Research Literacy – Core Element in a Physician's Development?

A DISSERTATION

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Acknowledgements

I would be remiss not to take a moment and acknowledge the support and encouragement I received from my family and professional colleagues as I pursued my doctoral program. First, I would like to thank my children, Marc and Laura, for reminding me of my dream to pursue this degree. As life's call had my full attention and time was ticking by, I was approaching a point where the idea of further education could have simply become one of those dreams that quietly faded away. Marc and Laura helped me ensure that did not happen. When I consider my life's achievement, my hand in guiding them on their life's journey will continue to rank as my greatest accomplishment. Words fail to adequately describe just how proud I am of them and how grateful I am for their love and support.

I want to thank the 22 professionals I formally interviewed for this research and the countless other colleagues who were willing to engage in discussions to help me explore this important topic. Busy professionals who have elected to apply their talents in the demanding field of healthcare were incredibly generous with their time. The commitment they have to their profession (be it medicine and/or healthcare education) was evident. Their thoughtful reflections and insights regarding their work highlighted for me the complexities involved in every player's contribution to the overall goal of delivering optimal care to patients.

I come from a large family and I have a strong bond with my siblings. I find them to be an energy source from whom I continually draw inspiration. In this endeavor, my sister, Ann, was my primary proofreader and she devoted her time (without regard for the

time of day) to help me prepare a polished document for review. Her artistic talents continue to impress me. Specifically, those skills helped me generate the sailboat graphic which served to highlight several key themes from this study. Her interest in my well-being and reassurance of my efforts was emblematic of what it means to have a supportive family.

I owe a debt of gratitude to the faculty who served on my committee and provided support and guidance to me throughout this process: Professor Alexandre Ardichvili (my advisor), Professor Lou Quast, Professor Carol Carrier, and Dean John Finnegan. Their critical review of my work and thoughtful insights helped me expand my view of the topic, prompted me to examine deeper connections, and reminded me of the opportunity that this work offered to generate valuable insights into how we can best prepare research-literate physicians.

A key lesson I gained through this process is as follows: Life can be unpredictable, and it would be easy to allow yourself to be set back by events you did not anticipate (e.g., changes in your career trajectory, health status, relationships, etc.). As cliché as it sounds, it is true that we should all remember as one door closes, others present themselves. I hope to continually take advantage of emerging opportunities to explore life's gifts and to be willing to shift out of my comfort zone to pursue a new path, if that is what is necessary. The key is to not lose too much energy attempting to explain the unexplainable. That energy is better spent figuring out what is next.

My mother, Gertie, passed away earlier this year and, unfortunately, was not on this Earth to see me complete my degree program. She was always one to race ahead in her thoughts and downplay any potential barriers one might face in pursuit of their goals. She instilled the notion that you can accomplish anything you set out to achieve. In her mind, I completed my PhD years ago, so I find comfort knowing I have ultimately caught up with the picture she painted for me.

Dedication

To everyone who has a dream, yet thinks it is too late to pursue it:

I encourage you to think again!

Abstract

The educational journey of a physician involves a long and intensive path beginning with a basic science curriculum and then building in clinical experiences. The ultimate goal is to develop research-literate physicians who can skillfully navigate the incredible amount of medical information that exists to make well-informed clinical decisions in the best interest of their patients. In this grounded theory study, five (5) Chief Residents (or recently graduated residents) were interviewed regarding their residency training experience and seventeen (17) medical professionals who were identified as Residency Program Directors and/or Planners were interviewed to gather their insights related to the development of research-related skills during a physician's training. While not all physicians conduct research, all physicians are required to be skilled consumers of research and for that reason, specific attention was paid in this study to the development of overall research literacy skills.

This study highlighted the fact that, as is true for any educational endeavor, there are important structural elements that provide a framework for a learner's journey (e.g., curriculum, regulatory and/or accreditation program requirements, etc.). In addition, there are critical motivational factors, such as self-directed learning and commitment to lifelong learning, which drive the direction and depth to which a learner explores that curriculum. The study identified the following three inter-connected themes (structural elements, curricular directions or guides, and motivational factors) regarding physicians' development of research literacy skills:

Theme 1: The regulatory/accreditation systems establish the base level expectations for each of the competencies required of learners across the medical education continuum, however, there is wide variability in how those requirements are interpreted and incorporated into each medical school's curriculum. Furthermore, the metrics used do not always align with the skills required to successfully perform Evidence-based Practice (EBP). (For example, the base level expectations related to research and scholarly activities do not necessarily assess the research and literacy knowledge and skills necessary for physicians.)

Theme 2: The influx of medical information has heightened the need for physicians and patients to be discerning consumers of research and medical information. There is wide variability in the level of proficiency a physician achieves during their training with respect to research literacy (driven, in part, by personal interest, pursuit of available opportunities and resources, and the demands of the physician's life, role, and institution), although now, more than ever, all physicians must develop and maintain those basic skills to be able to make well-informed clinical decisions.

Theme 3: The ability of a physician to meet the demands of the public to deliver EBP which leads to quality patient care (i.e., provide safe, effective, patient-centered, timely, efficient, and equitable care) is highly-dependent upon their commitment to self-directed, lifelong learning which facilitates the acquisition

and maintenance of research literacy skills and enables them to be a discerning consumer of medical information.

In this dissertation, I will discuss the following themes which were revealed in my studies related to: organizational structures (accreditation and regulatory oversight); curricular guidance; and the importance of individual learners' commitment to self-directed lifelong learning. Each theme will be examined to determine the role it plays in developing a research-literate physician. I will offer some perspective on steps that could be taken to address concerns, and offer recommendations for making progress as we move forward.

The implications for practice include: accelerating the adoption of updated accreditation requirements that relate to research and scholarship; identifying opportunities for collaboration across the continuum; developing meaningful metrics to track progress; highlighting the value of health sciences library services as it relates to research literacy; training HCPs to be more aware of the power and/or limitations of the evidence; stressing the importance of personal commitment to lifelong learning and acknowledging the role of the learning environment in guiding the learners' development journey. After describing the implications and the impact each has on the practice of medicine, I will then recommend one coherent theory which incorporates all of those factors. The dissertation concludes with limitations of the study and opportunities for further research which promote more direct links to patient outcomes.

Keywords: physician development, research skill development, research-literacy, self-directed learning, lifelong learning, grounded theory

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Chapter One: Introduction

Undoubtedly, we have all been in need of medical care at some point in our life, or perhaps we have had a family member or friend who has fallen ill and/or been diagnosed with a chronic condition. The outcomes of those challenging situations rely heavily upon a healthcare professional's ability to be well-informed and able to apply critical thinking skills to effectively diagnose and provide evidence-based medical (EBM) treatment. The quality of the care you or your loved one receives is dependent upon the entire healthcare team (and, to a great extent, on the physician's ability) to stay apprised of the latest medical updates and new discoveries (i.e., to find the best evidence to support their clinical decision-making). This is a tall order, given there has literally been an explosion of medical knowledge dating back several decades (Hunt & Newman, 1997; Verhoeven et al., 2002) and all signs indicate the influx of new medical knowledge is continuing to expand exponentially.

New discoveries in medicine, updated methods of care delivery, and increased access to big data, along with improved data analytics, have all contributed to a growing repository of healthcare research articles, scientific abstract presentations, and peer-reviewed journals. According to a 2011 study in Transactions of the American Clinical and Climatological Association, medical knowledge was estimated to have doubled in 50 years (from 1950-2000). That pace accelerated to 7 years in 1980, 3.5 years in 2010, and was projected to be 73 days by 2020 (Densen, 2011).

While medical discoveries and dissemination of new information can generally be viewed positively, it raises the question of how physicians can possibly keep pace and be discerning consumers of the research findings being generated. Even aside from the issue of the sheer magnitude and overwhelming volume of research being produced, finding value in available literature requires specialized skills and a critical lens. The reader must develop a mindset that values lifelong learning as it aids pursuit of the ongoing refinement of skills required to be able to filter mounds of literature to efficiently identify and interpret meaningful, relevant findings. It is imperative that serious consumers of research be able to vet the findings that are on display in an article, abstract, or study, determine its relevance, and be aware of what special considerations must be made before attempting to confidently adopt any evidence-based process or system change into practice.

Significance of the Study

Physicians face mounting pressure to keep current with the research literature in their field and to develop "*research literacy*," so they can deliver well-informed, evidence-based medicine. Research literacy is defined as the ability to access, interpret, and critically evaluate primary medical literature (Senders et al., 2014). In a more recent article, research literacy is defined as "the cognitive and social understanding of the basic purpose, process, and value of research and research participation." It is described as "a fundamental skill for research utilization and evidence-based practice" (Hines, 2016, p. 202).

In the spirit of professional development, medical school curriculum and residency training programs in the United States are intentionally designed to establish a pathway that addresses the competencies required of physicians, as determined by the accrediting organizations – the Liaison Committee on Medical Education (LCME), Commission on Osteopathy College of Accreditation (COCA), and the Accreditation Council for Graduate Medical Education (ACGME). While the competency-based models provide desired outcomes, the specific programmatic details contained within the medical school curriculum and residency training program pathways are quite varied as they align to meet those goals. Each institution interprets how to best address research skill development, and then assigns curricular elements and support structures, in alignment with the general outline provided by the accrediting organizations.

Need for the Study

Advances in medicine have resulted in an explosion of new medical knowledge and yet physicians are expected to stay abreast of new developments to be able to apply critical thinking skills to deliver optimal care to their patients. This rapidly evolving emergence of new medical information highlights the importance of a physician's ability to discern the quality of the research that is being presented. It is more critical than ever that our healthcare professionals possess research literacy so they are able to skillfully interpret and integrate EBM into their practice. A physician's educational journey is guided by a medical school curriculum and residency training program and general guidelines are provided by accrediting organizations. However, there is no one clear-cut path to achieve the stated goals, as reflected in the many variations noted across medical school residency programs.

Since specific pathways to reach individual program requirements are not mapped out in detail and there are various supporting competency models related to the development of research and scholarship skills, residency programs do vary greatly. These variances reflect each institution’s interpretation of how to develop and sustain the necessary research skills as part of the physician’s development journey.

Across the medical education continuum (i.e., undergraduate, graduate, continuing practice) institutions are expected to develop physicians who are research-savvy, skilled critical thinkers capable of meeting the demands of patients’ healthcare needs now and in the future. The feedback gathered from residents is often gathered in their early training years and it typically relates to how they might assess their skill gaps and how they anticipate they will be able to apply their training to their future role. Requests for programmatic feedback and insights do not typically extend to the period as the resident is transitioning into practice, even though those reflections could generate insights that would lead to improvements in residency program design and content. In addition, gathering feedback from those who are devoted to the development and delivery of the resident program curriculum would provide meaningful input in this discussion. We believe there is a valuable opportunity to gather feedback and reflections from both groups of individuals, as a means to explore a program director’s and ‘graduating’ resident’s perspectives related to the research skill training delivered during their residency program.

Review of the literature revealed a growing need and interest in equipping learners with better research-related skills and perspectives to enable them to successfully navigate the explosion of medical information, new discoveries, and findings from clinical trials that are increasingly complex. Before launching into the literature review, I would like to provide some context, set the stage, and call attention to several key terms which are important to this study. I also believe it is imperative to provide several relevant underpinnings which are useful when describing the landscape of medical education:

1. This study pursued an examination of the factors that contribute to a resident's development of research literacy skills, not necessarily the skills required to produce research (although there are different skill sets required by each, they are not mutually exclusive).
2. There appears to be a natural tendency to think about research primarily as it relates to the skills necessary to produce research (i.e., generate new knowledge or to validate existing knowledge based on a theory). While important, that is not necessarily a priority for all physicians.
3. Research literacy is the ability to access, interpret, and critically evaluate primary medical literature – a definition which is inexorably linked to evidence-based medicine (EBM) and evidence-based practice (EBP).
4. EBM is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients. It involves integrating

clinical expertise with the best available external clinical evidence from system research (Sackett et al., 1996).

5. EBP requires research literacy in order to decipher relevant research findings and make informed patient-care decisions by integrating individual clinical expertise and the best available external evidence.
6. Any confusion deciphering research and evidence-based medicine may stem from the common misconception that those terms are one and the same. While somewhat inter-related, there are fundamental differences in their respective purpose and application to critical decision-making skills.
7. Research literacy promotes evidence-based practice through critical appraisal which is the process of carefully and systematically examining a research report to judge its trustworthiness, make sense of the results and assess the relevance of the findings in a particular context (Burls, 2015).
8. Critical appraisal skills enable a physician to systematically examine research to assess its reliability, value and relevance in order to direct professionals in their vital clinical decision making.
9. The purpose of evidence-based practice (which requires research literacy and, obviously relies upon EBM) is to make informed patient-care decisions by integrating individual clinical expertise and the best external evidence.
10. Participation in research and scholarly activity is known to increase residents' ability to critically evaluate literature, foster critical thinking, and improve patient

care through increased use of evidence-based medicine (Brouhard, 1996; Rothberg, 2012).

11. Evidence-based medicine is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (Sackett et al., 1996).

Purpose of the Study

The purpose of this study is to develop a greater understanding of the factors that contribute to the development of a physician's research literacy and the establishment of a lifelong learning mindset. We expect that medical school and residency training contributes to the practitioners' growing body of research knowledge, however, we want to specifically ask practitioners to examine retrospectively what factors from their residency training program contributed most (or, for program directors, are designed to contribute) to the development and application of research literacy skills.

Specifically, the healthcare community wants practicing physicians to know how to identify and apply the best evidence and critically review published studies and research findings to effectively integrate evidence-based information into their clinical practice. Through this study, I will develop a theory of the factors (programmatic and/or personal) that are embedded into residency training to support and advance a physician's ability to develop research literacy (a core requirement for an individual to function as a scholarly practitioner).

Research Question

This proposed study will explore the following research question:

- ***What factors found in residency training most effectively contribute to a physician's ability to develop and apply research literacy skills to practice evidence-based medicine?***

I believe it is to our collective benefit to better understand the path of professional development that accompanies efforts to develop a research literate physician workforce. There is an opportunity to examine individuals' perceptions of what factors serve to build and reinforce the development of the skills necessary to become a discriminating producer and/or consumer of quality research and scholarship.

The educational journey of a physician involves a long and intensive path beginning with a basic science curriculum and then building in clinical experiences. The ultimate goal is to develop research-literate physicians who can skillfully navigate the incredible amount of medical information that exists to make well-informed clinical decisions in the best interest of their patients. In this grounded theory study, which included an extensive literature review, I conducted semi-structured interviews with five (5) Chief Residents (or recently graduated residents) regarding their residency training experience and seventeen (17) medical professionals who were identified as Residency Program Directors and/or Planners were to gather their insights related to the development of research-related skills during a physician's training. While not all physicians conduct research, all physicians are required to be skilled consumers of research and for that reason, specific attention was paid in this study to the development and advancement of overall research literacy skills during residency training.

This study highlighted the fact that, as is true for any educational endeavor, there are important structural elements that provide a framework for a learner's journey (e.g., curriculum, regulatory and/or accreditation program requirements, etc.). In addition, there are critical motivational factors and personal commitment factors that come into play, such as self-directed learning and lifelong learning, which drive the direction and depth to which a learner explores the formal and informal curriculum.

In this chapter, I shared the significance and need for this study and outlined the research questions explored. In Chapter Two, I present the literature reviewed for the study. In Chapter Three, I share some details of the methodology used to conduct this grounded theory study. In Chapter Four, I share the findings resulting from the interviews I conducted, while highlighting relevant links to the literature, as a means to offer context for the discussion which then appears in Chapter Five. In Chapter Five, I discuss the three major themes that emerged from my study and the role each theme plays in developing a research-literate physician, and then, after discussion the implications on practice, recommend one theoretical framework, which incorporates all of those themes related to the development of a physician's research literacy skills. I will share practical recommendations, acknowledge the limitations of this study, and outline ideas for future research.

Chapter Two: Literature Review

The purpose of this literature review is to delve into the topic of research literacy and its underlying elements as presented to students and practicing physicians as part of their professional development journey. A key inquiry will examine what structures are in place to foster research literacy and examine links from that skill to a physician's ability to integrate the best evidence into clinical practice decisions.

This exploration of the literature is relevant for general public health and general medical practice as it will focus on skills that are essential to a physicians' development. It is believed that to achieve the goal of developing research-savvy physicians (both as critical consumers of peer-reviewed journal articles and scientific conference presentations and knowledgeable producers of research and scholarship), healthcare education must do all that it can to deliberately develop and promote research literacy skills. It is well-established in the evidence-based practice literature that the difficulty many clinicians experience with reading and understanding research hinders a physician's ability to effectively incorporate evidence-based medicine into their practice, leading to sub-optimal care delivery.

For purposes of this study, we will focus on individuals who have completed their residency training, a key component of graduate medical education (GME) and critical phase within a physician's development journey. Figure 1 shows the contextual frame of the medical education continuum from medical school through residency and into practice.

Figure 1

The Medical Education Continuum

Source: G. Jacobs, gjacobs@umn.edu.

Table 1 provides greater details in terms of the organizational structures that are responsible for outlining program requirements and providing oversight to a physician's professional development journey.

Table 1

Professional Development across the Medical Education Continuum

Accrediting Organization (responsible for establishing/monitoring standards)	Acronym	Responsibility for specific phase within the Medical Education Continuum
Liaison Committee on Medical Education	LCME	Undergraduate Medical Education (Medical School, 3-4 years)
Accreditation Council for Graduate Medical Education *(allopathic training)*	ACGME	Graduate Medical Education (Residency 3-10 years, dep. on specialty)
Commission on Osteopathic College Accreditation *(osteopathic training)*	COCA	Graduate Medical Education (Residency 3-5 years, dep. on specialty)

Accreditation Council for Continuing Medical Education	ACCME	Continuing Medical Education (Balance of career 20+ years)

Source: G. Jacobs, gjacobs@umn.edu.

The literature review will serve multiple purposes:

1) Review the state of the field of healthcare information, the development of research literacy, and the importance of a lifelong learning mindset
2) Discuss the link from education to evidence-based medicine (EBM)
3) Highlight the systematic approach to a physician's medical training to include development of health system research core competencies
4) Outline the characteristics of various competency-based models describing the development of research skills

By applying a strategic, targeted approach to my search, I conducted a literature search initially focused on the concepts of research literacy and lifelong learning while then focusing on specific requirements within the field of medical education. I utilized the following keywords: research literacy, medical education, research and scholarship, healthcare professional development, medical school curriculum. This broad net garnered well over 350 articles spanning a broad spectrum of research-related literature to include research policy, implementation research, and institutional research capacity building. Through a systematic process, I honed in on those sources that were relevant to medical training within North America and I chose articles pertaining to the development of research-related skills (to include critical appraisal). I was most interested in articles that were published in the last 3-5 years, however, I did also find value in some that analyzed the current challenges related to the medical education continuum and/or those that highlighted seminal work in the field of medical education and/or described innovative approaches to responding to the challenges of the medical information overload that is descriptive of our current healthcare environment. This sifting process led me to conduct a more thorough review of 65 articles.

In addition to peer-reviewed journal articles, the search led to websites for healthcare competencies and accreditation requirements with special attention paid to requirements for research and scholarship at each stage of a physician's professional development (e.g., Accreditation Council for Graduate Medical Education (ACGME) resident program requirements related to research and scholarship). This emphasis on resident training was particularly relevant in that residency training is a critical step in a physician's development journey and the residency programs are held accountable (through accreditation oversight) to ensure that competencies are outlined, programs are aligned, and residents' progress is assessed in a structured manner. This literature search also involved delving into the specific requirements that guide medical schools program planning, as well as policy and curriculum development as it relates to building, advancing, and supporting research literacy skills which results in the development of scholarly practitioners.

Several themes emerged from the literature to include: the value of research literacy; the links of research literacy to evidence-based medicine; the organizational or system guideposts that exist to drive the development of research skills in medical education; and, the various competency models and established accreditation requirements that provide structure for curriculum in support of the development of research skills (and to promote a scholarly approach to one's work) as part of a physician's lifelong learning.

This section presents a review of the literature relevant to the research literacy concept across the framework of the medical education continuum. The summary starts by examining the background and definitions of research literacy in the information age and its relationship with information overload and its contributions to evidence-based practice, and link to lifelong learning. Further review is conducted to explore the existing support structures (e.g., competency models, accreditation guidelines) that potentially promote, advance, and help sustain skills required for health professionals to display research literacy as skilled consumer and/or producers of research in the healthcare setting. There is a benefit in looking across the medical education continuum to describe what messaging and education is delivered as part of the physicians' professional development journey. There is a constant effort underway in the field of medical education to establish links between the stages of a physicians' development, rather than considering each stage independent from the others.

Healthcare Information - The State of the Field

In a reflection on the growth in journals publishing, de Solla Price (1963) plotted the growth of the number of journals from 1665 through to 2000. His calculations showed the number of titles doubling every 15 years, increasing by a power of ten in 20 years, and by a factor of 1000 in 150 years. Price discussed the exponential growth curve that would lead to nearly a million journal titles by 2000 if the historical rate of growth continued.

In an effort to measure how many scholarly articles are published annually, Björk et al. (2008) worked with Ulrich's and the Thomson Scientific ISI citation databases, (Björk et al., 2008) and estimated that of 23,750 journals published in 2006, the total number of peer-reviewed journal articles was approximately 1,350,000. That calculation of the total number of journal articles published yearly appears in line with the estimate by Elsevier (2004) that 1.2 million articles are published every year in peer-reviewed journals by publishers in science, technology and medicine.

The International Association of Scientific, Technical, and Medical Publishers (STM), a leading global trade association for academic and professional publishers, has over 120 members in 21 countries, periodically generates an overview of scientific and scholarly journal publishing. The number of articles published each year and the number of journals have both grown steadily for over two centuries, by about 3% and 3.5% per year respectively. According to a 2012 STM Report, there were about 28,100 active scholarly peer-reviewed journals in August 2012, collectively publishing about 1.7–1.8 million articles a year.

An added perspective can be gained when considering just one area of specialty in medicine. One example cited that over 130,000 articles on the topic of cancer had been published and cited by Medline in the prior 10 years (Hunt & Newman, 1997). Hunt and Newman (1997) used Medline and took the following three areas of cancer, arthritis, and lupus as examples and discovered that over 176,000 articles were identified as having been published during the past decade. This is equivalent to almost 150 journal issues per month (assuming 10 articles per journal issue) or five journals per day. The time commitment necessary to keep up with the literature is significant and it should be noted those figures have only increased for each of the last 20+ years. The growth of information by specialty has not been uniform, resulting in certain fields of specialization being inundated with new literature. Using data from that time, it was pointed out that it would be easier to keep up with 1,400 articles per year as a lupus specialist than the 7,700 articles per year the rheumatologist encounters in the medical literature, however, both are daunting tasks. While the publishing growth trend was noted back in the 1990s (Hunt & Newman, 1997), the trend has accelerated since that time and yet the physician must keep current while the body of literature keeps expanding. That requires the ability to skillfully sort through this expanding body of literature.

