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Working with multidisciplinary or non-academic collaborators as mentors

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Working with multidisciplinary or non-academic collaborators as mentors

Abstract

Mentoring relationships in academia are traditionally constructed as hierarchies, where a supervisor mentors a trainee, or an advisory committee guides a trainee. We propose that all collaborations are mutual mentorship opportunities, where all people involved learn from each other while working towards a common goal. Moreover, researchers and trainees can be mentored or learn from non-academic mentors in different disciplines or sectors. Herein we outline a tutorial on how to break down a research project into stages, and the logistics and value of engaging mentors or collaborators from different sectors and disciplines at each stage, and how multidisciplinary or non-academic collaborators can provide mentoring to support trainee learning and academic success.

Keywords

collaboration, mentorship, implementation, physical activity

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Working with Multidisciplinary or Non-academic Collaborators as Mentors

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Abstract

Mentoring relationships in academia are traditionally constructed as hierarchies, where a supervisor mentors a trainee, or an advisory committee guides a trainee. We propose that all collaborations are mutual mentorship opportunities, where all people involved learn from each other while working towards a common goal. Moreover, researchers and trainees can be mentored or learn from non-academic mentors in different disciplines or sectors. Herein we outline a tutorial on how to break down a research project into stages, and the logistics and value of engaging mentors or collaborators from different sectors and disciplines at each stage, and how multidisciplinary or non-academic collaborators can provide mentoring to support trainee learning and academic success.

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Introduction

Trainee-led research in academia is often perceived as a hierarchical relationship with one learner and one or more academic advisors, or mentors. However, it is really a group of people asking a question and collecting information to answer it, where the entire team learns from the experience. Researchers are encouraged to collaborate with researchers from other disciplines, or with knowledge users, such as industry partners, health care providers, policy makers, patient advocates, or non-profit organizations. What if we expand the concept of mentor to non-academic collaborators? Non-academic or multidisciplinary collaborators can offer support similar to what should exist in a good mentoring relationship: providing moral or psychological support; enhancing self-awareness, vision-building, and goal setting; supporting skill development, networking, advocacy, or system navigation; being a role model; and advising on career progress (Byars-Winston & Dahlberg, 2019; Sambunjak et al., 2010). Having non-academic mentors can help trainees develop professional, leadership, and communication skills, and can create networking opportunities. Engaging with knowledge users as mentors or collaborators can help trainees identify real-world problems, and formulate research questions to bridge knowledge-to-practice gaps. Or, various mentors can provide "micro-mentoring" at specific stages of a project, consistent with the idea that having one single mentor may not be the most efficient or effective way to meet a mentee's needs (Byars-Winston & Dahlberg, 2019).

The National Sciences and Engineering Research Council of Canada (NSERC) has a competitive funding initiative, called the

Collaborative Research and Training Experience (CREATE) program, to support innovative graduate training programs that encourage collaborative, multidisciplinary, and integrative approaches to mentorship, as well as research. NSERC CREATE training programs can be situated either within natural sciences and engineering, or at the intersection between natural sciences, engineering, and health, or between natural sciences, engineering, and social sciences. Programs that receive NSERC CREATE funding must be recognized nationally for a rich training environment, the excellence of the researchers in terms of their success in training highly qualified personnel, the capacity to raise the standard for best practices in research training and mentoring, and encouraging trainee mobility between universities, or between universities and potential workplaces (e.g., collaboration between industry and academia). The University of Waterloo received NSERC CREATE funding to establish a Training in Global Biomedical Technology Research and Innovation program, a "needs-first" graduate program, where trainees learn to directly interact with end-users in the patient, medical, and biotechnology industry communities to co-discover problems and solutions based on defined needs. One of the goals of the training program is "to eliminate artificial boundaries that exist between disciplines and to approach each design problem, and need, holistically without disciplinary silos." However, that goal requires deliberate and thoughtful strategies about how to mentor students on collaboration within academic settings, outside of academic settings, or within a diverse collaboration that includes people from both settings. The authors of this work represent mentors and mentees in the program. Herein we outline the logistics and value of engaging collaborators and mentors from different sectors and disciplines at each stage of the research process. Thus, the aims of this article are to: 1) provide guidance on how to collaborate or establish mentoring relationships with knowledge users or researchers from other disciplines; and 2) provide guidance to training programs on how to mentor students on initiating collaborations outside of academic settings.

Who Can Be a Mentor?

