Trainee-led research using an integrated knowledge translation or other research partnership approaches: a scoping review

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Abstract

Background: There are increasing expectations for researchers and knowledge users in the health system to use a research partnership approach, such as integrated knowledge translation, to increase the relevance and use of research findings in health practice, programmes and policies. However, little is known about how health research trainees engage in research partnership approaches such as IKT. In response, the purpose of this scoping review was to map and characterize the evidence related to using an IKT or other research partnership approach from the perspective of health research trainees in thesis and/or postdoctoral work.

Methods: We conducted this scoping review following the Joanna Briggs Institute methodology and Arksey and O’Malley’s framework. We searched the following databases in June 2020: MEDLINE, Embase, CINAHL and PsycINFO. We also searched sources of unpublished studies and grey literature. We reported our findings in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Extension for Scoping Reviews.

Results: We included 74 records that described trainees’ experiences using an IKT or other research partnership approach to health research. The majority of studies involved collaboration with knowledge users in the research question development, recruitment and data collection stages of the research process. Intersecting barriers to IKT or other research partnerships at the individual, interpersonal and organizational levels were reported, including lack of skills in partnership research, competing priorities and trainees’ “outsider” status. We also identified studies that evaluated their IKT approach and reported impacts on partnership formation, such as valuing different perspectives, and enhanced relevance of research.

Conclusion: Our review provides insights for trainees interested in IKT or other research partnership approaches and offers guidance on how to apply an IKT approach to their research. The review findings can serve as a basis for future reviews and primary research focused on IKT principles, strategies and evaluation. The findings can also inform IKT training efforts such as guideline development and academic programme development.

Keywords: Integrated knowledge translation, Health research, Research trainees, Partnership approaches, Collaborative research

Introduction

Collaborative research approaches, such as coproduction, codesign, engaged scholarship and integrated knowledge translation (IKT) [1], aim to produce relevant
research partnerships to address healthcare issues. IKT, specifically, focuses on making research more useful through research partnerships. IKT is defined as “a model of collaborative research, where researchers work with knowledge users who identify a problem and have the authority to implement the research recommendations” [2]. Studies have shown that use of an IKT approach improves the quality of research [3], enhances value for research among decision-makers [4], increases capacity among decision-makers for engaging in research [4–6], and creates more impactful and useful research findings [3, 7, 8]. Research partnerships have been shown to be critical during the COVID-19 pandemic, as patients, citizens, healthcare providers, researchers, policy-makers and health system leaders from around world have come together to collectively address this global crisis [9].

Despite the value of IKT and other research partnership approaches, studies report many challenges in establishing and maintaining research partnerships with knowledge users [3, 4, 10]. Significant time is needed to develop trusting, authentic relationships, and there may be insufficient resources to support partnership development and maintenance [10]. Further, differing needs and priorities among researchers and health system decision-makers [3, 4, 10], as well as unclear goals, roles and expectations, can hinder research partnerships [4].

Health system leaders have identified a lack of researcher preparation for engaging in collaborative partnerships as a significant barrier to successful research partnerships [11]. This can lead to ineffective researcher behaviour (e.g., mismatch of researcher interests and organizational needs, lack of researcher understanding of health system context, lack of respect) and affect the development of positive, mutually beneficial research partnerships [11]. Other studies have shown that researchers require specific knowledge and skills for working in partnership with health system decision-makers [12]. However, researchers often do not have the opportunity to learn how to establish effective research partnerships with knowledge users in the health system [10].

Specific training in IKT or other research partnerships is needed to promote collaborative health research moving forward. Most graduate students do not receive formal training in collaborative health research approaches [13, 14]. Efforts are needed to support trainees, defined as graduate students (master’s, doctoral) and postdoctoral fellows, in developing an understanding of health system context and skills to engage in collaborative research partnerships [11, 15]. Such training efforts are essential to support trainees in building trusting, effective relationships with knowledge users to foster meaningful, ethical research with relevant outcomes [16].

Currently, the IKT or research partnership literature describes strategies, barriers and facilitators to research partnerships from the perspective of researchers and knowledge users [10, 11, 17–19]. However, little is known about how trainees engage in research partnership approaches such as IKT. This is needed as a first step to inform research trainees on the use of IKT or other research partnership approaches and future academic training modernization efforts. As such, the purpose of this scoping review was to map and characterize the evidence related to using an IKT or other research partnership approach from the perspective of health research trainees in thesis and/or postdoctoral work.

Methods
We conducted this scoping review following the Joanna Briggs Institute (JBI) methodology [20, 21] and Arksey and O’Malley’s framework [22]. Our a priori protocol has been published previously [23]. This full report followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Extension for Scoping Reviews (PRISMA-ScR) checklist [24] (Additional File 2).

Stage 1: Identifying the research question
We conducted a scoping review to map and characterize the available evidence related to using an IKT approach or other research partnership approach from the perspectives of trainees in thesis and/or postdoctoral work. Specifically, we answered the following research question:

1. How have IKT or other research partnership approaches been applied in thesis and/or postdoctoral health research?

Additional research objectives included:

a. Identifying IKT/research partnership principles, strategies and/or tools used in trainee-led health research
b. Identifying barriers and facilitators to using IKT or other research partnership approaches in trainee-led health research
c. Identifying if/how outcomes were reported and evaluated in trainee-led health research using IKT or other research partnership approaches.

Stage 2: Identifying relevant studies
Participant
This review considered literature for which health research trainees (i.e., graduate students [master’s, doctoral] and postdoctoral fellows) were the primary author/researcher of the paper. Postdoctoral fellows
were described as postdoctoral researchers or postdoctoral research associates. Students/fellows in the position of a trainee meant that the included studies were related to the student’s or fellow’s thesis/programme project/dissertation/fellowship projects.

Concept
This review considered studies that explored IKT or other research partnership approaches in trainee-led health research. We included studies that described the trainee’s experience with IKT research or related partnership approaches (i.e., manuscript or thesis/dissertation chapter that provides a reflection or description of the approach, text or opinion paper describing how the partnership approach was used). Included papers explained how the research partnerships approach was used, including principles, strategies and/or tools. Studies that stated the use of a research partnership approach but did not describe how it was used were excluded. Studies that described barriers and facilitators to using an IKT or other research partnership approach were included. Studies that evaluated the IKT approach were also included. Papers that did not describe a research study were excluded as wrong design. For this review, we used the following operational terms and definitions (Table 1).

Context
We considered literature focused on trainee-led health research. For the purpose of this review, health research referred to research that aimed to “increase our knowledge of health, disease, and health services, and to then apply that knowledge to help people lead healthier lives” [25]. It also included “biomedical research, epidemiological studies, and health services research, as well as studies of behavioral, social, and economic factors that affect health” [26].

Search strategy
In collaboration with a health science librarian, we developed a search strategy to locate both published and unpublished primary studies, reviews, and text and opinion papers. Hoekstra and colleagues’ [27] comprehensive search strategy for synthesizing the research partnership literature was used to inform our search strategy. We followed the three-step process in accordance with the JBI Scoping Review Methodology. First, we conducted an initial limited search of MEDLINE and CINAHL to identify articles on the topic. Second, from the selected articles, we derived relevant text words and index terms to develop a full search strategy. Third, the search strategy, including all identified keywords and index terms, was adapted for all included information sources. We searched the following databases on 24 June 2020: MEDLINE (Ovid), Embase (Elsevier), CINAHL (EBSCO) and PsycINFO (EBSCO). The final search strategy for each database can be found in Additional file 1. We included peer-reviewed studies, editorials and commentaries. We also searched sources of unpublished studies and grey literature (not empirical studies) including ProQuest Dissertation & Theses Global databases (ProQuest) and the first 50 pages of Google Scholar during the period of September–November 2020. Only papers published in English were included. No date limits were applied, to allow for exploration of the use of IKT or other research partnership approaches in trainee-led research over time. We also used websites of research and academic institutions and health system organizations, together with concept papers, reports and blog posts, that reported non-peer-reviewed literature. We searched relevant websites of professional bodies or organizations such as the Integrated Knowledge Translation Research Network (IKTRN), Strategy for Patient-Oriented Research (SPOR) SUPPORT [Support for People and Patient-Oriented Research and Trials] Units, National Institutes of Health (NIH) Dissemination & Implementation, National Institute for Health Research (NIHR) Collaborations

| Term                                | Definition                                                                                                                                                                                                 |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Integrated knowledge translation    | “A model of collaborative research, where researchers work with knowledge users who identify a problem and have the authority to implement the research recommendations” [2] |
| Research partnerships               | “Individuals, groups, or organizations engaged in collaborative research activity involving at least one researcher (e.g, individual affiliated with an academic institution) and any stakeholder actively engaged in any part of the research process (e.g., decision or policy-maker, health care administrator or leader, community agency, charities, network, patients, lived experience advisor, etc.)” [144] |
| Approaches                          | The IKT and research partnership activities that comprise or promote collaboration in the research process |
| Barrier                             | “A circumstance or obstacle that keeps people or things apart or prevents communication or progress” [145]                                                                                                     |
| Facilitator                         | “Someone or something that facilitates (to make easier)” [146]                                                                                                                                          |
for Leadership in Applied Health Research and Care (CLAHRCs), and KT Canada, and we also contacted individuals or groups for additional material (i.e., Twitter, IKTRN members, relevant KT listservs). We used our professional networks in the area of IKT and collaborative health research to email relevant content experts to identify additional sources that met the inclusion criteria. Reference chaining was conducted with all included papers.

Stage 3: Study selection
All identified citations were collated and uploaded into Covidence [28], and duplicates were automatically removed. A pair of reviewers (CC, HDS, JL, CL, ER, KM, MDV) independently screened and assessed titles and abstracts against the inclusion criteria. Next, full-text articles were retrieved for potentially relevant studies. After screening titles and abstracts, two independent reviewers (CC, HDS, JL, CL, ER, KM, MDV) assessed the full text of relevant studies in detail against the inclusion criteria. Any discrepancies between the reviewers at each stage of the study selection process were resolved through discussion or by a third reviewer. We sought out the trainee status of each primary author during the full-text assessment stage. When papers did not mention a primary author’s status, we searched the author’s name and the indicated affiliation in Google. If the primary author was found to be a trainee, we included the paper. We also made use of available LinkedIn profiles of the authors to identify their trainee status.

