Review of Literature on Mentorship Networks in Medicine:

Where Are We Now and Where are We Going?

BY

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THESIS

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SUMMARY

Mentorship is imperative in medical training. Conceptual frameworks and best practices for mentoring are continuing to evolve. In this study, we focus on the role of mentoring networks in residency training. First, we reviewed the literature generally on the role of mentoring. Following this, we completed an integrated overview of the literature on mentoring networks that includes a qualitative analysis of the major themes and subthemes in this literature. Finally, we discuss the implications for scholarship and practice related to mentoring in residency training, particularly the role of mentoring networks.
I. BACKGROUND

Mentorship has been described as essential in developing physicians [1-15]. Both medical students and residents indicate that mentors are critical in their career selection [1, 7,9,12-15]. In this era of rapid technological advances in medical education, the role of the mentor appears to be “unsimulatable”. No amount of educational innovations can make up for the lack of a mentor [16]. The need for this interaction remains essential for developing successful trainees and practitioners. This role of mentoring has come under increased scrutiny in certain specialties as career preferences for medical students and residents have begun to shift [17,18]. The authors of one study reported that nearly 80% of pediatric residents indicated that having a mentor was very useful or critical for surviving residency training [16,19]. Authors of another study reported that personal satisfaction and mentorship were top factors listed by respondents who decided to pursue surgical training [20]. Other authors reported that mentorship was identified as the second most important factor for predicting excellence in one’s field [21].

Mentorship is a fluid process that changes as individuals develop in their training; the individual’s needs change and, as a result, their relationship with mentors can change accordingly. Due to the fluidity of this relationship, the defining features of the ‘mentor’ are difficult to delimit, often encompassing aspects of the role-model
A. Defining Mentorship

The literature on mentorship has applied multiple labels to the meaning of the word “mentor”. These labels have included advisor, friend, teacher/helper, coach, role model, sponsor, manager and leader [17,22,28-32]. Within residency all of these labels potentially apply, but this wide variety of definitions and activities makes it difficult to define mentorship and, therefore, to compare across studies to better understand the value of mentorship and how to do it well. Thus, it is important to understand each of these concepts and how they might be different from the concept of mentorship.

The unique nuances of the meaning of “mentor” are important to highlight, in order to distinguish this term from parallel terms. The original term “Mentor” originated in Greek mythology [33]. Pellegrini sought the definition of mentor in Greek mythology commenting,

“Mentor was not only teacher in the strictest sense, but a role model and guardian responsible for the emotional and intellectual development of Telemachus. The powerful example we are given is the role of substitute father Mentor fulfilled. Such is the role of mentors for our residents, who are in need of emotional and intellectual growth as they prepare to be independently practicing physicians.” [33].

Pellegrini goes on to explore Anderson and Shannon’s definition of a mentor as “role model, sponsor, encourager and a friend to a less skilled or less experienced
person for the purpose of promoting the latter’s professional and/or personal development” [30,32]. He summarizes the definition well by stating,

“From these collective perspectives, it is apparent a good mentor is more than a teacher who provides the bits of knowledge to the learner, and much more than a role model, who may simply demonstrate a pattern of desired behavior for the learner. An effective mentor transcends the roles of educator and role-model and serves as the guardian and promoter of the young physician’s personal and professional development.” [29].

The concept of mentor as “guardian and promoter” is reflected also in Souba’s work [30]. Souba suggests that the best mentors “are totally committed to the professional and personal growth of their mentee and genuinely want their people to do better than they have done” [30]. This selfless concept of the mentor suggests that the mentor develops and promotes the mentee.

Mentorship is distinct from advising. The mentor relationship is a “two-way street” [30]. An advising relationship involves a unidirectional communication from advisor to advisee. Historically mentors may have taken on a more advisory role. Souba argues that the older paternalistic view of mentorship is changing. Now mentors are seen as needing to “inspire, empower and liberate” [30]. Inherent in this two-way relationship is trust and commitment.

Commonly, mentorship relationships involve teaching and learning. Pellegrini suggests that conventionally a teacher is a purveyor of knowledge but a mentor “transcends this role” to take an interest in the professional development of the
mentee [29]. As much as mentors may actively teach, more importantly they help their mentees to develop applied knowledge and professional skills. Mentorship is also different than role modeling. A role model simply displays behaviors to be emulated but a mentor must interact with the mentee to shape the professional or personally desired outcome [29]. Megginson describes how mentoring is different than coaching [34]. He suggests that coaching helps those that are coached to build performance. Performance is often broken down into discrete steps to accomplish a task. A coach assists the learner in mastering these steps [34]. Mentoring is more comprehensive, in that a mentor helps the mentee through “life stages” or “crises” to help build a mentees “life’s work” [34].

B. Shifting from Dyad Relationships to Mentorship Networks – Kram’s Conceptual framework of the Relationship Constellation and evolution to the Developmental Network

Foundational to the Greek myth of the concept of “Mentor” is a relationship involving two people. This relationship has incredible potential for growth, richness and development if it is functional for both the mentee and mentor. The critical flaw however, relates to what happens if some aspect of the relationship is failing to fulfill essential needs for either the mentee or the mentor. Given the multidimensional nature of mentoring, one person rarely embodies all that is required in a mentor. As Neumayer commented, it is likely that the modern
surgeon is going to require “multiple mentors” to address all aspects of personal and professional development [12]. Increasingly, clinicians require skills beyond clinical management and patient care and must be adept in skills such as research, leadership, administration, management and communication; they must also develop a sense of self and wellness. Identifying one individual to satisfy this broad array of professional needs is almost impossible. DeCastro drew comparable conclusions, documenting the value of multiple mentors in the development of junior faculty [5]. As a result, utilizing the construct of a constellation or network is helpful in lifting the onus of responsibility from one mentor and onto the shoulders of many [5]. Thinking beyond the single dyad relationship of mentorship as an individual’s support structure, authors have suggested that “developmental interactions can occur with multiple providers from various sources with varying degrees of strength” [37-39]. The variety inherent in multiple relationships is reflected in mentoring networks.