The Need to Combat Information Overload

The rapidly-growing production of healthcare information – both scientific and popular – increasingly leads to a situation of potential information overload affecting all actors of the healthcare system and threatening to impede the adoption of evidence-based practice (Klerings et al., 2015). Information overload can be defined as ‘a state where the volume of the information exceeds an individual's information processing capacity’ (Sweller, 1988). While suggesting the concept needed further refinement, Wilson (2001) defined ‘information overload’ at the individual level as “a perception on the part of the individual (or observers of that person) that the flow of information associated with work tasks is greater than can be managed effectively, and a perception that overload in this sense creates a degree of stress for which his or her coping strategies are ineffective” (p.113). That early commentary noted concern regarding the impact of information overload on a physician's ability to provide quality care to patients (Wilson, 2001). That concern was the impetus for a subsequent literature review (Hall & Walton, 2004) which was conducted in an effort to find the evidence to validate the widespread view held by health clinicians that their work effectiveness is being impaired by 'information overload' (Hall & Walton, 2004). Acknowledging the pressures faced by physicians to stay current in their field of expertise, a study examined physicians' available time for reading professional journals which had dramatically declined over the previous five-year period (Hunt & Newman, 1997). The stress associated with the need to sort through the wave of new information is further exacerbated by the fact that patients and their families are increasingly using the Internet to access and seek health information (Trotter & Morgan, 2008).

According to Eppler and Mengis (2004), drawing upon literature across multiple disciplines, in ordinary language, the term "information overload" is often used to convey the simple notion of receiving too much information. Within the research community, this everyday use of the term has led to various constructs, synonyms, and related terms, to include cognitive overload (Vollmann & Systems, 1991), information fatigue syndrome (Wurman, 2001), and knowledge overload (Hunt & Newman, 1997). Cognitive load represents the overall burden experienced by an individual, as a sum of the various sensory, task-specific demands, as well as the psychological and emotional factors faced. While the study did not specifically include medicine, it can be deduced that as occupational complexity and demands increase, with coinciding rise in the emotional risks and strains, the total load placed on individuals rises (Sweller, 2011). There are risks associated with information overload, especially when critical clinical decisions are involved. For example, while the symptoms of cognitive overload may vary, they can include increased rate of errors, inability to carry out activities or impaired judgment as compared to previous work, or more subtle signs such as a deterioration in intrapersonal and communication skills (Iskander, 2019). With interconnection between health literacy and health information overload for patients for whom physicians care, concern has also been voiced regarding the increasing significance of health information and its potential impact on patients' decision-making and self-management (Khaleel et al., 2020).

Anyone reading a health news story or summary of findings from a clinical trial/study should possess the skills to be a discerning consumer. Not only is there an explosion of medical information, there is also increased access for any and all individuals to such information, which may or may not have been properly vetted or accurately portrayed.

As noted in a recent British Medical Journal article (Schwitzer, 2017), people are bombarded with medical news stories, television and radio talk shows, social media, pop culture magazines, websites, direct-to-consumer drug and medical device ads, hospital marketing messages and other media sources, much of which are incomplete or wildly inaccurate.

Described as the 'medical misinformation mess (Ioannidis et al., 2017), the stark message is that most physicians and other healthcare professionals are unaware of the pervasiveness of poor quality clinical evidence that contributes considerably to overuse, underuse, avoidable adverse events, missed opportunities for right care and wasted healthcare resources. Ioannidis and his co-authors point out that, unbeknownst to most healthcare professionals (HCPs), much published medical research is not reliable or is of uncertain reliability, offers no benefit to patients, or is not useful to decision makers. Many HCPs reportedly lack the skills necessary to evaluate the reliability and usefulness of medical evidence. All of this results in scenarios where patients and families frequently lack relevant, accurate medical evidence and skilled guidance at the time of medical decision-making.

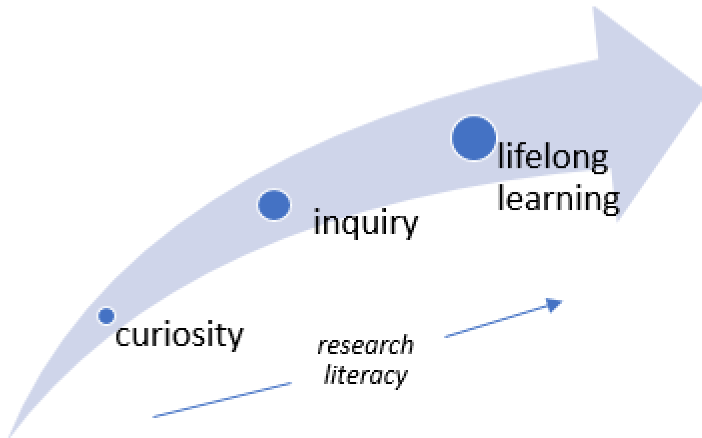
A plan to simply increase the reliability of available, published evidence may not be a realistic goal in the short run. Therefore, the emphasis should focus on making HCPs (and patients and journalists and all healthcare stakeholders) more sensitive to the limitations of the evidence, training them to do critical appraisal, and enhancing the communication skills necessary to effectively summarize and discuss medical evidence with patients to improve decision-making. We need to help physicians and the public better understand the strengths and weaknesses of news media coverage of medical and health topics. Critical appraisal tools and resources do exist, such as a list of review criteria (Schwitzer, 2017) developed by a watchdog organization previously housed through the University of Minnesota. This list is designed for HCPs and patients to apply when health news.

Developing a Lifelong Learning Mindset

The fields of medicine and healthcare will continue to change and increase in complexity. As with any highly-skilled profession that continues to evolve, the medical profession calls for continuous or lifelong learners. Individuals who show a tendency to desire to keep pace with the rapid information growth in the information society, develop themselves, and learn to learn (Oguz & Ataseven, 2016). This learning process is an understanding that spreads throughout human life and aims for the individual to continuously renew themself. This idea of continuous learning, or ‘lifelong learning’, is defined by Uzunboylu and Hursen (2011) as “the activities which enable the individuals to constantly improve themselves in the personalities, professions and socio-cultural life through a planned or unplanned training” (p. 455). Demirel (2012) defines this as “a lifelong process that ensures that everyone gets what they need with the time and opportunities they want” (p. 1710). Longworth (2001) defines lifelong learning as the “development of human potential through a continuously supportive process which stimulates and empowers individuals to acquire all the knowledge, values, skills, and understanding they will require throughout their lifetimes and to apply them with confidence, creativity and enjoyment in all roles, circumstances and environments” (Longworth, 2001, p. 592). Kozikoglu and Onur (2019) describe the predictive links of information literacy and academic self-efficacy to lifelong learning and list the characteristics of the individuals who possess information literacy as those who can define their information needs, know the ways of effectively reaching and using the knowledge, benefit from the technological opportunities to access information, and have lifelong learning habits. It has become one of the goals of the educational systems to educate individuals so that the flow of the knowledge can be traced and the information obtained is used correctly. That education also seeks to better understand how information literacy, coupled with a curiosity and state of inquiry often prompted by a need or wish to solve problems, helps promote the development of a lifelong mindset (Figure 2).

Figure 2

Research Literacy Supports Lifelong Learning Mindset



Source: G. Jacobs, gjacobs@umn.edu

Learning to Learn

Lengrand's 'Introduction to Lifelong Learning' presentation at the UNESCO conference in 1970 (Frey, 1972) was an important step in the concept of lifelong learning. His presentation highlighted the fact that lifelong learning is a process that enables the individuals to transfer experiences, insights and perspectives they have acquired throughout their lives to real life. The report 'Today and Tomorrow of World Education' published in 1972 by the International Education Development Commission emphasized the need to place more importance on lifelong learning in order to prepare the individuals for future societies. It was noted this focus should not be limited to a school system or its related educational activities or be restricted to a certain age range.

In its 2006 report, the American Library Association Presidency Committee called for more attention to be paid to information literacy. In the first detailed description of information literacy, it described individuals who possess information literacy as ‘the individuals who have learned to learn and are ready for lifelong learning as they know how the knowledge forms, how to find and use their knowledge’ (American Library Association, 2006). Studies on lifelong learning have continued and the year of 1996 was considered ‘lifelong learning year’ in Europe.

In a Turkish study, it was concluded that prospective teachers’ information literacy and academic self-efficacy are significant predictors of their lifelong learning tendencies (Kozikoglu & Onur, 2019). Eisenberg et al. (2004) stated that being successful in all areas of life necessitates being a conscious information consumer (cited in Onal & Cetin, 2014).

A blended review of the literature which consisted of learner-centered experiences coupled with system-level requirements facilitated a broader view of the research competency models that are in place. In addition, it appears an examination of the messaging across the continuum which may or may not leverage consistent language, can identify appropriate skill building and application of those skills in a more cohesive manner.

Learning Along the Medical Education Continuum

My approach to the topic of education/development for the medical profession utilizes the framework that aligns with a physician’s professional development across the medical education continuum (see Table 1). Competency models and/or curricular requirements are outlined for physicians' training starting with Medical school, as defined by the Liaison Committee for Medical Education (LCME), for allopathic medical students – or the Commission on Osteopathic College Accreditation (COCA), for osteopathic medical students. Once a student graduates from Medical school, their development is guided through a residency program which requires they encounter specific learning experiences, as dictated by the Accreditation Council for Graduate Medical Education (ACGME). Once residency is completed, practicing physicians are held to standards related to maintenance of certification and continuing professional development, as described by the American Board of Medical Specialties (ABMS) and the Accreditation Council for Continuing Medical Education (ACCME). It will be interesting to discover the extent to which research literacy is included in the curricular maps and accreditation requirements that exist.

Much has been written about the formation of a physician. For those considering medical school, the American Association of Medical Colleges (AAMC) developed a description of the 15 core competencies desired of students entering the field of medicine. Several items point to cornerstones present in a lifelong learning mindset and they are particularly relevant to this discussion as they describe foundational characteristics that predict success in a career in medicine (AAMC, 2020). Under the 'Intrapersonal' heading, one of the listings is for "Capacity for Improvement" with a focus on a student's ability to set goals for continuous improvement and for learning new concepts and skills; engages in reflective practice for improvement. Not surprisingly, competencies listed under 'Thinking and Reasoning' included critical thinking, quantitative reasoning, and scientific inquiry, which speaks to the ability to apply knowledge of the scientific process to integrate and synthesize information, solve problems and formulate research questions and hypotheses. Scientific inquiry points to mindset necessary to participate in the discourse of science and explain how scientific knowledge is discovered and validated which aligns with the expectations of research literacy.

Accreditation Expectations for Research/Scholarship across the Education Continuum

Using the professional development stages outlined in the earlier section (Figure 1), this literature review examined the requirements that are set for the development of research skills at each stage of a physician's development. Each of the four accrediting organizations have statements designed to provide an overarching guide for those expectations (Table 2).

Table 2

Accrediting Agencies' Reference to Research and Scholarship

Organization	Document / Section	Expectations Outlined for Research Skills
LCME	Standards for Accreditation of Medical Education Programs Leading to the MD Degree Section: Community of Scholars/Research Opportunities (3.2)	A medical education program is conducted in an environment that fosters the intellectual challenge and spirit of inquiry appropriate to a community of scholars and provides sufficient opportunities, encouragement, and support for medical student participation in the research and other scholarly activities of its faculty.
ACGME	Common Program Requirements (Residency)	The program must advance residents' knowledge and practice of the scholarly

	Section: Requirements for scholarship	approach to evidence-based patient care. (Core) The program must demonstrate dissemination of scholarly activity within and external to the program. Residents must participate in scholarship scholarly activity. (Previously only recommended, now required.) (Core) ACGME approved major revision: June 10, 2018; effective: July 1, 2019
COCA	Commission on Osteopathic College Accreditation College of Osteopathic Medicine (COM) Continuing Accreditation Standards Section: Standard 8: Scholarly Activity	A COM must: 1) demonstrate a commitment to research and scholarly activity through its budgetary processes, support of faculty research, and inclusion of its students in research throughout all four years of the osteopathic medical education. 2) produce and publish a strategic plan for research and scholarly activities that documents how the COM intends to contribute to the advancement of knowledge through research and scholarly contribution. 3) publish and follow policies and procedures to support student driven research and scholarly activity, as well as student participation in the research and scholarly activities of the faculty.

Source: Accreditation Council for Graduate Medical Education (ACGME), 2021, July 1.

In their Program Requirements, the ACGME notes that the critical skill development of a physician must ensure they fill the role of "a humanistic scientist who cares for patients." This requires the ability to think critically, evaluate the literature, appropriately assimilate new knowledge, and practice lifelong learning. They emphasize the institution's role in creating an environment that fosters the acquisition of such skills through resident participation in scholarly activities which may include discovery, integration, application, and teaching. (ACGME Common Program Requirements, 2019-2020).

The ACGME defines a scholarly approach as a synthesis of teaching, learning, and research with the aim of encouraging curiosity and critical thinking based on an understanding of physiology, pathophysiology, differential diagnosis, treatments, treatment alternatives, efficiency of care, and patient safety. They highlight the responsibility of all faculty members for advancing residents' scholarly approach to patient care.

Elements of a scholarly approach to patient care include:

- Asking meaningful questions to stimulate residents to utilize learning resources to create a differential diagnosis, a diagnostic algorithm, and treatment plan
- Challenging the evidence that the residents use to reach their medical decisions so that they understand the benefits and limits of the medical literature
- When appropriate, dissemination of scholarly learning in a peer-reviewed manner (publication or presentation)
- Improving resident learning by encouraging them to teach using a scholarly approach. The scholarly approach to patient care begins with curiosity, is grounded in the principles of evidence-based medicine, expands the knowledge

base through dissemination, and develops the habits of lifelong learning by encouraging residents to be scholarly teachers.

Education Links to Evidence-based Medicine (EBM)

Evidence based medicine (EBM) is the "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett et al., 1996, p. 71). EBM requires that clinicians be able to critically assess the strength of the information being presented in the field through an integration of their individual clinical expertise and the best external evidence available. EBM requires physicians steadily increase their base of knowledge in a discerning manner as they develop the critical skills required to apply their intake of new knowledge. Without current best evidence, healthcare practices risk becoming rapidly out of date, to the detriment of patients (Sackett et al., 1996).

Advancements in evidence-based health care are contingent upon the successful conduct of incisive and ethical biomedical research (Brody et al. 2012). Evidence-based medicine or practice is based on the idea that current valid evidence should be used to support clinical decisions (Deshpande et al, 2003).

In an evidence-informed practice model, the clinician bases treatment decisions on a blend of information gleaned from best research evidence, patient values, and clinical expertise, the latter encompassing experience and skills (Sackett et al., 2001). In addition to this, it has been shown that patient and practitioner preference, and peer group advice also influence decision making (Gabbay & LeMay, 2004). Fundamental to evidence-informed practice is not only the existence of relevant research evidence, but also the ability of practitioners to evaluate the literature in an informed and reasonable fashion. This reflects the notion that one of the early steps in developing an evidence-informed approach to practice within a professional group is the creation of a research-literate cadre of practitioners, research literacy being defined as ‘understanding research language and its application to practice’ (Finch, 2007).

The research and scholarship skills required of physicians are not necessarily intuitive, and for most practitioners, they must be systematically taught, practiced, and honed so they can make good use of the available literature (Senders et al., 2014).

The principles discussed in the context of physician leadership for allopathic medicine applies to other healthcare disciplines as well. The ability to critically appraise and communicate research findings with our patients and other healthcare professionals improves the value of clinical work, increases interdisciplinary collaboration, and advances naturopathic medicine as a whole (Senders et al., 2014). Evidence-based practice (EBP) in nursing requires that research evidence is found, appraised and understood, so that the relevant findings can be integrated into nursing practice (Hines, 2016).

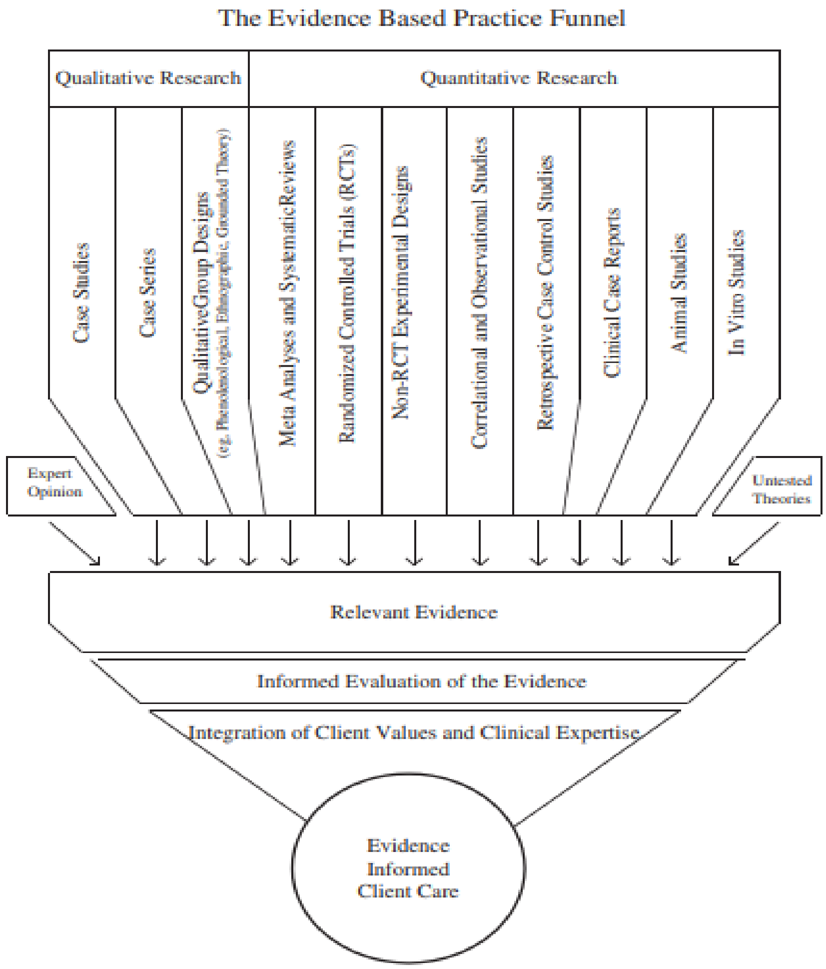
Given the connection between research literacy and effective recruitment for clinical trials, a conceptual formulation for ‘research literacy’ and preliminary evidence for the utility of the construct in enhancing knowledge of and ethical participation in research (Brody et al., 2012). To achieve the goal of developing research-savvy physicians, healthcare education must do all that it can to deliberately develop and promote research and scholarship skills. Healthcare research can provide important information about disease trends and risk factors, outcomes of treatment or public health interventions, functional abilities, patterns of care, and health care costs and use. Healthcare professionals are required to be critical consumers of peer-reviewed journal articles and scientific conference presentations. It is well-established in the evidence-based practice literature that the difficulty many clinicians experience with reading and understanding research is a significant barrier to implementation, which hinders a physician's ability to effectively incorporate EBM into their practice.

Development of Research Skills

The evidence-based practice funnel shown in Figure 3 helps to demonstrate the crucial role of research literacy in linking a non-hierarchal evidence structure to evidence informed patient care. This highlights the perspective that calls for professional programs and schools to plan curricula such that students develop a reasonable understanding of basic research methods. Additionally, students should have sufficient opportunity to evaluate and utilize evidence during, in particular, the clinical component of their education (Finch, 2007).

Figure 3

The Evidence-Based Practice Funnel



Source: Finch, 2007.

A Call for a Competency-based Development of Research Skills

The various training models developed by healthcare governance and healthcare quality organizations (e.g., Agency for Healthcare Research & Quality, Institute of Medicine, etc.) each emphasize a personal responsibility that physicians have for developing their research literacy. At an organizational level, work by the Institute of Medicine (IOM), the American Association of Medical Colleges (AAMC), the Howard

Hughes Medical Institute, and international study groups such as International Association of Medical Science Educators (IAMSE) have highlighted the emerging imperative to instill a systematic approach to a competency-based medical education curriculum to ensure that all future physicians are capable of effectively navigating the world of research in medicine and healthcare (des Cruser et al., 2012).

In response to a charge from the IOM, a group of physician scholars examined how the nation uses scientific evidence to identify highly effective clinical services. The resulting book, *Knowing What Works in Health Care* (IOM, 2008) provided an overall vision and roadmap for improving how the nation uses scientific evidence to identify the most effective clinical services. Although this topic extends beyond the scope of this literature review, it is interesting to see efforts made to frame questions regarding what constitutes acceptable evidence and how the recommendations that are generated from the research will be used. This book examined how to set priorities for evidence assessment, assess evidence (systematic review), and develop evidence-based clinical practice guidelines. This establishes an organizational standard for assessing the quality of the evidence and how it can and should be applied (Eden et al., 2008). As a practical guide, Guyatt and Rennie (2002), developed the *Users' Guides to the Medical Literature: A Manual for Evidence-Based Clinical Practice* which aims to make medical research literature accessible to clinicians. Designed in two parts - Part one is designed to teach clinicians ways of using research literature in their daily practice. It covers the philosophy of evidence-based medicine (EBM) as well as the ways to find, analyze, and identify practical applications for the research to patient care. Part two is developed for educators who instruct clinicians on how to best use the medical literature in their daily practice.

Educational research and, more specifically, the healthcare research paper, has long been recognized as a unique 'genre' of literature with a specific and broadly consistent structure and a specific vocabulary. The process of developing an understanding of the function of each element of a research paper (i.e., genre analysis) helps learners to develop a mental 'road-map' to navigating and understanding (Hines, 2016).

Competency-based Development of Research Skills

While the initial literature review related to accreditation structures which highlight the competency models and curricular requirements for physician training, there will also be a benefit in looking at those healthcare research and quality structures that are provided at the healthcare system level. There are a number of healthcare-related organizations that have developed competency models to summarize the knowledge and skills that are necessary to develop scholarly practitioners. For example, the Agency for Health Research Quality (AHRQ) has highlighted the fact that limited attention has been given to the unique attributes and skills of learning health system (LHS) researchers (i.e., those individuals within a health system who collaborate with its stakeholders to produce novel insights and evidence designed to rapidly implement improvements in health system performance). In response to this identified gap, AHRQ developed a set of core competencies to guide the design, implementation, and evaluation of training programs for healthcare researchers. It is easy to envision how efforts to address these quality domains advancements experienced by healthcare systems can be efficiently be enhanced by sharing insights and best practices through research and scholarship. Improvements can be accelerated by gaining insights from efforts tested within peer academic, hospital, and/or clinical settings.

Health Professions Education Scholarship Units (HPESU)

Many medical schools and academic teaching hospitals around the world have adopted the model of a health profession education scholarship unit (HPESU), a dedicated work group designed to promote engagement in educational scholarship (Varpio et al., 2017). In 2004, a series of case studies of “eight highly-productive research in medical education groups” from Canada, the United States, and the Netherlands were featured (Arnold, 2004).

In a retrospective case-study analysis of those same eight HPESUs, it was determined directors were able to identify three key factors that helped shape the longitudinal development of these work groups: 1) The people working within and overseeing the unit (the need for a critical mass of scholars, a pipeline for developing scholars, and effective leadership); 2) institutional structures (issues of centralization, unit priorities, and clear messaging); and funding (the need for multiple funding sources). The researchers acknowledged the challenges of longitudinal studies, especially since they do not have (or require) a public reporting mechanism along with the wide diversity of structures and policies Humphrey-Murto et al. (2019).

