptation of an evidence-based intervention to promote colorectal cancer (CRC) screening: a quasi-experimental study	To investigate the adaptation of an evidence-based intervention designed to increase CRC screening in one limited English-proficient (LEP) population (Chinese), for another LEP group (Vietnamese) and to investigate effectiveness of the adapted intervention	Two primary care practices affiliated with the same community health center in Seattle, Washington	Two group pre-test post-test design	Diffusion of innovations theory	Education/training; decision support
Vanderpool, Am J of Prev Med, 2015, USA	Implementation and Evaluation of a School-Based Human Papilloma-virus Vaccination Program in Rural Kentucky	To design, implement, and evaluate the impact of a school-based HPV vaccination program on vaccine initiation and completion among students in two high schools	2 high schools in Kentucky, located in the same county	Single group pre-test post-test design	None	Education/training
Walling, Journal of Oncology Practice, 2017, USA	Effect and Efficiency of an Embedded Palliative Care Nurse Practitioner in an Oncology Clinic	To determine whether implementation of a palliative care nurse practitioner (NP) within an oncology clinic using comprehensive implementation strategies and a shared mental model improves the quality of supportive care provided to patients	2 oncology clinics in the University of California Los Angeles health system	Two group pre-test post-test design	None	Education/training; workflow modification
Berkowitz, 2015, J Gen Intern Med, USA	Building Equity into Quality Improvement: Reducing Socioeconomic Disparities in Colorectal Cancer Screening	To determine if implementation of a system-wide screening intervention could reduce disparities in the setting of overall improved screening rates	18 primary care practice sites around Boston, MA, affiliated with the same practice-based research network	Interrupted time series	Conceptual model of primary care delivery	Workflow modification
Chiang, J Oncol Pract, 2015, USA	Incorporating Patient-Reported Outcomes to Improve Emotional Distress Screening and Assessment in an Ambulatory Oncology Clinic	To improve emotional distress screening and assessment in ambulatory oncology clinics	Smilow Cancer Hospital at Yale Cancer Center in New Haven, Connecticut and two affiliated clinics	Single group pre-test post-test design	None	Workflow modification; rapid cycle testing
Cohen-Cline, Medical Care, 2014, USA	Use of Interactive Voice Response (IVR) to Improve Colorectal Cancer (CRC) Screening	To understand whether IVR could be effective to engage individuals overdue for CRC screening in community practice settings and to determine if the effect would persist over time	Men and women aged 50–81 years who were not adherent to CRC screening, were insured by Group Health in Washington State, and had a primary care physician who was a member of that network	RCT	None	Workflow modification
Fasola, 2014, BMC Health Services Research, Italy	Drug waste minimization as an effective strategy of cost-containment in oncology	To evaluate the impact of a drug waste reduction protocol on drug waste expenditures	Department of Oncology at the University Hospital of Udine	Single group pre-test post-test	None	Guideline or protocol development
Jackman, J Oncol Pract, 2017, USA	Cost and Survival Analysis Before and After Implementation of Dana-Farber Clinical Pathways for Patients with Stage IV	To explore the clinical and financial impact of the creation and implementation of a lung cancer pathway	Patients who were diagnosed with stage IV NSCLC and treated within the Dana Farber Cancer Institute Network	Single group pre-test post-test design	None	Guideline or protocol development; decision support

(continued on next page)

Table 3. (continued)

Studies categorized as implementation science						
Author, journal, year, country	Title	Objective(s)	Setting	Evaluation design	Use of theory	Approaches to practice change
Keng, J Oncol Pract, 2015, USA	Non-Small-Cell Lung Cancer (NSCLC) Reducing Time to Antibiotic Administration (TTA) for Febrile Neutropenia (FN) in the Emergency Department	To assess whether implementation of an FN pathway reduced antibiotic delays and provided improved quality of care for patients, and to identify value in prompt TTA	Adults patients with cancer who presented to the Cleveland Clinic emergency department	Single group pre-test post-test design and cross-sectional design	None	Guideline or protocol development; education/training; workflow modification
Montero, J Oncol Pract, 2016, USA	Reducing Unplanned Medical Oncology Readmissions by Improving Outpatient Care Transitions: A Process Improvement Project at the Cleveland Clinic	To examine the impact of (1) outpatient follow-up appointments within 5 days of discharge and (2) oncology nurse coordinator callbacks within 48 h of discharge on unplanned readmission rates	Palliative medicine and solid tumor oncology inpatient services at the Cleveland Clinic	Interrupted time series	None	Education/training; workflow modification
Reddeman, J Oncol Prac, 2016, Canada	Improving the Quality of Radiation Treatment (RT) for Patients in Ontario: Increasing Peer Review Activities on a Jurisdictional Level Using a Change Management Approach	Assess the impact of the change management initiative on uptake and quality of RT peer review	RT teams in Cancer Care Ontario (CCO)'s 14 regional cancer centers	Single group pre-test post-test	None	Education/training; feedback
Wahlberg, BMC Health Serv Res, 2015, Norway	Impact of Referral Templates on Quality of Referrals from Primary to Secondary Care: a cluster randomized controlled trial	To assess the effects of a referral template intervention on quality of referrals for various conditions, including suspected colorectal cancer	14 primary care practices served by University Hospital of North Norway, Harstad	Cluster RCT		Education/training; feedback; guideline or protocol development