Kram formulated the conceptual framework of the Relationship Constellation [35,39]. The relationship constellation is made up of a range of social relationships that support an individual’s development at every career stage. This constellation changes with time and allows for new or changed relationships to provide for additional functions. An individual’s personal and professional needs shape these relationships. This constellation of relationships is important in the
support of those involved in the mentor-protégé relationship [40] as demonstrated in Figure 1.

![Figure 1. The Relationship Constellation [39].](image)

The relationship constellation supports recruitment of multiple members into the development role [39,4]. Inherent in this constellation is the need for protégés to pursue relationships both within and outside medicine to promote both their professional and personal development.

Kram’s work has evolved since the original conception of the relationship constellation. Kram has collaborated with Higgins to describe the creation of a developmental network [36,42]. A developmental network is a “sub-network of people – a small group of five to six people - who you turn to for mentoring … a personal board of directors” [42]. As distinguished from looking at the mentor strictly as an “expert” the evolution of the conception of mentoring is seeing the mentor as a “co-learner” [42]; a peer as well as an expert.
Kram and Higgins described using multiple mentors with different areas of expertise to create a Developmental Network within the context of the business world [36,42]. Adapting this model, a developmental network for medical trainees would include a collection of traditional mentors and peers (Figure 2). This mentor structure may alleviate the onus on a singular mentor; providing more diversity in mentors for the trainee and potentially allow for more mentor relationships. Trainees should anticipate that multiple mentors will be needed as they develop as physicians [43]. Medical students and residents need to have access to these different mentors in academic, personal and clinical arenas.
Figure 2. Modified Relationship Constellation [39] including multiple mentors for trainee development.

The concept of mentoring networks, as distinguished from dyad relationships, is an evolving concept in medical training. Kram’s proposal [39] of the relationship constellation is integral to a new “world view” of mentoring. We need to think of mentorship in terms of mentorship networks with multi-member, dynamic and fluid constructs which change with time. The relationship constellation [39,41] paired with the work from Developmental Interaction literature [37,38] has lead to
the creation of the Developmental Network [36,42]. The Developmental Network is a helpful conceptual framework for re-framing mentoring relationships in medical training.

An additional lens that could enhance the understanding of mentorship networks in training is derived from Social Network theory. Social network theory “explains social relationships in terms of nodes and ties” [44,45]. Nodes are the separate participants in the network and the “ties are the relationships between and among the participants” [45]. Social network theory suggests that it is the relationships or ties between participants that is more important than the individual attributes of the participants. As well the strength of these relationships can be monitored and evaluated over time [44,45]. Focusing on the relationships within a mentorship network would enhance understanding of the dynamic richness of the network for the mentee. It would allow the mentee to think less about ‘what is this individual in my network doing for me’ and more about ‘how are these relationships enhancing the development of my learning and skill set.'
II. GOALS AND PURPOSE

The problem grounding this study is that the traditional dyad relationships of mentoring are often not sufficient to provide needed mentorships in the context of residency training. The questions driving this study are: What do we know from the peer-reviewed literature about the formation, preservation and nature of mentorship networks inside and outside of academic medicine and, how do these findings apply to the residency training setting? This paper explores these challenges in conceptualizing mentorship. First, we reviewed the literature on mentoring generally. Now, we explore these challenges to the traditional dyad conception of mentoring in reviewing the literature on mentorship networks in residency training. Through a review of the literature on mentorship networks in medical training, we will identify conceptual and practice limitations that exist in the mentorship network literature and propose future directions in exploring and developing mentorship networks in training.
III. METHODS

In this integrative review of the literature, we used a systematic approach to review the literature relevant to mentorship in residency training. In the first phase of the review, we searched the medical education literature. The parameters of this initial search included peer-reviewed English language literature. Databases examined included Medline, PubMed, PsycInfo, ERIC, Google Scholar and Web of Science. Peer-reviewed articles were filtered from these databases and non-peer-reviewed articles were excluded. The search was limited to articles published in English. MeSH terms used for the initial search included “Mentors” and a search for key words included mentor*, coach, role model*, role models, medicine and network*, in combination with the terms ‘medical student’ and resident*. For all articles identified through the search, the titles were read and abstracts were selected based on relevance to mentorship networks. Relevant articles were read in full. Using an iterative process, references cited in, or citing, the identified articles were reviewed for relevance to the review and for additional terms to be entered in the database searches. Articles identified through this iterative process were used to establish the current state of knowledge in the medical education literature regarding mentorship networks in residency education.
The second phase of the review expanded the frame of inquiry outside the medical education domain. Initial domains searched included education, business, and leadership using appropriate databases as identified by an information sciences expert. The process of identifying search terms was similar to that described in Phase 1. As in Phase 1, for all articles identified through the search, the abstract was read for relevance to the topic and articles deemed relevant were read in full. Using an iterative process, references cited by the identified articles were reviewed for relevance to the review and for additional terms to be entered in the database searches. Peer review of themes identified in the qualitative review was completed by a colleague in medical education (PAI). This peer review was undertaken to establish the trustworthiness of the themes.
IV. RESULTS