Wide diversity was noted in the structure of these groups; there were no standardized reports generated by each HPESU and, as such, a number of different outcome measures were used to report their progress (e.g., grant money secured, peer-reviewed publications disseminated, and number of faculty affiliated with the unit.) (Humphrey-Murto et al., 2019).

A qualitative study was initiated in the interest of developing consistent terminology regarding the individual roles and organizational structures that are active in the field of health professions education scholarship (Varpio et al., 2017). The goal is to develop working definitions to identify cross-context similarities and differences. This type of foundational work is intended to promote transferability and support international scholarly investigation and debate.

Practitioner Research Literacy Skills

There are six basic core competencies in the United States that are foundational to the core curriculum for graduate medical students completing their residency part of their training. They are: medical knowledge, patient care, communications, professionalism, systems-based practice, and practice-based learning and improvement. In an effort to combine the international trends in developing core competencies specifically as related to practitioner research literacy skills (PRLS), a group at the University of North Texas Health Science Center proposed a universal approach to integrating PRLS into a competency-based medical education curriculum (CBME) (des Cruser et al., 2012). This diagram is displayed on the next page. Study groups have urged medical educators and students to consider embracing PRLS as an integral part of their medical education. Taking the view that these skills are no longer peripheral, or irrelevant to, or isolated from clinical training. The call is for educators of future physicians to excite students about research and to share with students a spirit of curiosity, skepticism, creativity, and beauty about science and the scientific method.

The Venn diagram shown in Figure 4 is a visual depiction of how to integrate PRLS into the “fabric of all of the core competencies and thus into a competency-based medical education curriculum” (des Cruser et al., 2012).

Figure 4

The Venn Diagram of PRLS

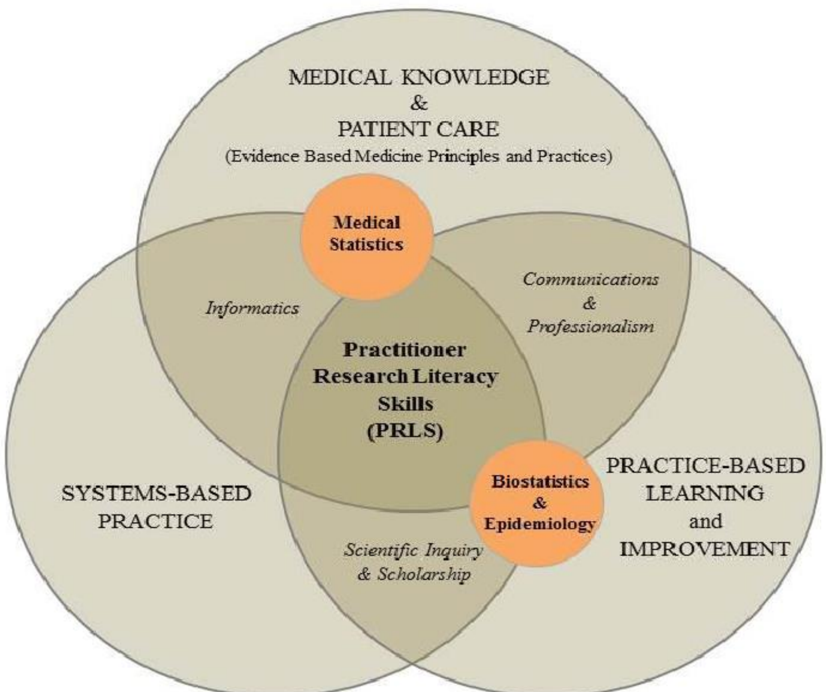


Figure 1. The “Venn” of PRLS

Source: des Cruser et al., 2012.

This model embeds skills related to medical statistics and biostatistics and epidemiology against the backdrop of the six core competencies. It also calls out the value of data (informatics) and highlights the importance of scientific inquiry and scholarship.

Learning Health System (LHS) Researcher Core Competencies (IOM)

In 2012, the Institute of Medicine (IOM) generated a report which defined the learning health system (LHS) which combines research, data science, and quality improvement, yielding knowledge as a by-product of the patient-clinician interaction. Subsequently, a set of core competencies for LHS researchers was generated to guide the development of learning objectives, evaluation methods, and curricula for training programs.

Further refinement of definitions led by the IOM through a roundtable on value and science-driven health care resulted in the LHS Competency project report (IOM, 2013). This effort landed on the identification of seven domains and specific competencies under each: 1) systems science; 2) research questions and standards of scientific evidence; 3) research methods; 4) informatics; 5) ethics of research and implementation in health systems; 6) improvement and implementation science; and 7) engagement, leadership, and research management. A total of 33 core competencies were prioritized across these seven domains (Forrest et al., 2018).

Health Services Researcher Core Competencies (AHRQ)

The Agency for Healthcare Research and Quality (AHRQ) developed Health Services Research Doctoral Level Core Competencies through a rigorous planning process and stakeholder engagement process. The list defines each competency and offers examples under each of the domains, described in Table 3.

Table 3

AHRQ Domains for Learning Health System Researcher

Foundational knowledge	Research conduct management
Theoretical knowledge	Data analysis
Relevant and important health science research question development	Professional development
Conceptual models and operational methods	Communication
Study designs	Knowledge transfer
Data collection and management methods	

Source: AHRQ, 2021.

Conclusions from the Literature Review

In conclusion, research literacy is a critical skill for physicians, as it enables them to identify and integrate best evidence into their clinical practice. The pace of change in the field of medicine highlights the need for a lifelong learning mindset – an approach toward skill development that acknowledges the importance of self-reflection and promotes continuous improvement. The value of research literacy is clear for both producers and consumers of research. Accreditation systems have incorporated research skills into their program requirements and, while general guidelines are provided, institutions are left to interpret those elements and adopt their own approach through curricular elements. Several years ago, the ACGME stepped up their expectations for residents to develop and apply research skills through the design and implementation of a research project as part of their learning experience. Attempts to assess the effectiveness of the curriculum are typically reserved for current residents and they are asked to comment on what they anticipate will be the applicability of their training to their practice. Instead, we are interested in asking physicians to retrospectively comment on the value of their research training after they have completed their residency and once they have had time to transition into practice.

Based upon the review of the literature, I elected to pursue a dissertation study on the following central research question: ***What factors found in residency training most effectively contribute to a physician's ability to develop and apply research literacy skills to practice evidence-based medicine?***

Chapter Three: Methodology

Methodology is "'a contextual framework' for research, a coherent and logical scheme based on views, beliefs, and values, that guide the choices a researcher makes" (Kara, 2015, p. 4). A methodology offers a theoretical perspective for understanding which method, set of methods, or best practices can be applied to the research question(s) that are being addressed.

This chapter outlines the methodology applied to this constructivist grounded theory study by providing: an overview of the research design; a brief description of grounded theory methodology and its evolution; the research procedures (related to participants, data collection, and data analysis); the role of the researcher; and steps taken to ensure the quality and integrity of the research.

Research Design

My research question examined physicians' reflections on the training they received in residency (or, for directors and planners, the training they seek to deliver for residents) to promote and develop research literacy. My aim was to develop a theory of how practitioners develop research literacy to inform their clinical decision-making in addition to gaining insights in terms of how they position themselves as lifelong learners. When searching for a methodology that aligned with the project's objectives, the research question called for a qualitative approach, which is well suited for understanding views and perceptions (Morse & Richards, 2002) and I adopted a grounded theory approach to guide and analyze this work.

Qualitative research is “an approach for exploring and understanding the meaning individuals or groups ascribe to a social or human problem” (Creswell, 2014, p. 4). It involves an interpretative, naturalistic approach to its subject matter which means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. Qualitative research involves the studied use and collection of a variety of empirical materials – case study, personal experience, introspective, life story, interview, observational, historical, interactional, and visual texts – that describe routine and problematic moments and meanings in individuals’ lives (Denzin and Lincoln 2005. p. 2).

As mentioned, my goal was to explore the factors that contribute to (or hinder) the effectiveness of a resident’s research literacy training. This study set out to highlight how both residents and residency program directors view the applicability of the training they received which was focused on the development of research literacy. In addition, this study examined to what extent the residency program was able to promote and instill the value of lifelong learning throughout the physician’s practice. After evaluating various forms of research, I elected to use a constructivist grounded theory methodology to explore the research question, what factors are found in residency that most effectively contribute to a physician’s ability to develop and apply research literacy skills?

Grounded Theory Methodology and its Evolution

Grounded theory is a systematic, yet flexible, inductive approach for collecting and analyzing data (Charmaz, 2014; Strauss & Corbin, 1994; Glaser & Strauss, 1967). Grounded theory was introduced by Glaser and Strauss in 1967 as a means to further legitimize qualitative research. It is an approach whereby the analysis and development of theory occurs after the data is collected. This was a suitable, pragmatic approach in that grounded theory can identify the situated nature of knowledge, as well as the contingent nature of practice. The emphasis of grounded theory is on the utilization of a variety of data sources that are grounded in particular contexts, which brings value to this project which is situated in a healthcare education. Grounded theory sets out to discover or construct theory from data that has been systematically obtained and analyzed using comparative analysis (Yie et al., 2019).

Within the portfolio of qualitative research methodologies, I found a constructivist grounded theory (CGT) to be suitably aligned with my study. Constructivist grounded theory (CGT) is an inductive and iterative approach designed to construct theory from data and it is a method often applied to studies in the disciplines of psychology, education, and the health sciences. CGT is described as an inherently flexible approach which sets out to discover or construct theory from data, systematically obtained and analyzed using comparative analysis. I considered this approach it to be an appropriate fit, as it would address the research question I had outlined and allow me to produce a theory of pragmatic value. Prior to making this decision, I examined qualitative research and, specifically, reviewed other predominant variations of the grounded theory approach.

While the grounded theory has foundations established by Glaser and Strauss (1967), I applied the Strauss and Corbin (1990) approach which highlighted the fact that the researcher is active in the process, theory is interpreted by the observer, and the data is structured to reveal theory. Another advantage with grounded theory is that it avoids making assumptions and instead adopts a more neutral view of human action in a social context (Simmons, 2006).

In the 1990s, Strauss began to work alongside Juliet Corbin, applying a more interpretivist approach to the methodology. In so doing, this addressed some of the previous concerns of rigid structure and clarity in its flexible nature. Strauss and Corbin continued to work together to constantly improve and clarify interpretive grounded theory (IGT). The 4th edition of Basics of Qualitative Research (2015), which was published after Strauss' death, includes a reflection on how far IGT has come as well as conveying anticipation for how new grounded theorists may use IGT. Kathy Charmaz, a student of both Glaser and Strauss, began applying a more modernized and constructivist approach towards grounded theory. This modernized approach includes acknowledging the "interaction between the 'viewer' (researcher) and the 'viewed' (subject of the research)" (Farragher & Coogan, 2018, p.5; Lian, 2016; Martin & Barnard, 2013). This said, Charmaz's constructivist grounded theory (CGT) does remain true to some of the key tenets of the original grounded theory articulated by Glaser and Strauss (1967), particularly interpretive understanding and iterative logic (Charmaz, 2014). Throughout many changes and interpretations between GT, IGT and CGT, the constant comparative method has remained one of the original and most important criteria. As discussed by Holton and Walsh (2017), "constant comparative analysis is a strategy for directing the collection and analysis of data in tandem with theoretical sampling as a means of guiding the direction of further data sampling" (p. 34). This method allows for primary data to emerge – or, in the case of CGT, to be constructed – as patterns that lead to substantiated theoretical understandings.

There are still several distinct alterations that have occurred within the conceptual tenants of any grounded theory research. Table 4 provides succinct overviews of the central tenets (philosophical influence, prior knowledge and experience, as well as data coding and analysis) and how they are interpreted within GT, IGT, and CGT.

Table 4

Illuminating the Types of Grounded Theory

	GT *(Classical Grounded Theory)*	**IGT** *(Interpretive Grounded Theory)*	**CGT** *(Constructivist Grounded Theory)*
Philosophical Influence	(Attempts to be) free from influence	Interpretivism	Constructivism and Pragmatism
Role of the Researcher	The researcher is *distant* and *detached.*	The researcher is *engaged* with and *actively interprets* the data.	The researcher *constructs* rather than *discovers*.
Allowance of Prior Knowledge	No, the researcher and research must remain neutral. Only the information provided by the collected data should influence the progress of the research. Prior knowledge could negatively influence the direction or quality of the concluding theory.	Yes, it can be used to strengthen the overall research and data collection. Referred to as *'sensitivity'* and includes having insight on relevant issues.	Yes, it is understood that one cannot escape prior knowledge. Examine and understand how it influences the researcher and research; do not ignore, erase or let it control the direction of the research.
Literature Review	To be conducted following data analysis.	Allowed prior to and during the data collection process. Can be used for data comparisons, enhance sensitivity, stimulate observations, and confirm or explain results.	There is no prescribed location; it is up to the decision-making process of a given researcher. If written early, it should be revisited to critique and confirm it aligns with the research's conclusion.
Research Question(s)	There should be no pre-set or vaguely established questions prior to data collection. Questions should become clear during data analysis.	Kept partially vague for flexibility; will become clearer as data emerges. Each additional question can reference another topic of interest.	Influence how data is collected. Can and should be altered if more significant or pressing questions arrive.

Data Coding and Analysis	(1) Substantive coding, and (2) Theoretic coding (TC) Focuses on patterns or trends within the data. Includes the Constant Comparative Method and use of a core category. Includes TC to merge categories together into a substantive theory.	(1) Open-coding, (2) axial-coding, and (3) selective-coding Allows for single occurrences within the data to be coded and analyzed for significance. Includes the Constant Comparative Method and use of a core category. Have broken down and rebuilt codes to create more significant and descriptive categories that lend themselves to a substantive theory.	(1) Code everything, and (2) group all data around the most predominant codes (includes focused coding) Purports these as flexible guidelines rather than strict rules. Allowance of more than one core category.
Theory Creation and Verification	There is a distinct separation between theory generation (primary) and verification (secondary). Creation of a substantive or formal theory is central to the completion of a research study. Verification can only occur afterwards by quantitative analysis.	Creation of a substantive or formal theory is central to the completion of a research study. Verification occurs through multiple perspectives confirming the same data.	The constructed theory is an interpretation rather than an exact representation. The theory is dependent upon the researcher's view and cannot occur or stand without it.

Source: Sebastian, 2019.

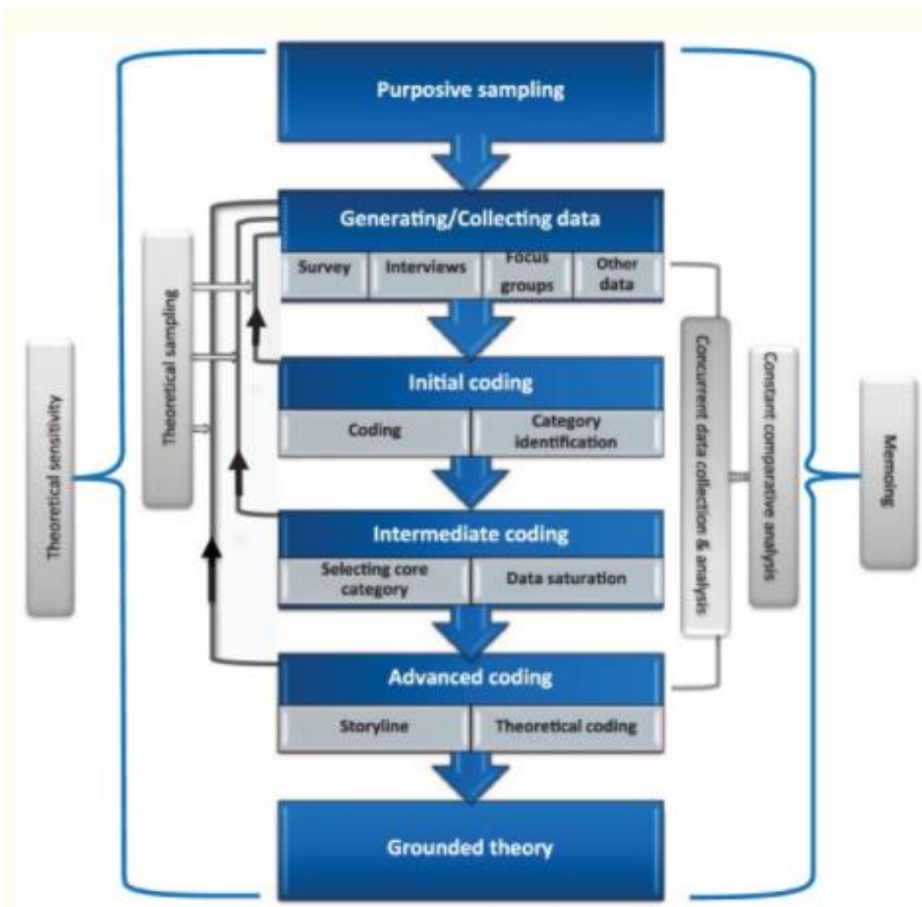
Research Procedures

To explore the research question, qualitative data was collected through interviews and analyzed to generate a well-grounded theoretical construction of the process of physician development. The research was exploratory in nature and well-matched to qualitative research, since that design allows the researcher to illuminate the experience and interpretation of events by individuals with widely-differing roles.

Data was collected through semi-structured interviews with current or recent Chief Residents and practicing physicians to gather detailed qualitative information in response to the research question. Before launching into a description of the details related to this study, it is helpful to review Figure 5 (Yie et al., 2019) which depicts the research design framework that is present in grounded theory. This figure portrays the steps from purposive sampling, through data collection and coding, to the resulting theory building.

Figure 5

Research Design Framework: Summary of the Interplay Between the Essential Grounded Theory Methods and Processes



Source: Yie et al., 2019.

What follows is a description of the details related to the research design, participants and recruitment, plus data collection and analysis. In addition, I have listed what I consider to be the limitations of this particular study.

Participants and Recruitment

Participants were selected for this study by purposeful convenience sampling. I initially intended to select 12 participants for the study and I anticipated they would consist of physicians in practice who completed their residency 1-2 years earlier. The selected physicians would include a mix of gender, residency programs, and institutional affiliations to ensure diverse perspectives drawn from a variety of contextual settings. Given the variations across residency programs, I decided to focus on primary care programs (i.e., family medicine, internal medicine, and pediatrics), rather than introduce some of the complexities that rest in specialty residency programs where there is often a more intensive research focus. Participants were drawn from three different institutions and it was not required that individuals had completed a residency at the same institution at which they now work.

Recruitment of these participants relied upon my ability to reach out to residency program directors through available networks. Calls were made in an effort to solicit their involvement in interviews and extended to request to allow me to gain access to residents who currently hold (or have recently held) the position of Chief Resident. To meet the study criteria, participants needed to be in a residency program as a Chief Resident, or have completed a residency within the previous 1-2 years and have successfully transitioned into a practice setting. A follow-up email was sent to the identified program director formally requesting their support in the participation of recruits for the study. The email included the communication that would be sent to prospective study participants informing them of the purpose of the study, the manner in which data will be collected, details regarding how the results will be used, and assuring them of steps being taken to maintain confidentiality, anonymity, and privacy.

Once a list of prospective participants was identified, individual emails were sent to each prospect. The communication included a consent form (see Appendix D-HRP 587) which described the details related to the study, highlighted the fact that their participation was voluntary, and requesting their consent to participate in the study. Since this study was deemed by the IRB to be exempt, it was not necessary to receive the signed consent form, however, I still approached the prospective participants in a manner that was transparent and open to address any questions they may have. I worked with interested parties to schedule time on their calendars for a 30- to 45-minute semi-structured interview. In each case, I confirmed the participant's willingness to respond to a brief follow-up call after the interview notes were transcribed, should there be a need to clarify any points that were unclear. Participants were made aware of the fact they had the ability to withdraw from the study at any point.

Data Collection

Data was collected through semi-structured qualitative interviews designed to gather qualitative, descriptive information. The selection of interviews as the method of data collection works well with the grounded theory approach. As previously noted, this approach provides a direct but flexible structure that allows for the constant comparison of emerging data (Charmaz, 2006).

Interview questions were developed in alignment with the research question. The process for developing the interview questions consisted of breaking down the overarching research question into sub-categories and then developing more refined questions within each category. Sub-questions from the literature review informed the interview outline by addressing the following: the physician's role as a researcher, their perspectives on the training they received, and insights into lessons learned and suggestions for improvement.

Specifically, the interview questions will be aligned to address the following topics:

1-2 Your experience and role; your relationship with research

3-5 Motivation, incentives to pursue research training

6-7 Self-Assessment - Level of confidence with research development/design

8-9 Staying current - Educational resources

10 Reflections / Recommendations

The necessary steps were taken to perform a pilot test of interview questions for Residency Program Directors/Planners, and Administrative Support staff, to ensure appropriate ethical considerations are taken into account to protect participants' confidentiality and anonymity, and follow-up clarification (also known as informant feedback or respondent validation, a technique conducted to help improve the accuracy, credibility, validity, and transferability of a study). (Creswell, 2014; Lincoln & Guba, 1985).

The 30- to 45-minute interview was conducted over the phone or online via Zoom at a time that was convenient for participants. Each interview was digitally recorded to capture complete responses and to ensure confidentiality, those digital files were uploaded to a secure server. The raw data will be kept confidential and will be deleted three years after collection. Participants were given the option to remove themselves from the study at any point and to omit one or more questions while still participating in the study. A comprehensive version of the interview guide (Appendix C) will provide a more detailed outline to be used during the interview to gather deeper insights and descriptive explanations of key points.

The process for developing the interview questions consisted of breaking down the overarching research question into sub-categories and then developing more refined questions within each category. A comprehensive version of the interview guide (Appendix B and C) will provide a more detailed outline to be used during the interview to gather deeper insights and descriptive explanations of key points.

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The necessary steps were taken to perform a pilot test of interview questions for Residency Program Directors/Planners, and Administrative Support staff, to ensure appropriate ethical considerations are taken into account to protect participants' confidentiality and anonymity (Creswell, 2014; Lincoln & Guba, 1985).

In keeping with the grounded theory approach of interviewing, all participants were interviewed using a qualitative semi-structured interview protocol and schedule.

The interview background preparation (Appendix B, which focused on an organizational perspective for Residency Program Directors/Planners, and Administrative Support staff, and Appendix C, which focused on an individual perspective for current or recent Chief Residents) included ten (10) questions designed to help the participants prepare for the interview and the appropriate document was shared with the participants, based upon their role, at least two days in advance of their interview.

Data Analysis

After an interview was completed, it was transcribed and reviewed for accuracy. Transcriptions will be used for analysis purposes only and any additional notes captured during the interviews were included with the transcriptions. A code was randomly assigned to each participant to ensure anonymity when discussing his/her interview. In keeping with responsible and transparent scholarship practices, the results of the study will be available to participants, if they should so desire. As is the case with grounded theory, data analysis will be conducted simultaneously to data collection.

I conducted a constant comparative analysis of the data, which included interview transcripts and research notes. The process consisted of an initial coding and focused coding process, followed by theoretical coding. The following steps (as described by Charmaz, 2006) were taken:

1) Transcribed interview and re-reviewed for accuracy
2) Completed initial coding by segment
3) Identified potential categories and themes using the participant's own words
4) Conducted focused coding, calibrating categories and labels

5) Engaged in constant comparative analysis as data emerges or was added
6) Assessed for saturation of information
7) Conducted theoretical coding to establish theory draft

As described in the process, several passes through the transcripts facilitated a review process designed to reveal key themes in response to the interview questions. The transcripts were read carefully and the initial coding phase was completed manually. Coding was be done by segment, summarizing and accounting for each piece of data, avoiding coding word-by-word where there is a risk of missing the bigger picture and over-emphasizing the worldview of respondents (Charmaz, 2006). After key themes were established, theoretical coding informed the building of theory. Specifically, the findings inform addressing the central research question (Wengraf, 2001).