demonstrate a care delivery gap in the setting under study,^{12, 14, 16, 17} and 2/10 referenced a system-wide initiative that prompted program development.^{16, 17}

Overall, approaches to support practice change were similar across study categories (Table 3). Common practice change strategies included education or training of clinicians and staff (4/10 improvement science and 8/10 implementation science) and performance monitoring and feedback to support clinician or staff behavior change (2/10 improvement science and 3/10 implementation science). Both fields used clinical decision support, workflow modifications (e.g., development of patient registries and systems for patient outreach), and rapid cycle testing. Clinical guideline or protocol development and distribution was used in 4/10 improvement science studies^{21, 23, 25, 26} but no implementation science studies. In general, implementation science studies provided more detail about their approaches to practice change. For example, descriptions of clinician or staff training in implementation science studies contained more specificity about the specific approach to training (e.g., academic detailing), its venue, frequency, and resources provided.

DISCUSSION

The fields of improvement science and implementation science have complementary goals but arose from different philosophical underpinnings. The fields have historically interacted sporadically, remaining relatively isolated from one another as they have developed.⁴ We hypothesized that each field has qualities the other could benefit from, and that aligning and cross-fertilizing the fields could lead to more rapid advancement in cancer care delivery. To that end, we reviewed 20 highly cited implementation science and improvement science studies relating to cancer care and found that across the two fields, studies used different terms to describe the program under study (e.g., strategy vs. intervention), and provided differing amounts of detail about the local context surrounding program development and about specific program components. However, they had similar objectives, used similar methods, and employed common approaches to changing practice. In terms of the overall scientific development of each field, we noted only two studies from each category used a theoretical or conceptual model to develop the program under study. These findings lead us to several

practical observations about the commonalities and distinctions between improvement and implementation science.

First, we observed a number of important similarities between the two categories of studies, particularly with respect to their objectives, methods (including setting and evaluation design), and approaches to practice change. Regarding objectives, most studies, regardless of category, sought to improve the uptake of evidence-based and/or guideline recommended programs or practices. With respect to setting, improvement science is often described as being location-specific, while implementation science is often described as focusing on generalizable mechanisms of change across locations.^{4, 31} Yet, nearly all (16/20) studies included in our review were conducted across multiple sites. In most cases, sites were described as being part of the same health care system or network. Regarding study design, improvement science has been described as highly pragmatic, potentially at the cost of attributing observed improvements to the intervention under study, while the field of implementation science is often described as scientific and research-oriented.³¹ Yet the majority of studies from both fields used fairly basic observational methods and therefore were limited in terms of their ability to establish that observed outcomes resulted from the program under study. In recognition of this limitation, the Standards for Quality Improvement Reporting Excellence (SQUIRE) 2.0 guidelines³—published in 2015—emphasize that studies should use methods to establish that observed outcomes were due to the intervention(s) of interest. The Standards for Reporting Implementation Studies (StaRI) guidelines, published in 2017, contain similar language.

Second, the two disciplines have historically been described as taking different approaches to promote practice change (e.g., adapting industrial-based improvement techniques for improvement science and behavioral science techniques for implementation science).³¹ However, in this review, we identified that several approaches to practice change are employed across both improvement science and implementation science studies. For example, education/training is recognized as a common implementation strategy in the implementation science field³² but was also used in nearly half of studies categorized as improvement science. Another example is rapid cycle improvement. Although an established improvement science method derived from the Institute for Healthcare Improvement's "Model for Improvement,"³³ rapid cycle improvement was also employed in one of the implementation science studies included in our review.

Third, despite their similarities, improvement science and implementation science studies differed with respect to the terminology they used to describe the program under study. Specifically, most implementation science studies used the term "strategy" and most improvement science studies used the term "intervention." We also noted differences with respect to the amount of information provided about the context in which gaps in care were identified and prioritized, and solutions developed, with improvement science studies

generally providing more information about these processes. On the other hand, implementation science studies tended to provide more specificity about approaches to practice change.