Figure 3 outlines the search strategy on mentorship networks. We initially identified 943 English language articles after removal of duplicates. All articles were published between 1983-2016. All titles were reviewed and 108 abstracts were reviewed. Twenty-four (24) abstracts were identified as relevant to mentorship networks or peer-group or collaborative mentoring from this refined reverse search. This led to a total of twenty-four (24) articles that were reviewed using qualitative methods to identify themes, regarding mentorship networks. Table I, Appendix is a summary table of the articles reviewed.
An iterative approach was taken to formulate themes and codes from the qualitative analysis of these 24 articles using qualitative methods. Seven (7) papers described mentorship networks [3,8,12,13,15,46,47], 6 described intensive group mentorship or peer-mentoring as a type of mentorship network [6,9,10,48-50,3] and 11 papers described both mentorship networks and peer
mentorship together [1,4,5,7,11,14,51-54]. Three papers were literature reviews on mentorship that outlined the importance of an expanded definition of mentorship to include mentorship networks, collaborative or group mentorship and peer mentorship in the definition of mentorship [7,11,13]. Twelve (12) papers were described as qualitative reviews involving mentorship networks, peer or group mentorship [1,2,4-6,8,9,48-50,52,54]. The remaining studies (9) were either empiric research focused on mentorship networks [3,46], application of conceptual tools or models for the development of mentorship networks [10,15,51,53], recommendations from a joint task force review [47] or presidential addresses reviewing mentorship [12,14]. Authors of seven papers examined mentorship networks in residency or medical student training [1,7,9,13-15]. Thirteen (13) papers described mentorship networks or peer mentorship of faculty [2,4-6,8,10,11,46,48-52]. Authors of four papers identified discussion of mentorship networks in disciplines including business [3], pharmacy [47], education [54], and translational research [53].

Using a qualitative approach for analysis, major themes and subthemes were identified from the 24 papers focused on mentorship networks. The papers were reviewed until a point of saturation was reached in the thematic analysis. Trustworthiness of themes was established though peer review completed by a colleague in medical education. Three major themes were identified in these papers. The first was that mentorship through group or peer networks meet
evolving and dynamic or changing needs through training and career
development [1-3,5,7,12,14,46-48,53,54]. The second major theme was that
mentorship networks offered a solution to barriers associated with the dyad
model of mentorship [1,9,11,14,15,50-52]. The third theme formulated was the
importance of the informality or “voluntary marriages”, as distinguished from
structured formal programs, to create meaningful mentorship networks
[1,4,7,8,47,52].

A prominent subtheme was identified within the theme of the evolving and
dynamic nature of mentorship networks. The subtheme identified was the need
for mentees to be the architects or directors of their evolving mentorship
networks [3,5,14,15].

Less prominent themes included: the inability for one mentor to provide expertise
in all venues [1,5,8], that mentorship networks can be used to promote career
and personal developments along with dyad mentorship relationships [1 6,10,46]
and that mentorship networks decrease a sense of social isolation experienced in
career development [4,10,49]. Authors of two papers suggested that there may
be an “ideal” number of mentors participating in these networks, ranging from 2
members in a network 3 up to 13 members [4]. As well, another subtheme was
that multiple mentors in networks could lead to role conflict for mentees and may result in confusion or complications in the mentoring process [10,49].
V. DISCUSSION

This literature review focused on mentorship networks revealed that mentorship networks or group/peer mentorship opportunities are an integral and complementary addition to medical training for both faculty and trainees [1,2,4-15,46-53]. Interestingly the bulk of the papers on mentoring are still focused on mentorship networks for faculty [2,5,6,8,10,11,46,48-52,56] as distinguished from trainees [1,7,9,12-15,50-52]. However, many of the ideas from the literature on faculty mentorship networks are transferable to the residency and medical student training setting.

The first major theme is that mentorship networks or group/peer networks meet evolving and dynamic or changing needs through training and career development [1-3,5,7,12-14,46-48,52-54]. Balmer and Halvorson suggested that mentorship networks will often evolve from one or two senior members to a more collaborative peer–based network [2,46]. Balmer also suggested that the network would expand based on the needs of the mentee as distinguished from formalizing the number of participants at the outset [2]. This dynamic shift in the mentor membership in the network is organic and is the result of the need for peer collaboration for progression in various projects and domains. An example of these dynamic shifts is represented by the concept of “mosaic mentoring” [7,14,57]. Mosaic mentoring starts with a more formalized senior faculty serving
as “temporary mentor” who then helps mentees by “triaging” protégés to more appropriate mentors based on their mentoring needs [7,14,57]. Mosaic mentoring can also bridge the gap from early more formalized mentoring relationships to more mature relationships with multiple members [7,14,57] which are more self-directed. This bridging could potentially promote the continuation of the network over time. This may be an appropriate model for medical students or junior residents as they are establishing themselves in their disciplines of choice.

A prominent subtheme was identified within the theme of the evolving and dynamic nature of mentorship networks. The subtheme identified was the need for mentees to be the architects or directors of their evolving mentorship networks [3,5,14,15]. Baugh suggested that mentoring relationships “unfold differently depending on needs of the protégé” [3]. DeCastro argued that the needs of mentees change over time and as a result the mentoring networks also must change. Mentees need to recognize their unique needs and seek out appropriate mentors [5]. This recognition of the protégé as an active participant in these dynamic relationships is important. Several investigators including Pellegrini and Souba suggested that the mentorship relationship is a ‘two way street’ [29,30]. It is no longer enough to focus on simply developing better mentors. We also need to develop better mentees.
Singletary outlines characteristics of what good mentees “do” and “not do” to be identified as good mentees in surgical training [14]. The bulk of these traits listed reflect resilience, persistence and self-motivation in protégés [14]. Melanson outlined what he felt were characteristics of an ideal mentee. These characteristics included a love of learning, being a self-starter, confidence, careful risk taking, resilience, enthusiasm, commitment, loyalty, open-mindedness and gratitude [58].