All collaborations can be mutual mentorship opportunities, where all people involved learn from each other while working toward a common goal. A mentor's role includes creating connections with potential collaborators, providing networking opportunities, advising on career progress, supporting knowledge mobilization (e.g., uptake of research by academic and knowledge user audiences), and providing psychological support and guidance on how to manage difficult situations (Byars-Winston & Dahlberg, 2019; Straus et al., 2009). A non-academic mentor can do all of those things, and their mentorship may be of particular value to researchers and trainees that are considering non-academic careers, or who do research that has translational, clinical, or implementation science applications. Mentees could have the autonomy to identify what their needs are, and seek the appropriate mentor for those needs (Byars-Winston & Dahlberg, 2019). However, it may be daunting to figure out the logistics of engaging collaborators from other disciplines or sectors, and at what stages. A first step could be breaking the research into stages, defining learning needs at each stage, and identifying who might be a good mentor to support the learning needs. Example stages or tasks include (Figure 1): defining who is leading the research; defining the problem; developing research questions and methods; conducting data collection, analysis and interpretation; getting approval from the

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research team; facilitating academic dissemination; and promoting knowledge mobilization and implementation. At each stage, think about:

- Am I doing one project, or are there several projects that I need to do to answer the question that I am trying to answer?
- Who is the research about? Who will use the research? How can I understand what they need?
- What methods would I use? What resources, skills, or perspectives do I need?
- What do I need to learn? What can I offer to others?
- Who can provide mentoring, provide access to networks, advise on progress, or support knowledge mobilization?

How to Break It Down into Stages, Identify Your Needs, and Identify Mentors to Support the Needs

Who is leading the research? While researchers often lead the research, there are scenarios where others direct the research. An industry partner, or even a policy or decision maker might have a question they want to answer, and they reach out to researchers to help them lead that research. A basic science researcher who wants to test their novel discovery in a clinical trial may need a clinical trialist to co-lead the research. If the research involves indigenous peoples, consider locating resources to guide the collaboration, or identifying a mentor or knowledge keeper as a guide (https://ethics.gc.ca/eng/tcps2-eptc2_2018_chapter9-chapitre9.html). Trainees can go beyond collaboration to seeking mentors or research co-leads from the group of people they are researching (i.e., involving them from the design phase to conducting the research and disseminating the findings). Clinical, translational, or biomedical research may have more real-world usability or influence broader audiences if there are people who will use the research as mentors or co-investigators on the research team. In all of the above scenarios, the collaboration provides an opportunity for mutual learning and mentorship of trainees by non-academic mentors, or mentors in another discipline.

Defining the problem. It is important to define *why* it is important to do the research (e.g., testing behavior change interventions to increase physical activity, understanding how epigenetics contribute to obesity, understanding how power structures influence a person's experience of disability, or improving ultrasound technology for imaging arteries). Before defining objectives, hypotheses, or methods, researchers must be able to define and understand the problem they are addressing. One way to do that might be to perform a literature search, or systematic or scoping review, to understand what is known about a topic. A survey on knowledge user needs, values, and preferences, or qualitative studies of barriers to knowledge use can provide comprehensive insights on knowledge user perspectives and needs (Figure 2). An audit of existing practices using administrative data can reveal practice gaps. Research ideas can emerge from identifying knowledge or practice gaps, user needs, or barriers to implementing research. However, sometimes the trainee, academic supervisor, or researcher does not have expertise in qualitative or survey research, or systematic reviews. They may need an additional mentor to provide expertise, or access to collaborators or networks (Table 1).

Developing research questions and methods. Once the problem and knowledge gaps are defined, the researcher must define the hypotheses or research questions, and the associated methodology. A good mentor will