Role of the Researcher

This grounded theory approach acknowledged the exposure that I have had throughout my career in the field of healthcare education and views that experience as providing a valuable understanding by which I was able to gather and analyze data. It would have been unrealistic to envision a process that does not draw upon that experience, while noting that it is important to follow an objective path throughout this inquiry.

Research Integrity

When sociologists Barney Glaser and Anselm Strauss's (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research* proposed a new method of analysis, they also led the charge of defending the quality of qualitative research. In grounded theory studies, the researcher's analytic focus emerges during the research process, rather than being determined before empirical inquiry begins (Charmaz & Thornberg, 2021). As a systematic method of conducting research that shapes collecting data and provides explicit strategies for analyzing data, grounded theory has within it certain guardrails to help researchers maintain integrity in the process and achieve credible findings. The goal is to construct a theory that offers an abstract understanding of one or more core issues. Using grounded theory means making what the researchers learn transparent by showing how the research has been conducted thoroughly and systematically. The grounded theory method offers useful strategies to develop researchers' theoretical analyses.

To ensure credibility in my work, I applied core principles to address the inherent risks associated with grounded theory in the following manner: acknowledging potential biases in sampling; promoting adequate depth and relevance of data collection and analysis; taking steps in the critical reflection to account for personal biases which may influence the findings.

Chapter Four: Findings

This chapter presents the findings of my grounded theory study, which explored the research question, ***What factors found in residency training most effectively contribute to a physician's ability to develop and apply research literacy skills to practice evidence-based medicine?*** Through a qualitative approach, I examined this research question by organizing the interview into three parts: a) determining the individual's role (teacher or learner) and distinguishing their primary position as a promoter of or consumer or producer of research; b) identifying the elements in the program and/or curriculum that support and contribute to a physician's development journey, along with the barriers and challenges faced; and c) exploring ideas for how to improve the programming and support structures designed to foster research literacy.

My approach was designed to focus on the research skill development that appears within the residency training (commonly referred to as graduate medical education or GME) physicians receive as part of their professional development journey. Within the medical education continuum (Figure 1), residency consists of the three to ten years of training that physicians receive following their completion of the Medical Degree (M.D.) or Doctor of Osteopathy (D.O.) degree and prior to going into practice. The number of years of residency training varies based upon the particular specialty. For purposes of this study, I chose to focus on those who completed their undergraduate medical degree and have elected to pursue primary care residency training in either family medicine, internal medicine, and/or pediatrics, which typically spans a 3–4-year period. I examined this research question by conducting interviews with two distinct groups: 1) Residency Program Directors, preceptors (those who supervise students on various clinical rotations within practice settings), and residency administrative staff (representing program planning functions and centralized services, such as the health science library), those who represent a program from an organizational perspective; and, 2) Chief Residents, those who can offer an individual perspective as they are in the process of (or have just recently completed) their residency training.

After an overview of the interview participants and the recruitment process I utilized, this chapter is presented in three main sections which describe the themes that emerged from the discussions. The content clustered around the following two major groups of issues:

1) **Structural elements – Features and reinforcements that drive and support research literacy**
   - Organizational Perspective - regulatory/accreditation, program requirements, etc.
2) **Motivational Elements – Factors that contribute to a resident's ability to achieve their educational and clinical goals**
   - Organizational Perspective - Competing demands, lower prioritization within the program, lack of resources – faculty expertise, mentors
   - Individual Perspective – intrinsic motivation, alignment with personal/professional goals

For each section, I will present the findings and then share additional insights related to the category, while highlighting the comments and any particular distinctions between the perspectives of the two groups. Furthermore, I will provide details regarding how I made determinations about the categories throughout the constant comparative analysis of the interview data.

Professional Development Insights - After describing those themes and calling out the highlights, I will share a summary of professional development insights that were gleaned from the interviews. For residents, that will consist of insights designed to enhance pursuit of evidence-based medicine. For program directors/planners, that will highlight possible program features or opportunities for improvement to existing programs to increase the level of outcomes for future learners.

In this chapter, I will incorporate several contextual highlights to describe the landscape surrounding medical education and acknowledge some of the challenges attributed to the varying interpretations that exist in terms of the expectations of each part of the development pathway. The connection will be made to the research question which specifically addresses the development of research literacy skills as a vital link to evidence-based practice (EBP). Before delving into the key findings, I will start with a brief summary of the interview participants, as well as some insights and considerations related to the recruitment process.

Overview of the Interview Participants

To examine the topic of research literacy and its role in medical training and practice, I interviewed a total of 22 individuals. The group consisted of 17 medical education leaders and affiliated administrative staff from a mix of academic and community-based institutions to explore the programmatic research literacy strategies being implemented by residency training leaders. And, to gain the perspective of individuals who have recently completed their residency and address those who are preparing to go into medical practice, I interviewed five (5) current or recent Chief Residents. My purpose in visiting with this sub-group was to better understand their residency experience, their reflections on their personal development journey, and to examine the value they saw placed on the development of research literacy skills through their training. I was specifically interested in gaining a better understanding of the educational content and guidance they received to be able to routinely conduct a critical review of the research literature, to pursue scholarly activities, and to apply their research findings in pursuit of evidence-based practice (EBP).

Recruitment Process and Considerations

Having worked extensively in the medical education field, I was able to identify institutions that were known to have a well-established medical school curriculum and respected residency programs. Given the field of medicine has 24 specialties (ranging from Allergy/Immunology to Urology) and there are notable differences across several of those specialties as it relates to residency scholarly activity (SA) training requirements, I elected to primarily focus on the training path of physicians pursuing Primary Care Programs (i.e., Family Medicine, Internal Medicine, and Pediatrics). In the interest of introducing a diverse and valuable perspective from a specialty care group within an academic setting, I did make a few exceptions to the primary care focus, as I draw upon the expertise of a Program Director who had extensive experience across the medical education continuum (UME-GME-CME), a Health Sciences Librarian who served learners across the entire continuum, and a health journalist whose insights pertain to anyone who wants to be confident in their reliance upon mainstream medical information.

For each portion of the medical education continuum, there is a corresponding national regulatory agency that governs the program requirements. I chose to cast a wide geographic net and deliberately reached out to individuals across distinctly separate regions of the country. At the same time, noting that research priorities vary across academic and community-based settings, it was important to look at a mix of practice settings. The interview participants selected were from academic and community-based practice settings in the Midwest, South, and Southeast regions of the United States. Through purposive sampling, I was able to extend invitations to Program Directors and Residency Support Service Staff (e.g., preceptors –, health science librarian, and program managers) who were able to address the strategic plan and infrastructure dedicated to the institution's residency training initiatives. I also established inclusion criteria for the current or recent Resident pool to consist of individuals who were in their final year of residency and one to two years out.

As mentioned, the number of years of residency varies by specialty. For Family Medicine residents, Chief Residents are typically completing their third and final year of training. For those pursuing completion of a three-year residency in Pediatrics, individuals may apply to fill the role of Chief Resident during what ends up being an additional year of residency (Year 4). This provides the resident with a more flexible schedule to pursue systems-based projects, to assist with the development/improvement of educational programming, and to dedicate time to address specific areas of interest. Since they have completed their residency requirements, it would seem Chief Residents are in an ideal position to leverage their experience, to help identify and address opportunities for improvement, and introduce new ideas or approaches that will benefit the coordination and implementation of future residency training efforts.

I sincerely set out to interview an even mix of program directors/administrators and residents, however, I quickly discovered the pool of program planners were more readily available and able to carve out time in their schedule for a call. I relied upon reminder notices and follow-up communications to arrange Zoom interviews and I was fortunate to make contact with a number of Medical Education leaders who are involved in establishing and monitoring (or guiding others to meet) learner program requirements related to scholarly activity (SA) at the department or institutional level.

My attempts to recruit Chief Residents highlighted the challenges of fitting ‘one more thing’ into the schedule of a busy learner, especially one that is completing their capstone residency experience and launching into their career. During my employment in a Medical School, I recall the frustration often voiced by the school leadership as they attempted to deliver messages and get responses from residents who were scattered across a wide variety of organizations and working long and varied shifts. In order to address this challenge, I relied upon the program directors and preceptors I was able to contact to help me identify suitable candidates and then introduce me and my project to those individuals. It was extremely helpful for the Program Directors to send an introductory email and voice their support of this study, even though my actual yield of

Chief Residents for interviews was lower than I had hoped. I must acknowledge the timing of my request was less than ideal, as evident by the significance of Spring semester - the period during which residents discover where they will be offered employment as they launch their career as a practicing physician. For that reason, I am grateful for all those individuals who did take time to share their perspectives regarding their residency training experience.

Through my discussions with residents and program planners, it became apparent to me that the focus on research is clearly placed early in a future physician's development journey. Increasingly, applicants interested in a science-related profession are getting acquainted with basic research principals and pursuing research project opportunities in their college (and possibly even high school) training as a matter of preparing to submit an application to Medical School. A research-related project can prove to be an ideal way for a candidate to demonstrate their interest in a particular field of study. It also connects them with subject matter experts and potential mentors who can provide guidance at a critical point in their exploratory journey, and both serve to strengthen their application. One of the Program Directors I interviewed from an academic setting underscored their concern that by examining and discussing research skills training delivered during residency, I would draw the conclusion that the training provided was woefully inadequate. In actuality, for most residents who have an interest in producing research, that type of training will have been completed much earlier. This concern provided an opportunity for me to emphasize the greater focus of this study which is on being a critical consumer of research and examining the skills developed, refined, and applied during residency training to achieve that goal.

While initially disappointed I could not achieve a more balanced mix between the two groups I sought to interview, I discovered the fact that when focusing on being a good consumer of research, there is often greater value derived by providing individuals with a longer period of reflection on their experience as a learner. We know the medical training process is intense and some insights or valuable links to curricular elements and/or the application of knowledge and skills are not immediately evident. I realized it was almost too soon for the Chief Residents (Years 3 or 4 of their residency training) to provide in-depth reflections on their medical education training and exposure to research literacy skill development and application. The true test of research literacy skills is experienced when faced with a less-controlled practice environment.

The participants in this study represented a mix of gender and organizational settings (academic institutions, independent healthcare systems, community-based healthcare). Table 5 provides a breakdown of the participants' backgrounds.

Table 5

Summary of Participants' Background

Chief Residents and/or Recent Graduates from Residency *Individual Perspective (n=5)*		
Gender	Male 3 (60%)	Female 2 (40%)
Practice Setting	Academic-Based 2 (40%)	Community-Based 3 (60%)

Program Directors/ Support Service Providers *Organizational Perspective (n=17)*		
Gender	Male 9 (53%)	Female 8 (47%)
Practice Setting	Academic-Based 11 (65%)	Community-Based 6 (35%)
Totals for both groups (n=22)		
Gender	Male 12 (55%)	Female 10 (45%)
Practice Setting	Academic-Based 13 (59%)	Community-Based 9 (41%)

Source: G. Jacobs, gjacobs@umn.edu.

Interestingly, while the program directors and preceptors I did visit with were generally quite experienced (i.e., having completed their residency anywhere from 5 to 16 years earlier), they were still able to reflect and draw vivid descriptions from their own residency experience. This point highlighted for me the significance of those years within their own personal training. It was evident the experience and reflections they shared were fresh in their mind and the improvements they sought to make through their leadership roles were often driven by the opportunities they identified and insights they gained from their personal journey. This group of directors and planners comprised the majority of the interviews I conducted (17 of 22). A strong sense of community and honor within the medical profession was evident. My conversations with all parties demonstrated the genuine appreciation and respect they have for their community of peers and mentors, the commitment they know is required to successfully navigate and complete one's medical training, and (for the directors/planners) the difference that can be made through delivery of a structured, supported, and well-guided residency experience.

Throughout the interview process which presented some challenges, I engaged in purposive sampling to ensure I recruited a broad mix of learners and leaders from a variety of settings (both academic and community-based). Traditionally, the emphasis on producing research is greater within an academic setting as compared to those practitioners in a community-based healthcare setting. However, both groups are required to be critical consumers of research, evaluate the available literature on a given topic and be able to integrate new information into their clinical decision-making in the interest of quality patient care. Early in the interviews, it was evident that different connotations emerge and areas of emphasis exist when referencing the term "scholarly activity". I discovered the natural tendency when discussing research was to presume one is describing the act of conducting research. One of my early interview questions was designed to identify whether individuals considered themselves producers or consumers of research. I took special care in the interview process to highlight the fact that, for purposes of this study, my interest was on their role as a critical reviewer and interpreter of research findings.

As is typical in grounded theory, I adjusted the interview questions and sampling efforts based upon insights I gained from early interviews. In terms of my data collection process, I extended my recruitment and selection efforts until I did not see any new categories emerge from the interviews. For example, my early interviews posed questions related to the resources and decision tools and databases that were introduced and utilized as part of a residency program's research skills training. There were clear patterns that developed in that regard with frequent mention of the use of Up-to-Date, an established clinical decision support tool. Since I had reached saturation on noting the use of this particular tool, I pursued additional questions related to the potential risks that were cited by some individuals associated with an over-reliance on the use of this tool. I delved further into this topic in subsequent interviews which provided some texture surrounding the risk-benefit aspect associated with the use of any database tool to vet relevant research articles, while also noting how results will vary across different tools – reinforcing the notion there is not necessarily one right or clear answer in medicine.

Through those additional questions, I gained additional insight into the manner in which those database resources and search tools were being positioned and, in so doing, discovered some creative approaches incorporated into training programs to demonstrate the need for a balanced review of relevant research on a given topic. For example, some training included case examples designed to demonstrate the effectiveness (or lack thereof) related to searches that may or may not garner a comprehensive, balanced collection of relevant research on a selected topic. There was an opportunity to explore any concerns for commercial bias that may be inherent in a database (especially those with for-profit or commercial origins) that is, in essence, nothing more than a summary of expert opinion as opposed to pure evidence-based medical advice.

It took some energy to focus interviewee's attention on the skills necessary to be critical consumers of research (which is described as a universal requirement for all practicing physicians). Numerous organizations and institutions have outlined various competency models as a guide to outline the skill set required to be a research-literate professional.

The amount of new medical knowledge is exploding and that highlights the importance of a physician's ability to discern the quality of the research that is being presented. It is more critical than ever that our healthcare professional have research literacy and they are able to skillfully demonstrate evidence-based practice. I believe it is to our collective benefit to better understand the path of professional development that accompanies efforts to develop a research literate physician workforce. This study provided an opportunity to examine how successful individuals and organizations are able to develop, reinforce, and assess their ability to be discriminating producers and/or consumers of quality research and scholarship.

Residency – It Takes a Village

As students near completion of their medical degrees (Undergraduate Medical Education), individuals make application to various residency programs to pursue their more-specialized clinical training. Those programs may vary widely, dependent upon the specialty and the practice setting which will reflect the institutional priorities. Given this step involves a highly-competitive application process and students are vying for limited openings across all specialties across the country, a resident will typically submit multiple applications for a variety of residency programs at different institutions. The selections that are made and communicated involve a nationwide coordinated effort that is administered at the same time across the country on "Match Day" - a targeted date in

March of each year whereby all applicants (usually surrounded by their families) are informed of the decisions regarding their next step in their physician development journey.

Research production may not be a high priority for a program, yet all programs have scholarly activity requirements for residents and seek to develop residents' competencies in sifting through, and appropriately applying, research findings. Specifically, as stated in the ACGME's Common Program Requirements, the program must equip the resident to demonstrate attitudes that encompass:

i. A posture of perpetual curiosity and inquiry in approaching knowledge deficits;
ii. A desire to practice evidence-based medicine;
iii. An appreciation of the importance of scholarly activity within the field of medicine;
iv. A desire to identify areas for improvement within one's clinical practice.

<u>Residency program requirements</u> serve as a guide for what essential elements must be made available to residents and programs are held accountable by the governing agency (ACGME or COCA). Content is delivered through both formal and informal curricular methods. Once the basic requirement for scholarly activity is met, specifics related to how much more in-depth each resident chooses to go is reliant upon their self-directed learning (SDL). As a result, the outcomes and the intensity with which they are pursued (i.e., range of interests, time invested, demonstrated skill levels, expectation for production of research) can be quite variable. No matter with which residency a student

matches, the programmatic content of a residency program must develop the residents' knowledge and skills in such a way as to lay a foundation for the provision of evidence-based care and advancement of the field.

Residency is described as a privileged time to learn new skills, build expertise, and shape a career path (Vasanthan et al., 2020). One program director described it eloquently when noting that "you learn the science in UME, and you seek to apply it with solid clinical decision-making skills in GME." Through a complex funding model (supported, in part, by Center for Medicaid Services-CMS funding), institutions establish a set number of resident positions across their organization. In order to be an accredited institution able to certify learners' residency experience, institutions are required to devote multiple staff positions and dedicated educational services to the development and delivery of residency program curriculum. That curriculum will vary somewhat in accordance with the respective specialty boards that oversee that specialty. As noted by one of the program directors I interviewed, "It truly takes a village to develop a well-rounded resident capable of making positive contributions to the field of medicine through the delivery of quality care to their patients. From an institutional perspective, a meaningful learning experience for residents is dependent upon the proper alignment and coordination between the curriculum, the faculty, the centralized support services (such as program schedulers, health sciences librarians, continuing medical education staff, etc.). A resident's success is dependent upon their commitment to meet the program's requirements, leverage the educational resources made available, and be an inquisitive learner in pursuit of evidence-based practices designed with the patient's best interest at heart. From an organizational perspective, a residency program is most successful when it can instill the view within its residents that research literacy is key to effective, sustainable clinical decision making. Residency calls for a collaborative, team approach and it is advisable to stress the importance of resources made available to the resident (in the form of health sciences library, literature search tools and strategies) to ensure the best care is being delivered to their patients.

Institutional Culture Makes a Difference

The interviews revealed how the competitive nature of medical school and the intense residency application process left an imprint on many individuals. While a new resident should seemingly find some welcome relief in the cooperative team approach promoted in many clinical settings, it isn't necessarily that simple to make a switch. It does require a different mindset and some period of adjustment. The tone of the messaging set by the institution reflects their culture and that is a critical component in facilitating the type of shift to a collaborative work environment that is warranted in residency. In a resource-constrained healthcare system, it is easy to consider the fact that residents could be treated as cheap labor, providing much-needed staff coverage. However, that does not appropriately position their role as trainees. It is that point which draws criticism in some circles as it may be suggested that the emphasis on training and oversight is not given the attention it deserves. That point must be reinforced through the institution's culture and the expectations they place on their faculty, so as to avoid the inclination to focus on clinical scheduling demands in lieu of the program training requirements.

To varying degrees, all residents spoke of the value they placed on a work environment that allows individuals to learn from one another. While it is important to promote self-directed learning and encourage residents to pursue knowledge and develop skills, it is not an effective teaching method (in a collaborative environment) to shame residents into not having the right answers when initially faced with a patient case. One resident mentioned it was “good to learn the attendings do not know everything either. I appreciate the openness of the faculty to admit they may not know the answer. They would say, let’s sit down together and figure this out.” That type of candor involved with admitting a knowledge gap was refreshing and encouraged a collaborative problem-solving mindset. One physician who had just completed their residency the year earlier called attention to an element they wished had been emphasized in their training. They stated, “I don’t know what other physicians do to seek out information/answers. I wish we had walked through that investigation and follow-up (as a team) while on rounds in the hospital.”

The selection of residency is built on alignment of goals and matched interests. It is not surprising to learn that the level of research-related activities relates to the institutional priorities. In general, the academic settings were more inclined to present opportunities for more traditional scholarly work. The community and academic settings relied on case-based education to promote the steps needed to navigate the available literature to research topics and then arrive at clinical decision-making practices.

Two Categories of Interviewees

Within my process of coding the interview transcripts, I was certain to divide responses into the two overarching perspectives, given the different roles of the interviewees: a) the experience as seen through an individual lens – this was voiced by a resident as they reflected on their experience, or b) a program director or administrator's programmatic perspective as they reflected on their involvement in the development and delivery of the residency curriculum and/or the collective experiences of a particular resident cohort. The thematic content analysis that I conducted allowed me to cluster participants' responses into the following main categories: 1) Structural elements (features and reinforcement strategies that drive and support research literacy); 2) Motivational elements (drivers and incentives that contribute to a resident's ability to achieve their educational and evidence-based practice goals); and, 3) Professional Development Advice.

I will explain the frame for each category and then share highlights from the analysis I conducted.

<u>Setting the stage</u> – This topic speaks to the demands of the profession, the impact of information overload experienced by healthcare professionals, and the relationship of the individual with research. I posed three questions within this category as I asked each individual to describe their place on their professional development journey, to highlight the role research plays in their practice (as a consumer, producer or both), and to share how they manage to stay abreast of developments within their field or medical specialty. Here is an example of how one of the general questions was adapted for each of the two groups:

<u>Individual perspective</u>: How do you personally keep up with the flood of new medical information? What lessons have you learned in this regard?

<u>Programmatic perspective</u>: What elements have you incorporated into the residency training curriculum to train residents to keep current with the flood of new medical information?

None of the residents interviewed currently placed a great emphasis on producing research, they had varying levels of engagement in the scholarly activity requirements of their program, and yet they all viewed themselves as routine consumers of research. This may be a reflection of the residencies they represented, which were all primary care settings (family medicine, internal medicine, and pediatrics). One individual had been in the MD/PhD (physician-scientist) track, which made them an outlier, as they had three years of lab research experience before pursuing Years 2 and 3 of their residency program. Several noted that conducting/producing research was an important element for them earlier in their college education, as a way to strengthen their medical school application. It was a means to demonstrate their interest in a particular field of study and in two particular instances it literally allowed them to prove their passion for a topic, establish important contacts within that field who served as meaningful references for their application.

All interviewees spoke of the need for discipline in looking for ways to navigate the influx of new medical education with the assistance of database applications, technical tools, continuing medical education, to include online webinars and podcasts.

Getting to Know Your Audience – Taking Their Pulse

The two contextual factors that came to light through the interviews, at the highest level, were: structural elements and motivational factors. An important theme emerged during the interviews with respect to how a particular institution disseminates messaging regarding scholarly activity requirements, the importance of research literacy and its link to evidence-based medicine and relevance to clinical decision-making. In essence, I viewed this as a reflection of the culture of the institution as it establishes an expectation for physicians to be life-long learners.

Here are several specific questions I posed to examine this topic.

Individual: How would you describe your level of involvement with scholarly activity as part of your residency program? How did you view the assigned scholarly activity projects that you completed during residency?

Program: How has the organization's approach to meeting the ACGME's scholarly activity requirement evolved over time? How do you position the concept of lifelong learning for residents and physicians in your program? To what extent do you engage residents with available health sciences library resources?

As anticipated, responses to these overarching questions led to a deeper examination of the structures and messaging that surround research literacy training. The following questions provided some further insights which contribute to this study of research literacy skills for practitioners.