Recognizing that mentees are active participants in the mentor-mentee relationship, Zerzan argued for getting the most out of mentoring relationships by “managing up” [15]. Managing up is a corporate idea where the mentee takes responsibility and ownership of the mentor-mentee relationship and directs this relationship. However, these skills are not necessarily possessed by all mentees. Critical to protégé development is letting protégés know what is expected of them so that they can maintain the “two way street” of the mentorship relationship. Zerzan argued that by the mentee taking ownership of the relationship, this makes the role of mentorship easier for the mentor and more sustainable over time [15]. Then, mentors would be less prone to burnout.

The second major theme was that mentorship networks offered a solution to barriers associated with the dyad model of mentorship [1,9,11,14,15,50]. Alisic, along with Pololi, concluded that group mentoring may reduce the number of
failed mentoring relationships due to incompatible dyads [1,50]. Singletary commented in a similar vein that mentoring networks can “break down the power differential” that is often inherent in dyad relationships [14]. Jefferies suggested that mentorship networks can often overcome geographic barriers. The barrier of multi-site training of perinatal specialists was eliminated by creating collaborative mentorship of Faculty Advising Committee triads with one staff neonatologist at each site of training. This allowed for collaborative mentorship for trainees with multiple mentors although not all mentors existed at the same site. These trainees may not have been able to establish effective dyad mentor relationships due to geographic limitations.

Kashiwagi suggested that in settings with limited available mentors, “peer and facilitated models can extend limited resources and may allow for more mentees than a dyad model“ [11]. This point was also echoed by Pololi who noted that mentorship networks can serve as a solution for an inadequate number of “informal” mentoring opportunities [52]. Lewellen-Williams discussed how peer mentorship also enhanced or promoted senior mentors’ roles for focused mentorship tasks [51].

The intimacy and demands of the dyad mentor relationships is often a hidden element of a clinician-educator’s job description. As a result, clinician-educators may find themselves overwhelmed as residents and medical students seek them
out for mentor relationships. Inherent to the mentor relationship is a trust relationship that creates a position of vulnerability for both the mentor and mentee [59]. Unless adequate supports are in place, mentors can find themselves without the resources and direction needed to support the relationship.

Creating a culture of mentorship for trainees and mentors is paramount to developing successful mentorship programs [14]. Health care organizations need to recognize the importance of trainee and faculty development through mentorship. Clinicians are increasingly feeling forced to devote more time to clinical endeavors and, therefore, time and resources to serve as mentors become scarce [16,26]. As a result, there is a need for time and financial support to be made at the organizational level so that faculty can feel supported to enter the mentorship role.

Commonly coupled with the health care organization is an academic institution with participating faculty and students. As important as the organizational role in mentorship is, the academic institutional role is even more critical. Mentorship can be recognized at two levels in academic institutions: at the promotion and tenure level and recognition of mentorship as a professional activity [16]. Singletary recommended that mentorship activities should be included in curricula vitae and highlighted as part of faculty achievements [14]. University promotion policies need to be revised to allow clinician educators involved in
education, leadership, teaching and mentorship roles to have similar opportunities for tenure as clinician scientists [16,43,60]. Similarly, mentorship needs to be viewed as a professional activity. In turn, faculty who have shown strong mentorship traits need to be recruited to promote mentor relationships [16]. In addition, the role of mentoring needs to be included in formal faculty reviews. In a study by Levy, faculty were asked to report their mentorship roles and identify their personal mentors to enable the department to identify its most effective mentors [26].

Perhaps the most complex level of development of mentors is at the level of the mentors themselves. Although not the focus of this paper or discussion, the development of mentors continues to be an important factor in the success of mentoring relationships. As a result, it warranted to say that mentors need better training and professional development to facilitate effective functioning in their roles [16,61]. In a study by Skeff, excellent role models reported feeling more support than their counterparts who did not identify themselves as good role models [43]. Faculty need opportunities to develop, practice and guide their skill development as mentors [16,30]. Rowley has identified six distinctive aspects of good mentors [62]. These include that a good mentor:

1. is committed to the role of mentoring
2. should accept the beginner (empathy is critical)
3. is skilled at providing instructional support
4. is versatile and effective in different interpersonal contexts
5. must model a life of continuous learning
6. must communicate hope and optimism.

The qualities outlined by Rowley, suggest the dimensions of personal development that an individual must undertake to function as an effective mentor [62].