Stage 4: Charting data
We developed a data extraction tool to capture information on the general characteristics of the included paper, trainees’ characteristics, IKT approaches, the trainee-reported barriers and facilitators to knowledge user engagement, and outcomes. Two reviewers (CC, HDS) first pilot-tested the extraction tool on three studies to identify any discrepancies and ensure consistency of data extraction. Then reviewers (CC, HDS, JL, TN, ER, AB, AC, RD, LD, MDV) were paired and independently extracted data using Covidence. Conflicts between reviewers regarding data extracted were resolved through discussion or by a third reviewer.

We used several frameworks to analyse the extracted data. First, we mapped included papers onto the seven phases of the knowledge-to-action (KTA) cycle [29] based on the reported research purpose and objectives. Second, we categorized the knowledge users’ engagement into the five levels of public participation of the International Association for Public Participation (IAP2) spectrum to help conceptualize the data and offer a structure for reporting the results [30]. Third, we identified the research stages [31] that knowledge users were engaged in, including (1) development of research question, (2) development of research proposal, (3) pre-study launch administration, (4) recruitment and data collection, (5) data analysis, and (6) dissemination and implementation. Fourth, we used the Workgroup for Intervention Development and Evaluation Research (WIDER) [32] reporting checklist to describe details about the IKT approach, including (1) content (nature and goal of the study and/or IKT partnership); (2) mode of delivery (specific types of IKT activities in which knowledge users were involved); (3) duration and/or frequency (timing of IKT activities); (4) participants (who was involved in specific IKT activities); and (5) personnel (who coordinated or led IKT activities) (review objective A). Fifth, we used the Capability, Opportunity, and Motivation-Behaviour (COM-B) model [33] and Theoretical Domains Framework (TDF) [34] to describe trainee-reported barriers and facilitators to knowledge user engagement (review objective B). We first coded data using the COM-B and TDF, and then generated themes inductively. Next, we used McLeroy’s social-ecological model [35] to map where the reported barriers and facilitators existed within the trainee’s research ecosystem (i.e., individual, interpersonal and/or organizational levels). Lastly, we developed three categories informed by the IKT outcomes reported by Gagliardi [4, 36] to organize reported outcomes and impact of the IKT approach in the included studies (review objective C), if the studies reported outcomes. We coded reported outcomes into the following three categories: (1) immediate outcome of partnership formation (e.g., mutual understanding of language, work style, needs and constraints, and appreciation for the collaborative process are established [4]); (2) intermediate outcome of partnership that occurred during the preparation and research process (e.g., identification of research questions, and conduct of research[36]); and (3) long-term outcome of partnership at the completion of the research process and post-study (e.g., scale-up/spread of research, and use of research in practice and policy [4, 36].)

One reviewer (HDS) initially coded data using the coding schemes for the first five papers. This coding was verified by a second reviewer (CC) to identify any discrepancies and ensure consistency in coding. After verifying the coding strategy, one reviewer (HDS) coded the remaining data, and the second reviewer (CC) verified the coded data. Findings were presented and reviewed with all team members to interpret key findings.

Stage 5: Collating, summarizing and reporting results
We charted the data in a tabular form to align with the review objectives. In addition to the tables, we created a figure of the barriers and facilitators. We also produced
Results
Our database searches resulted in 3237 citations. We identified an additional 23 relevant papers through other information sources (e.g., IKTRN, Google Search), for a total of 3260 citations. After duplicate removal, 2895 citations remained for assessment against the inclusion criteria. After screening titles and abstracts, 343 citations remained for full-text review, and 74 citations, describing 72 studies, were included. See Fig. 1 for the PRISMA flow chart.

Characteristics of included studies and trainees
Of the 74 papers, 34 were peer-reviewed studies, 28 were theses, 9 were web-based sources and 3 were other published grey literature. The 72 studies were a mix of participatory action research (n = 41), mixed or multi-methods (n = 12), codesign (n = 1), scoping or systematic review (n = 2) or other qualitative designs (n = 12). Web-based sources included casebooks from the IKTRN and text interviews of trainees who used an IKT approach in their research. Most grey literature sources were theses (i.e., primary research) and non-peer-reviewed journal articles.

Papers originated from Canada (n = 36), the United States (n = 23), Australia (n = 5), the United Kingdom (n = 6), Norway (n = 1), Slovenia (n = 1) and Iceland (n = 1). The trainees (primary authors of these papers) were in nursing (n = 14), education (n = 12), public or population health (n = 8), medicine (n = 5), social work (n = 5), physiotherapy (n = 2), occupational health (n = 3), dietetics (n = 1) and speech language pathology (n = 1). These trainees were in master’s (n = 12), doctoral (n = 52) or postdoctoral (n = 6) training. Table 2 summarizes the overall characteristics of included papers along with trainee characteristics.