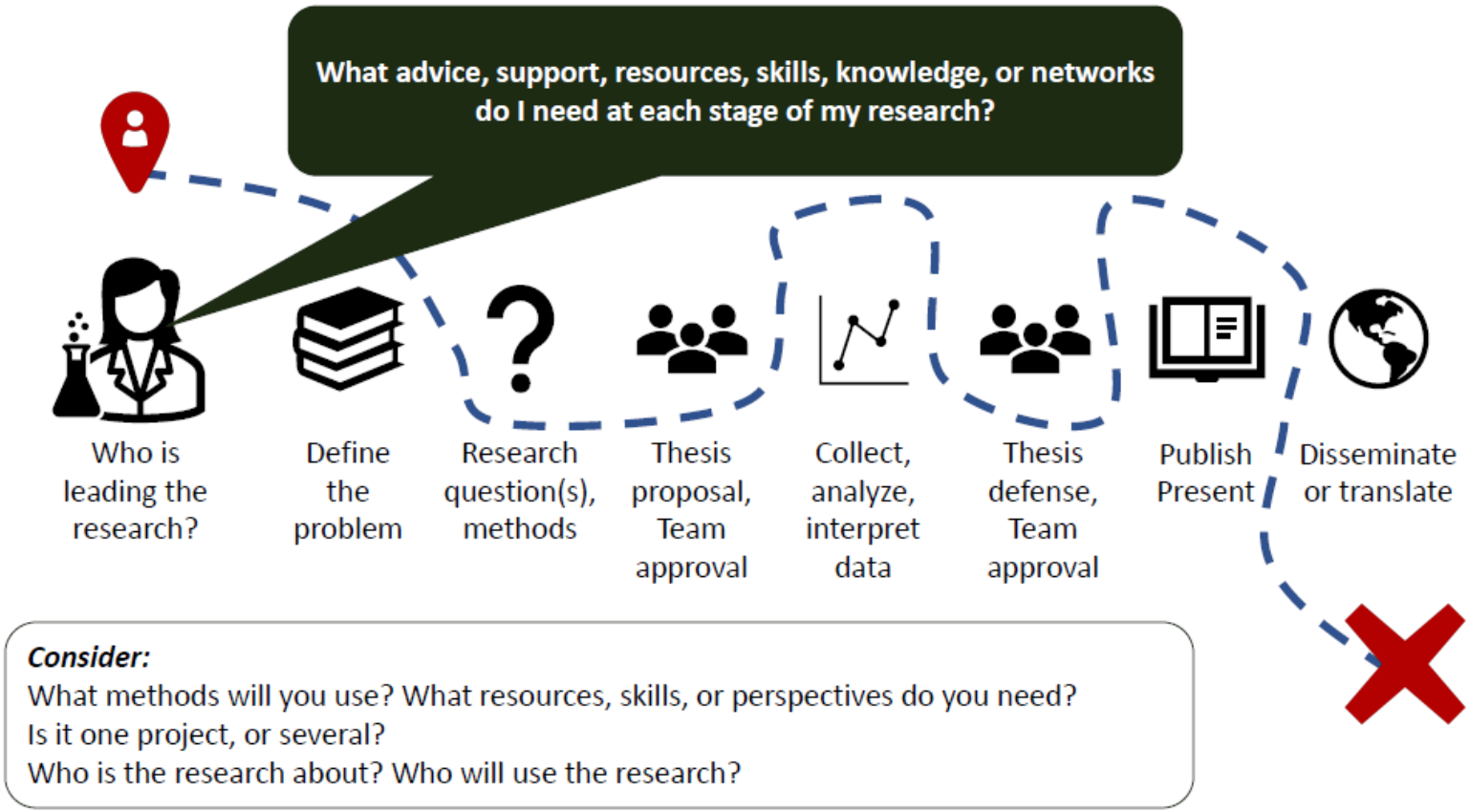

Figure 1. Outline the stages of research and what mentorship you need at each stage.

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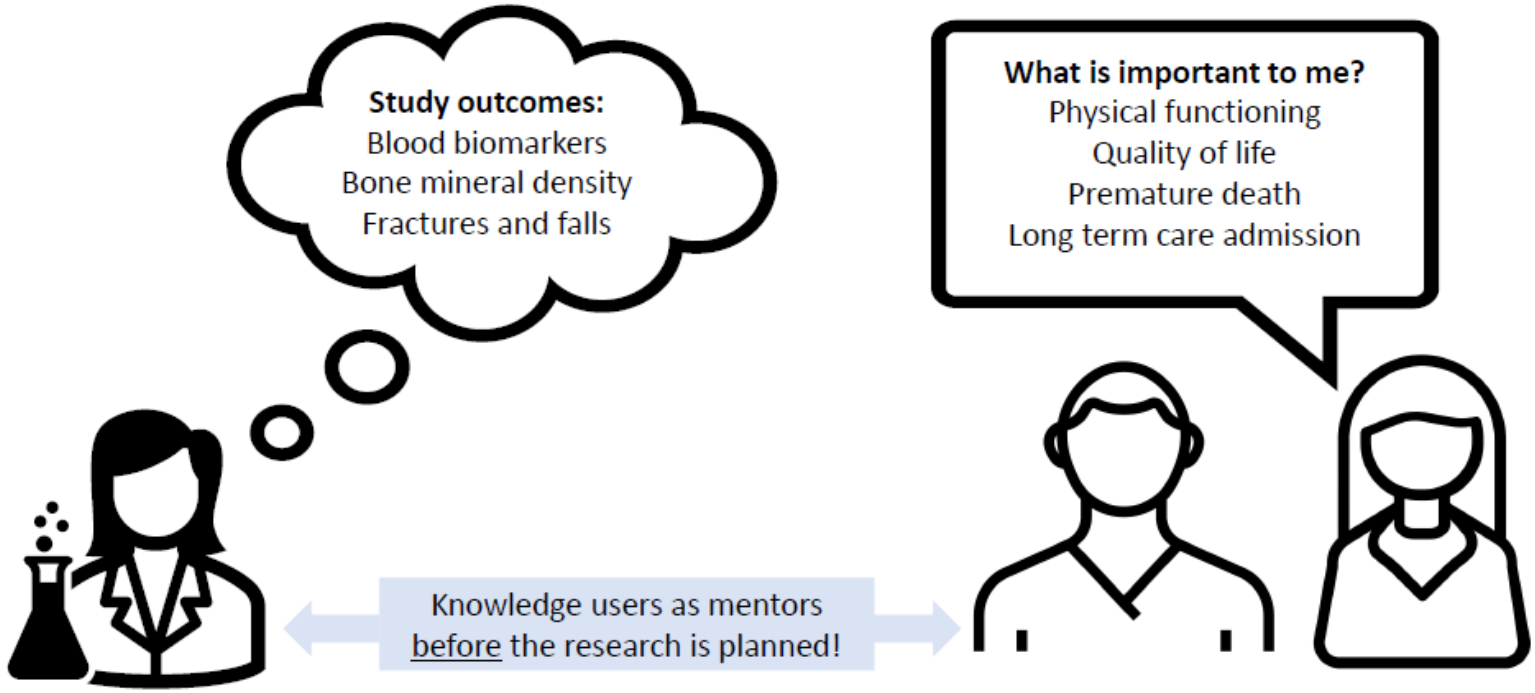