The third theme identified was the importance of the informality or “voluntary marriages”, as distinguished from structured formal programs, to create meaningful mentorship networks [1,4,7,8,47,52]. In Darwin’s qualitative study on mentoring circles, when reviewing why one mentoring group failed, comments included that “you cannot put people together in a formal/targeted way and expect there to be quality relationships” [4]. This comment reflects the concern that formalized mentor programs may not satisfy the needs of the protégé. In a study by Reynolds, 50% of residents felt an “interpersonal awkwardness” when assigned a mentor and proceeded to find an “accidental mentor” on their own [61]. Similarly, a study of orthopedic residents by Flint demonstrated that residents were more satisfied when they could pick their own mentor as compared with having one assigned to them [63]. Despite the best intentions, an assigned mentor program may not satisfy all of the mentoring needs within the residency training setting. These “forced marriages” have not necessarily resulted in meaningful mentorship relationships [8,47].
Alisic commented that informality coupled with a formally organized mentorship program may be complimentary for residents completing training in anesthesiology residency [1]. This point was also reflected by Healy who suggested that for “training and research purposes” mentoring may take a more formal structure but for “personal and career development” that mentees should select their own mentors [7]. Authors of several other studies have also described peer and group mentorship as a “support” [6], “complement” [10] or “expanded vision” [52] to dyad mentoring relationships. Study participants in Jackson’s review of mentoring academic faculty members repeatedly emphasized the importance of the right “chemistry” in mentoring relationships, and in order to achieve this, mentees may need to “experiment with many different potential mentors” [8].

Knowing that “forced marriages” created by mandatory mentorship programs are not what protégés are looking for, we must consider of the opportunities for hybrids of formal and informal mentoring. Options such as mosaic mentoring offer an avenue to start protégés on the right path to finding mentors. Such options may be an example of a hybridization of formal and informal mentoring programs [7,14,57]. As well mosaic mentoring may promote the continuation of the network over time allowing the protégé to get over the initial inertia associated with identifying mentors [7,14,57]. Another potential for avoiding forced marriages of mentors and mentees is to use “step ahead” mentors [64].
These are colleagues who are “one level higher than the mentee or a more experienced peer” to help mentees shape their networks [53,64] Investigators have argued that we must start to explicitly teach residents how to find and cultivate mentors as well as how to determine when (and how) the relationship should end [15,53].
VI. FUTURE DIRECTIONS

Although in the literature there has been recognition of the need for networks of mentors as distinguished from individual mentors, the maintenance and development of those networks has yet to be explored in the context of residency training. When individuals are helping to create and shape a mentoring network; each individual will need to identify their special needs for mentoring [41]. As a result, there is a question as to the critical number of mentors within the network, and whether this is different for different protégés or different stages of professional development [3,4]. There are also questions about the extent to which such networks function more or less effectively when members of the network interact with each other rather than with just the protégé who sits at the center of that network.

Paramount to the success of mentoring networks will be the ability to empower trainees to see the value of their network and attend to the maintenance of their networks. With efforts taken at individual, organization and institutional levels toward developing mentor networks, it is important for mentees to be able to determine if their mentor relationships are working for them. This is a shift to a more “mentee driven” approach. As well, mentees need to identify where the gaps in their network are so they can modify their network, tailoring or expanding their network accordingly. What is needed conceptually is a structure for reflection about mentorship and mentorship networks. We have made the
mistake of saying, “What makes a good mentor?” Rather we should be saying, “How do I become mentored well? What mentor relationships do I need to form and maintain to have success?” There needs to be mentee-centered as distinguished from a mentor-centered shift in thought.

Empowering mentees to maintain their networks could be looked upon as part of development of professionalism. Zerzan’s description of ‘managing up” as a strategy for mentor-mentee relationships is a good foothold to a shift in this direction. The gap that could be expanded upon, however, is knowing or determining if the mentor relationship is working for the mentee. This reflection should be in the hands of the mentee so they feel that their mentor network is current and effective.

Seely applied Development Network theory to help translational science researchers to consider mentorship networks. Seely adapted a developmental network exercise created by Kram and Higgins [42] for the business setting to be used for translational scientists [53]. Using a developmental network exercise, participants were asked to map out their current mentorship network. This model could be adapted for residents to map out their mentorship networks and develop these networks over time. Below is an example of how this adaption of this exercise may look for residents in training. This map also borrows from Zerzan’s
concept of “managing up” the networks and being responsible for their maintenance [15].

Shown below is a description of Seely’s exercise rooted in an exercise developed by Kram and Higgins [53,42] and adapted for residency training. In Seely’s description of this exercise, the exercise can be done as a one-one or group activity. This mentorship activity would, ideally, be facilitated by a respected mentor, and usually the exercise takes 60-90 minutes. Part 1 is a reflection about current support system networks asking “What are my goals in residency training”, “What skills do I have to reach those goals?” and “What skills do I need to reach those goals?”

For Part 2 of the exercise, residents would be asked to define their network as a set of relationships that either helps in their development (i.e. helps get the job done), advances their career or provides personal and professional support. To do this, residents would list people they feel are critical to their development and would apply a symbol to those people representing the role that person plays (e.g. helps get job done, advances career or personal support). See Table II below for a description of Part 2 of the exercise.
TABLE II
DESCRIPTION OF RELATIONSHIP IN MENTOR NETWORK AND SYMBOLIC REPRESENTATION BASED ON SEELY’S MODEL [53]

<table>
<thead>
<tr>
<th>Relationship</th>
<th>Role</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>People who help you get the job done</td>
<td>Helpful and useful in doing your work, may work directly with you, or have provided leads to others who helped you with important information, scientific or technical advice, professional expertise, or other resources to do your work</td>
<td>□</td>
</tr>
<tr>
<td>People who help you advance your career</td>
<td>Contribute to your professional development or career advancement; give you career guidance or direction, arrange exposure to critical people, provide political advice, serve as “sponsors” to help you get important opportunities or assignments (such as appointments on hospital or national Committees, journal editorships, or grant panels), advise you on promotion, provide advice on funding opportunities, and/or advocate for you</td>
<td>△</td>
</tr>
<tr>
<td>People who provide personal support for you</td>
<td>People you go to for your emotional well-being and psychosocial support; ones with whom you share experiences (positive and negative, consult about decisions or concerns that are important to you, vent or commiserate with, debrief critical experiences with), and people with whom you can be yourself</td>
<td>○</td>
</tr>
</tbody>
</table>

Once the symbol has been applied to each of the people they identify in their network, the resident would then place these symbols in a visual map including senior member, juniors and peers. A star symbol would be applied, in addition, to those people who the resident feels are particularly well connected in the department or job setting and would be used to designate a mentor. A solid line is used to indicate relationships within the organization and a dashed line is for
relationships outside of the organization. An example of a developmental network map from Seely’s exercise is shown in Figure 4.