The included studies were mapped onto the KTA cycle [29] based on the reported research purpose and objectives, as follows: identify problem (n = 30) [37–67]; adapt knowledge to local context (n = 34) [37–40, 43, 44, 46, 49, 52, 55, 56, 61, 62, 64, 65, 67–86]; assess barriers/facilitators to knowledge use (n = 14) [39, 40, 52, 56, 63, 68, 72, 74, 81, 83, 87–90]; select, tailor, implement interventions...
| Author(s), year, Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics | Stage of training |
|-----------------------------------|------------------|--------------|-------------------------------------------------|------------------------|------------------|
| Abdul Qader and King, 2015 [37], Canada | Patients with ostomies | Qatar | Multi-methods approach (literature review + engagement) | Nursing | Master's |
| Abelsohn et al., 2011 [38], Canada | Graduate students at the University of Toronto, academics and community-based members of the lesbian, bisexual, trans and queer (LGBTQ) communities and organizations | Conference on LGBTQ health | Case study | Public health, nursing, health policy | Master's and PhD |
| Allen and Hutchinson, 2009 [68], Canada | Patients with end-stage renal disease | Hospital | Participatory action research using photovoice | Health science | Postdoctoral fellow |
| Atherton et al., 2016 [39], Australia | Speech-language pathology graduates in Vietnam (graduates from the 2010–2012 Pha Ngoc Thach University of Medicine, speech-language training programme, in Ho Chi Minh City) | Vietnam | Participatory action research | Speech-language pathology | PhD |
| Baukus 2019 [69], United States | 14 to 15 refugee and immigrant teens | Community and university/college | Community-based participatory research, over a series of 8 after-school workshops | Public health | Master's |
| Bellows Riecken, 2012 [89], Canada | Individuals at risk for physical inactivity-young adults ranging from 18 to 35 who resided in Greater Victoria or Duncan, British Columbia (BC) | The first location provides distance education, job training certification, and alternative programmes for students completing lower grade level BC curricula The second location provides First Nations education programmes as well as high school equivalency classes for other students needing an alternative schedule or learning environment | Action research (Study 2) | Health education | PhD |
| Björnsdóttir and Svensdóttir, 2008 [105], Iceland | Young Icelandic adults with learning disabilities who were born in the years 1974–1984 and are actively involved in various social activities such as self-advocacy, sports, religion and arts | Reykjavík, community | Life histories and follows an inclusive research paradigm, participatory action research | Social sciences | PhD |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics | Reported health/clinical discipline |
|----------------|------------------|------------------|--------------|--------------------------------------------------|-----------------------|----------------------------------|
| Bloodworth et al., 2004 [43] | United States | Graduate students | Three Chicago universities | Qualitative reflections on student experience with participatory community research | The majority of editors and contributors are academic faculty | Nursing and medicine |
| Bishop et al., 2018 [97] | Canada | KT Canada Summer Institute (KCSI) | Primary healthcare setting | Participatory action research study | Faculty of Human and Social Development, School of Nursing and Faculty of Education, Curriculum and Instruction | NR |
| Burgess 2009/67 | Canada | Primary health care nurses and healthcare providers | Hospital | Participatory action research study | NR |
| Boland, 2020 [100] | Canada | Paediatric clinical practice (cancer, patients and parents) | Hospital | Participatory action research using geographic information systems, mixed-methods research design (multiple-case study design) | Health sector worker/health care professional | PhD |
| Bowyer, 2018 [95] | Scotland | Health service users and healthcare providers in rural Scotland | Rural community on Prince Edward Island | Participatory action research using the Ottawa Model of Research Use (OMRU) knowledge translation framework | Nursing | PhD |
| Cassidy, Burgess & Donnelly, 2013 [56] | Canada | Four family health teams, with occupational therapists | Rural community on Prince Edward Island | Participatory action research using the Ottawa Model of Research Use (OMRU) knowledge translation framework | Nursing | PhD |
| Cassidy and Foley et al., 2019 | Canada | Healthcare providers at medical, surgical and neurosciences unit | Rural community on Prince Edward Island | Participatory action research using the Ottawa Model of Research Use (OMRU) knowledge translation framework | Nursing | PhD |
| Campbell, 2006 [93] | Canada | Rural coastal community | Rural coastal community | Participatory action research using the Ottawa Model of Research Use (OMRU) knowledge translation framework | Nursing | PhD |
| Blum, 2006 [86] | United States | 15 nurses | A hospital in South Florida | Participatory action research using the Ottawa Model of Research Use (OMRU) knowledge translation framework | Nursing | PhD |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics | Stage of training |
|-----------------|-------------------|------------------|---------------|-----------------------------------------------|------------------------|------------------|
| Conway et al., 2020 [81] | Canada | Healthcare providers | Urban hospital, Ireland New Haven | NR | Informational specialist | PhD |
| Dalal et al., 2009 [104] | United States | Physician-researcher postdoctoral fellows and the communities they worked in/ did their research with and community leaders | | Community-based participatory research | Medicine | Postdoctoral fellow |
| DeLemos et al., 2007 [47] | United States | People with chronic kidney disease in the Navajo population | Navajo community | Community-based participatory research | Engineering | PhD |
| Dewitt 2011 [103] | United States | Members of Oakland’s Promise Alliance | Oakland community | Participatory action research | Education | PhD |
| Dunn et al., 2020 [91] | United States | Eight students (youth, middle school boys) | Local middle school with a high percentage of students of low-income and minority backgrounds | A mixed-methods approach included a focus group and a pre-test/post-test with quantitative items and open-ended questions | Nursing | PhD |
| Feroz, 2009 [110] | United States | Early Head Start parents, Early Head Start practitioners, and community stakeholders in cycles of relevant dialogue during the development of a participatory action research project | University setting: Early Head Start programme located in rural western Pennsylvania | Qualitative inquiry using ethnography to observe a participatory action research | Department of sociology | PhD |
| Fletcher and Marchildon, 2014 [106] | Canada | Health system leaders at three levels: frontline units, senior leadership below the CEO level and senior executive leadership in the ministry and health regions | Saskatchewan, Canada health system | Participatory action research, Delphi method | Public policy | Postdoctoral fellow |
| Fletcher and Marchildon, 2018 [107] | Canada | | | | |
| Gibbon, 2002 [40] | United Kingdom | Two voluntary sector organizations, focused on women | Kenya and Nepal | Qualitative reflective article | Community health | PhD |
| Gilhooly and Lynn, 2014 [41] | United States | Three Karen adolescent brothers | Two communities in Georgia, one in Iowa and one in Wisconsin | Collaborative ethnography | NR | PhD |
| Goesslering and Doyle, 2009 [42] | Canada | Nine full-time students and active members of an at-risk student intervention programme | An urban high school in the Pacific Northwest | Participatory action research | Counselling psychology | Master's |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics |
|----------------|-------------------|------------------|--------------|---------------------------------------------------|------------------------|
| Smithers, Graeme and Mandawe, 2017 [46] | Canada | Urban First Nations men | Community | Community-based participatory health research project | Department of geography PhD |
| González 2012 [71] | United States | Five co-researchers and five participants, all Latino immigrant parents of English language learner students | Northern California elementary school, located on the east side of San Jose in a predominantly Latino neighbourhood | Participatory action research | Education PhD |
| Haywood et al., 2019 [72] | United States | Adolescents and young adults with chronic conditions | Los Angeles County | Participatory action research | Occupational therapy PhD |
| Hilario, 2018 [57] | Canada | Immigrant and refugee men living in Greater Vancouver, British Columbia | Community | Integrated knowledge translation using participatory video method | Nursing PhD |
| Hohn, 1998 [65] | United States | The adult literacy programme participants, the student action health team and the public health and education agencies | Broad Street Learning Center in Lynn, Massachusetts. Lynn is known as "immigrant city", hosting many waves of immigrant groups since the turn of the century | Participatory action research with an empowerment focus | Education PhD |
| IKTRN [98] | Canada | N/A | N/A | N/A | Nursing and medicine Trainee A: PhD Trainee 2: medical student |
| Jervis, 2019 [59] | United Kingdom | Nursing staff, children and families visiting adult relatives in hospital | Large teaching hospital | Participatory action research | Nursing PhD |
| Author(s), year, Country of origin, Study population, Study setting, Study design (reported and assessed by review team), Trainee characteristics, Reported health/clinical discipline, Stage of training |
|---|---|---|---|---|---|---|---|
| Jull et al., 2019 [92], Canada, Inuit community support workers (CSWs), Ottawa, Ontario. Nunavut in Inuit Nunangat, specifically the Qikiqtaaluk (Baffin) region, Qualitative study with two theory-driven phases: (1) Using consensus-building methods to tailor a previously developed shared decision-making (SDM) strategy with Inuit and developing training in that SDM strategy (2) Training CSWs in the SDM strategy, and then matching the CSWs with community member volunteers to test the SDM strategy, Occupational therapy, Postdoctoral fellow |
| Jones, 2012 [64], Canada, 51 students and 7 staff members from schools A and B, Uganda, school, Participatory action research, Global health, Master’s |
| Jones, 2019 [62], Australia, Aboriginal and Torres Strait Islander, Mayi Kuwayu: The National Study of Aboriginal and Torres Strait Islander Wellbeing, Epidemiology and population health, Master’s |
| Kinman, 2017 [82], United States, Paediatric residents rotating on the adolescent medicine rotation and the high school students enrolled in the women’s alliance elective class at the high school, School, Participatory action research, Education, Master’s |
| Khobzi and Flicker, 2010 [70], Canada, The Positive Youth Project (Flicker): HIV-positive teens and young people, The Trans PULSE Project (Khobzi): trans (transgender, transsexual and transitioned) people in Ontario, Community-based participatory research (both), Health, PhD (both) |
| Lac and Fine, 2018 [74], United States, High school students, School, Participatory action research, Education, PhD |
| Author(s), year, Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics | Reported health/clinical discipline | Stage of training |
|----------------------------------|-----------------|--------------|-----------------------------------------------------|------------------------|-----------------------------------|-----------------|
| Laur et al., 2020 [79] Canada    | Hospital units (directly related to patient nutrition) | Hospitals | NR | Public health and health systems | PhD |
| Leslie et al., 2010 [49] United States | Hawaiian workers and administrators | 4 health agencies, 3 social service agencies, and one faith-based organization | Community-based participatory research | Medicine | PhD |
| Lewis, 2020 [77] Canada | Patients receiving implantable cardioverter-defibrillator | Canadian tertiary care centre | NR | Nursing | PhD |
| Lillehagen, 2017 [96] Norway | Six physiotherapy institutes within primary healthcare. Clinical coordinators who were all experienced clinicians with more than 10 years of practice | Hospital, primary healthcare | Participatory action research | Medicine | PhD |
| Lind, 2006 [87] Canada | Adolescents in North American society | School | Hermeneutically inspired, participatory action research | Nursing | PhD |
| Maher, 2018 [61] Australia | Outbreak investigation: Members of the Aboriginal community, Yarrabah, Queensland, with confirmed or probable cases of mumps. Evaluation and epidemiological study: Members of the Aboriginal community in Wadeye, Northern Territory | Outbreak investigation: Yarrabah, Queensland. Evaluation and epidemiological study: Wadeye, Northern Territory | Study 1: secondary data analysis, mixed-methods approach. Study 2: descriptive analysis. Study 3: programme evaluation | Epidemiology and population health | Master’s |
| McCaig, 2019 [63] Scotland | 38 participants (18 patients, 14 staff, 4 carers, 2 students) | A 25-bed mixed-sex acute mental health ward | Appreciative action research | Mental health nursing | PhD |
| McHugh, 2008 [85] Canada | Students (specifically young Aboriginal women, aged 14–18 years), teachers and staff of Nutana Collegiate | An urban high school (i.e., Nutana collegiate) in Saskatoon | Participatory action research | Kinesiology | PhD |
| Murdoch, 2006 [66] Canada | Women with disabilities, an academic, a community leader of a local disability organization, a woman with disabilities and a graduate student in women's studies | St. John's, Newfoundland and surrounding areas | Feminist case study | Nursing | Master’s |
| Medcaif, 2008 [75] Canada | Six elders, at least 70 years old | Community | Participatory action research | Education | PhD |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics |
|----------------|-------------------|------------------|--------------|---------------------------------------------------|------------------------|
| Mitchell, 2018 [102] | United States | American Indian (AI) tribe located in the Midwest region of the United States | Small reservation community | Community-based participatory research using photovoice methodology | Institute for Policy and Social Research | PhD |
| Munro, 2018 [54] | Canada | Women who had caesarean section | British Columbia, hospital NR | Interdisciplinary studies | PhD |
| Moll & Clements, 2008 [73] | Canada | Eight stakeholder groups; participants included a mix of representatives from human resource departments, occupational health, disability managers/employee assistance programme providers, managers or supervisors and consumers of mental health services. Businesses represented included municipal service providers (e.g., police, transit commission), healthcare providers (large and mid-sized hospitals as well as community-based programmes), the educational system (school boards and postsecondary institutions), large and mid-sized retail and manufacturing businesses, and experts in the field who have addressed these issues in practice (e.g., disability managers, occupational psychiatrists, employees) | Research foundation | Multi-method, knowledge translation (reported as: an interactive process of KT) | Occupational therapy (Mental illness in the workplace) | PhD |
| Nadimpalli et al., 2016 [48] | United States | Sikh Asian Indian community | Community | Community-based participatory research | Nursing | PhD |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics | Reported health/clinical discipline | Stage of training |
|----------------|-------------------|------------------|--------------|---------------------------------------------------|------------------------|-----------------------------------|-----------------|
| Oosman, 2012 [83] | Canada            | 8- and 9-year-old children living in Île-à-la-Crosse, Saskatchewan Participants of focus group: eight individuals: non-Aboriginal and five Métis, four teachers, two healthcare professionals, one parent and one elder | Community | Participatory action research | Interdisciplinary studies | PhD |
| Ormel and Law, 2020 [53] | Canada | Cholera-affected populations in Haiti | Haiti | Participatory action research | Humanitarian | PhD |
| Pratt et al., 2019 [108] | Australia | Master’s in nursing students and registered nurse/professor (a group of five academic staff, a mixture of sessional and permanent) | A metropolitan university in New South Wales, Australia | The co-construction processes with participatory practice development principles | Nursing | PhD |
| Ramage et al., 2020 [80] | Australia | People living with stroke 174 students (kindergarten through grade 8) | Stroke rehabilitation centre Corryville Catholic school | Codesign method | Physiotherapy | PhD |
| Ramstetter, 2010 [88] | United States | High school students, stakeholders and staff (administration to teachers) | Suburban comprehensive high school in southeastern Connecticut, USA | Whole-school, exploratory, single-case study, participatory action research | Health promotion and education | PhD |
| Reale, 2011 [84] | United Kingdom | Young women in the community (ages 11–17 years) | Community | Formative research, grounded in participatory research methodology | Education | PhD |
| Roberts and Jette, 2016 [109] | United States | Female adults (over the age of 21) who have, or have had, some form of mental illness (broadly defined) and who have participated in mental health-related research activities | US | Mixed-methods, cross-sectional survey approach | Social work | PhD |
| Robinson, 2007 [94] | Canada | Postsecondary students with psychosis | Hospital and research setting | Mixed-methods systematic review | Nursing | Master’s |
| Sanderson et al., 2020 [99] | Canada | Hispanic immigrants in Charlotte Mecklenburg | Community | Community-based participatory research | Health | PhD |
| Shelton, 2012 [51] | United States | Upper elementary students | Elementary school | Participatory action research | Sociology | Master’s |
| Author(s), year | Country of origin | Study population | Study setting | Study design (reported and assessed by review team) | Trainee characteristics |
|----------------|-------------------|------------------|--------------|--------------------------------------------------|------------------------|
| Sim et al., 2019 [101] | Canada | Postdoctoral fellows (n = 46) | Fellowship launched in 2017–2018, through which postdoctoral fellows were colocated between a health system-related organization | Reflection paper | NR | Postdoctoral fellow |
| Suderman et al., 2020 [90] | Canada | Cancer survivors | Community | Multi-method IKT approach | Physical therapy | NR | PhD |
| van der Meulen, 2011 [76] | Canada | Canada's oldest sex worker-run organization | Community | Action research methodology | Department of criminal justice and criminology, women studies | PhD |
| Videmšek and Fox, 2018 [55] | First author: Slovenia | First author: experiences of people with mental ill health living in group homes in Slovenia | First author: Slovenia | First author: interpretive methodology adopting cooperative inquiry | Social work | PhD |
| | Second author: United Kingdom | Second author: carers of people with schizophrenia | Second author: United Kingdom | Second author: a participatory action research approach | | |
| Volpē, 2017 [60] | United States | High school students | Upward Bound programme located at a large public university in the Appalachian region of the United States | Participatory action research using photovoice | Education | PhD |
| Wilbricht, 2017 [52] | United States | American Indians and Alaska Natives | An Indian reservation in northern Arizona, and a rural, Indigenous community in western Alaska | Community-based participatory research | Communication | PhD |
| Wine et al., 2017 [58] | Canada | N/A | N/A | Scoping review | NR | Master's |