Figure 2. The outcomes that a researcher is interested in may be very different than the outcomes a knowledge user is interested in.

Table 1

Mentorship on How to Define the Problem

Mentor	Mentoring Opportunities
Librarian	Mentorship on a scoping or systematic review to outline what is known in existing literature: developing search methods (e.g., academic database selection, search strategy construction, grey literature searching), management of references, organization of the screening process, critical appraisal, or writing the Methods section.
Systematic review expert	Academic guidance on methodology, narrative or meta-analysis methods, interpretation, dissemination, and vision-building for next steps.
Knowledge user to provide a 'practical' perspective (e.g., patient partner, healthcare provider, policy maker, industry partner).	Can describe the problem from their experience, share values, needs, or preferences, or outline the barriers to implementing knowledge or research. Can help refine topics or outcomes of interest (Figure 2), pilot test survey or interview guides, or help with interpretation.
Academic collaborator with expertise in qualitative research, survey methods, or behavior change.	Can help define the sampling frame, or survey or qualitative method. Can advise on reading or learning materials, or make connections with networks of people to survey or interview.
Public health professionals, organizations, epidemiologists, biostatisticians.	Mentorship on an audit of existing practices using available performance or administrative data (e.g., access to data, navigating data access or ethics board requirements, data management and analysis, knowledge mobilization.

support skill development (Sambunjak et al., 2010), but if a trainee or researcher wants to use a new research design or methodology, they may need to seek a specific mentor with that expertise to support their learning. For example, a basic scientist or engineering researcher that has designed a new treatment or intervention may want to apply for a grant to do a proof of concept, pilot, or feasibility study (Thabane et al., 2010), followed by a randomized controlled trial to test its efficacy. If they have never done a pilot or feasibility study or a randomized controlled trial before, they could establish a formal mentoring relationship with someone who has the expertise, to guide their learning, and connect them with collaborators and professional networks.

A patient group, advocacy organization, people in your network, or healthcare providers can help with research design, networking, communication, or recruitment strategies. The outcomes that a researcher is interested in may be very different than the outcomes a knowledge user is interested in (Figure 2). Patient partners or clinicians can

foster conversations about outcomes, equity, how representative the research is, or understanding the clinical context or target population, such as clinical characteristics that should be listed as inclusion or exclusion criteria. Working in multidisciplinary teams helps trainees to understand the population from different perspectives (e.g., researchers, physicians, patient advocates, caregivers, etc.).