Figure 4. Example of Developmental Network Map from Seely’s Exercise [53].
These developmental network maps can then be used to frame discussion about strengths, weaknesses, redundancy, balance, interconnectivity and size of the network [53]. Ultimately the goal is to identify three action steps the mentee can take to strengthen his or her network [53]. This exercise taken from Seely’s work with adaptations to residency training, may be a good first step in helping residents to ‘manage up’ their mentorship networks in training [15,53,64].
VII. CONCLUSIONS

The role of mentorship in residency training is evolving. Historically, mentoring was viewed as a dyad relationship involving two people; the mentor and the mentee. Increasingly residents are seeking more from their mentors than can be provided by one mentor. Mentors, as they have always been conceptualized, serve as guides, guardians, and promoters [29,30], along with clinical, personal and professional teachers and role models [29,34]; these are important roles that require multiple mentors. There is a shift to recommendations for network or multi-member mentorship relationships. The conceptual framework of a relationship network [41] developed by Kram, evolved to developmental networks [42], outlines a basis for understanding what these mentorship networks could look like in training [38,41].

Based on our integrated review of the literature on mentorship networks, we know that these networks are dynamic and evolving relationships that need to be maintained and change over time [1-3,5,7,12-14,46-48,53]. The role of the protégé should not be under-estimated as they are active participants in the dynamic mentorship relationship [14,15]. It is important that these networks form informally and that formal mentorship networks established must not create “forced marriages” amongst participants [1,4,7,8,47]. Hybrid programs, involving formal and informal mentorships, may be beneficial. Mentorship networks also offer a solution to barriers associated with the dyad model of mentorship [1,9,11,14,15,50]. Mentorship networks can decrease the burden on an
otherwise taxed medical training system with limited resources. We know that mentorship, as an activity, is often not well supported. In turn, we argue for the need for solutions at an organizational, institutional and individual level. Support at these levels for the concept and the role of mentorship and recognition of its importance in training will continue to be critical to the success of mentoring relationships.

Given this concept of mentorship, future directions in mentorship development and scholarship should involve considering the implications of the roles of the protégé in determination of the mentorship network. We know that mentorship is important and that it is multi-dimensional; however, moving forward, how do we better harness the potential power of a functioning mentorship network relationship? The conceptual deficiencies of a dyad model may limit our breadth of understanding of how powerful the mentoring relationship could be. The conceptual deficiencies remain: how do we help mentees develop and maintain their mentoring networks? We proposed a modification of Seely’s work on developmental networks as a method to help residents to “map their network” and see the strengths and weaknesses of their network. Examining the efficacy of such an exercise may be helpful in further understanding mentorship network development.
CITED LITERATURE