NR not reported, N/A not applicable
Knowledge user engagement

Knowledge users were engaged in multiple stages of research: (1) research question \( (n = 42) \); (2) research proposal \( (n = 39) \); (3) administrative pre-launch \( (n = 30) \); (4) recruitment and data collection \( (n = 51) \); (5) data analysis \( (n = 45) \); (6) dissemination and implementation \( (n = 26) \). Seven studies did not report the stages of knowledge user engagement. We also recorded the level of knowledge user engagement based on the IAP2 Spectrum for Public Participation \[111\]: inform \( (n = 2) \); consult \( (n = 8) \); involve \( (n = 15) \); collaborate \( (n = 43) \); empower \( (n = 3) \). Four studies did not report the level of knowledge user engagement. See Table 3 for more detail.

IKT strategies

Overall, there was a lack of reporting on the use of IKT strategies. As detailed in Table 3, meetings were the most common mode of engagement with knowledge users \( (n = 27) \). Written communication, such as handouts or letters, was also used \( (n = 11) \), as was email \( (n = 7) \) and phone communication \( (n = 6) \).

Barriers and facilitators to the IKT approach

Table 4 summarizes the key barrier themes identified from the included papers. Trainees’ lack of knowledge and skills posed challenges for IKT research \[48, 71, 72, 74, 79, 84, 97, 109\]. IKT knowledge and skills were related to knowing how to apply an IKT approach and specific procedural techniques related to IKT research processes. Also, trainees reported that their “outsider” status from the health system made the knowledge user engagement challenging \[44, 51, 52, 67\]. In terms of the IKT process, trainees reported that competing priorities among trainees (e.g., coursework, thesis/project completion), knowledge users (e.g., patient care, service delivery, resource use) and university institutions (e.g., timely thesis completion, resource use) posed challenges to the IKT approach \[62, 65, 70, 72, 78, 79, 94\]. Furthermore, knowledge users can have full schedules, making it difficult to find a common time to meet as a team \[47, 89\]. It was also difficult for trainees to define the scope of the research project that fulfilled knowledge user needs, aligned with health system priorities, and adhered to institutional guidelines (i.e., thesis requirements) \[44, 63, 67, 74, 83\]. The time-limited nature of graduate programmes also posed challenges to trainees \[64, 81, 99\]. Trainees also experienced power dynamics within the academic and health system institutions, which further contributed to the difficulties of knowledge user engagement \[44, 51, 56, 72, 93\]. Lastly, it was challenging to meet knowledge users in person when they lived too far and had to travel a long distance \[39, 47, 52\].

Table 5 summarizes the key facilitator themes identified from the included papers. Some trainees gained the necessary knowledge and skills to undertake IKT research in specialized graduate courses focused on applied health research \[69, 82\]. Similarly, trainees viewed themselves as facilitators \[39, 55, 65, 110\] and reported that facilitation skills helped with knowledge user engagement \[38, 53, 65, 80, 91, 102\]. For example, trainees aimed to use clear and common language to facilitate knowledge user engagement activities \[80\]. Additionally, trainees’ flexibility and problem-solving skills were helpful when engagement challenges required quick adaptations \[45, 53, 91\]. Trainees also reported that being an “insider” was a facilitating factor for doing IKT research \[63, 76, 88, 110\]. A pre-existing relationship with knowledge users or previous experience in the related field helped with building partnerships \[70, 76\]. Trainees also reported that trusting relationships and a safe place for partnership development were facilitating factors for knowledge user engagement \[38, 50, 65, 66, 72, 80, 83\]. This includes promoting a team culture that respects diverse perspectives. Trainees described using agendas and written agreements, such as a memorandum of understanding, to help set common goals early in the IKT process \[65, 83, 98\]. Supervisors played an important role in facilitating trainees’ IKT involvement \[69, 70, 80, 100\]. Trainees reported that having supervisors or committee members with expertise in IKT was helpful to guide them through the research partnership.

Figure 2 represents a modified illustration of McLeroy’s social-ecological model \[35\] to help visualize where the reported barriers and facilitators exist within the trainee’s research ecosystem (i.e., individual, interpersonal and organizational levels). As shown in Tables 4 and 5, barriers and facilitators have been categorized to corresponding level(s) to guide interpretation of the data. First, the individual level represents trainees themselves. Second, the interpersonal level represents people that trainees interact with, such as supervisors and knowledge users. Lastly, the organizational level represents institutions, including universities and health systems, as well as communities. Identified barriers and facilitators are not static or absolute; as represented with connected lines, some of these barriers and facilitators exist across the three
| Author(s), year | Knowledge users                                                                 | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|---------------------------------------------------------------------------------|--------------------------|-----------------------|--------------------|----------------------------|
| Abdul Qader and King, 2015 [37] | Student's academic supervisor, clinical experts (the physician lead for colorectal cancer services and two advanced clinical nurse specialists in the gastrointestinal programme), clinical pharmacologists | Involve                  | ✓                     | ✓                  | Receiving advice and feedback (mode not described) |
| Abelsohn et al., 2011 [38]   | LGBTQ members, students, faculty members                                         | Involve                  | ✓                     | ✓                  | Meeting, a callout for committee members sent through various channels |
| Allen and Hutchinson, 2009 [68] | Patients with end-stage renal disease (ESRD), policy-makers, healthcare providers or anyone trying to improve the quality of life and treatment for patients living with ESRD, film-makers working with patient populations | Collaborate               | ✓                     | ✓                  | Meeting and discussion 3 h |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|-------------------------|----------------------|-------------------|-----------------------------|
| Atherton et al., 2016 [39] | Healthcare providers: new speech-language pathologists with undergraduate degrees in other health professions (e.g., physiotherapy, medicine, nursing) | Collaborate | ✓ ✓ ✓ ✓ ✓ ✓ | Interview, meetings (e.g., Skype) | 24–30 months |
| Baukus 2019 [69] | Independent community groups and a faculty member. Community partner is a local group of artists, designers, researchers, educators and social workers working together to improve access to quality mental healthcare services | Collaborate | ✓ ✓ | Meetings and conference calls | NR |
| Bellows Riecken, 2012 [89] | Community partner organization | Collaborate | ✓ ✓ ✓ ✓ | Survey | NR |
| Blum, 2006 [86] | Nurse preceptors, clinical faculty, nurse preceptors, hospital nurse educators and nursing administrators | NR | ✓ ✓ | Action plan | 13 months, from May 2005 to June 2006 |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|--------------------|-----------------------------|
|                |                 |                          | 1 Research question   |                    |                             |
|                |                 |                          | 2 Research proposal   |                    |                             |
|                |                 |                          | 3 Admin pre-launch    |                    |                             |
|                |                 |                          | 4 Recruitment and data collection |                    |                             |
|                |                 |                          | 5 Data analysis       |                    |                             |
|                |                 |                          | 6 Dissemination and implementation |                    |                             |
|                |                 |                          | N = 42                |                    |                             |
|                |                 |                          | N = 39                |                    |                             |
|                |                 |                          | N = 30                |                    |                             |
|                |                 |                          | N = 51                |                    |                             |
|                |                 |                          | N = 45                |                    |                             |
|                |                 |                          | N = 26                |                    |                             |

Björnsdóttir and Svensdóttir, 2008 [105]  
Young Icelandic adult who is a self-advocate with learning disabilities  
Collaborate ✓

Bloodworth et al, 2004 [43]  
Community researchers  
NR NR

Burgess 2006 [44]  
Nurse Practitioners  
Involve ✓ ✓

Burgess 2009 [67]  
Clinician-scientist (medical director of the Children’s Hospital of Eastern Ontario [CHEO] shared decision-making programme, paediatric endocrinologist), registered nurse  
Involve ✓ ✓ ✓ ✓ ✓ ✓

Boland, 2020 [100]  
Clinician-scientist (medical director of the Children’s Hospital of Eastern Ontario [CHEO] shared decision-making programme, paediatric endocrinologist), registered nurse  
Involve ✓ ✓ ✓ ✓ ✓ ✓

NR  
Once per week for 6 months

NR  
NR  
Meeting, written handout, discussion  
A total of five meetings 2–3 h in length

NR  
NR  
Meeting, and regular team meetings, regular process updates  
Regular team meetings (3–4 per year)
Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|-----------------|-----------------|--------------------------|-----------------------|--------------------|----------------------------|
|                 |                 |                          | 1 Research question   |                    |                            |
|                 |                 |                          | 2 Research proposal   |                    |                            |
|                 |                 |                          | 3 Admin pre-launch    |                    |                            |
|                 |                 |                          | 4 Recruitment and data collection | | |
|                 |                 |                          | 5 Data analysis       |                    |                            |
|                 |                 |                          | 6 Dissemination and implementation | | |
|                 |                 |                          |                       |                    |                            |
|                 |                 |                          |                       |                    |                            |
| Bowyer, 2018    | Professionals engaged in health planning within NHS Scotland, community stakeholder groups | Collaborate | ✓ | ✓ | ✓ | Focus group, participatory mapping techniques, interviews | NR |