In a clinical trial, the *intervention/ exposure* is the experimental condition, and the *comparator* can be a control group, placebo, or "usual care/activities" condition, or they can receive a different intervention. Knowledge users, ethicists, biostatisticians, or clinical trial methodologists can provide mentoring or guidance on critical features of the intervention or comparator. An engineer designing a walker for people who are at risk of falls might need mentoring from an occupational therapist that often assesses people for walkers and prescribes them; the occupational therapist could provide mentoring on the challenges with using walkers, what user needs are, or what the standard of care is. An ethicist might help determine if the comparator is ethical (e.g., if you are using deception, or if you are not providing an intervention that is thought to be of benefit), or help define the process for monitoring and adjudicating adverse events. In some studies, it is not possible to use a placebo. For example, in exercise research, you know whether you've been randomized to the exercise or the control group because you're exercising or you are not. If the participants are not blind to group allocation, people may get disappointed when they get randomized to the control and drop out. Or, they might seek intervention elsewhere, which is a form of contamination. Patient partners can provide advice on the design of comparators to prevent attrition or contamination, such as having an attention control, or even an active control. A biostatistician or methodologist mentor can advise on pragmatic or innovative clinical trial designs, such as a stepped wedge design, so that everyone gets the intervention. A user or referring health care provider may be concerned about an intervention's usability, or whether use will be sustained over time. Thus, an expert in usability studies or implementation science can provide mentoring on research questions, outcomes, or study design related to usability or implementation. Or, if the cost of implementing a new technology relative to the benefits is a concern, a health economist can provide mentoring on collecting, analyzing, and reporting costing data (Hassan et al., 2020).

Data collection, analysis, and interpretation. What expertise is needed to collect and manage the data? For a qualitative study, seek a mentor that understands which approaches (e.g., ethnography, phenomenology, grounded theory) and methods (e.g., observation, interviews, case studies, thematic analysis, content analysis) to use. If a study requires access to existing datasets, a mentor can create collaborations that foster access to the data, or obtain legal advice on data sharing agreements or privacy standards. A biostatistician mentor can guide how to manage data or how to deal with missing data. It is better to involve a biostatistician mentor to advise on the data analysis plan **in advance** of data collection rather than involving them afterward, only to realize you should have collected or managed data differently. It is even better to involve a biostatistician when writing the grant or designing the protocol. When interpreting the data, a knowledge user mentor can help you understand what the results mean to a policy maker, to a healthcare provider, or to a person who's living with a disease that you're studying. For example, one could present the results of the analysis to them and say, "What does this mean to you?" or "What other

questions do you have?" to get insights on interpretation or dissemination.

Approval from the research team. Once a study is complete, it is customary to present it to the research team or thesis advisory committee to get input on interpretation, limitations, and plans for dissemination. With collaborative research, you have more people involved, which means you have more voices when it comes to data collection, analysis, and interpretation. There may be disagreements, or a lack of consensus. Poor communication can lead to failed mentoring relationships (Straus et al., 2013). One strategy is to have a plan, in advance, for how the collaboration or mentoring relationship will work, and revisiting that plan over time. The plan should outline clear expectations, mutual respect, trust, transparency, communication methods, and strategies to make the relationship sustainable and mutually rewarding, consistent with the principles of successful mentoring relationships (Byars-Winston & Dahlberg, 2019; Straus et al., 2013). Some collaborators or mentors want to be involved in all aspects, and some only wish to contribute intermittently. A governance strategy or charter for collaboration can be used to establish trust and transparency (Byars-Winston & Dahlberg, 2019). It can describe how often meetings or communications will occur, how disagreements will be resolved, who the members of the team are and any hierarchical relationships, what the expectations are of team members, and their options regarding participation. To allow the relationship to evolve over time, the mentor(s) and mentee can revisiting the mentoring plan, governance strategy, or charter regularly (Byars-Winston & Dahlberg, 2019). Extend the structured communication to project planning, particularly when mentees or trainees are seeking feedback or agreement on a project. For example, use a project planning template (Table 2) for trainee projects to ensure that trainees, mentors, and other team members are in agreement regarding a trainee's project objectives, the data to be collected, and the statistical analysis plan. The trainee should outline and circulate the plan in advance, for feedback, before data collection occurs.

Academic dissemination. It is important for trainees and mentors to agree on the scope, schedule, and costs of a project, and what the deliverables will be, including deliverables related to academic dissemination. Trainees may need mentoring on how to decide on who to include as an author, author order, or target journal. Discussing the scope, schedule, and authorship for academic deliverables in advance can be a way to set tangible goals and align expectations, which are key roles of a good mentor (Byars-Winston & Dahlberg, 2019). For example, for a given research project, list the dissemination mechanisms (e.g., peer-reviewed journal article with target journal, presentation at a conference, infographics or other lay communication(s)). Decide which research questions or data will be used in each academic deliverable, who the authors will be, and in what order they should be listed. Be transparent about who should be included in the planning and dissemination of a project, and select authors and author order as early as possible. To be listed as an author, one should have made meaningful contributions, such as those outlined in the International Committee of Medical Journal Editors authorship guidelines (http://www.icmje.org/recommendations/browse/roles-and-responsibilities/defining-the-role-of-authors-and-contributors.html).