- To what extent is there an established curriculum and/or framework that is consistently applied and reinforced across the physician's development pathway to foster research literacy? What expectations are outlined in medical school, residency programs, and continuing professional development to foster skill development in research literacy? What training models, materials, and/or tools are used for research literacy and skill development?

- What routine messaging and educational efforts are provided across the physician's development pathway to establish and reinforce the importance of research literacy? What support is made available or steps are being taken to foster research literacy and consistently guide healthcare professionals to apply a systematic, critical review of the literature being presented?

The residents who were interviewed appeared to downplay the seriousness and significance of the scholarly activities that were required of them during their residency training. One common statement indicated there was a strong focus on learning how to conduct literature searches as a means to examine the literature on a given clinical case. In relaying the experiences they had with research-related activities, all but two of the residents viewed the assignments they were given as simple tasks to be completed (e.g., research a topic, conduct a literature review, make a presentation or poster). They viewed this as a transactional process necessary to explore the best evidence for a particular patient case. It was not necessarily positioned as a lifelong learning skill – one that should be continually refined as it relates to an on-going, professional development continuum. All residents (or former residents) indicated they were invited to pursue additional research-related projects, if that was of interest to them. Program leadership made a point to offer to connect residents with research leads and/or mentors, but pursuit of those beyond the assignments were totally optional.

As you might expect, the input from the program directors/planners outlined a deliberate communication strategy and approach (albeit a wide range) toward curricular elements, resources, and expectations for residents' scholarly activity. On one end of the spectrum was an institution that placed the emphasis on making residents aware of what the program expected, showcasing the resources that were available to residents as part of their orientation. This program representative noted that individual residents can pursue their interests on their own, as long as they fulfill the program's requirements related to a required number of poster presentation, conference or grand round presentations, etc.

To varying degrees, all residency programs seek to foster an environment that develops a scholarly approach to case reviews and clinical decision-making. On one end of the spectrum, one institution made a point of engaging each resident with the health sciences librarian so as to ensure they were held accountable throughout their training to establish and build a systematic approach toward addressing the building blocks associated with evidence-based practice. This particular program had a well-established base curriculum and built in checkpoints to ensure that as residents complete their training over the span of UME and GME, they are advancing their critical review skills and building research capacity. As residents near the completion of their program, staff librarians even work with residents to help them make plans to meet their on-going need for access to research and literature search tools and databases once their link to the residency program resources are no longer active. It was evident that programs (to varying degrees) promoted the concept of lifelong learning, search strategies and tools that support a systematic and critical review of the literature. Attempts were consistently made during resident orientation to present the long-term value of research literacy skills as a key ingredient, however, those messages were not necessarily deliberately stated thereafter. Those programs that applied the lifelong learning frame and competency-based approach to research literacy as a matter of going well beyond merely meeting the program requirements for residency were examples of programs attempting to break down the traditional siloed approach to medical education. This reminded me of a criticism of what is too often a siloed approach to medical education whereby each stage is considered a standalone and links or building blocks are not always made evident. Given the foundational nature of research literacy, it serves as an excellent example of professional skill development that relies upon building blocks and applied practice over one's entire career.

Structural Elements That Drive and Support Research Literacy

There were three (3) main structural elements or forces that came to light through the interviews that guide medical education and emphasize the role of research literacy to include: regulatory program requirements, formal and informal curricula, and resources. While department and institutional goals may vary, one constant faced by all residency programs is the fact that the ACGME (and COCA for osteopathic schools) are held to Program Requirements. With that, residents are required to meet various expectations for completing specific tasks and/or demonstrating particular skill sets as defined by the institution's program. The ultimate goal is for the program to make obvious the link between research literacy skills (to include critical appraisal of research) and clinical decision-making, which results in optimal patient care.

As with all stages of the medical education continuum, there are regulatory agencies (in the form of accreditation organizations) that provided structure to the training that was delivered to learners. Having said that, admittedly the definition of scholarly activity remains quite general and little guidance is provided to institutions in terms of how to interpret those requirements. Scholarly activity that encompasses research and quality improvement is an integral aspect of the curriculum in residency programs across clinical specialties. The Accreditation Council for Graduate Medical Education (ACGME) common program requirements stipulate that programs in all disciplines "provide education to advance residents' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care." Furthermore, residents also must be able to ''systematically analyze practice using quality improvement methods and implement changes with the goal of practice improvement.''

While each program is interested in taking the steps necessary to be compliant with the program requirements, many examples came to light that demonstrated that programs viewed the program requirements to be the bare requirement. Rather, they sought to exceed those minimum expectations as they established loftier goals related to their role and responsibility for developing well-trained medical professionals. Since the definition and application of the scholarly activity requirement was left quite open to institutional interpretation, there were varying degrees to which the institution met and exceeded the expectations of the accrediting organization. The focus on SA requirements and reporting primarily emphasized the traditional type of research-related activities to include the development of research posters, presentations at grand round and other professional conferences.

Here are several specific questions I posed to examine this topic.

Individual: What level of interest did you have in developing your research skills? What (if anything) did you find most compelling related to the research training you received? How did the research opportunities presented to you align with your areas of personal interest?

Program: How did your program respond to the ACGME Common Program Requirements related to Scholarly Activity? What tone did you set for your residents in terms of their pursuit of SA?

Here are the highlights from the interviews related to reinforcement strategies that are in place to support research literacy and promote scholarly activity:

At a **program level**, the factors mentioned by the interviewees included: accreditation oversight; compliance with program requirements; alignment of research activity with an institution's mission and values; commitment to provide infrastructure needed to support research (e.g., educational content, availability of expert faculty/mentors, access to resources, funding); uniform messaging and prioritization within learner's schedule (e.g., providing protected time); resources allocated to support resident training (e.g., educational content, library services, etc..

At an **<u>individual learner level</u>**, these factors included: personal assessment of the range of options; freedom to align scholarly activities with one's personal passion/interest; previous research-related experience; intrinsic motivation (e.g., perceived value of the work); access to projects (existing or new); availability and energy level of faculty/mentors; availability of protected time.

Compliance vs. Personal Pursuit of Interests

There were interesting differences between the two groups when discussing the goals and expectations of the residents as it pertains to production of research. The Program Directors were focused on ensuring compliance within their program. They described their responsibility to ensure that residents have opportunities to pursue their research interests (if that is important to them). Residents expressed appreciation for the opportunity to pursue research-related activities that align with their personal areas of interest. Residents found value in the flexibility that some programs offered to explore various scholarly activities. Again, there were a variety of resources made available to residents and some programs have instituted very structured educational modules to align with the skills necessary to become consumers of research and professionals able to utilize available evidence to make clinical decisions regarding patient care.

Regulatory Program Requirements

In terms of the medical education continuum, the Liaison Committee on Medical Education, the regulatory organization that oversees educational institution's undergraduate medical school curriculum, requires that medical schools provide learners with access to research opportunities and provide support for learners to participate in research.

The Accreditation Council for Graduate Medical Education (ACGME), the accrediting organization that oversees an educational institution's residency programs, as outlined expectations for faculty and learners related to the expectation for scholarly activity. In 1994, they introduced a requirement that residents engage in scholarly activity. The definition was vague to begin with and, although it has evolved and been broadened to include quality improvement initiatives, it remains quite generic.

The ACGME "came along in early 2010's with published rules and requirements for scholarly activity." They do mandate residents be taught life-long learning and critical thinking skills. They must be taught how to approach the literature. One Program Directors noted that "until the ACGME stepped in and gave us a structure, it was very much an apprentice model." They applauded the fact that the ACGME has stepped up their refinement of research-related skills with milestones and guidelines, although they added it is almost impossible to fully adhere to the stated reporting requirements. More recently, there has reportedly been some pull-back on how to produce a substantive scholarly project. There appears to be an understanding of some of the challenges faced within residency programs. The definition was expanded to allow teaching and case reports to count as scholarly activity. Also, for some specialties, it no longer is required that a resident must provide a PubMed number for a published piece tied to formal research they conducted (to include IRB and/or chart review involving large number of patients). The timing of that work did not necessarily coincide with the other clinical requirements of a residency program.

Several programs that have successfully integrated scholarly activities, including research or quality improvement, for residents in different specialties have been described in the literature. However, few have included information about common measures of scholarly activity, such as academic presentations or publications, to determine success of such educational interventions. Given there have been a number of citations issued by the ACGME for programs failing to meet the scholarly activity requirement, it is understandable that program directors wish to see further clarification in this area.

One update that has worked well for programs is to combine and align efforts within healthcare institutions pertaining to the fact that Quality Improvement (QI) projects are a requirement for ACGME. One of the Program Directors pointed out that those QI projects can be repurposed/expanded upon to meet other research-related program expectations. This demonstrates an efficient alignment of multiple requirements.

Some programs highlight their emphasis on advocacy and community-engagement, which may be in lieu of an emphasis on producing scholarly research, although there is always an opportunity to disseminate/share findings. The alignment of institutional priorities came through in the manner in which the scholarly activities requirement was interpreted and applied within a residency program. One program director highlighted how the core curriculum for their residency programs now require they teach residents how to critically consume medical literature. Those specifics are in keeping with the need to be more specific about non-publishing type of scholarly activity requirements.

Curricular Guidance (Formal and Informal)

Each residency program has a curricular map which outlines the learning objectives and milestones required of residents over the span of their training program. Given the clinical focus of residency programs, the intensive schedules that residents maintain in clinical and/or hospital settings, and the competing demands on their time, many of the elements of research literacy training are available to residents, yet they remain within the informal curriculum. This consists of those opportunities and connections that are present within the healthcare and research environment and its links to community settings. Leveraging those connections calls for a sense of creativity and adventure, as it typically involves making a path. That means much is left to one's discretion to determine how proactively they choose to pursue the development of sustainable critical appraisal skills and how consistently they apply those skills to their clinical decision-making, especially in a busy clinical environment where time constraints are evident. Bottom line (especially for those residents who do not pursue a physician-scientist role which has research work as a core component, the pursuit of research literacy skills is highly dependent upon the ability of the resident to view this as an essential ingredient, a foundational skill, that drives the consistent delivery of the best possible care for their patients.

Along with a formal curriculum, all program directors acknowledged that a number of residents tap into what could be described as the informal curriculum. Within the formal curriculum, most programs describe a systematic overview of their training related to the development of research-related skills. One example described the following area of focus for each of the three years of residency training:

Year 1

Just-in-Time learning (utilize Up-to-Date, DynaMed, other resources) - Encourage residents to do background reading, specifically journal articles. Be sure to follow the references.

Year 2

Encourage residents to become more versed/skilled at utilizing decision-support databases and look at the specialty society guidelines

Year 3

Encourage residents to develop their own decision-making architecture.

Another example of a formal curriculum was presented by a health sciences librarian who proudly described the following series of online modules designed to build research literacy skills within their medical students and residents: 1) Intro to the library; 2) Basic PubMed; 3) Adv PubMed; 4) Working through lit searches from diagnostic, therapy…. Different terms, different publication types; 5) Critical appraisal light; 6) Look at other databases (How PubMed differs from MBase.); 7) When do you use Up-to-Date, Google Scholar); 8) Putting it all together – Evidence-based Medicine. These modules are made available to learners and they rely upon self-directed learning.

Residency programs tend to rely upon journal clubs and conferences which often focus on various aspects of addressing clinical scenarios. They do not always include insights in terms of how to conduct a critical review, as that work is done behind the scenes. This critical appraisal skill allows for an opportunity to evaluate a journal article or case through a systematic methodology and examining various aspects of the situation. Many of the elements of research literacy training rest within the informal curriculum, which involves tapping into subject matter experts, exploring existing research initiatives, and being open to pursuing connections which may result in opportunities that are not otherwise publicly made known.

Resources

The critical role of supportive faculty and mentors was an important resource described by the residents I interviewed. One Chief Resident aptly described that "Nothing is better than experienced people / co-workers. You cannot replace the value of a collaborative environment." An incoming resident can accelerate their skill development by participating in an on-going (or previously established) research project. Program directors admitted the institutional challenges they face with carving out time for faculty to serve as mentors, preceptors, in support of residents research-related goals.

Several practical materials and resources were identified by both residents and program directors/planners, although, the specifics varied greatly across programs. The resources that were provided ranged from technical database and educational tools (e.g., Up-to-Date, DynaMed, BMJ case reports), live and online education (to include podcasts and health sciences library curriculum), specialty board guidelines and specialty society newsletters (e.g., AAFP), to various tools and checklists designed to bring structure to one's approach to conducting research, literature searches, and/or critical appraisal (e.g., Problem Intervention Comparison Outcome (PICO) method PICO approach to critical appraisal). Some programs have formal, dedicated library resources with structured relationships developed early on between residents and the Health Sciences Library. Other programs rely upon a more fluid educational calendar of events to address current issues or hot topics. Within some programs, it was apparent that the educational content being delivered varied greatly across the resident pool and, aside from some core components, the direction of the curriculum was left to the discretion of the Chief Residents.

An appropriate focus on research requires resources (funding, support, expertise) and must be seen as relevant. There are costs associated with the resources mentioned above and budget constraints was a point that was specifically raised by three of the program directors I interviewed. Libraries negotiate contracts with various journals and database tools which they make available to their learners.

Motivational Factors

There were three (3) main motivational factors that came to light through the interviews that guide medical education and emphasize the role of research literacy to include: disciplined approach to learning (time management, self-directed learning); relevance; and a shift in mindset (one that moves away from the competitive approach that was prominent through medical school to a more collaborative approach to learning, discovery, and practice).

While department and institutional goals may vary, there was one theme that was repeated by all those that were interviewed. All of the program planners and administrators interviewed acknowledged the demands of residency – the seemingly unrealistic expectations and demands on the residents' time. The Chief Residents echoed this theme as well and noted that it was the periods of intense clinic work that often presented challenges in terms of establishing other patterns of research-related activities. From an organizational perspective, it is a matter of ensuring program requirements are met and clinical workforce needs are addressed, while maintaining the proper balance of supervision and oversight. The program's goal is to provide training opportunities for residents, while helping them develop a systematic, well-informed approach to patient care. For the residents, it is a matter of applying their education and building confidence in their ability to effectively care for patients in a busy clinical setting. In so doing, all parties acknowledged the need to be able to instill solid skills in each resident to support their clinical decision-making by being able to conduct thorough and balanced literature searches, be able to recognize solid study designs, and to confidently vet relevant studies and findings that relate to their patient cases. These individuals acknowledged varying degrees of challenge they personally face when attempting to keep up with today's influx of medical information. The common theme was that it was not humanly possible to remain current and that now, more than ever, the key to navigating the mounds of new findings rests in an individual's ability to become a critical consumer of research – to utilize available technology (e.g., database applications and literature search tools) and to recognize well-designed studies and meaningful evidence that can be applied to their practice.

Several of the program directors noted a word of caution about developing an over-reliance on specific database tools (a topic that will be addressed in greater depth in a subsequent category), as it may too narrowly address a topic. The concern pertains to the need to ensure that critical thinking skills are being applied to a literature search encompassing a broad spectrum of findings. It is important that an appropriate net is being thrown so as to ensure a balanced search and discriminating review of findings.

Disciplined Approach to Learning (Time Management, Self-directed Learning)

One of the program directors astutely pointed out that “Residents need to set the stage early on to embrace the concept of life-long learning. If you don’t build that in early in your training, it is difficult to fold it in later.” It is wise to routinely ask ourselves, What are the pressures we face to stay up-to-date on medical information and, more importantly, what is the impact of our failure to stay current?

A couple of quotes from the interviews highlighted the challenges residents face in terms of managing their time. One physician who just completed their residency two years earlier, stated “I feel like most of residency is self-study. There is only so much you can do while you are in the middle of patient care. Diagnosis and management of a disease process are mostly self-study driven.”

The demands placed on residents involve intensive work schedules and do not always lend themselves to much, if any, flexibility. In fact, the Program Requirements have placed limits on the number of hours that a resident can be scheduled per week. Residents are scheduled for clinical sessions and other aspects of their training (such as any type of traditional research project and/or team project) is left for them to find time to pursue. Unfortunately, that type of arrangement does not always lend itself to participating in a scheduled research-related activity, since the resident’s availability is subject to change on short notice which can be disruptive. “It gets really overwhelming, especially during the intern year. For the first three to six months, it is like drinking out of a firehose. That makes it hard to incorporate those scholarly habits into our work.”

One program director referred to “self-regulated learning” which is synonymous with SDL. They also stressed the importance of residents taking ownership of the professional development journey. The reality is that the resident may not have any control over their schedule. Conversely, they may be eager to extend their time in the hospital setting in the interest of seeing through the steps involved in a patient’s care plan, or perhaps awaiting test results and not wanting to leave without closing the loop on a diagnosis and/or proposed treatment decision.

Relevance

As with any learner, there is greater motivation to pursue studies that are deemed relevant to future success. One of the residents I interviewed noted that “residents in the community setting may not always see their role as it relates to research.” It was easier to see the connections that residents made when they were able to link their pursuit of research-related skills to efforts that advanced their personal area of interest. For example, one resident was interested in adolescent health and they found the opportunity to participate in a research study involving teen pregnancies.

If the training that is provided such as journal clubs or sessions offered by the library related to critical appraisal of literature is not linked to the skills that are critical for patient care, some residents will not view the lesson as anything more than a task. One of the health science librarians I interviewed indicated that “making that connection and constantly reinforcing it through all of the learning modules is the way to make an impact on the resident's commitment to the assignment. Otherwise, it is merely viewed as a task they must complete". That same individual was able to describe an innovative educational approach to a layered case scenario, where patient-related facts and updates (to include test results) are rolled out gradually to a group of residents. With each new piece of information, they are required as a team to research the topic and determine the best course of action. This approach appears to effectively make the case for the relevance of those research/critical appraisal skills. In that same assignment, the librarian demonstrates how different the search results are on a given topic, dependent upon which tool and which search terms are utilized.

From an Individual perspective: The interviews highlighted the multiple, competing demands that residents face within their programs. There is no shortage of reasons that scholarly activities do not take precedence over their schedule. Those reasons include: lack of time, lack of mentors and/or faculty direction, failure to identify relevant projects. The emphasis is clearly on the clinical aspects of their work and the schedules are extremely demanding. There are likely periods of intense clinical schedules and the sporadic nature of their available time may not lend itself to full ownership of a research project. A majority of the research-related training that is made available rests in the informal curriculum, which is reliant upon self-directed learning. Some individuals are unable to see the linkage in their research-related assignments and their significance in their on-going professional development journey.

<u>From an organizational perspective</u>: Programs seek to help residents see the linkage between scholarly activities and their value in preparing them for on-going clinical decision-making and evidence-based practice. Program directors noted potential barriers related to an over-reliance on web tools, use of quick search functions, over-use of Up-to-Date (commercial product which could more aptly be labeled 'expert opinion'). They expressed concern regarding the need to decipher between reliable or invalid tools. One way to approach the use of Up-to-date is to "view it as an expert opinion – a good jumping off point – good place to get the framework for the topic."

The amount of information that is released on a given medical topic is overwhelming and residents need to know how to use the tools to access information in a strategic manner. Even with the technology that facilitates the search process, residents need to be able to ask the right question.

One barrier that a Chief Resident candidly voiced was the fact that "You want to be viewed as the expert when teaching the residents." It may not be realistic to develop that level of expertise on topics that are just emerging.

There was a criticism voiced regarding requirements. A Chief Resident indicated "we are required to do QI work and we get support (to include protected time) to do that work." They went on to note "when you just say 'requirements' and you don't offer protected time, you don't get meaningful work.

Shift in Mindset (Collaborative Approach to Learning, Discovery, and Practice)

Many aspects of medical school establish and reinforce a competitive spirit between learners. In residency, there is a shift to more of a collaborative approach. Those who are able to make this transition are better able to develop the requisite skills and, essentially, leverage the resources and expertise of their mentors and colleagues, and apply a more systematic approach to their clinical decision-making.

It is important for residents to develop a lifelong learning mindset. One Chief Resident called attention to the fact that “In Medical School, you are always trying to impress people, since you are constantly being evaluated. In residency, you have already proven yourself and it is good to be reminded that you control the depth in which you pursue areas of interest.”

Professional Development Advice

There were many pearls of wisdom discovered within the interviews I conducted. Here are the themes that emerged related to ingredients for success regarding how to best maximize the residency learning opportunities. I will present these in two parts: first, from the residents’ lens; and secondly, for those involved in the program planning and delivery.

Ingredients for Success – From the Residents’ Lens

- Fully pursue your areas of interest or passion. The expression that “one should do what they love and they will never have to work a day in their life” is a good mantra to follow.
- Be diligent (and realistic) about digging into a case. One program director indicated they “encourage residents to be curious. Ask questions about the care they are providing. Try to understand the treatment plans. You are not going to

have time to delve into that deeply with every patient, but pick at least one patient each day to conduct a deeper dive."

- Scholarly activities can provide opportunities to advance or promote special interests (ex. patient advocacy, community health focus, etc.).
- The more you put into your learning journey (in terms of an inquisitive nature and eagerness to learn), the more you will get out of the training.
- Develop the discipline required to stablish behavior patterns regarding research training early on.
- Think critically and put issues in context of the patient. There are a lot of grey areas.
- As the use of technology expands and search tools and educational resources are more readily available, be sure to sharpen your ability to look critically at medical information being published (e.g., be able to recognize sound evidence, be sure to differentiate between good study design and non-generalizable findings) articles.
- Accept the fact that there will be many areas of grey. A physician-scientist commented on the push within some research circles to make the clinical decision-making process more structured and predictable.
- They said, "Some would like to apply a Bayesian decision-making model, however, nothing we do in medicine is that precise. It can give you an intuitive understanding of pre- and post-test probability, but nothing more." Accept the layers of information that will be presented in any patient care and seek ways to mitigate risk of delayed or incorrect decisions. One of the program directors

shared an interesting perspective about clinical decision-making. They stated that "Some points are not well-represented in the literature. For example, there are some doctors who do the same things all the time. That is costly and inefficient, but they are worried about missing something. Others say 'you're fine, just shake it off.' The key question is…how do you get into the middle? The intervention is not a test, it is starting to do something. Sometimes the test is just time. The intervention is just waiting." With that approach, the faculty or preceptor will have a conversation with a resident to ask "Does this situation rise to the threshold of wanting to do something? There are clear limitations of residency training – the program is so focused on in-patient care. That means the resident does not always have the long view. They don't always get to see the iterations and they don't have the patients (or patience) for the iterations." Find ways to expand the lens on the residents' experience with patient cases.

Ingredients for Success – From the Program Directors/Planners' Lens

- It is prudent to place a fair amount of attention on the need to be compliant with accreditation and regulatory agency requirements, while aligning with the advancement of institutional goals.
- Overall, it is important to remember the goal of the residency program which is to develop physicians who are able to apply critical research skills and clinical decision-making ability to ensure they deliver the best possible care for their patients.