## APPENDIX

### TABLE I

**SUMMARY OF STUDIES INCLUDED IN REVIEW OF THE LITERATURE ON MENTORSHIP NETWORKS**

<table>
<thead>
<tr>
<th>Source/Year of Publication</th>
<th>Journal</th>
<th>Type of Study</th>
<th>Study Population and Setting</th>
<th>Dominant theme/subtheme identified regarding mentorship networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alisic et al 2015</td>
<td>Canadian Journal of Anesthesia</td>
<td>Qualitative</td>
<td>A review of semi-structured interview data regarding the mentorship experience of 11 Anesthesia residents and 12 faculty at the U of Ottawa</td>
<td>MED(^a), MVM(^b), MSB(^c)</td>
</tr>
<tr>
<td>Alleyne et al 2009</td>
<td>Academic Psychiatry</td>
<td>Qualitative</td>
<td>A survey based review of 43 faculty mentors participating in group mentorship programs implemented in 2 psychiatry conferences</td>
<td>MED</td>
</tr>
<tr>
<td>Balmer et al 2011</td>
<td>Journal of Continuing Education in the Health Professions</td>
<td>Qualitative</td>
<td>A review of focus group data from 37 scholars in mentee groups at the Academic Pediatric Association’s Educational Scholars Program (ESP)</td>
<td>MED</td>
</tr>
<tr>
<td>Baugh et al 1999</td>
<td>Journal of Social Behavior and Personality</td>
<td>Empiric study</td>
<td>A questionnaire based study of 275 female business executives</td>
<td>MED/mad(^d)</td>
</tr>
<tr>
<td>Darwin et al 2009</td>
<td>Higher Education Research &amp; Qualitative</td>
<td></td>
<td>A survey review of a mentoring circle program at the University of</td>
<td>MVM</td>
</tr>
<tr>
<td>Source/ Year of Publication</td>
<td>Journal/ Type of Study</td>
<td>Study Population and Setting</td>
<td>Dominant theme/subtheme identified regarding mentorship networks</td>
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<tr>
<td>DeCastro et al 2013</td>
<td>Academic Medicine/ Qualitative review</td>
<td>Adelaide involving 20 participants from health science, Law and Commerce faculties</td>
<td>MED/mad</td>
<td></td>
</tr>
<tr>
<td>Fleming et al 2015</td>
<td>Academic Medicine/ Qualitative review</td>
<td>A review of data from semi-structured interviews of 100 former NIH mentored career development award winners and their 28 mentors</td>
<td>Less dominant theme identified – mentorship networks as a compliment to dyad mentorship</td>
<td></td>
</tr>
<tr>
<td>Halvorson et al 2015</td>
<td>Clinical and Translation al Science/ Empiric study</td>
<td>A survey 133 awardees in the Health Services Research and Development Service ‘s Career Development Award Program at VA hospitals reporting on mentorship structure</td>
<td>MED</td>
<td></td>
</tr>
<tr>
<td>Healy et al 2012</td>
<td>American Journal of Surgery/ Literature review</td>
<td>Literature review of mentors and role models in surgery</td>
<td>MED, MVM</td>
<td></td>
</tr>
<tr>
<td>Jackson et</td>
<td>Academic/ Qualitative</td>
<td>A review of telephone</td>
<td>MVM</td>
<td></td>
</tr>
<tr>
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</tr>
<tr>
<td>Jefferies et al 2010</td>
<td>Medical Teacher</td>
<td>Qualitative review</td>
<td>A review of questionnaire data of 24 neonatologists that participated in group mentoring Faculty Advisory Committee Triads (FACTs)</td>
<td>MSB</td>
</tr>
<tr>
<td>Johnson et al 2011</td>
<td>Academic Medicine</td>
<td>Review of application of mentoring tool</td>
<td>A review of the structure, activities and outcomes of MDs (3) and PhDs (2) participating in the Junior Faculty Laboratory (JFL) – peer mentoring model at Duke University Center for the Study of Aging and Human development</td>
<td>Less dominant theme identified – mentorship networks as a compliment to dyad mentorship</td>
</tr>
<tr>
<td>Kashiwagi et al 2013</td>
<td>Academic Medicine</td>
<td>Literature review</td>
<td>Literature review of mentoring programs for practicing physicians</td>
<td>MSB</td>
</tr>
<tr>
<td>Law et al 2014</td>
<td>American Journal of Pharmaceutical Education</td>
<td>Joint task force review to determine best practices in mentoring</td>
<td>Task force summarized findings from the American Association of Colleges of Pharmacy Joint Council Task Force on Mentoring and formulated recommendations and a checklist for faculty mentorship</td>
<td>MED, MVM</td>
</tr>
</tbody>
</table>
## SUMMARY OF STUDIES INCLUDED IN REVIEW OF THE LITERATURE ON MENTORSHIP NETWORKS

<table>
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<th>Journal</th>
<th>Type of Study</th>
<th>Study Population and Setting</th>
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</thead>
<tbody>
<tr>
<td>Lewellen-Williams et al 2006</td>
<td>Academic Medicine</td>
<td>Qualitative review</td>
<td>A review of the creation of the Peer-Onsite Distance (POD) mentoring model for under-represented minority (UMR) faculty based on the review of two inventories</td>
<td>MSB</td>
</tr>
<tr>
<td>Moss et al 2008</td>
<td>Academic Psychiatry</td>
<td>Qualitative review</td>
<td>A review of focus group data from 12 junior faculty members who participated a peer group mentoring program</td>
<td>Less dominant theme identified – networks decreased sense of social isolation</td>
</tr>
<tr>
<td>Neumayer 2003</td>
<td>American Journal of Surgery</td>
<td>Presidential address</td>
<td>A presidential address/commentary regarding mentoring in VA hospitals</td>
<td>MED</td>
</tr>
<tr>
<td>Pololi et al 2015</td>
<td>Journal of Continuing Education in the Health Professions</td>
<td>Qualitative review</td>
<td>A review of questionnaire data regarding the implementation and evaluation of a collaborative group peer mentoring program of 51 faculty at Weil Cornell Department of Medicine</td>
<td>MSB</td>
</tr>
<tr>
<td>Pololi et al 2005</td>
<td>Journal of General Internal Medicine</td>
<td>Qualitative review</td>
<td>A review of the dyad and Collaborative Mentoring Program (CMP) developed by the National Center of Leadership in Academic Medicine for</td>
<td>MED, MVM, MSB</td>
</tr>
</tbody>
</table>
# SUMMARY OF STUDIES INCLUDED IN REVIEW OF THE LITERATURE ON MENTORSHIP NETWORKS

<table>
<thead>
<tr>
<th>Source/Year of Publication</th>
<th>Journal/Brief</th>
<th>Type of Study</th>
<th>Study Population and Setting</th>
<th>Dominant theme/subtheme identified regarding mentorship networks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risser et al 2013</td>
<td>Teaching and Teacher Education</td>
<td>Qualitative review</td>
<td>A review of interactions and structure of mentoring networks created by one teachers’ informal mentoring network on Twitter</td>
<td>MED</td>
</tr>
<tr>
<td>Sambunjak et al 2006</td>
<td>Journal of the American Medical Association</td>
<td>Literature review</td>
<td>Literature review of the prevalence of mentorship and its relationship to career development</td>
<td>MED</td>
</tr>
<tr>
<td>Seely et al 2015</td>
<td>Translation Research</td>
<td>Review of application of mentoring tool</td>
<td>A review of an application of a framework of developmental networks to participants in translational research</td>
<td>MED</td>
</tr>
<tr>
<td>Singletary et al 2005</td>
<td>Annals of Surgical Oncology</td>
<td>Presidential address</td>
<td>A review of the authors own experiences in mentoring surgeons</td>
<td>MED, MSB</td>
</tr>
<tr>
<td>Zerzan et al 2009</td>
<td>Academic Medicine</td>
<td>Review of application of mentoring tool</td>
<td>A review of the application of “managing up” as a corporate strategy and the initiation and cultivation of the mentoring relationship from the perspective of the mentee</td>
<td>MSB</td>
</tr>
</tbody>
</table>
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<tr>
<th>Source/ Year of Publication</th>
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</tr>
</thead>
</table>

a MED - Mentorship networks meet Evolving/dynamic needs through training or career Development.