For studies with large teams or multiple potential academic deliverables, define authorship guidelines in advance, and if new ideas for dissemination might emerge later, what the process is for team approval and authorship. The authorship guidelines should

specify how author order is decided, including how to decide on first/last author. For example, listing the person who led the analysis and writing as first author, or listing trainees first, and principal investigator last, with the rest in alphabetical order. The authorship guidelines should also outline what to do if team members have ideas for ancillary publications using the data collected.

Table 2

Example Project Planning Template for Trainees

Research Question or Hypothesis	Dependent Variable	Independent Variable	Covariates, Confounders or Effect Modifiers to Consider	Statistical Analysis
Primary Research Question				
Does thrice weekly strength training at high intensity for 12 months improve lumbar spine bone mineral density (BMD) compared to control in men and postmenopausal women over the age of 50 years?	Lumbar spine bone mineral density, in grams per centimeter squared, measured using dual-energy X-ray absorpti-ometry	Strength training compared to control	Baseline BMD Sex Adherence	Linear regression Sensitivity analyses to determine if the effect is different in individuals with ≥ 90% adherence
Secondary Research Question(s)				
Does thrice weekly strength training at high intensity for 12 months reduce falls compared to control in men and postmenopausal women over the age of 50 years?	Rate of falls per person per year in each group, recorded daily using postage-paid calendar cards, mailed monthly	Strength training compared to control	Adjust for varying duration of follow-up, over dispersion	Negative binomial regression model

Mentors advise on career progress (Byars-Winston & Dahlberg, 2019; Sambunjak et al., 2010), and part of this should include advising on plans for knowledge mobilization, so that people read the research. The question, "What journal should I submit to?", was so common among our trainees that we created a flow chart (Figure 3). The flow chart encourages trainees to select a journal that strikes the best balance between being a good target for the audience and having a realistic chance of acceptance, to avoid

having to submit it to multiple journals to find a home. Researchers should determine whether there are reporting guidelines to improve reporting quality, or make the paper more rigorous and transparent (https://www.equator-network.org/about-us/what-is-a-reporting-guideline/).
Academic and non-academic mentors can support sharing of the research with collaborators, funding organizations, advocacy or regulatory organizations, and others in their networks. Using social media for dissemination is becoming much more common, so one could seek mentoring from experts in social media or traditional marketing, communications, knowledge mobilization research, or information technology on dissemination. Other collaborators or consultants to consider are graphic designers, translators, or plain language specialists. Trainees and researchers should include a budget for dissemination in grant proposals.

Knowledge Mobilization and Implementation

It is often important to not just disseminate, but do things to support implementation of research outside of academic audiences. Mentors can create connections or networks with non-academic audiences, or foster collaborations with experts in implementation science. Implementation scientists or knowledge users can help define the knowledge-to-practice gap or barriers to and facilitators of implementation, help select and tailor implementation approaches, or provide insight on evaluation and sustainability of implementation. Examples include working with non-profit organizations that might want to implement your work among academic, healthcare, policy maker, industry or lay audiences. Mentoring on how to approach knowledge mobilization may be particularly important if the findings are controversial or may influence politics or practices in specific sectors, to avoid negative political or professional consequences for the mentee.

Other Considerations

Equity, Diversity, and Inclusion (EDI)

An advantage to having more than one mentor is the opportunity to be mentored by a variety of people, creating opportunities for diverse perspectives. Consider EDI at all steps, from defining the team and problem to dissemination. Who is represented on the team? Are the inclusion/exclusion criteria so restrictive that the participants will not represent certain groups, or not target the right ones? Non-academic mentors may help foster conversations about who should be represented in the dissemination or knowledge mobilization plans, and how to reach them. For example, if the dissemination strategy is to use social media, but the research is about people who live rurally and who are older and maybe don't use social media, then it might not reach the target audience.