- Remote and rural area, 7 community groups including community council, primary school parent group, retrained fire service, patient participation group, community shop committee, community hall committee
- Accessible rural community, 5 community groups including primary school parent groups, friendship group, mother and toddler group, community council, patient participation group
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
|----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
| Bishop et al., 2018 [97] | A total of 15 faculty and facilitators, including two patient advisors. The two patient advisors represented independent patient advisory networks and were active in their respective provincial Strategy for Patient-Oriented Research (SPOR) units | Involve | NR | NR |
| Campbell, 2006 [93] | Paediatric community in Prince Edward Island, Canada | Consult | ✓ | Group meetings, group interviews | NR |
| Cassidy, Burgess et al, 2019 [45] | A group of Health System Impact (HSI) postdoctoral fellows | Collaborate | ✓ ✓ ✓ ✓ ✓ | NR | NR |
| Cassidy and Foley et al, 2019 [78] | Manager of the medical, surgical and neuroscience unit, clinical nurse leaders, researchers, administrators | Collaborate | ✓ ✓ ✓ ✓ ✓ | KT research processes | NR |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagements stage CORE | Mode of engagement | Duration, frequency, timing | Research question | Research proposal | Admin pre-launch | Recruitment and data collection | Data analysis and dissemination | Implementation |
|----------------|-----------------|--------------------------|------------------------|-------------------|--------------------------|------------------|-----------------|----------------|-------------------------------|-------------------------------|-----------------|----------------|
| Conway et al., 2020 [81] | Healthcare providers working in the neonatal and obstetric departments. Five knowledge users. | Collaborate | ✓ ✓ ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dunn et al., 2020 [91] | Administrator, consultant, two nonviolence educators, teacher, nursing faculty member and a doctoral student who possessed pediatric expertise | Collaborate | ✓ ✓ ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| Dalal et al., 2009 [104] | Steering committee consisting of community leaders and community focused academics | Involve | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| DeLemos et al., 2007 [47] | Navajo people | Collaborate | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |

**Table 3** (continued)
| Author(s), year | Knowledge users                                                                 | IAP2 level of engagement | Engagement stage CORE | Engagement stage CORE | Mode of engagement                                                                 | Duration, frequency, timing |
|----------------|---------------------------------------------------------------------------------|--------------------------|-----------------------|-----------------------|----------------------------------------------------------------------------------|-----------------------------|
| Dewitt, 2011   | Policy-maker, America’s Promise Alliance members, Oakland’s Promise Alliance members | Collaborate               | ✓                     | ✓                     | Dialogue, brainstorming, critical reflection, group meetings, field notes from formal and informal meetings, observation, and community consultation, interview | Two 2-h meetings            |
| Donnelly, 2013 | Occupational therapists, the executive director and the lead physician at the family health team, membership of the evaluation committee (all members of the memory clinic, one Alzheimer Society member, the executive director) | Collaborate NR           | NR                   | NR                   | Informal meeting, case study, evaluation committee was formed, member-checking    | NR                          |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
| Fletcher and Marchildon, 2014 [106] | Each round of the study included up to four health system actors as both research partners and participants. Participants in the study represented three levels of authority within the health system and were categorized into three corresponding participant groups: – Group 1 included governance and directional leadership at the ministry and health region executive level. – Group 2 consisted of shared services senior leadership immediately below CEO level at collective and individual project stream levels. – Group 3 included frontline leadership of existing business units within each project. | Collaborate | ✓ ✓ ✓ ✓ ✓ | Delphi technique | NR |
| Fletcher and Marchildon, 2018 [107] | N = 42 | N = 39 | N = 30 | N = 51 | N = 45 | N = 26 | |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|----------------|--------------------------|-----------------------|--------------------|-----------------------------|
| Feroz, 2009 [110] | Early Head Start parents, Early Head Start practitioners, and community stakeholders | Collaborate | ✓ | ✓ | ✓ | Group sessions, focus groups | Weekly, 22 group sessions |
| Gibbon, 2002 [40] | Academics/researchers | NR | NR | | NR | NR |
| Gilhooly and Lynn, 2014 [41] | Three adolescent Sgaw Karen brothers, and Karen communities | Collaborate | ✓ | ✓ | ✓ | Semi-structured interviews, informal meeting | 40 interviews, biweekly |
| Goessling and Doyle, 2009 [42] | High school students, teachers, counsellors, therapists, mentors and others who desire to have positive relationships with teenagers | Involve | ✓ | ✓ | ✓ | Tutoring, mentoring, leadership development, summer enrichment programmes, photo exhibition | 20 weeks |
| González, 2012 [71] | Latino immigrant parents of English language learner students | Collaborate | ✓ | ✓ | ✓ | Meeting, focus group | NR |
| Smithers, Graeme and Mandawe, 2017 [46] | Indigenous person research assistant, urban First Nations men | NR | ✓ | ✓ | ✓ | NR | NR |
| Haywood et al., 2019 [72] | Adolescents and young adults with chronic conditions, researchers, healthcare providers and related stakeholders | Collaborate | ✓ | ✓ | | Virtual or in-person meetings, phone or email communication, conference, academic meetings | At least monthly |
| Author(s), year | Knowledge users | Mode of engagement | Duration, frequency, timing | Research question | Engagement stage CORE | Engagement stage IAP2 level of engagement |
|----------------|-----------------|-------------------|-----------------------------|-------------------|-----------------------|--------------------------------------------|
| Hilario, 2018  | Six immigrant and refugee young men (self-identified as immigrants and refugees from China, Philippines, Mexico, Colombia, and Afghanistan), an advisory group comprising service providers and programme leaders | Collaborate ✓ ✓ ✓ ✓ | Conversations, structured meetings with advisory group, unstructured consultations, dialogue |  | N = 42 | N = 30 |
| Hohn, 1998 [65] | Student action health team, literacy programme, administration and staff | Collaborate ✓ ✓ ✓ | Meeting, field notes, discussions, informal conversations, interviews, surveys |  | N = 45 | N = 26 |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Duration, frequency, timing |
|----------------|----------------|--------------------------|-----------------------|-----------------------------|
|                |                |                          | 1 Research question   | N = 42                      |
|                |                |                          | 2 Research proposal   | N = 39                      |
|                |                |                          | 3 Admin pre-launch    | N = 30                      |
|                |                |                          | 4 Recruitment and data collection | N = 51 |
|                |                |                          | 5 Data analysis       | N = 45                      |
|                |                |                          | 6 Dissemination and implementation | N = 26 |
| IKTRN [98]     | Trainee A: clinical team of a pediatric inpatient unit | Consult | ✓ | ✓ |
|                | Trainee B: a team of people from Island Health, organized speakers from Island Health, community organizations, and members from the Nanaimo municipality |               | | |
| Jull et al., 2019 [92] | A steering committee that consisted of members from Inuit-led or Inuit-specific (or both) health and related organizations that support Inuit in cancer care systems | Consult | ✓ | ✓ | ✓ | ✓ | Consensus-building methods, feedback | NR |

Trainee A: NR
Trainee B: written report
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|----------------|--------------------------|-----------------------|-------------------|----------------------------|
|                |                |                          | 1 Research question   |                   | NR                         |
|                |                |                          | 2 Research proposal   |                   | NR                         |
|                |                |                          | 3 Admin pre-launch    |                   | NR                         |
|                |                |                          | 4 Recruitment and data collection | NR | NR |
|                |                |                          | 5 Data analysis       |                   | NR                         |
|                |                |                          | 6 Dissemination and implementation | NR | NR |
| Jervis, 2019 [59] | The Medicines for Children Research Network (MCRN), Young Persons Advisory Groups (YPAGs), National Institute for Health Research network | Consult and Involve | ✓ ✓ ✓ ✓ ✓ ✓ | Focus group, face-to-face discussion | NR |
| | - The YPAGs consist of 10 to 15 members who are aged 8–19 years | |  |  |  |
| | - The groups consisted of a total of 23 young people aged 8–17 years comprising 16 girls and 7 boys | |  |  |  |
| | - Nursing staff | |  |  |  |
| Jones, 2012 [64] | Students and academic staff from the selected schools | Involve | ✓ ✓ ✓ ✓ ✓ ✓ | Semi-structured focus groups and interviews | NR |
| Jones, 2019 [62] | Aboriginal and Torres Strait Islander: Palungu Wurrnangat Aboriginal Corporation (PWAC) and Kardu Lurruth Ngala Purrungime (KLNP) committee | Consult | ✓ ✓ ✓ ✓ ✓ ✓ | NR | NR |
Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
|                |                 |                          | 1 Research question   |                   |                             |
| Khobzi and Flicker, 2010 [70] | The Positive Youth Project (Flicker): service providers, unspecified “partnering organisations” and HIV-positive teens and young adults; a public health research unit, a hospital, a national AIDS service organization, grassroots POZ youth group. The Trans PULSE Project (Khobzi): trans people, representatives from trans community organizations, academic partners, and unaffiliated trans community members; a primary healthcare centre, a community centre | Collaborate | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | Meetings, interview | 35 interviews |
|                |                 |                          | 2 Research proposal   |                   |                             |
|                |                 |                          | 3 Admin pre-launch    |                   |                             |
|                |                 |                          | 4 Recruitment and data collection |                   |                             |
|                |                 |                          | 5 Data analysis       |                   |                             |
|                |                 |                          | 6 Dissemination and implementation |                   |                             |
|                |                 |                          | N = 42                |                   |                             |
|                |                 |                          | N = 39                |                   |                             |
|                |                 |                          | N = 30                |                   |                             |
|                |                 |                          | N = 51                |                   |                             |
|                |                 |                          | N = 45                |                   |                             |
|                |                 |                          | N = 26                |                   |                             |
Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|-----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
| Kinman, 2017 [82] | University of California, San Francisco Fresno Pediatric Residency Program and the women’s alliance class at the high school during the school years 2015–2016 and 2016–2017 | Collaborate | ✓ ✓ ✓ ✓ ✓ ✓ | Discussion, survey, | NR |
| Lac and Fine, 2018 [74] | The individual youth researchers in our cohort of 11 (high school students) | Collaborate | NR | Dialogical approach | NR |
| Laur et al., 2020 [79] | Local champions, who were already (in most cases) employed as dieticians within managerial or leadership roles | Empower | ✓ ✓ ✓ ✓ ✓ | Monthly group calls | Monthly |
| Leslie et al., 2010 [49] | 10 Native Hawaiian-serving organization workers, administrators, advisors from the worksites | Involve | ✓ ✓ ✓ ✓ ✓ | Meetings, interviews, focus groups for open discussion | 9 focus groups, 90 min |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
| Lewis, 2020 [77] | Steering committee: multidisciplinary team of knowledge users (director of the arrhythmia service, the ambulatory device clinic nursing manager, a device clinic registered nurse, expert researchers in patient decision aids development, two patients who had previously undergone implantable cardioverter-defibrillator replacement and the spouse of a patient with an implantable cardioverter-defibrillator) | Involve | ✓ | ✓ | ✓ | N = 42 | N = 39 | N = 30 | N = 51 | N = 45 | N = 26 | Steering committee, email, telephone, meeting, feedback |
| Lillehagen, 2017 [96] | Researchers, physiotherapist, physiologist, clinical coordinators | Collaborate | ✓ | ✓ | ✓ | Meetings with structured agenda | NR |
| Lind, 2006 [87] | Adolescents | Collaborate | ✓ | ✓ | ✓ | Interviews | NR |
| Author(s), year | Knowledge users                                                                 | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|--------------------------------------------------------------------------------|--------------------------|-----------------------|--------------------|-----------------------------|
| Maher, 2018 [61]| Aboriginal health workers, locally identified Aboriginal community researchers, including members of the Kardu Lurruth Ngalu Purrungime committee, department of the Prime Minister and Cabinet Indigenous Affairs Group, Policy Analysis and Evaluation Branch | Collaborate               | ✓ ✓                  | Survey, training    | NR                          |
| McCaig, 2019 [63]| Patients, staff, careers and students, mental health institution staff, policy-makers, educationalists and researchers | Involve                  | ✓ ✓ ✓                | Interviews, focus groups and reflection groups | NR                          |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage | CORE | Mode of engagement | Duration, frequency, timing |
|----------------|----------------|--------------------------|------------------|------|---------------------|-----------------------------|
| McHugh, 2008 [85] | The known sponsor (the director of Nutana's Integrated School-Linked Services programme) and a group of 7 young Aboriginal women who represented the Core Group. Students, teachers, and staff at Nutana Collegiate, and also a known sponsor who was embedded in the administration | Empower | NR | Interviews, focus groups | NR |
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|-----------------|--------------------------|-----------------------|-------------------|----------------------------|
| Medcalf, 2008 [75] | Six elders with a considerable diversity, including age, gender, socioeconomic status, formal education, religious affiliation, former occupation, current household and type of housing, sexual orientation, marital status, whether they have children or grandchildren, their interests as well as their life experience in general. All are white, speak English as their first language and all but one has grown up in southern Ontario | Collaborate | ✓ ✓ ✓ | One-page autobiography to present to the group, workshop, individual conversations | NR |
| Mitchell, 2018 [102] | American Indian tribe | Involve | ✓ ✓ ✓ | Recruitment flyer, attendance of local events including annual gatherings and reoccurring activities | NR |
Table 3 (continued)