b MVM - Mentorship networks with “Voluntary Marriages” as distinguished from structured formal programs for meaning within the network.

c MSB - Mentorship networks as Solution to Barriers associated with dyad model.

d mad - MED subtheme; mentees as architects or directors of their mentorship networks.
NAME: Jennifer Judith Mickelson

EDUCATION:
B.Sc. in Psychology, University of Victoria, 1998

M.D., University of British Columbia, 2002

Master’s of Health Professions Education,
Graduate College of the University of Illinois at Chicago,
2017

CLINICAL ACTIVITIES:
Pediatric and general urology – Richmond Hospital locum,
Richmond BC, Apr 2012 - present

Bladder Care Center UBC- Associate Staff – UBC
Vancouver General, Vancouver BC, Jun 2012 - present

Assist privileges for urology cases at Lion’s Gate Hospital,
North Vancouver BC, Apr 2012 - present

General Urology Locum – Lethbridge Hospital, Lethbridge
AB, Nov 2009 - 2013

General Urology Locum – Abbotsford Hospital, Abbotsford
BC, Nov - Dec 2012

Pediatric Urology – Attending – British Columbia Children’s
Hospital, Oct 2009 – Apr 2012

General Urology Locum - Lion’s Gate Hospital, North
Vancouver BC, July 2009

General Urology Locum – Royal Jubilee and VGH, Victoria
BC, Mar 2010
EDUCATION: Pediatric Urology Fellowship - Children's Memorial Hospital Department of Pediatric Urology, Northwestern University, Chicago IL, 2007 – 2009

Urology Residency – Department of Urologic Sciences, Faculty of Medicine, University of British Columbia, Vancouver BC, 2002 – 2007

Doctor of Medicine, Faculty of Medicine, University of British Columbia, Vancouver BC, 1998 – 2002

Bachelor of Science in Psychology, University of Victoria, Victoria BC, 1993 – 1998

ACADEMIC APPOINTMENTS:

Clinical Professor – Department of Urologic Science. University of British Columbia, Vancouver BC, 2012 - present

Assistant Professor – Department of Urologic Sciences, University of British Columbia. Vancouver BC - Head of Undergraduate Education, 2009 – 2012

AFFILIATIONS/ MEMBERSHIPS:

Fellow of the Royal College of Physicians and Surgeons of Canada
Canadian Urological Association
American Urological Association
Society of Pediatric Urology
Western Section of the American Urological Association
British Columbia Medical Association
Canadian Medical Association
Pediatric Urologists of Canada
AWARDS/ACHIEVEMENTS:


2nd Prize, Clinical Research Award, American Academy of Pediatrics, Section of Pediatric Urology, “Residency training in neonatal circumcision: a needs assessment and pilot study,” 2009


Dr Hjalmer Johnson and Dr Gerald Coleman Prize in Pediatric Urology - University of British Columbia, 2007

Dr. Harold L Chambers Memorial Prize in Urology University of British Columbia, 2002

William, Sadie, Edwin Rowan Scholarship in Medicine – University of British Columbia, 2001

David and Anne Beach Scholarship - University of British Columbia, 1999

Award for Academic Excellence, Faculty of Psychology, University of Victoria, 1996

GRANTS:

Total: $119,090
Principal investigator: $61,740
Co-Investigator: $57,350
PUBLICATIONS: Total of 18 publications since 2006


**TEACHING EXPERIENCE/ADMINISTRATION:**

Total of 16 activates since 2003

Activities for the past 7 years are listed below:

NMO and MS Patient information day – guest speaker for urology, Vancouver BC, 2016


Undergrad teaching - Clinical Skills Teaching – Male Genitourinary Exam, UBC, 2011, 2010

Gender Assessment Committee. BC Children’s Hospital, Vancouver BC, “Update in Hypospadias,” 2010

Grand Rounds, Department of Urologic Sciences Vancouver BC, “Robotics in Pediatric Urology,” 2010
PRESENTATIONS AT MEETINGS:

Total of 22 meeting presentations since 2003

Presentations for the past 7 years are listed below:


2012 Canadian Urological Association, Banff AB. Poster. Virtual Problem Based Learning – A needs assessment exploring on-line PBL group learning” – abstract accepted for presentation at CUA 2012.

2012 Canadian Urological Association, Banff, AB. Podium presentation. “Trends in matching to urology residency in Canada – are we becoming non-competitive? “–presented by M Melnyck

2012 Western Medical Student Research Forum. – Carmel, Ca. Poster presentation “Virtual Problem Based Learning – A needs assessment exploring on-line PBL group learning” – presented by R Lim


2011 OPSEI – Office of Pediatric Surgical Evaluation and Innovation. BC Children’s Vancouver BC “Medical Education Scholarship: Beginner’s Tips”

2011 OPSEI – Office of Pediatric Surgical Evaluation and Innovation. BC Children’s Vancouver BC “Medical Education Scholarship: Beginner’s Tips”


OTHER:

Journal Reviews

Canadian Urological Association Journal (vesico-uterine fistula article), 2010