Trainees and researchers can use PROGRESS-Plus (https://methods.cochrane.org/equity/projects/evidence-equity/progress-plus) to consider factors that may influence inequity in health. Researchers can collect data representing the

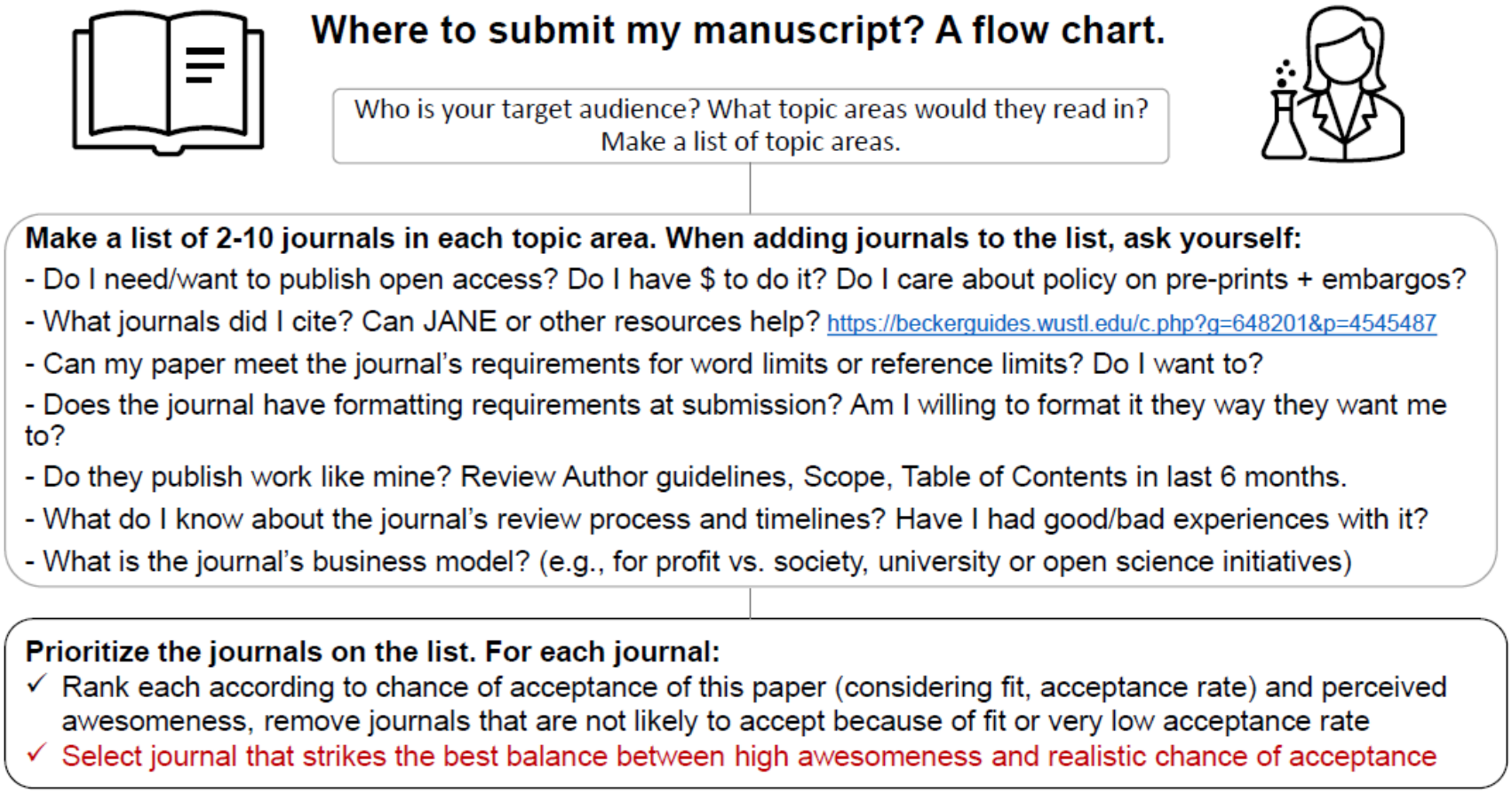

Figure 3. Where to Submit My Manuscript: A Flow Chart.

characteristics listed in PROGRESS-Plus to describe the study population, and understand who it represents, and who it doesn't. The Intersectionality and Knowledge Translation Toolkit can guide an appreciation for how the intersection of factors can influence a person's experience, and how to plan your dissemination strategies in a way that considers intersectionality (https://knowledgetranslation.net/portfolios/intersectionality-and-kt/). For example, if a person is female, is a person of color, is non-binary, has a low income, and lives with a disability, they may have a very specific experience of health or healthcare compared to someone who is middle class, white, and female, with no disability – the intersection of factors can influence a person's experience or may influence their inclusion in research. We are not advocating that research must represent all people, but it is important to understand who is represented on the team and in the data, and how that might bias the work, and that includes the biases of the mentor and mentee. A simple start is having the research team use the Toolkit to reflect on which intersecting social factors, and their interaction with compounding power structures (e.g., media, education system) and forms of discrimination (e.g., sexism), may influence the researchers' perspectives or research.

Reciprocity: What's in it for Them?