| Author(s), year | Knowledge users                                                                 | IAP2 level of engagement | Engagement stage CORE | Engagement stage CORE | Engagement stage CORE | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|-----------------|---------------------------------------------------------------------------------|--------------------------|-----------------------|-----------------------|-----------------------|-----------------------|----------------------|-----------------------------|
| Moll and Clements, 2008 [73] | Employees with mental health issues, insurers, healthcare professionals, human resource personnel, researchers and education, unions, managers, occupational health and disability management providers | Collaborate               | ✓                     | ✓                     | ✓                     | Focus group, feedback, meetings | NR                   |                             |
| Murdoch, 2006 [66]       | Women with disabilities, an academic, a community leader of a local disability organization, a graduate student in women's studies, government, researchers, policy-makers | Collaborate               | ✓                     | ✓                     | ✓                     | Email communication, interview, personal letter | NR                   |                             |
| Munro, 2018 [54]         | Patients, providers, and policymakers in British Columbia                       | Collaborate               | ✓                     | ✓                     | ✓                     | Ongoing feedback, co-writing | NR                   |                             |
| Nadimpalli et al, 2016 [48] | Sikh Asian Indian community partners (including social service agencies, advocacy groups, and healthcare providers) serving the South Asian community | Collaborate               | ✓                     | ✓                     | ✓                     | Coalition meetings, relationship-building activities | 2 years              |                             |
| Author(s), year | Knowledge users |
|----------------|-----------------|
| Ormel and Law, 2020 [53] | National and international staff member from the nongovernmental organization (NGO) Action Contre la Faim, different governmental agencies, NGOs, traditional healers |
| Oosman, 2012 [83] | Metis Community Collaborate |
| Pratt et al., 2019 [108] | Masters in nursing students |

| | Engagement stage CORE |
|-----------------------------|-------------------|
| | 1 Research question | 2 Research proposal | 3 Admin pre-launch | 4 Recruitment and data collection | 5 Data analysis | 6 Dissemination and implementation |
| | N = 42 | N = 39 | N = 30 | N = 51 | N = 45 | N = 26 |

| Engagement stage | Mode of engagement | Duration, frequency, timing |
|------------------|--------------------|----------------------------|
| CORE | ✓ ✓ ✓ ✓ ✓ ✓ | Telephone meeting, email communication, focus group discussion |
| Research question | | |
| Research proposal | | |
| Admin pre-launch | | |
| Recruitment and data collection | | |
| Data analysis | | |
| Dissemination and implementation | | |
| Duration, frequency, timing | | |

NR

NR

NR
| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|----------------|----------------|--------------------------|-----------------------|--------------------|-----------------------------|
|                |                |                          | 1 Research question   |                    |                             |
|                |                |                          | 2 Research proposal  |                    |                             |
|                |                |                          | 3 Admin pre-launch    |                    |                             |
|                |                |                          | 4 Recruitment and data collection |                |                             |
|                |                |                          | 5 Data analysis       |                    |                             |
|                |                |                          | 6 Dissemination and implementation |                |                             |
| Ramage et al., 2020 [80] | The research team: four knowledge-user partners (one person with a lived experience of stroke, two physiotherapists with research experience, one exercise scientist experienced in telehealth exercise with stroke survivors) and five researchers (one PhD candidate [physiotherapist] and four PhD supervisors with research expertise in physiotherapy and nutrition and dietetics) Knowledge-user informants: healthcare workers, such as doctors, nurses, physiotherapists, managers; stroke survivors; carers; behaviour change researcher | Collaborate | ✓ | ✓ | ✓ | ✓ | Workshops, individual interviews, teleconferencing into workshops |
| Ramstetter, 2010 [88] | Students, teachers, staff, parents, volunteers and the school board | Collaborate | ✓ | ✓ | ✓ | ✓ | ✓ | Meeting, written communication |
### Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|-----------------|-----------------|--------------------------|-----------------------|--------------------|-----------------------------|
| Reale, 2011 [84] | Students and staff at the high school | Consult                   | ✓                     | ✓                  | NR                          |
| Roberts et al., 2016 | Guardians of the youth, urban Indian young women | Collaborate                | ✓                     | ✓                  | Semi-structured interviews, art project |
| Robinson, 2007 [94] | The four individuals served as consultants in mental health-related research and had self-disclosed that they had (or previously had) a mental illness | Consult                   | ✓                     | ✓                  | Email communication, telephone communication, formal letter, written communication including journaling and feedback (via email) |
| Author(s), year | Knowledge users                                                                 | IAP2 level of engagement | Engagement stage CORE | Mode of engagement                                                                 | Duration, frequency, timing |
|----------------|---------------------------------------------------------------------------------|--------------------------|-----------------------|-----------------------------------------------------------------------------------|----------------------------|
| Sanderson et al., 2020 [99] | One registered nurse in a psychiatric outpatient setting, two medical doctors and one social worker in a post-secondary (PS) institution, one nursing student interested in mental health, one student with lived experience of psychosis and one director of health and wellness services in a PS institution, one occupational therapist working for a first-episode psychosis programme, a nursing professor of mental health at a PS institution, a mental health policy advisor at a PS institution, and a research scientist involved with improving youth mental health services and supports | Collaborate               | ✓ ✓ ✓ ✓ ✓ ✓               | Introductory meeting, written partnership agreement, advisory panel, meetings, email or telephone communication, presentation | NR |
### Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | Mode of engagement | Duration, frequency, timing |
|-----------------|-----------------|--------------------------|-----------------------|-------------------|-----------------------------|
| Schuch, 2017 [50] | Partners included health and social service providers, educators, Hispanic foreign-born residents and a community advisory board, which included representatives from the local school system, the county health department, and the city of Charlotte | Collaborate | NR | Key informant interviews, focus groups, a photovoice project, and community forums | NR |
| Shelton, 2012 [51] | First project: five graduate students and environmental sociology professor, a group of fourth-, fifth- and sixth-grade students at an upper-elementary school in Hammond, Louisiana. Second project: 12 graduate students and professor, fourth-, fifth- and sixth-grade students at the same upper-elementary school in Hammond | Collaborate | ✓ ✓ | Survey, meeting, dialogue, journal, discussion | NR |
Table 3 (continued)

| Author(s), year | Knowledge users | IAP2 level of engagement | Engagement stage CORE | N = 42 | N = 39 | N = 30 | N = 51 | N = 45 | N = 26 | Mode of engagement | Duration, frequency, timing |
|-----------------|-----------------|--------------------------|-----------------------|--------|--------|--------|--------|--------|--------|-------------------|---------------------------|
| Sim et al., 2019 [101] | Postdoctoral Fellows | Collaborate | ✓ | ✓ | ✓ | ✓ | NR | NR |
| Suderman et al., 2020 [90] | Cancer survivors and caregivers | Inform | ✓ | | | | | |
| van der Meulen, 2011 [76] | Sex workers | Collaborate | ✓ | ✓ | | ✓ | | |
| Volpē, 2017 [60] | Young people in a rural Appalachian community | Involve | | ✓ | ✓ | | | |
| Videmšek and Fox, 2018 [55] | First author: five people with personal experience of mental ill health Second author: a steering group of stakeholders including people from professional, family-caring and research backgrounds | Collaborate | | NR | | | | |
| Wilbricht, 2017 [52] | Primary community partners (the general managers of two tribal radio stations), community members | Empower | ✓ | ✓ | ✓ | ✓ | ✓ | NR | Written agreement, interviews |
| Wine et al., 2017 [58] | Health, and knowledge translation experts | Consult | ✓ | ✓ | ✓ | ✓ | ✓ | NR | NR |
levels. Further, the three levels demonstrate the complex nature of individual trainees within a broad micro-, meso-, macro-system. Some of the barriers are the direct opposite of facilitators; for example, lack of funding and financial resources are reciprocal barriers and facilitators.