- Residents are bombarded with assessments, communications and reminders throughout their training. Meet the learners where they are. Be sure to highlight the relevance of your messaging.
- Do not underestimate the power of branded messages. Consider creative ways to develop compelling, valued and recognizable communications that will get noticed.
- Look for ways to instill a long-term view versus short-term focus on program requirements. It is best to focus on processes versus tasks.
- More should be done across all of the medical education continuum to highlight the value of research literacy.
- Pursue opportunities to reinforce consistent messaging related to a physician's on-going professional development journey
- Acknowledge the changing nature of today's learners. One program director well-versed in the expectations across the entire medical education continuum offered this advice: "Today's learners have different expectations. They are inclined to question everything. In fact, they are as interested in how they are taught and how they learn as they are in what they are taught and what they learn. Earlier generations of learners were far more focused on consuming the information, memorizing it, and regurgitating the information. If I instructed a class to read a textbook, they would seriously question the value of that assignment."
- Accept the changing nature of today's learners and find innovative (and more engaging) ways to deliver educational sessions and achieve the stated learning

objectives of the curriculum. For example, one Chief Resident established a community of learners by offering an educational series consisting of focused ½ day sessions on topics that were identified and required for all residents.

- Rather than be frustrated with the fact that most learners will not have completed any pre-reading assignments prior to class, accept the fact and look for realistic, alternate approaches to advance the learning. In one example, a faculty member prompted learners to be more thoughtful about their otherwise cursory scan of an article. They instructed the learners to apply a systematic method for reviewing an article by asking questions about its structure: Does the population represent the population you are seeing? Is the effect both statistically and clinically meaningful? How is the effect size measured? Their point was to be engaging in a candid review of an article with the hopes that it will spur curiosity and inspire the learners to pursue further examination and engaging discussion.
- Build in deliberate steps at the end of a residency program to help physicians plan for their continued LLL (e.g., access to database tools, planned budget for decision tools, and strategy for how to access literature, etc.)

I appreciated the words of one of the program directors. “Every single patient has something to teach us. Your job is to figure out what that is. It is also important to remember that it takes time to develop clinical decision-making skills. The best way to approach that is through experiential learning. Reflection is key.”

Chapter Five: Discussion

Introduction

Figure 6

Dissertation Proposal Word Cloud

Source: G. Jacobs, gjacobs@umn.edu.

This word cloud (Figure 6) was generated from the proposal that I initially submitted for this study and as I reflect on the image, it is interesting to take a glimpse back at my initial thoughts related to the topic of research literacy and its place in a physician's professional development.

The purpose of this grounded theory study was to develop a greater understanding of the factors that contribute to the development of a physician's research literacy and the establishment of a lifelong learning mindset. It has been rewarding to explore this topic as it has allowed me to more closely examine the inter-connectedness of the topics that lead to the development of a research-literate physician who is able to deliver quality patient care through sound, evidence-based clinical decisions. This is especially meaningful noting we are all impacted at one point or another in our lives by the healthcare system's ability to deliver well-informed clinical care.

This study highlighted the fact that, as is true for any educational endeavor, there are important structural elements that provide a framework for a learner's journey (e.g., curriculum, regulatory and/or accreditation program requirements, etc.). In addition, there are curricular directions or guides that are made available through a particular program and/or educational institution. Those two elements are combined with an individual's motivational factors (e.g., self-directed learning and commitment to lifelong learning) to determine the direction and depth to which a learner explores the curriculum, takes advantage of the resources and expertise available through faculty support and mentorship, and seeks to confidently navigate the sea of inquiry which is central to the practice of evidence-based medicine.

In this chapter, I will discuss the following themes which were revealed in my studies related to: organizational structures (accreditation and regulatory oversight); curricular guidance; and the importance of individual learners' commitment to self-directed lifelong learning. I will examine what role each theme plays in developing a research-literate physician. After outlining those themes and describing the implications they each have on the practice of medicine, I will then recommend one coherent theory which incorporates all of those factors. In addition, I will offer some perspective on steps that could be taken to address concerns, and offer recommendations for making progress as we move forward. At the end of this chapter, I will note what I consider to be limitations to this study, implications for future research, and then close with my overall conclusion. It will be important to identify ways to build on this work and, in so doing, I will share recommendations for future research, discuss the multiple layers of implications for practice and the limitations of this study, before closing with a brief conclusion.

There is no question that the information explosion in healthcare affects everyone. The pace of change is only increasing and the emerging wave of literature, health-related news media, and clinical findings is overwhelming. During physician training, efforts are made through the curriculum (both form and informal) to equip learners with the ability to navigate those mounds of data. It is imperative that physicians have the ability to find and interpret and use information in an evidence-based fashion. Of even greater importance, all physicians must also adopt a lifelong learning mindset. They must acknowledge the importance of literature search and critical appraisal skills while also accepting the need for continual review, reflection, and reinforcement of their research-related skills.

Theme One: How Do Organizational Structures and Regulatory Oversight Contribute to the Development of Research Literacy Skills in Physicians?

The regulatory/accreditation systems establish the base level expectations for each of the competencies required of learners across the medical education continuum, however, there is wide variability in how those requirements are interpreted and incorporated into each medical school’s curriculum. Furthermore, the metrics used do not always align with the skills required to successfully perform Evidence-based Practice (EBP). (For example, the base level expectations related to research and scholarly activities do not necessarily assess the research and literacy knowledge and skills necessary for physicians.)

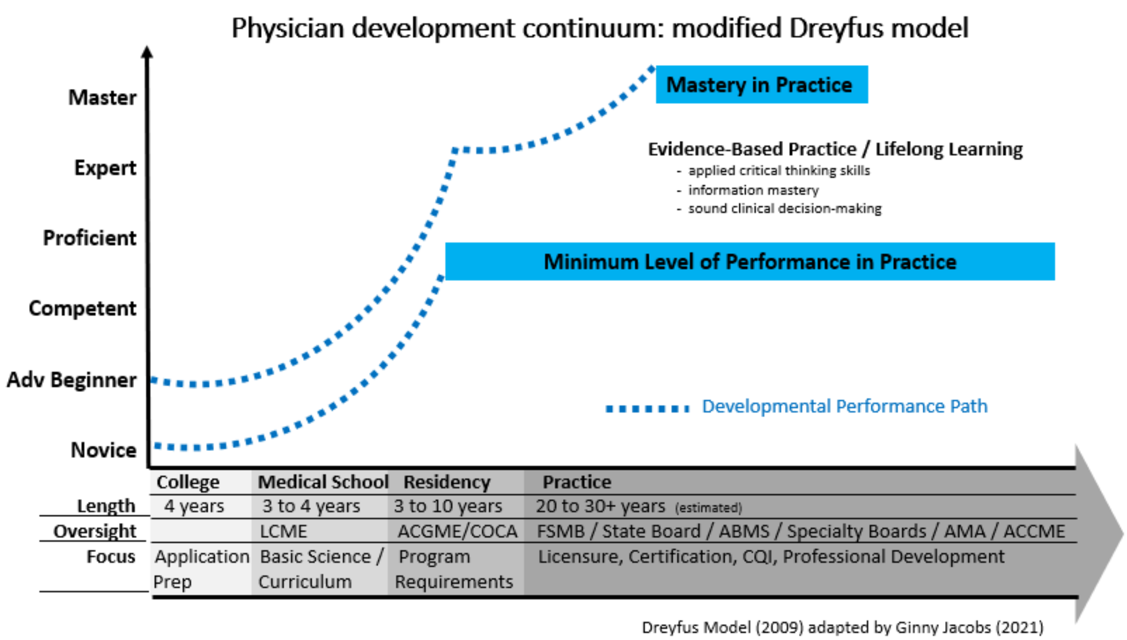
What Do We Mean by Medical Education Continuum?

As a matter of background pertaining to the discussion of the first of the three themes, which involves organizational structures (more specifically, those agencies involved with accreditation and regulatory oversight), I will provide some information related to the framework that surrounds and guides a physician's development. In the interest of public safety and learner accountability, there are a number of regulatory agencies, licensing boards, and accreditation institutions that are involved in providing guidance and oversight of a physician's development pathway across the medical education continuum. In essence, the regulatory/accreditation systems establish the base level expectations for each of the competencies required of learners across the medical education continuum. On an institutional level, through regular reporting and audits, leaders from each stage of the medical education continuum (Undergraduate Medical Education-UME, Graduate Medical Education-GME, Continuing Medical Education/Continuing Professional Development -CME/CPD are accountable to those particular regulatory agencies and/or accreditation organizations for demonstrating they have met the established requirements. The burden is on the institution to report their compliance with the requirements, their summary of the learners' progress (towards competence), and to prove they have systems in place to deal with remediation (i.e., learners who are not keeping pace with the requirements). In that sense, you could say they establish the floor in terms of achievement and their primary focus is on how the program identifies and addresses individuals who do not meet the minimum threshold on a given competency.

Figure 7 represents an adaptation of the Dreyfus model (Dreyfus & Dreyfus, 1980) which refers to a learner's progression across the entire medical education continuum from novice to master. It can be helpful to envision an overlay of the Dreyfus model of professional development for a physician whereby along the X-axis you will see the length of each phase of training, the organizations that are responsible for oversight of that phase, and the respective areas of focus for that portion of the training being delivered.

Figure 7

Physician Development Continuum: Modified Dreyfus model



KEY: FSMB – Federation of State Medical Boards
ABMS – American Board of Medical Specialties
AMA – American Medical Association

ACCME – Accreditation Council for Continuing Medical Education
MOC – Maintenance of Certification
MOL – Maintenance of Licensure
CQI – Continuous Quality Improvement
CPD – Continuing Professional Development

Source: Adapted by G. Jacobs from Dreyfus & Dreyfus, 1980; 2009.

Beyond Flexner

Dating back to the introduction of the Flexner Report in 1910, medical education in the United States has conformed to a fixed-time structure consisting of four years of undergraduate medical education (UME) and a defined number of years in residency (GME) and fellowship training. After completion of an undergraduate degree, physicians-in-training typically enter a four-year medical school curriculum (generally delivering two years of basic science education followed by two years of clinical education), after completion of an undergraduate degree. In an article intended to promote more innovative thinking about the medical education continuum, Aschenbrener (2015) reminded readers about the message Lowell T. Coggeshall presented to the Association of American Medical Colleges (AAMC) in 1965. In that report, Coggeshall introduced the concept of the continuum of learning in medical education. He envisioned that physician education should be "planned and provided as a continuum – a continuous process with all elements carefully integrated…" This line of thinking represents a comprehensive approach to a physician's development that goes well beyond a medical degree and residency training. Rather, it reflects a seamless integration between UME, GME, and CME that results in professionals who diligently pursue knowledge, recognize the importance of continual growth, and are keenly self-aware (Merriam & Caffarella, 2007).

What Are We Trying to Achieve? Core Competencies

The ACGME and the American Board of Medical Specialties (ABMS) have taken a number of steps to ensure the quality of medical education, primarily by formalizing the expectations of residents, which will then feed into the requirements for certification. In 1999, the ACGME adopted six core competencies expected to be addressed in residency training. This demonstrated a significant step away from time-based programming, since these six core competencies are designed to provide a more structured map of the expectations for a residency program. In essence, this move demonstrated a commitment to outcomes-based principles, as residency programs are required to apply a curriculum that generates physicians who have demonstrated their ability to deliver the following competencies:

1) Patient Care that is compassionate, appropriate, and effective for treating health problems and promoting health;
2) Medical Knowledge about established and evolving biomedical, clinical, and cognate (e.g., epidemiological and social-behavioral) sciences and the application of this knowledge to patient care;
3) Practice-Based Learning and Improvement that involves investigation and evaluation of their own patient care, appraisal, and assimilation of scientific evidence, and improvements in patient care;

4) Interpersonal and Communication Skills that result in effective information exchange and teaming with patients, their families, and other health professionals;
5) Professionalism, as manifested through a commitment to carrying out professional responsibilities, adherence to ethical principles, and sensitivity to a diverse patient population;
6) Systems-Based Practice, as manifested by actions that demonstrate an awareness of and responsiveness to the larger context and system of health care and the ability to effectively call on system resources to provide care that is of optimal value.

These statements for each competency represent a tall order, but the shift to a model which describes the educational program in terms of outcomes was a critical step forward. It brings clarity to the accountabilities of the program and the learners, as well as the linkage those outcomes provide to the licensing boards and maintenance of certification processes which apply to all physicians.

A Steep Learning Curve

Medical student graduates enter residency with only 12 to 20 weeks of experience in their discipline, and they are then charged with climbing the steep curve into proficiency within 3 to 7 years during residency (depending upon their specialty). Following completion of residency, they then (hopefully) continue developing their expertise beyond residency and throughout practice (Pusic et al., 2015). In the current U.S. GME training model, the five Dreyfus levels (Dreyfus & Dreyfus, 1980) can be translated to the ACGME milestones for residency programs, by outlining:

1) expectations for a beginning resident; 2) milestones for a resident who has advanced beyond entry but is performing at a lower level than what is expected at mid-residency; 3) key developmental milestones mid-residency and into a specialty; 4) knowledge, skills, and attitudes for a graduating resident; and 5) exceeding expectations. The ultimate goal of residency programs (GME) is to achieve the 'proficiency' level that should ensure that all residency graduates are prepared for unsupervised practice. Readiness for unsupervised practice in each sub-competency is a goal, but not a requirement.

What is a Competency Model?

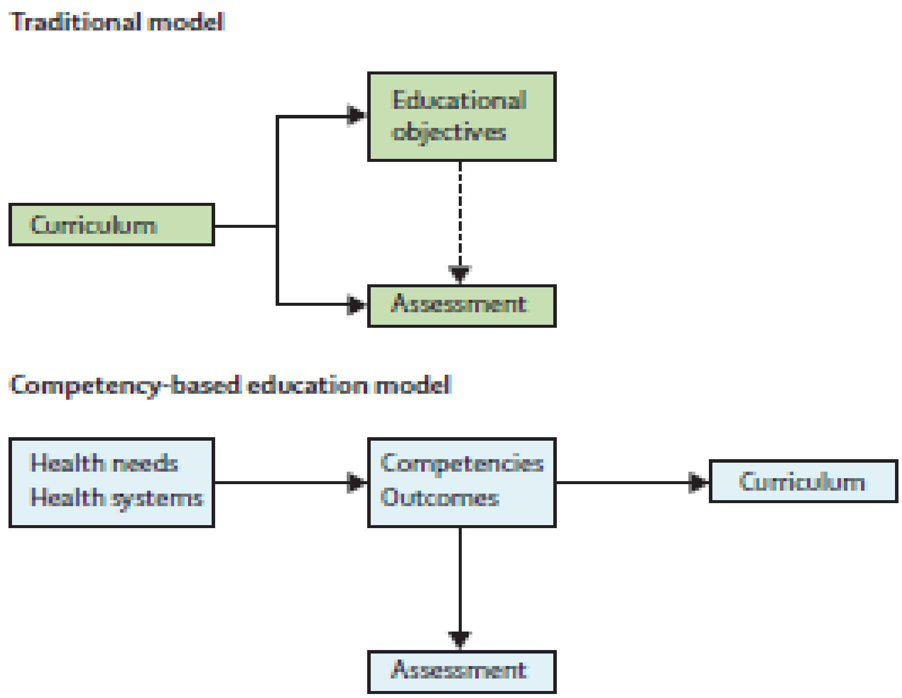
A competency model concentrates on the actual accomplishment of a program to educate and not just their level of preparedness or potential to educate. Questions posed during an outcome-based evaluation carry this theme forward as they will include:

1) Do the residents achieve the learning objectives set by the program? (Not just a matter of whether or not you had established learning objectives in place);
2) What evidence can the program provide that would show how a resident will meet the learning objective? (Not just a matter of displaying anecdotal comments about the level of satisfaction of the learners and/or faculty, but measurable results on some level);
3) How does the program demonstrate continuous improvement in its educational processes? (Not viewing the evaluation as the most important point in time, but part of a series of steps along the continuum – driving the point that any type of review of a residency program should be part of a process and not necessarily considered an event).

The work to enhance the level of rigor with which our medical education system is able to apply, articulate and assess progress in terms of a physician's development of core competencies is, indeed, a work in process. Upon completion of a medical degree, graduates enter some form of graduate medical education (GME) program offering them further discipline-specific clinical training to become licensed and qualified for specialty board certification. While GME programs have evolved, they too have traditionally relied on a time-based path to certification in a medical specialty, although there are some signs that it is changing. Competency-based medical education (CBME) has been advocated for many years and the initiation of the ACGME Outcomes Project in the late 1990s was instrumental in reviving interest in a shift to this outcomes-based approach. Conceptually, this effort focused on the outcomes of medical education programs rather than the process of curriculum delivery. CBME emphasizes outcomes, or competencies, in defined areas as the pathway to practice, suggesting that learners would logically progress at variable rates toward this goal and the time required should not be pre-determined for those who progress at a different pace. As Figure 8 reflects, CBME responds to public health needs, as well as the needs of the system to inform curricular decisions that align with desired outcomes. By its nature, it is designed to adapt to the needs of the health system with a focus on outcomes.

Figure 8

Comparison of Traditional Education Model vs CBME Model



Source: Frenk et al., 2010.

A Call for Competency-Based Medical Education

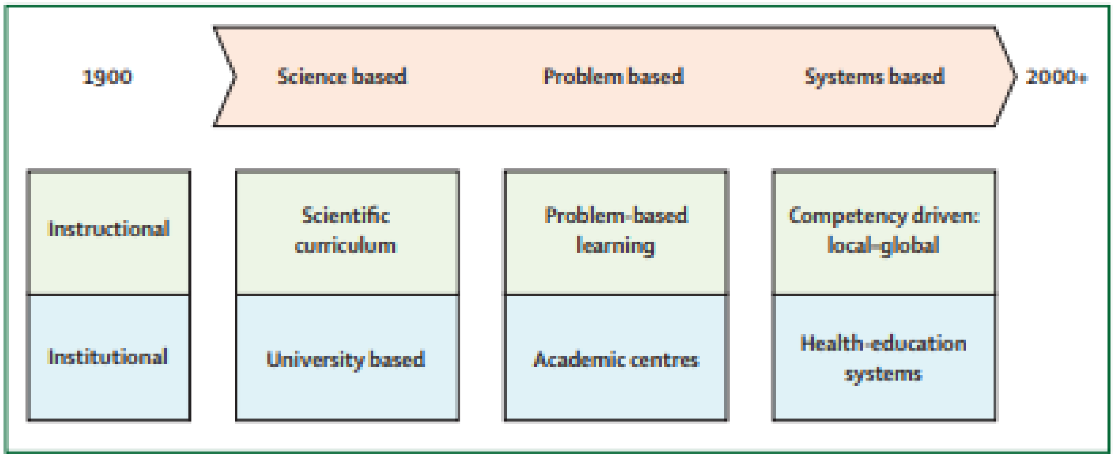
At the highest level, the aim of imparting medical education is to train graduates to efficiently take care of the health needs of the society. In the past, the medical education system was based on a curriculum that is subject-centered and time-based. Most evaluations were summative, with little opportunity for feedback. In terms of the teaching and learning activities, the assessment methods focused more on knowledge than on attitude and skills. As a result, graduates may have extraordinary knowledge, yet lack the basic clinical skills required in practice. In addition, the soft skills related to communication, physician–patient relationship, ethics, and professionalism may be absent or deficient to effectively practice shared decision making. Figure 9 reflects how the medical education system has transformed over time to evolve in response to shifts occurring in healthcare and respond to the needs of patients and public health. Shifting from a focus on a scientific curriculum to a systems-based competency-driven learning experience.

It is important to mention, there are a number of innovative efforts (or, in some cases, pilot projects) underway to rethink and potentially reshape the existing paradigm in order to generate more meaningful educational journeys for the learners. For example, in response to the push to shift away from a time-based educational model and move toward a competency-based system, some schools have reconfigured their undergraduate program requirements, allowing motivated students to pursue an accelerated pathway which involves completing some of their pre-med requirements en route to their bachelor's degree.

In a pilot program designed to help realize the dream of competency-based education, the Education in Pediatrics Across the Continuum (EPAC), has defined an operational approach that offers a different path through medical school and into pediatric residency training, based on the attainment of competence. EPAC identifies students early in their UME training, guarantees them a residency position in pediatrics at the institution where they attended, and advances them a residency program when they are carefully-assessed and determined to have met the pre-established competency standards for entry into GME (Andrews et al., 2018).

Figure 9

Three Generations of Reform Leading to CBME



Source: Frenk, 2010.

The evolution to a system-based setting calls out the many inter-dependencies that exist in today's world. Patients are more active participants (or at least many strive to be more informed participants) in their healthcare decisions. HCPs are faced with an insurmountable wave of new medical information. Program directors are required to identify and measure specific learning objectives and assess a learner's level of proficiency. These factors were the basis for the ACGME's adoption of CBME, as the field of medical education continually adapts to the changing environment. The plans for this approach are well-documented and the need is more intense than ever given the likelihood we will continue to see an escalation of medical updates and clinical findings into the foreseeable future. Figure 10 provides a breakdown of the elements found in the previous approach to education, while describing how the paradigm has shifted with the current CBME outcomes-based approach. In an article which related to the shifts occurring in medical school and residency curricula, Caraccio et al., (2002) reviewed the history of CBME and the steps needed for its successful implementation. A key element that is displayed on this graphic reflects a shift away from time-based education and an emphasis on formative (i.e., more frequent and, potentially, less formal) evaluation and feedback.

Figure 10

Comparison of the Elements of Structure- and Process-based vs CB Programs

A Comparison of the Elements of Structure- and Process-based Versus Competency-based Educational Programs

	Educational Program	
Variable	Structure- and Process-based	Competency-based
Driving force for curriculum	Content—knowledge acquisition	Outcome—knowledge application
Driving force for process	Teacher	Learner
Path of learning	Hierarchical (teacher ⇒ student)	Non-hierarchical (teacher ⇔ student)
Responsibility for content	Teacher	Student and teacher
Goal of educational encounter	Knowledge acquisition	Knowledge application
Typical assessment tool	Single subjective measure	Multiple objective measures ("evaluation portfolio")
Assessment tool	Proxy	Authentic (mimics real tasks of profession)
Setting for evaluation	Removed (gestalt)	"In the trenches" (direct observation)
Evaluation	Norm-referenced	Criterion-referenced
Timing of assessment	Emphasis on summative	Emphasis on formative
Program completion	Fixed time	Variable time

Source: Carraccio et al., 2002.

As defined by Frank et al. (2010), competency is "An observable ability of a health professional, integrating multiple components such as knowledge, skills, values, and attitudes. Since competencies are observable, they can be measured and assessed to ensure their acquisition. Competencies can be assembled like building blocks to facilitate progressive development." (p. 641). Competence is multi-dimensional and dynamic and best defined as the arrangement of abilities (knowledge-skills-attitudes) across multiple aspects of performance within a certain context. When referencing statements about competence, it is expected descriptive qualifiers will be provided to define the relevant abilities, context, and stage of training.

The various curricular building blocks and educational resources that were revealed in my discussions with chief residents and program residency directors spotlighted the essential ingredients applied by physicians to deliver EBP. Taking those insights up to the programmatic level, it is easy to see how the notion of a CBME approach to the key elements places an emphasis on the importance of being able to assess achievement of each of the stated competencies. Table 6 provides a high-level perspective on the timeline that corresponds with some of the key dates in the educational milestone history.