Reciprocity and mutual respect are important principles in a mentoring relationship (Byars-Winston & Dahlberg, 2019; Straus et al., 2013). In a traditional academic mentoring relationship, the mentor may be expected to mentor trainees, but what is the benefit for non-academic collaborators? Non-academic collaborators may value learning about the research process, or contributing to something important. Some may value being formally acknowledged as a co-author. There has been increasing recognition for providing compensation to knowledge users (CIHR, 2022). If a patient partner is being asked to be involved in a year-long project, is there funding in the grant to give them an honorarium? Are there tangible benefits to a collaborating organization that will result from the work – does it align with their mission? Create a culture of continuing collaboration by offering time to support a mentor's or collaborator's projects or work (e.g., being on a scientific advisory council for an organization, or being a person they can reach out to for advice on program evaluation or content expertise).

How Do I Initiate Collaborations or Mentoring Relationships?

Trainees benefit from creating a network of academic and non-academic colleagues. Mentors can create networks, and provide advice on how to initiate collaborations (Straus et al., 2009). Example strategies that could be used to seek mentors, collaborators, or knowledge users include:

- Create a newsletter mailing list or social media profile for people interested in learning about what your research team is up to. Use it to send out information about your research, educational events, or opportunities to participate in research. Every time you give a public or academic lecture, share social media channels or other communication mechanisms your research team uses. Advertise using traditional or social media (e.g., "We are looking for older adult representatives to be on this panel to help advise on this research strategy").
- Are there individuals at your institution whose job it is to help

identify potential knowledge users, industry partners, non-profit groups, or communication networks to foster collaboration?

- Identify whether there are non-profit, community, advocacy, or regulatory organizations or other groups that have interests that align with yours. Volunteer to work with them by giving lectures, or being on advisory committees.
- To identify researchers with specific expertise that you need help with, you can:
    - look at the authors of papers that do the type of work you want expertise in;
    - identify conferences in the field with that expertise, and see if anyone is presenting on relevant topics;
    - ask colleagues if they know of potential collaborators;
    - if your social media interactions are in academic circles, post a call-out on social media for researchers with the expertise you want.
- Do your homework. If approaching an organization, what is their mission statement? What are the activities they're currently involved in? Do they do their own research? Do they fund research? Do they have a strategic plan for the next five years and how does your research fit with that? Why should they care?
- When sending an invitation for collaboration or request for mentoring, be concise and clear (see example below). Provide specific examples of expectations and benefits. Specify what they need to do next. How can you make it easy for them to participate?
- Make it clear how they can expect to be acknowledged or compensated (e.g., pay, co-authorship).

Example: I'm writing a grant and I would like an organization to facilitate dissemination via their networks. The invitation might say, "Hello, I'm a professor at the University of Waterloo, leading a grant proposal to (insert organization here) for funding for ____ project (summary below). It aligns with your interests in _____. I'm wondering if your organization would be willing to disseminate the findings at the end of the study, and accordingly write a letter of support indicating your contribution to dissemination. I can draft a template letter of support for you. It is due on (this date). I would be happy to give a public lecture on the topic for your members as well. Thank you for considering my request."

Seeking mentors or collaborators from diverse disciplines or sectors may seem like a lot of work. One strategy is to plan to start with a smaller project and do it well, like a feasibility study, needs assessment, or usability study, rather than launching into a large research project without the right reasons or expertise. Trainees may feel daunted by research to answer big questions. A good mentor guides the mentee in vision-building and goal-setting (Sambunjak et al., 2010). For example, a mentor can help the mentee identify an important research question, and then break the process of answering it into steps, where the thesis may only be the first step or two leading to a future program of research. Many trainees may not realize that they can publish at every step. Publish the systematic review, the needs assessment, the pilot study, the usability study, the protocol for the randomized trial, the results of the trial, and any studies related to knowledge mobilization.

Summary

Non-academic collaborators or multi-disciplinary collaborators can offer the features of a good mentoring relationship, including providing moral support, role modeling, enhancing self-awareness, vision-building and goal setting, reciprocity, mutual respect, skill development, networking, advocacy, navigation, and advising on career progress (Byars-Winston & Dahlberg, 2019; Sambunjak et al., 2010). Graduate training programs should consider mentoring students on multidisciplinary and multisectoral collaboration, and including knowledge users in the research. Key steps include: breaking the research into stages; understanding the skills, expertise, and resources needed, and who can provide them at each stage; considering what the collaborator cares about, and how you can add value; aligning clear expectations and maintaining mutual respect; considering equity, diversity and inclusion; and establishing clear project, communication, dissemination, and implementation plans. You can have many mentors in your life. If you get lucky, they can also become lifelong friends and colleagues.

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