**IKT impact and outcomes**
As shown in Table 6, reported IKT impact and outcomes were related to immediate (n = 38), intermediate (n = 40) and/or long-term (n = 15) outcomes of partnership formation. Twenty studies did not report outcomes related to IKT or other research partnerships. See Table 6 for more detail.

**Discussion**
This scoping review describes how IKT or other research partnership approaches have been applied in thesis and/or postdoctoral health research. We identified 74 papers from published and grey literature sources to be included in the review. Overall, study findings provide insights for trainees interested in IKT or other research partnership approaches, and offer guidance on how to apply an IKT approach to their research. Further, the review highlights the important role that academic supervisors, knowledge users, and academic and health system institutions play in providing support and infrastructure to facilitate IKT or other research partnerships in trainee-led health research.

### Table 4 Trainee-reported barriers to IKT

| COM-B [147] component | TDF Version 2 [148] 14 Domains (definition) | Themes | Levels |
|------------------------|---------------------------------------------|--------|--------|
| Capability             | Knowledge (An awareness of the existence of something) Skilled (An ability or proficiency acquired through practice) | Lack of knowledge and skills Know-how Procedural techniques (related to research processes) Interpersonal skills related to relationships | Individual |
| Motivation             | Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting) | Trainee as an outsider Shifting between community, health system, academia | Individual, interpersonal |
|                        | Goals (Mental representations of outcomes or end states that an individual wants to achieve) | Competing priorities of knowledge users, trainees and university Containing scope for thesis project University guidelines and expectations Health system priorities | Interpersonal, organizational |
| Opportunity            | Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours) | Power dynamics Power/pressure from institutions Administrative pressure Intergroup relationships or group dynamics Connecting, communicating and building relationship Push-back and scepticism | Interpersonal, organizational |
|                        | Environmental context and resources (Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour) | Lack of funding to support knowledge user participation Barriers to engagement due to physical location/distance Lack of time for trainees Engagement activities Trainee's institutional programme Institutional restrictions University thesis guidelines Research ethics board Health organizations | Organizational |
partnership in the decision-making process. This is not surprising, as IKT and research partnerships are rooted in deliberate partnership and shared decision-making throughout the research partnership from start to finish [112]. There are distinct differences between research partnerships that empower partners to be active participants in the shared decision-making process and lesser levels of engagement, such as communication, information-sharing and consultation [113]. The included papers described the former, where trainees made deliberate efforts to support research collaboration with knowledge users and described this partnership in detail. While the IAP2 Spectrum was a useful framework for categorizing engagement, its origins are in broad public participation [111], and it does provide a comprehensive representation of the types of knowledge users involved in health research (i.e., patient, caregivers, healthcare providers, health system leadership and policy). Efforts are needed to develop a clearer set of IKT principles and strategies for knowledge user engagement in the health context.

### Table 5 Trainee-reported facilitators of IKT

| COM-B component | TDF Version 2 [148] 14 Domains (definition) | Themes | Level |
|-----------------|-----------------------------------------------|--------|-------|
| **Capability**  | Knowledge (An awareness of the existence of something) | Education/coursework on research partnerships | Individual |
|                 | Skills (An ability or proficiency acquired through practice) | Facilitation skills | |
|                 | Behavioural regulation (Anything aimed at managing or changing objectively observed or measured actions) | Use of clear and common language | |
|                 |                                                  | Trainee’s reactivity and problem-solving skills | |
|                 |                                                  | Trainee’s flexibility and reflexivity | |
|                 |                                                  | Adapting expectations | |
|                 |                                                  | Project adaptability | |
|                 |                                                  | Fluidity between knowledge user and academia | |
|                 |                                                  | Self-reflection | |
| **Motivation**  | Social/professional role and identity (A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting) | Trainee as an insider | Individual, interpersonal |
|                 |                                                  | Pre-existing relationship with knowledge user | |
|                 |                                                  | Previous experience in the field (e.g., clinical background) | |
|                 |                                                  | Ongoing efforts to maintain meaningful relationship | |
|                 |                                                  | Trainees view themselves as a “facilitator” | |
|                 |                                                  | Setting common goals early when doing research and setting goals in knowledge user meetings | |
|                 |                                                  | Clear plan | |
|                 |                                                  | Memorandum of understanding (MOU) | |
|                 |                                                  | Planned agendas | |
| **Opportunity** | Environmental context and resources (Any circumstance of a person’s situation or environment that discourages or encourages the development of skills and abilities, independence, social competence and adaptive behaviour) | Financial resources | Interpersonal, organizational |
|                 | Social influences (Those interpersonal processes that can cause individuals to change their thoughts, feelings or behaviours) | Academic resources | |
|                 |                                                  | Time/scheduling to support partnership | |
|                 |                                                  | Person and environment interaction | |
|                 |                                                  | Straddle both environments (i.e., community, institution, hospital) | |
|                 |                                                  | Trusting relationship and creating safe place for partnership | |
|                 |                                                  | Team transparency | |
|                 |                                                  | Respect for diverse perspective | |
|                 |                                                  | Existing relationship and/or partnership | |
|                 |                                                  | Supportive group dynamics | |
|                 |                                                  | Knowledge users who support the research | |
|                 |                                                  | Partners’ aligned interest with the research | |
|                 |                                                  | IKT expert support | |
|                 |                                                  | Supervisors and committee members | |

Barriers and facilitators to using IKT or other research partnership approaches in trainee-led health research

This review illustrates the intersecting barriers and facilitators for IKT and research partnership approaches at the individual, interpersonal and organizational levels (Fig. 2). Many of the reported facilitators were reciprocal to the barriers and have the potential to support IKT or research partnerships, including partnership skill
development, co-creation of common goals and leveraging research programme partnerships. We used the COM-B model of behaviour [33] to categorize reported barriers and facilitators related to trainees’ capability, opportunity and motivation for using an IKT or research partnership approach.

**Capability**
Our review identified several capability-related barriers and facilitators at the individual trainee level for engaging in IKT research, including IKT knowledge and skills, and flexibility in the research approach. These findings align with recent research highlighting the lack of researcher preparation in research partnership approaches [11, 114]. Building on this known gap in the literature, our review offers a clearer understanding of what types of knowledge and skills are needed to support researcher preparation for collaborative health research, including the development of facilitation skills. Facilitation is defined as “the process of enabling (making easier) the implementation of evidence into practice” [115]. It supports a purposeful two-way process of change that focuses on building trusting relationships and establishing common goals between the facilitator and those engaged in making the change [116, 117]. More formal training efforts are needed to support facilitation skill development for health research trainees. Dogherty and colleagues developed a taxonomy of 53 facilitation strategies, ranging from providing assistance with certain tasks, to a more holistic process that empowers change in individuals’ attitudes and ways of thinking and working. This taxonomy may be a helpful starting point to develop trainees’ skills as facilitators in the research process, which to date has not been a primary focus in traditional academic programmes.

Previous research has identified core competencies that trainees need for applied health research and knowledge translation [118, 119]. A baseline self-assessment on these competencies may be helpful for trainees interested in developing their IKT or other research partnership skills [120]. Further, several training programmes exist to provide trainees with experiential learning opportunities in IKT or other research partnerships. For example, the Canadian Institutes of Health Research (CIHR) Health System Impact (HSI) Fellowship was designed to modernize doctoral and postdoctoral training to better equip researchers with the professional and research skills needed to address complex health system challenges [121]. HSI doctoral and postdoctoral research fellows are embedded in health system organizations to develop Canadian Health Services and Policy Research Alliance’s 9 enriched core competencies, understand the intricacies of health system delivery, and partner with members of the health system to support relevant research efforts [121]. Similarly, in the United States, AcademyHealth developed the Delivery System Science Fellowship to provide experiential learning and professional development opportunities for postdoctoral trainees [122]. These types of training programmes offer formalized experiences focused on development of professional skills not currently emphasized in health

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**Fig. 2** Barriers and facilitators to IKT/research partnerships in trainee-led research
services graduate training. Trainees may wish to consider these types of formalized training programmes to further their IKT skills development and better support the use of a research partnership approach in their graduate or postdoctoral research.

**Opportunity and motivation**

Successful research partnerships require more than individual trainees having the right skills and willingness to engage with knowledge users. The majority of barriers and facilitators identified in this review were categorized in the interpersonal and organizational levels, specific to intersecting opportunity and motivation determinants that either support or hinder research partnerships for trainees.

Trainees reported that their status as an insider or outsider to the organization/community was a key facilitator or barrier for building partnerships. This is consistent with Dwyer and Buckle’s [123] previous work; having an insider membership typically gives an advantage to researchers, as it creates a sense of trust and openness from the participants. However, researchers are never completely insiders or outsiders, and their status does not make for a better or worse researcher [123–125]. Dwyer and Buckle [123] challenge the dichotomous insider and outsider identity of researchers and propose that “space between” is critical. In this “space between,” [123], researcher’s positionality is complex and fluid in nature [126] and can impact the research topic, epistemology, ontology and methodology [127]. Therefore, when trainees engage in IKT, it is more important that they practice self-reflexivity to understand their positionality in the study rather than focus on whether they are insiders or outsiders. Moreover, this is consistent with our findings on trainees reporting reflexivity as a facilitator for engaging in IKT research. We encourage trainees to reflect on the commonalities and differences they share with their research partners and how their positionality in the “space between” might affect research relationships. From there, trainees may have a better sense of how to

| Table 6 Reported outcomes |
|---------------------------|
| **Outcomes**               | **Frequency (N)** | **References** | **Examples from included papers** |
| **Immediate outcomes of partnership formation** | Total = 38 |
| Value for different perspectives/broadened perspective | $N = 13$ | [37, 38, 46, 57, 61, 75, 76, 78, 80, 84, 96, 97, 106] | Bringing in diverse perspectives from different stakeholder groups |
| Mutual understanding of language, work style, needs and constraints | $N = 12$ | [46, 47, 54, 62, 74, 77, 79, 81, 88, 94, 97, 103] | Inclusion of strategies to support a use of common language during workshops |
| Appreciation for collaborative process | $N = 8$ | [38, 42, 47, 48, 50, 68, 69, 105] | Trainees reported that they experienced the value of collaborations |
| Capacity developed by researchers and decision-makers | $N = 5$ | [37, 69, 72, 98, 109] | Trainees and/or partners gained experience (e.g., public speaking, professional networking and writing) |
| **Intermediate outcomes of partnership formation** | Total = 40 |
| Enhanced relevance of research | $N = 18$ | [37, 47, 48, 63, 72, 73, 76, 77, 80, 84, 90, 97–101, 103, 106] | Trainees reported improved relevance of the research being conducted and/or its findings |
| Awareness and acceptance of research | $N = 11$ | [42, 45, 52, 71, 76–80, 85, 95] | Gaining approval or “buy-in” of research from partners |
| Conduct of research | $N = 5$ | [38, 46, 58, 91, 109] | Trainees reported that partnership approaches allowed for an improved research process |
| Identification of research questions | $N = 3$ | [39, 94, 96] | Developing research questions together |
| Research output | $N = 3$ | [50, 70, 72] | Co-authorship publication with knowledge users |
| **Long-term outcomes of partnership formation** | Total = 15 |
| Use of research in practice/policy | $N = 9$ | [67, 76, 80, 82, 83, 95, 101, 106, 110] | Development of relevant practice change(s) in hospital or community |
| Scale-up/spread of research | $N = 5$ | [37, 38, 41, 88, 100] | Research is spread to new areas |
| System/health service outcomes | $N = 1$ | [77] | Changes in clinic processes and increased clinicians self-efficacy |

Not reported $N = 20$
navigate relationship-building with different knowledge user groups.