Table 6

Key Dates in Educational Milestones History

Dates	Structure
1999	The six Core Competencies endorsed by ACGME and American Board of Medical Specialties (ABMS)
2001	The Outcome Project formally launched
2009	ACGME approves structure of NAS, including inclusion of the Milestones
2013	First seven specialties implement NAS, including Milestones reporting
2014	Remaining accredited specialties and subspecialties implement NAS, including Milestones reporting
2015	All specialties and subspecialties begin to report Milestones data
2018	Work begins on Milestones revisions, called Milestones 2.0

Source: This table was retrieved from ACGME The Milestones Guidebook. Version 2020. Accessed at https://www.acgme.org/Portals/0/MilestonesGuidebook.pdf

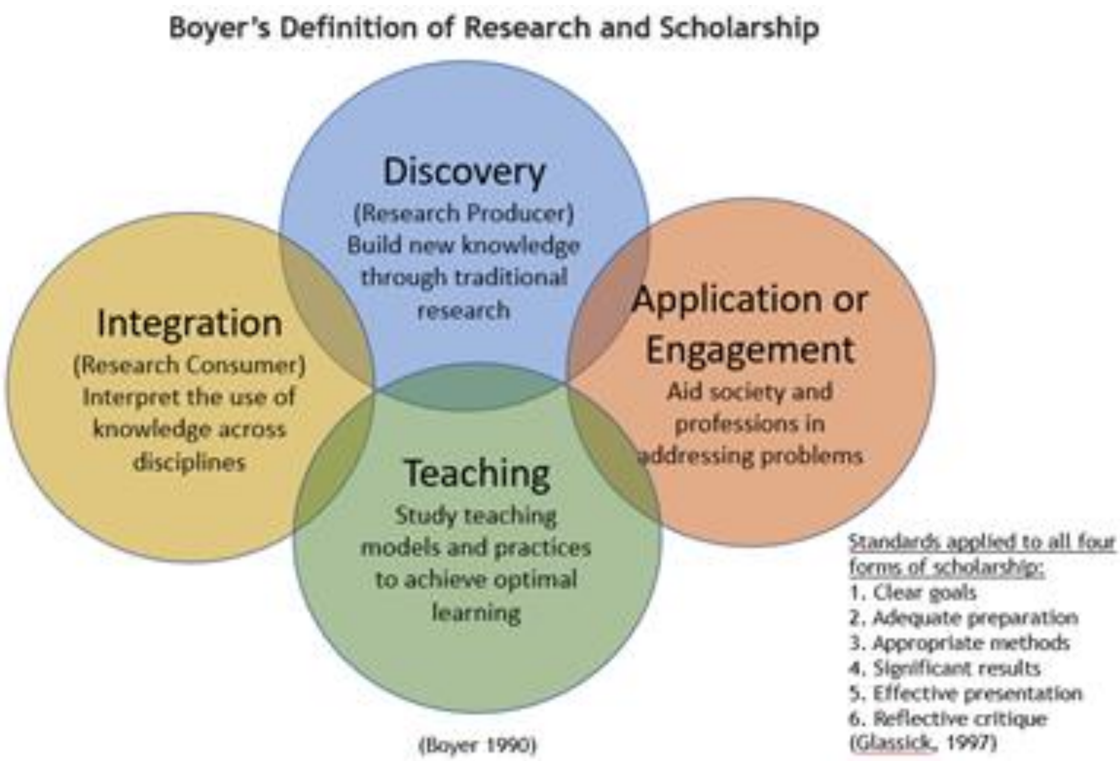
While the core competencies address six broad required categories, I am interested in drilling down to those skills required for a physician to be research-literate. That is to say, not necessarily a producer of research, but a skilled consumer of research.

The accreditation boards often refer to research and scholarship or scholarly activity. In Chapter 2, an outline of the accreditation expectations for research and scholarship across the medical education continuum was provided, and it was evident those requirements are quite general and brief. The insights gained from the interviews confirmed that there is wide variability in how requirements are interpreted and incorporated into medical school and residency program curricula, starting with varied interpretations of what constitutes scholarly activity. I would like to step back and broaden the lens on the topic of residency requirements. The introduction of the next accreditation system (NAS) called for a more outcomes-based approach to all aspects of training, to include scholarly activities for residents and faculty. The earlier pathway was not necessarily uniform for all learners, nor was there a clear metric or set of expectations outlined. It was also noted that it is not possible to predict a standard pace with which each learner will arrive at a defined level of proficiency, especially in light of the varying levels of experience of the incoming residents. For example, when discussing the level of rigor in the residency program requirements related to scholarly activity, one of the Chief Residents I interviewed offered an interesting perspective. They had actually been enrolled in a physician-scientist program, working in the lab for several years, before determining that they did not wish to pursue that path. That is quite different from the incoming resident who had only dabbled in conducting literature reviews and conducting article critiques as part of an assignment for a class. The experienced researcher indicated residents in their community-based setting were basically allowed to determine what depth they wished to pursue in terms of research skills. The only requirement (in this particular setting) was for the resident to research a topic, conduct a literature search, and make a presentation at one of the department's grand round sessions at least two times during the year.

Boyer (1990) provided an academic model of scholarship which advocated expansion of the traditional definition of scholarship and research into four types: discovery, integration, application, teaching (Figure 11).

Figure 11

Boyer's Definition of Research and Scholarship



Source: Boyer, 1990; Glassick, 1997.

In the interest of providing some structured performance measures that correspond with various aspects of research and scholarship, Boyer's model was expanded to include purpose and metrics (Table 7). Advancing Boyer's work, Glassick developed criteria to judge whether a particular piece of work qualifies as scholarship.

Table 7

Boyer's Purpose and Measure of Performance for Each Type of Scholarship

Boyer Model of Scholarship

Type of Scholarship	Purpose	Measures of Performance
Discovery	Build new knowledge through traditional research.	• Publishing in peer-reviewed forums. • Producing and/or performing creative work within established field. • Creating infrastructure for future studies.
Integration	Interpret the use of knowledge across disciplines.	• Preparing a comprehensive literature review • Writing a textbook for use in multiple disciplines. • Collaborating with colleagues to design and deliver a core course.
Application	Aid society and professions in addressing problems.	• Serving industry or government as an external consultant. • Assuming leadership roles in professional organizations. • Advising student leaders, thereby fostering their professional growth.
Teaching	Study teaching models and practices to achieve optimal learning.	• Advancing learning theory through classroom research. • Developing and testing instructional materials • Mentoring graduate students. • Designing and implementing a program level assessment system.

Source: Boyer, 1990.

Translating the ACGME Requirements as it Pertains to Research and Scholarship

Translating the ACGME requirements related to research and into successful educational programs and actual scholarly production has remained a difficult challenge for medical educators (Robbins et al., 2013). The Program Requirements aim to provide an avenue for promoting trainee and faculty curiosity. The requirements apply a structured scholarly framework for creating, synthesizing, teaching, and applying new knowledge while nurturing an environment of inquiry. In terms of research production, one can measure the number of presentations and/or posters that are developed, however, you will notice these requirements extend beyond those physicians who elect to produce research, as they are very relevant to those seeking to interpret and apply knowledge in their clinical practice. It does not seem sufficient to establish a required number of literature reviews or article critiques, since that does not speak to the depth of one's understanding, but merely measures the completion of a task or series of tasks. The goal will be to shift from transactional or episodic types of measures to establish assessment criteria that ensure a proficient level of understanding of key concepts.

While each specialty board applies its own unique interpretation to the ACGME standards, Figure 12 outlines common features of the scholarly activity requirement as interpreted by the various residency review committees. The notion of faculty requirements in parallel with resident requirements highlights the critical role of faculty and the importance of the learning environment. Furthermore, this serves to spotlight the institutional commitment that is necessary in terms of providing educational resources to support residents' involvement in scholarly activity.

Figure 12

ACGME Common Program Requirements Pertaining to Scholarship and Scholarly Activity

II.B. Faculty

II.B.5. The faculty must establish and maintain an environment of inquiry and scholarship with an active research component. (Core)

II.B.5.a) The faculty must regularly participate in organized clinical discussions, rounds, journal clubs, and conferences. (Detail)

II.B.5.b) Some members of the faculty should also demonstrate scholarship by one or more of the following:

II.B.5.b).(1) peer-reviewed funding; (Detail)

II.B.5.b).(2) publication of original research or review articles in peer-reviewed journals, or chapters in textbooks; (Detail)

II.B.5.b).(3) publication or presentation of case reports or clinical series at local, regional, or national professional and scientific society meetings; (Detail)

II.B.5.b).(4) participation in national committees or educational organizations. (Detail)

II.B.5.c. Faculty should encourage and support residents in scholarly activities. (Core)

IV.B. Residents

IV.B.1. The curriculum must advance residents' knowledge of the basic principles of research, including how research is conducted, evaluated, explained to patients, and applied to patient care. (Core)

IV.B.2. Residents should participate in scholarly activity. (Core)

IV.B.3. The sponsoring institution and program should allocate adequate educational resources to facilitate resident involvement in scholarly activities. (Detail)

V.B. Faculty Evaluation

V.B.2. These evaluations should include a review of the faculty's clinical teaching abilities, commitment to the educational program, clinical knowledge, professionalism, and *scholarly activities* (emphasis added). (Detail)

Source: Philibert et al., 2013.

Research and scholarly activity are integral parts of residency training. Research participation increases residents' ease in critically evaluating literature, fosters critical thinking, and can improve patient care through increased use of evidence-based medicine (EBM) (Simpson et al., 2013; Ledford et al., 2013).

It has been noted there are significant variances across the medical specialties and some specialties, such as orthopedics and surgery, have strict requirements for research projects. In primary care specialties, there is a sense of frustration with the perceived and real barriers to scholarly activities, and an overall lack of resident scholarly production (Ledford et al., 2013). There are a number of factors likely to contribute to this to include: limited time, lack of funding, lack of interest in scholarship, difficulty identifying mentors, and lack of technical support.

The ACGME states that "residents should participate in scholarly activity" (ACGME, 2021, p. 14). Residency programs must provide a curriculum that advances residents' knowledge of basic research principles, ensures participation in scholarly activity, and allocates resources to facilitate this. There are corresponding faculty requirements for scholarly activity issued by the ACGME as well. These are in place to ensure that faculty establish an environment of scholarly activity for each program. This means engaging in and producing enough diverse and in-depth scholarship to create an environment suitable for supporting residents and fellows in the development of critical thinking, literature review, and research skills, as well as the principles of evidence-based medicine. Institutions training medical students and residents are called upon to provide exposure, access, opportunities to participate, educational resources, and guidance to their learners to participate in scholarly activities as defined by their program requirements. The definition of scholarly activity is quite generic and, to some extent, especially in some of the primary care specialties, it is left up to individual institutions to interpret what constitutes compliance with the requirement, which does not instill great confidence that the necessary emphasis is being placed on those items you know to be foundational in nature.

Easier Said Than Done – Building on Lessons from the Past

Recognizing the challenges faced by the ACGME's earlier transition to a competency model, they introduced two important new components to the accreditation process; the Milestones and the Clinical Competency Committee (CCC), both of which are designed to monitor and iteratively improve educational outcomes, and by extension, clinical outcomes, at the level of the individual learner and the program. As an example, the ACGME Milestones were introduced in 2013 and they are intended to be used as a tool to better prepare physicians for a changing health care system by emphasizing a focus on the competencies of residents and fellows and ensuring they match patients' needs in a variety of clinical settings. The Milestones provide narrative descriptors of the ACGME Core Competencies and sub-competencies along a developmental continuum with varying degrees of granularity (Batalden et al., 2002; Ericcson, 2007; Hodges, 2010). Their adoption is dependent upon each of the specialty boards working to tailor the interpretation of the milestones to their unique requirements and doing this in collaboration with the ACGME requirements.

A key ingredient in introducing any changes at the accreditation level is to be sure to engage stakeholders in the process of early discussions, ensure that a communication strategy/campaign is developed which highlights the 'why' behind the action, and find the right balance between providing definition and leaving some aspects up to individual sites to best tailor the details to fit their setting.

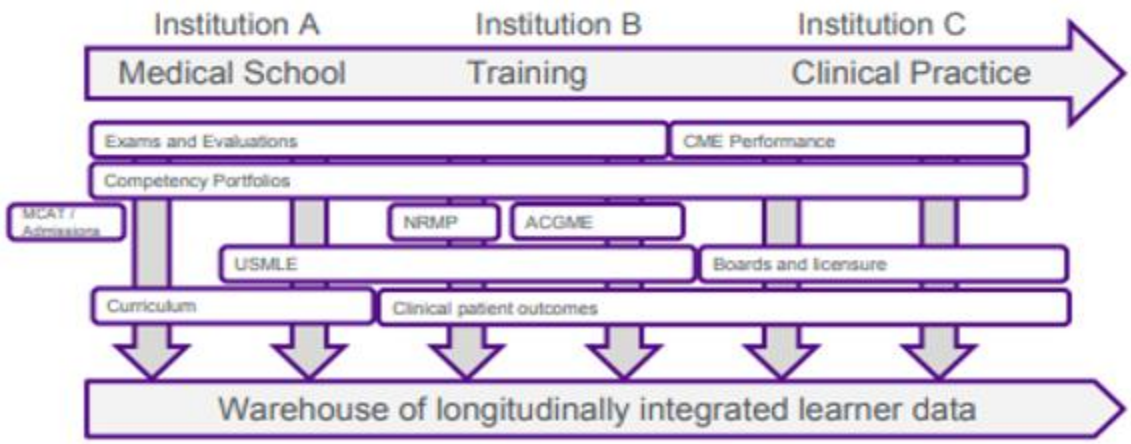
That Which Gets Measured, Gets Done

In the reflective article by Caraccio et al. (2002), the authors highlighted the fact that in the 1970s and 1980s much attention was given to the need for and the development of professional competencies for many medical disciplines. However, little attention was devoted to defining the benchmarks of specific competencies, and much less focus was spent outlining how to attain them or imagining how one could evaluate competence of the learner. Many would suggest that the lack of evaluation strategies was one of the forces responsible for the lengthy delay between initiation of the movement and wide-spread adoption. The desire for CBME was not accompanied by a detailed implementation plan and those lessons learned from past experiences call attention to the need for strategic planning and faculty and learner buy-in for defining competencies. In addition, the benchmarks for defining competency and the thresholds for attaining competence must be clearly outlined. Those insights explain the attention that has been paid in terms of addressing better definitions and refined assessment tools to describe and measure competence. Medical educators must be responsible for studying the impact of this paradigm shift to determine whether it has the ultimate effect on the production of more competent physicians.

For the most part, the data that is made available across the medical education continuum to assess a learner's progress is focused on test scores, evaluations, and compliance factors related to licensure and board certification (Figure 13). There tends to be a siloed approach to this type of data and certainly in terms of clinical data/feedback, there is generally a lack of robust, readily-available performance data that allows for much depth in terms of assessing key aspects of the desired competencies for residency. Triola and Pusic (2012) make a case for a longitudinal warehouse of learner data which spans the continuum. This suggestion is parallel to discussions related to the desire for a learner portfolio (to contain education, research and scholarship accomplishments) which could be retained over the span of one's career.

Figure 13

Medical Education Continuum Data



MCAT = Medical College Admission Test
NRMP = National Resident Matching Program
USMLE = U.S. Medical Licensing Examination

Source: Triola & Pusic, 2012.

Going forward, there is an even greater emphasis placed on data and outcomes to link back to the ability of the residency program to achieve its goals. The ACGME fully embraces the outcomes-based principles that started with the release of the Core Competencies in 1999, and the launch of the Outcome Project in 2001 (Batalden et al., 2002; IOM 2014). However, the ACGME and GME programs struggled to operationalize the Core Competencies and create meaningful outcomes-based assessments. Recognizing these challenges, the ACGME's transition to the current model included two important new components to the accreditation process; the Milestones and the Clinical Competency Committee (CCC), both of which are designed to monitor and iteratively improve educational outcomes, and by extension, clinical outcomes, at the level of the individual learner and the program.

Where Do Research and Scholarship Skills Fit into the Global Core Competencies?

It is interesting to note differences across the globe in terms of the stated core competencies for physicians. Table 8 shows an excerpt from a table compiled by des Cruser et al. (2012) in an article that examined physician core competency standards and CBME. From the article, I was able to more closely examine where research-related skill development was positioned within the core competencies. In the far left column, the ACGME competencies are listed in addition to competency models from other parts of the globe. As indicated by the red text highlights, the category labeled within the ACGME model as 'Practice-Based Learning and Improvement' (and labeled differently across the other systems, was the portion of the competency that primarily delved into research-related skills. On a simple level, the varied labels on these categories gives hint to the lack of the standardized language which is problematic in the field of medical education.

Table 8

Global Core Competencies: Focus on Research and Scholarship

ACGME **United States**	**CanMEDS** **(Canada)**	**MEDINE** **(Europe)**	**IIME – GMER** **(Global Minimum Essential Reqt's)**
Medical Knowledge	Medical Expert	Medical Knowledge	Scientific foundation of medicine
Patient Care	Medical Expert Health Advocate	Patient Care Patient Advocate	Clinical Skills
Interpersonal Communication Skills	Communicator	Interpersonal Communication Skills	Communication Skills

Professionalism	Professional	Professionalism	Professional values, attitudes, behaviors and ethics
Systems Based Practice	Collaborator Manager	Supervisor & Teacher, Responsive to the larger health care system content	Population health & health systems
Practice Based Learning and Improvement	Scholar	Scientific Knowledge Contributing Scholar Health Care Improvement	Information Management Critical thinking & research

Source: des Cruser et al., 2012.

The Need to Make Time for Research-related Skill Development

Residency has been described as a privileged time to learn new skills, build expertise, and shape a career path. The message of the article by Vasanthan et al. (2020) points out that the increased need to provide clinical services, the intensity of residency training, and the time that consumes should not be accepted as barriers to pursuing research and scholarly activities. The authors note that proper planning and appropriate mentorship within one's training program can offer opportunities to effectively integrate research and evidence-based practices into clinical training. It was unclear from the interviews how much was anticipated on the research consumer spectrum.

According to the program directors, it is wise to be deliberate about one's plans to pursue research and not leave it up to chance to happen. Even though residents have been taught to be competitive through their medical school training, in residency, they are better served to realize the collaborative nature of their work and the opportunities it presents for group research initiatives. That is an interesting observation that was echoed by the Chief Residents I interviewed. Two of the five indicated some regret for not having taken fuller advantage of the resources that existed within their healthcare setting, noting that it is advisable to develop study patterns early in your training. The key is to accept the fact that for some periods of time the demands of the clinical setting will drive your schedule and make it challenging to address any other priorities. There is a need for a disciplined approach to revisit those other non-clinical activities, as the schedules change. All the residents I interviewed voiced the sentiment that you get out of the training what you put in. The level of intensity with which they pursued research-related activities was relatively mild, with the majority of focus placed on other mandatory duties.

Need for a Focus on Scholarly Activity / Supportive Infrastructure

There was a lot of variability in the breadth and depth of resources made available in programs to support resident scholarly activity. Examples fell into several different categories: educational resources (e.g., training modules, research day); staff expertise (e.g., dedicated faculty advisors, mentors, library services, statistician support); protected time (e.g., scheduled study time and/or scheduled group study sessions); and funding (e.g., funds to offset poster production, conference attendance – travel and registration fees)

According to Abramson's national survey of pediatric residency programs (2014), only one-third of programs (35.1%) had a research curriculum and very few (7.2%) had protected faculty time devoted to support resident's scholarly activities. Notably, only 35% of programs reported having a formal resident research curriculum, as compared to rates reported in internal and family medicine (47% and 76.6%, respectively). On a positive note, that number for pediatric residency programs was up from 27% revealed in a 1996 national survey.

From my experience with the chief residents, each institution had resources available and all residents had access to those training materials. That was even true for those that worked in community-based settings, given they had an affiliation with an academic institution. Two academic institutions stood out as having formal curriculum, although one positioned it entirely as self-study modules. The other provided some guidance and courses, coupled with individual coaching related to an assigned research project. The definition of scholarly work was varied in my discussions with residents, but typically included case reports, posters, and/or grand round presentations. Abramson identified the following three factors associated with high-participation programs: a requirement for scholarly activity, program director belief in the importance of all residents presenting their work regionally or nationally, and broad-based faculty mentorship.

The issue this material brought to life was the fact that the measure of scholarly activity may merely be a count of the number of presentations or case reports delivered. That metric does not necessarily speak to the quality of the work that went into framing the issue, critically appraising the literature, and arriving at sound evidence-based clinical decisions. It is a lesson in learning within a training program, but the optimal measure would be found in the manner in which the patient’s care is impacted and the resulting outcomes they experience. Not always an easy thing to measure and even more challenging to link back without some data analytics at play.

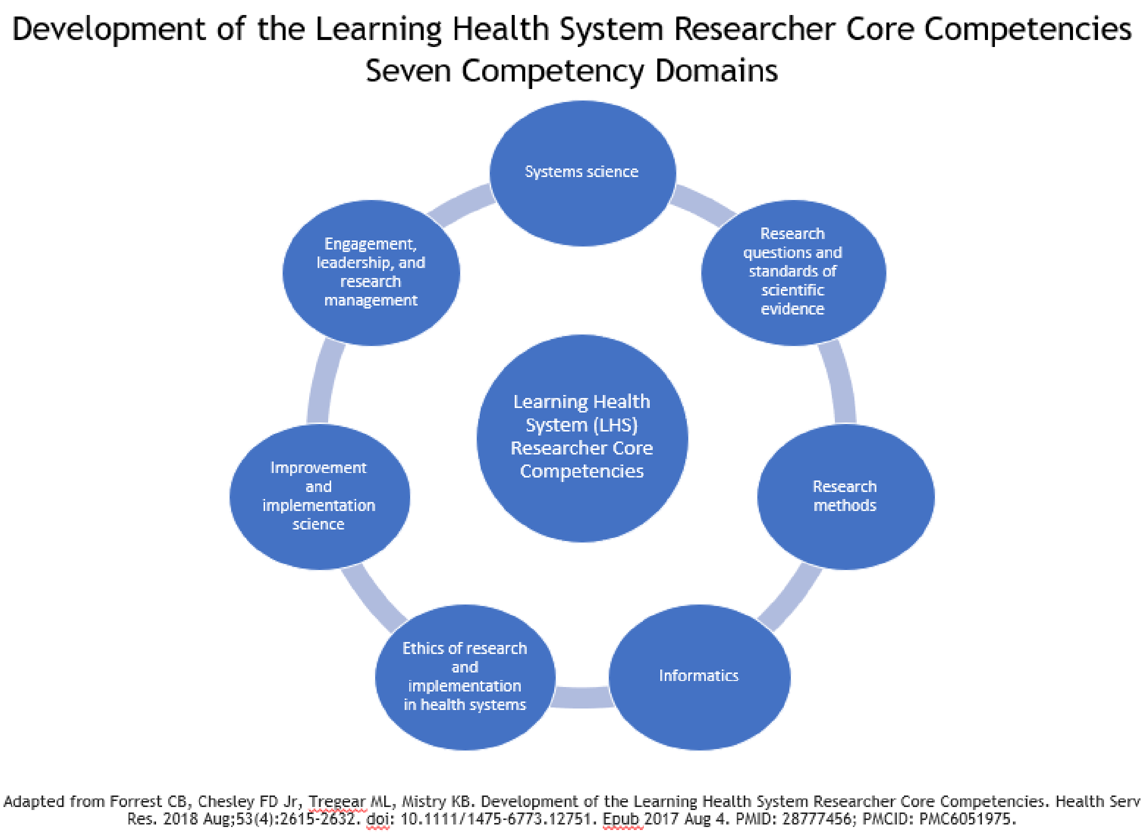
Abramson (2014) asked program directors to rate the importance of certain goals for resident scholarly activity and the following five goals emerged at the top of the list on the survey: teaching scientific inquiry (91.8%), teaching problem-solving skills (88.7%), providing research exposure (79.4%,), having all residents present their work locally (59.4), training residents how to conduct research (52.1%). As compared to the responses from the program directors that participated in the interviews, critical-thinking skills was most commonly-stated, which would mirror the scientific inquiry label from the survey. I was surprised to see mention of 'providing research exposure' ranked so high on the survey results. That point did not align with the conversations I had, although I wonder how much of that related to the basics of EBP only with a different title so the parallels may not be obvious. In the interviews, reference was made to the matter of making sure residents knew of faculty who may have interest in their particular area of study. That was positioned as an invitation to explore areas of research that may already be on-going with hopes that the resident would find an opportunity to participate on some level. However, once again it was left up to the resident to pursue those available connections.