Finally, our findings suggest that the level of scientific development of both fields is similar. In particular, only two studies from each category used theory. The application of theory has the potential to shorten the time needed to develop interventions, optimize intervention design, identify factors necessary for intervention success, and to enhance learning from these efforts.^{34–38} Both the SQUIRE 2.0 and StaRI guidelines emphasize the importance of applying theory to understand the problem of interest and to develop interventions to address that problem.^{3, 10} It is important to note, however, that SQUIRE 2.0 and StaRI guidelines were published in 2015 and 2017, respectively. Possibly as a result of our focus on more frequently cited articles, several of the studies included in our review were published in or before 2015. More recently, published studies not eligible for inclusion in our targeted review may better align with these standards.

Our study has several limitations. First and foremost, our review is relatively limited in scope as a function of our study objective, which was to generate preliminary data to inform future efforts to enhance alignment between improvement science and implementation science in cancer care. We limited our search to 17 journals identified by a panel of experts as publishers of implementation science or improvement studies, and we focused specifically on improvement science and implementation science studies in the field of cancer care delivery. Among implementation science and improvement science studies relating to cancer care, we purposively selected recently published and higher-impact studies. Consistent with commonly used standards,^{8, 9} higher-impact studies were defined as those that were more frequently cited. It is important to note, however, that the average number of citations for included studies was 8, which is relatively low, likely as a result of our concurrent focus on studies that were published between 2014 and 2019. Without the publication date restriction, we expect that the average number of citations included in our review would have been slightly higher. Finally, our results may not generalize to other cancer-related implementation or improvement science studies, or to studies conducted in other clinical contexts (e.g., behavioral health). However, as the first article, to our knowledge, to empirically compare published studies from each field, our work represents an important first step toward improving alignment between and enhancing the potential of both disciplines for positively impacting cancer care.

The extent of overlap that we observed in the scope and methodology of cancer-related improvement science and implementation science studies highlights opportunities to better align the two fields. The fields are already quite close in several respects, suggesting that stronger alignment has the potential to not only reduce duplication but also, more importantly, to introduce synergies that enhance the potential of both

fields to improve care. By drawing on developed methods from each field rather than re-developing approaches, work can proceed more rapidly. For example, a combined approach might incorporate methods from improvement science for engaging local leadership to identify and prioritize gaps in delivery of evidence-based cancer care, and then use implementation science frameworks to apply or develop strategies to address those gaps. In addition, the iterative nature of improvement science may facilitate the adaption of as evidence-based interventions and/or implementation strategies as they are implemented in practice.³⁹

We noted several instances from the studies reviewed where a more synergistic approach may have benefitted study authors' efforts to improve cancer care delivery. For example, one of the implementation science studies we reviewed (Stock et al.)¹⁷ examined the impact of two sequential implementation strategies—one targeting primary care providers (PCP) and the other targeting patients directly—on patients' uptake of follow-up colonoscopy after a positive fecal occult blood test. The authors observed no increase in colonoscopy uptake in the 8-month period following implementation of the PCP-directed strategy. This study might have benefitted from the inclusion of improvement science methodology, particularly rapid cycle testing, to optimize the PCP-directed implementation strategy.

In addition, a study by Berkowitz et al.¹⁹ tested the impact of a population management intervention on overall rates of colorectal cancer screening and on disparities in screening by educational attainment. The authors observed a 3% increase in screening completion overall, and a modest (< 1% decrease) in screening disparities. As acknowledged by the study authors, systematically assessing and targeting the unique challenges that patients with lower educational attainment face may have reduced disparities to a greater degree. For example, formative research guided by an implementation science framework—such as the Consolidated Framework for Implementation Research⁴⁰—may have revealed that factors at levels beyond patients and providers indirectly contribute to disparities in cancer screening, informing the development of a more comprehensive intervention.⁴¹

Future studies aiming to improve quality of cancer care should ideally involve consideration of methodological approaches from both disciplines at the research design stage. We suggest several steps that may facilitate such alignment, including terminology mapping to clarify differences and unify terms. We also suggest explicit sharing through the development of co-developed standards for rigor in study design and reporting. Funding opportunities are needed that encourage joint leadership of research projects to facilitate novel collaborations that leverage the complementary expertise of implementation and improvement scientists. More broadly, strategies to train, support, and incentivize professionals to work across improvement science and implementation science are critically needed to maximize the potential of both fields to fulfill the shared goal of effecting rapid, positive change in cancer care delivery.

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Compliance with Ethical Standards:

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