Academic supervisors play an important role in supporting trainees to navigate the “space between” and develop effective research partnerships with knowledge users. Our findings reinforce previous research on leveraging pre-existing research relationships to support IKT [18, 128] and highlight the value of research programme partnerships to facilitate trainee IKT research. Research programme partnerships and longer-term relationships, as opposed to one-off project partnerships, offer time and space for clear articulation of expectations, which allows for effective collaboration and mutual gain [129]. If research programme partnerships exist, it is easier for trainees to align their project within their supervisors’ larger research programme, which includes clearly developed practice linkages and existing research partnership supports [128]. Further, research programme partnerships ensure continuity of relationships between academia and the health system; when a trainee finishes their training and moves on to their next career stage, the supervisor can maintain the research partnership with the knowledge user. There may also be instances where trainees bring their own knowledge user partnerships into their academic training. For example, several papers described an existing role that trainees had within a community or organization, in which they used their partnerships to build a research study [76, 88]. In this scenario, supervisors should respect this pre-existing relationship and offer support on the academic research process to further develop the existing relationship into an effective research partnership.

Our findings also highlight how interpersonal influences can help and/or hinder the research partnership. The interpersonal and group dynamic barriers and facilitators to research partnerships illustrate the inherent relationship focus of IKT. Previous reviews of IKT-related literature have highlighted similar relationship-focused barriers and enablers to partnership research [4, 5, 17, 130]. Power dynamics are often at the core of research partnerships [131]. Several included studies highlight the influence of power hierarchies on the trainee experience with IKT, including pressure from both the academic and health institution to meet certain deliverables and timelines. This is particularly relevant for trainees who are already challenged with power hierarchies within the academy and may be entering into additional power differentials with knowledge users. Establishing mutually respectful relationships requires trust-building and being trustworthy to promote power-sharing and co-create knowledge [130]. Humility is an emerging area of interest in the field of IKT for developing meaningful and trustworthy research partnerships [132]. Humility stresses the need for self-assessment of one’s intellectual strengths and limitations, but also an appreciation of the contributions of others [133, 134]. Key strategies for practicing humility include clarity of thinking, open-mindedness, a commitment to mutual learning and ensuring that researchers do not bring a view of themselves as superior to the research team [132]. It is important for trainees to practice humility during research partnerships by acknowledging their positionality and taking the time to learn about the context and culture of an organization or community [132, 135]. These efforts will support collaboration, mutual learning and responsiveness among researchers, communities and health organizations.

Several organizational barriers and facilitators influence trainees’ opportunity and motivation for engaging in IKT or other research partnerships. Included papers reported a number of competing priorities among trainees (e.g., thesis/project completion), knowledge users (e.g., patient care, service delivery, resource use) and university institutions (e.g., timely thesis completion, resource use). Similarly, previous IKT research has illustrated how competing priorities can hinder successful research partnerships [4, 27, 136]. However, this review details specific challenges that trainees encounter with IKT. Individual trainees may have the motivation to engage in research partnerships, but there is often a lack of structures and resources in place to support the IKT process (e.g., funding to support knowledge user engagement). Our findings build on previous IKT recommendations including co-creating value-driven work with a shared purpose, and thereby fostering mutual gain [129, 137]. Further, institutional resources (e.g., funding) and policies are needed to support research partnership approaches for trainees, including flexibility in thesis guidelines, memoranda of understanding between academic and health system institutions, and tangible resources (i.e., guidelines, worksheets) to support co-creation of common goals.

**IKT or other research partnership outcomes**

IKT and other research partnership approaches suggest that active engagement of knowledge users throughout the research process increases the use of research in practice and policy [2, 4]. Despite the positive intent of IKT and research partnerships, there has been limited empirical evidence of the effects of IKT on evidence use to inform policy and practice [4]. Building on Gagliardi and colleagues’ scoping review on IKT [4], we organized our outcome findings into three categories of partnership formation. Most papers reported on intermediate outcomes of partnership formation, such as enhanced relevance of research (n = 18), and partnership formation outcomes, such as valuing different perspectives (n = 13).
However, only nine studies reported the use of research in practice/policy as an outcome, which is the primary goal of IKT. Further, over a quarter (n = 20/72) did not report outcomes at all. These findings highlight the lack of studies evaluating the impact of the IKT beyond the partnership formation and relevance of research. Efforts are needed to advance the science by moving the field beyond partnership formation studies and understanding the impact of IKT on conceptual, symbolic and instrumental use.

Our findings align with recent calls to advance IKT evaluation, including Kreindler’s [138] work on using a realist evaluation approach to examine how IKT influences the tangible use of evidence in decision-making related to practice and policy. Realist evaluation investigates “what is it about an intervention that works, for whom, and under what conditions” [139] and is a valuable approach for understand the complexity and nuances of IKT partnerships. Quantitative research methods are also warranted in IKT research, including the application of valid and reliable measurement tools of knowledge user engagement. Several tools exist for patient and public engagement in research that may be useful in examining broader stakeholder engagement (i.e., patients, public, healthcare providers, health system leaders) [140–142]. Trainees involved in IKT research are encouraged to apply these qualitative and quantitative methods to evaluate their IKT approach and contribute to the growing body of evidence on IKT impacts and outcomes [143].

Summary of implications
Findings from our review address two of the four main goals of scoping reviews [22]: (1) examine the extent, range and nature of the research activity; and (2) identify research gaps in the existing literature. First, this study mapped what is known about trainee-led IKT and partnership research in the literature. Our findings highlight that more formal training efforts may be needed to support skill development for research trainees involved in partnership research. Further, our findings build on previous IKT work highlighting the need for organizational resources and policies to support research partnership approaches.

Second, this review identified research gaps in the existing IKT literature. To advance our understanding of IKT principles and strategies and how trainees partner with knowledge users, we recommend clearly articulating specific activities used in each level of engagement. These details would help trainees to plan knowledge user engagement during their research projects, including the feasibility and utility of different levels of engagement, and would help to understand differences among types of knowledge users. Further, while the included studies described IKT and research partnership approaches, it was not clear why trainees embark on IKT. Additional empirical research is needed to understand the trainees’ motivations for using an IKT approach in their research. This type of research should also aim to understand the unintended consequences of IKT and the power dynamics experienced by trainees and knowledge users, and to identify strategies to promote authentic collaboration, power-sharing and co-creation of knowledge. Lastly, our findings highlight the need for more evaluation of IKT and partnership approaches. We recommend that trainees evaluate their IKT approach and contribute to the growing body of evidence on IKT impacts and outcomes.

Limitations
Several limitations may affect the interpretation and use of our review findings. First, although we built our search strategy from an umbrella review of IKT and research partnership reviews [144], partnership research is a broad phenomenon. We narrowed our focus to IKT approaches or similar research partnerships that focused on working with knowledge users throughout the health research process. However, IKT is predominantly a Canadian term, and we may have missed papers that described research partnerships differently or in a language other than English. This may be why no papers were identified from lower- and middle-income countries. Second, we only included papers that were written by trainees. Although we conducted a follow-up search of the author’s information to identify trainee status, it is possible that we may have missed papers and did not capture all trainees who have used an IKT or other research partnership approaches in their work. Third, many papers lacked detail on the IKT principles and strategies, which made it challenging to analyse the IKT approach using the WIDER [32] reporting checklist. A specific reporting guideline for this type of work is needed to improve reporting and understanding of the IKT approach, including level-of-knowledge user engagement and IKT strategies. Fourth, we categorized the barriers and facilitators into three levels (individual, interpersonal, organizational) to aid in interpreting how the individual trainee is situated within the academic-health system. These categories are not absolute; many barriers and facilitators exist across the three levels and could be categorized differently depending on the context. Lastly, we found that a quarter of included papers did not evaluate their IKT approach outcome of partnership formation. However, it is important to note that our focus was on the IKT trainee experience and not specifically on evaluation of IKT. These types of evaluation studies may have been published separately and at a later
date, as the impact of IKT projects can take years to be fully realized and evaluated.

Conclusions
This scoping review of 74 papers describes how health research trainees have used an IKT or other research partnership approach in their research. Most trainees have collaborated with knowledge users in the research question development, recruitment and data collection research stages. We identified key barriers and facilitators related to individual, interpersonal and organizational factors. Findings illustrate the importance of having specific knowledge and skills to engage in research partnerships, interpersonal influences of supervisors and knowledge users, and institutional support for a different way of working in graduate and postgraduate work. We also identified enhanced relevance of research findings as an important outcome of IKT trainee research. These review findings can serve as a basis for future reviews and primary research focused on IKT principles, strategies and evaluation. Further, we expect these findings can be used to inform IKT training efforts including trainee guideline development and academic-health system research supports.

Supplementary Information
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Additional file 1. Search strategy.
Additional file 2. PRISMA_ScR Checklist.

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Authors' contributions
CC, AB, AC, MDV, CL, ER, TN and SS designed the scoping review protocol including data collection and interpretation planning. CC, HDS, KM, SS, CL, MDV and JL performed the title and abstract and full-text screening. CC, HDS, TN, AB, MDV, AC, JL, RD and LD performed data extraction. CC and HDS conducted data analysis, and the full team participated in data interpretation. CC and HDS wrote the first draft of the manuscript. All authors critically reviewed and revised the manuscript and approved the final version.

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