Learning Health System Researcher Core Competencies

Up to this point, the discussion related to competency models has focused at the residency program level. Through this research study, I found it interesting to discover specific competency models devoted to the role of a health system researcher (Mistry, 2018). Figure 14 reflects the domains considered core to the skill set required of this role within a practicing physician. These domains, which are each accompanied by detailed descriptions of necessary knowledge and skills, serve as a guide for those who are responsible for developing educational content to boost the proficiency of physicians in the world of research.

Figure 14

Learning Health System Researcher Core Competencies



Source: Adapted by G. Jacobs from Forrest et al., 2018.

Hierarchy of PRLS across the Medical Education Continuum

Another model geared to those involved as a consumer of research was outlined in an article by des Cruser et al. (2012). The model contains the labels for what are called, Practitioner Researcher Literacy Skills (PRLS). As I relate back to the Dreyfus model of skill acquisition discussed earlier, it was helpful to see elements of a hierarchy of skills and corresponding learning/teaching strategies outlined in the PRLS article. I adapted the content of the article to generate Figure 15 which maps out the level of PRLS (from basic to mastery), lists the desired outcome for each level (noting some overlap), and briefly summarizes the teaching or learning strategy best applied to each level.

Figure 15

The Hierarchy of PRLS Across the Medical Education Continuum

The hierarchy of PRLS across the medical education continuum

PRLS Level	Desired Outcome	*Teaching and Learning Strategies*
Mastery	Demonstrates maintenance of skills by Physicians in practice exercising applied critical thinking skills, information mastery, and sound clinical decision-making.	*Advanced and Mastery: Established commitment to evidence-based practice and lifelong learning (collaborative clinical decision-making and commitment to self-directed learning)*
Advanced	Acknowledges importance of reflection and commitment to development of skills as described in advanced PRLS skills of Physicians in GME or fellowships, and pre-doctoral medical students in UME dual degree programs.	
Apprentice	Demonstrates the ability to communicate with relevant others, in a clinical training setting or professional discussion information from moderately complex scientific research material.	*Apprentice: Learning/applying critical thinking and problem solving in patient care (mentored clinical training; small group and individual scholarly activities (scholar role demonstrated); Discussing research using medical statistics (facilitated small group and classroom activities with access to on-line resources (comprehension and application demonstrated)*
Intermediate	Demonstrates an applied understanding of, and ability to interact with mentors and peers in discussions of moderately complex materials in a small group or classroom setting using clinical case scenarios.	*Basic and Intermediate: Learning the language of Medical Statistics, Biostatistics, and Epidemiology (on-line, interactive, comprehension practiced)*
Basic	Demonstrate a basic grasp of commonly used biomedical and clinical research concepts in minimally complex materials.	*Basic: Introduction to research in medicine using non-statistical concepts (on-line, interactive: knowledge demonstrated)*

Adapted by G. Jacobs (2021) from "Practitioner Researcher Literacy Skills in Undergraduate Medical Education: Thinking Globally, Acting Locally," by des Cruser, A., Brown, S. K., Ingram, J. R., Papa, F, Podawiltz, A. L., Lee, D., & Know, V., 2012, *Med Sci Educ*, *22*, 162-184 https://doi.org/10.1007/BF03341781

Source: Adapted by G. Jacobs from des Cruser et al., 2012.

Theme One Summary Discussion: How Do Organizational Structures and Regulatory Oversight Contribute to the Development of Research Literacy Skills in Physicians?

The organizational structures may have initially served the needs of the healthcare community in an environment focused on scientific curricula, however, I do not believe they have kept pace with many of the complexities associated with the field of healthcare and medical education. In my view, the organizational framework is inadequately positioned to support the development of research literacy. The organizational structures that have been in place to establish and monitor program requirements associated with research literacy are insufficient to align, drive, measure, and track the achievement of all expectations and/or milestones related to specific core competencies across the medical education continuum.

While well-intentioned, accreditation requirements tend to place their burden on the program or institutional level and they rely upon the program/institution to push the learner to achieve, but only to the minimum required level. While there are signs that the system is receptive to exploring models that are less reliant on time-based measures, that progress has been slow and it appears some resist change in the face of the burden it can create with new reporting requirements. The accreditation agencies tend to focus on making certain the program/institution has established the minimum threshold for a particular skill and oversee group's compliance with their requirements – unfortunately, that emphasis uses up resources and it does not typically foster as much concern for how to raise the bar and push for higher standards on an individual and programmatic level.

In terms of defining research and scholarship or scholarly activities, there is much to be desired, as the descriptions are very general and some would argue the metrics chosen do not necessarily align with skills that demonstrate proficiency. The accreditation systems that are in place do not concern themselves with promoting adoption of specific research-related practices.

The emphasis is on the program requirements and the burden rests with the accredited organization to demonstrate they have the systems and mechanisms in place to address individuals who do not meet the minimum thresholds.

Other Implications for Practice

The accreditation system is in the midst of a dramatic transformation with their continued roll-out and reinforcement of competency-based educational milestones and EPAs. Having initially experienced pushback, there is greater acceptance of the concept that calls for a shift to an outcomes-based approach to education. The system is extensive and it takes time for each of the 24 specialty boards to adapt the system to their unique characteristics, but there appears to be some traction for the intent to step up the pace. The ACGME has introduced the Clinical Learning Environment Review (CLER) model, which has been viewed favorably in that it offers a more constructive (i.e., non-punitive) mini-audit and review of a program with a focus on continuous quality improvement. The hope with any accreditation system, and especially one that oversees a complicated, high-stakes system such as is true in healthcare, is that it maintains the appropriate level of definition of the expectations and that the reporting aspects of the program do not become overly burdensome

It should be noted there are a number of promising projects underway which are utilizing longitudinal milestones data and learning analytics to facilitate the professional development of residents. They have proven their ability to create predictive indices that provide programs and specialty disciplines formative data in key competencies beyond medical knowledge to guide continuous quality improvement (CQI) of residency training. These types of predictive measures can help identify residents who may be struggling and guide their improvement and their professional growth. This is an example of how an initiative can help to breakdown the siloed thinking that often accompanies the medical education continuum by casting a wide angle lens on the full spectrum of a physician's development and remembering the ultimate goal is to ensure that all graduates of residency programs are truly ready to enter clinical practice with high levels of ability across all essential competencies (Holmboe et al., 2020).

In the spirit of promoting on-going assessment and continuous improvement, while also setting a different tone, CLER visits are providing opportunities for clarification, sharing of best practices, and continuous improvement. While the program directors I interviewed were respectful of the ACGME, there were several comments directed at their frustration surrounding the lack of clear definition related to scholarly activity requirements and the reporting burden under the current requirements. I suspect some of this is complicated by the fact that there are 24 different specialty groups and each takes the opportunity to tailor the competencies to their specific specialty when it comes to certification. For residency programs, they are required to submit updates regarding faculty and resident activity related to scholarship. Again, the metrics used focus on the production of research (i.e., number of presentations, posters, peer-reviewed published articles, etc.).

In parallel with the CBME movement which has been gaining traction, there has been a theme in the medical education circles that seeks to look across the continuum to identify opportunities for collaboration across the UME and GME curriculum, as well as into the clinical settings. This is in an effort to broaden the lens on the continuum and avoid siloed thinking whereby each phase represents a door that closes behind you. Each step through the continuum should be accompanied by an expectation that the transition (e.g., from medical school to residency, from residency to practice) will involve an extension of the skill development, and the portfolio of scholarly activities (and underlying skill set) will continue to grow through their practice.

Currently, there is said to be an episodic approach to the completion of scholarly work during medical school and/or residency. Ideally, there would be metrics in place to establish the scholarly activity expectations more clearly and to facilitate a plan to continue to develop and build on the requisite skill sets of the learner in a measurable way. Given the diverse interests of the residents and varying degrees of interest in research and scholarly work, there should be a way to tailor or customize the training plan to align with those goals, while also maintaining a higher standard across the board.

Theme Two: How Do Curricular Decisions Contribute to the Ability to Sort Through Today's Information Overload Which is Central to Research Literacy?

Someone once described medical schools as resembling snowflakes, where no two are exactly alike. That could be said to be true regarding their curricular approaches to residency as well**.** There is an abundance of material to cover during medical school and residency, as reflected in the competencies. There are on-going conversations between Deans, Designated Institutional Officers (the institutional liaison with the ACGME), and Program Directors regarding the prioritization of curriculum, which can generate much discussion and debate over how to allocate the residents' time, as well as how to assess the most effective and impactful way to deliver the content. When making those curricular decisions it is important to consider the potential power of the formal and informal (hidden) curriculum, the importance of planning, and the opportunity to provide tailored learning solutions for physicians.

Information Overload / Curricular Response

In today's world, the amount of new medical information that is being disseminated is truly overwhelming. There is an abundance of new discoveries, new medications, new therapeutic options, and on-going results from clinical trials. Research and scholarly activity are an integral part of a resident's training to prepare them to function in the complex healthcare environment. While not every medical student will pursue a research-intensive career, physicians should possess the capacity to understand the scientific literature and critically interpret research findings (Windish et al., 2007; Wegwarth et al., 2012). It is clear the learning curve for residency training is steep, so where do you start and how do you integrate research-related skills into the residents' curriculum?

The influx of medical information has heightened the need for physicians and patients to be discerning consumers of research and medical information. There is wide variability in the level of proficiency a physician achieves during their training with respect to research literacy (driven, in part, by personal interest, pursuit of available opportunities and resources, and the demands of the physician's life, role, and institution), although now, more than ever, all physicians must develop and maintain those basic skills to be able to make well-informed clinical decisions.

Formal vs. Informal Curriculum

It is easy to put your hands on a document that outlines the formal curricula in a residency program. The same is not true of the informal or hidden curricula which refers to learning in response to unarticulated processes and constraints, falling outside the formal medical curriculum (Doja et al., 2020). The informal or hidden curriculum in a specific clinical workplace refers to the transfer of the culture of that workplace. In contrast to the formal curriculum, the informal or hidden curriculum refers to the implicit learning that takes place outside of the formal learning environment. It is not documented and it is inferred by learners rather than delivered intentionally by faculty (O'Donnell, 2014). Much of the education directed toward residents in family medicine, internal medicine, and pediatrics takes place experientially through practice and interpersonal interactions in the workplace (Hafferty, 1998; Dornan, 2012; Vaughan, 2016).

Dealing with uncertainty is one of the elements that is said to often be learned through a context-dependent informal curriculum (Rothlind et al., 2020) encompassing both a trickling down effect of organizational values and attitudes passed on by a mentor or colleague (Lawrence et al., 2018). That concept certainly aligns with the need to find answers for challenging patient cases and to know how to navigate the materials revealed through a search of the literature. Given the level of influence that program directors or preceptors have on a resident's outlook and prioritization of duties, it is easy to imagine how their attitude toward research literacy skills plays a strong part in the hidden curriculum. Important aspects of being a family practitioner, such as cultural competence and dealing with uncertainty (which is germane to research literacy), are learned through a context-dependent informal curriculum.

Given the potential impact of the informal curriculum and the wish to ensure a more uniform base for all residents and to reduce the impact of the individual supervisor's preferences, complementary formalized training would be beneficial

(Lawrence et al., 2018). To date, there are few studies published to conclude how to best teach the informal curriculum. While specific interventions designed to improve resident scholarly activity cannot be individually tied to an increase in resident productivity, it does appear that a culture of research emphasis is likely the most important factor in leading to improvements in resident research productivity (Wood et al., 2018). This would be a worthy topic for further study.

No One Plans to Fail, But How Often Do We Fail to Plan?

When suggested changes or enhancements are brought to the table for discussion, often the counter-point is a matter of where will we find the time in an already full scheduled curriculum. Residency Program Directors described the intense battle required to carve out time on the residents' schedule for something considered to be non-clinical activities. In terms of formal curriculum, programs are required to deliver training to develop a resident's skill set and prepare them for their work as independent practitioners. The residency curriculum must address all six core competencies in a manner compliant with ACGME Program Requirements.

In their article, Carraccio and Englander (2013), provided a sequel to their 2002 article which had been published only a few years after the initiation of the shift to CBME. The authors reflected on the major forces (regulatory bodies, international peers, and the general public) which had influenced the movement and tipped the balance toward widespread adoption of CBME in the United States, primarily in GME. There were several important lessons learned over the decade to include: 1) the need for standardization of language to develop a shared vision of the path ahead; 2) the power of direct observation in assessment; 3) the challenge of developing meaningful measures of performance; 4) desired outcomes as the starting point for curriculum development; 5) dependence on reflection in the development of expertise; 6) the need for exploiting the role of learners in their learning; and (7) competent clinical systems as the required learning environment for producing competent physicians.

In previous attempts to introduce a new model or approach, several ingredients appeared to be absent. Most notably, the earlier attempts failed to explain what the vision of successful implementation would look like. They did not adequately place emphasis on the importance of milestones, EPAs, as well as an integrated approach to assessment of competence. When dealing with issues of public health and healthcare, it is easy to identify the common goal which is focused on a healthy population and patients who are well cared for. Drawing upon that common overarching goal, the fundamental question at each step along the way in implementing CBME should be "How do we improve medical education to provide better care for patients?" While lofty in nature, posing that question should allow us as medical educators to focus our attention on the common goal. In theory that should help defuse some of the internal battles that may interfere with necessary changes, as that can only cloud matters when it comes to confirming how to carve out priorities for a resident's training schedule.

The purpose behind the competency model and the subsequent refinement with the Milestones project was to create objective criteria, hold faculty and students accountable, and provide some mechanism by which programs could link the effectiveness of their initiatives to their program's success, while also identifying and addressing areas for improvement. At the end of residency, programs must demonstrate provision of an educational experience that will ensure proficiency for all graduates in each of the core competencies. Programs must assess residents in their achievement of each of the six core competencies and the programs will be assessed by their institutional and governing agencies on their ability to advance their residents to a suitable level of proficiency.

I will approach this discussion from two perspectives: the first having to do with the confusion that is created by the influx of medical information and the challenges it creates when caring for patients and seeking to make well-informed clinical decisions. Secondly, I will step back and discuss my findings from a programmatic lens – describing systems designed to outline how to best respond to the need to train physicians to navigate the complexities presented by the current and future medical information explosion, systematically sort through the abundance of information, and decipher what is and should be relevant to the patient case scenario being addressed.

Information Overload

Not surprisingly, everyone who participated in the interviews indicated they have to work hard to stay apprised of new developments in their field. There was a certain comfort reflected by those who are surrounded by experienced colleagues, as they have grown to rely upon their expertise in helping to identify data points that would contribute to difficult clinical decisions.

The explosion of scientific and non-scientific online publications in the health sector is leading to a situation of information overload that impacts all players in the healthcare system. It was not surprising to read the results from a recent survey conducted by Univadis of 550 physicians across four specialties in which 64% said the time they spend keeping up to date in their field is insufficient. One could wonder if that number should actually be higher, if individuals were being completely honest. The increased volume of research findings and the ease of online access has resulted in a shift in the profile of patients as well. They are now more inclined to be tech-savvy and, quite possibly, dedicate significant time online to research their condition. When they arrive for an appointment, they show up more informed than ever, sometimes bringing forward information that is new to their physicians which changes the dynamic in terms of shared clinical decision making (Dean, 2019). There is also a concern about the validity of information that is made available online, which is something that likely complicates the conversation.

According to Klerings et al. (2015), the strategies best aligned to combat information overload focus on the introduction of new and/or the adaptation of existing information filtering systems, and the improvement of information literacy for healthcare professionals and patients alike. I translate that to mean better skills in identifying and critiquing relevant research literature. That was consistent with the emphasis in the programs I learned about, as many had curriculum devoted to the development and refinement of residents' literature-searching strategies and skills.

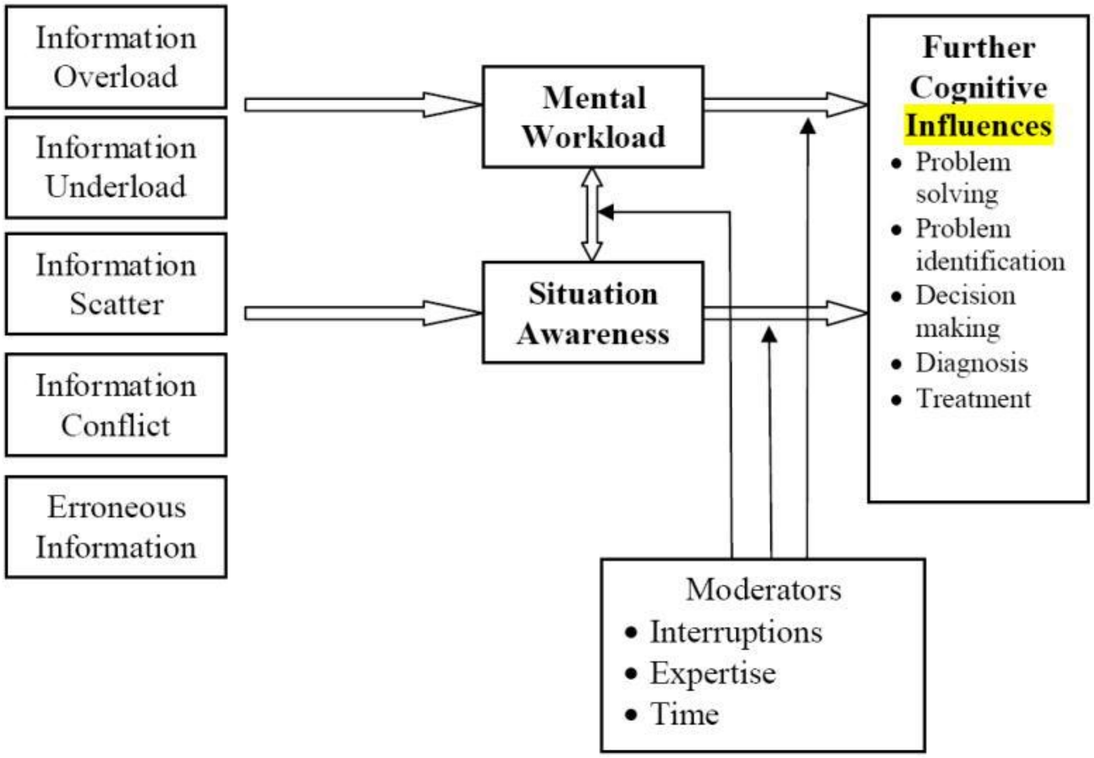
Implications for Practice - The Impact of Information Chaos

Fundamental to evidence-informed practice is not only the existence of relevant research evidence, but also the ability of practitioners to evaluate the literature in an informed and reasonable fashion (Finch, 2006). Information chaos is comprised of various combinations of information overload, information underload, information scatter, information conflict, and erroneous information (Beasley et al., 2011). It is experienced routinely by physicians and is not only inconvenient and frustrating, but it has serious implications for physician performance and patient health and safety. Information overload occurs when there are too many data for the clinician to organize, synthesize, draw conclusions from, or act. Without information that is comprehensive, accessible, timely, and correct, physicians cannot deliver high-quality care (Beasley et al., 2011). In the clinical setting, when faced with information overload, physicians' performance suffers (Deshpande et al., 2003) and clinicians often fell back on imprecise (implied) 'clinical judgement' (Weed, 1997). Beasley et al. (2011) provides a framework (Figure 16) for understanding information chaos, its impact on physician mental workload and situation awareness, and its consequences.

According to the International Association of Scientific, Technical and Medical Publishers, approximately 28,000 scholarly journals collectively publish nearly two million articles each year. There is no question that sorting through the literature can be a daunting task, however, fortunately, there are sophisticated tools and search strategies available for diving into the literature to seek answers to clinical questions.

Figure 16

Information Chaos Impact on Workload and Situational Awareness



Source: Beasley et al., 2011.

The value of health sciences librarians was stated by the program directors I interviewed. It was not always apparent that the residents made full use of the expertise that exists within the library. The two individuals who had extensive research experience prior to starting their residency program were exceptions to that statement. In an article (Perrier et al., 2014) this service was shown to bring value to clinical decision-making. Metrics were applied to the study – one related to time-savings of the HCP and the second tied to the quality and depth of the information that was pulled. Librarian-provided services directed to participants in training programs (e.g., medical students, residents) improved skills in searching the literature to facilitate the integration of research evidence into clinical decision-making. It was particularly novel to see two scenarios within the Perrier et al. (2014) study actually measured the impact of the library services and was able to document a reduction in patient length of stay when physicians requested literature searches related to a patient's case. One of the health science librarians I spoke with did indicate this study was extremely time-consuming, however, the results were quite rewarding and they can only leave one to wonder if an increased investment in those services would pay big dividends in terms of helping to reduce healthcare costs and improve the quality of patient care.

While the title of the article may seem dramatic, the authors of The Medical Misinformation Mess (Ioannidis et al., 2017) gave us legitimate cause for concern regarding information that is shared with the public and/or the health community. In their view, much of it does not tell the whole story or present a balanced view of the issues being discussed.

I heard concerns in my interviews related to the overuse of a specific application or database searching tool, especially knowing that in many cases there were commercial products being utilized (e.g., Up-to-Date) and the information they compile does not necessarily align with what a health science librarian would consider to be a well-designed or adequate search. Many of the commercial tools commonly used in residency programs generate a summary of articles within the frame of an opinion-based critique, as opposed to an evidence-based analysis. According to Ioannidis et al, (2017), most physicians and other healthcare professionals are unaware of the pervasiveness of poor quality clinical evidence that contributes considerably to overuse, underuse, avoidable adverse events, missed opportunities for proper care and wasted healthcare resources.

According to the Ioannidis article (2017), there are four key problems core to the current concern regarding misinformation:

1) Much published medical research is not reliable or is of uncertain reliability, offers no benefit to patients, or is not useful to decision makers.
2) Most healthcare professionals (HCPs) are not aware of this problem.
3) Most HCPs also lack the skills necessary to evaluate the reliability and usefulness of medical evidence.
4) Finally, patients and families frequently lack relevant, accurate medical evidence and skilled guidance at the time of medical decision-making.

Realistically, it is not possible to immediately increase the reliability of available, published evidence, as that will require a long-term development plan targeted to all those who produce and review/approve scholarship, as well as those who publish it. Therefore, efforts should focus on making HCPs more sensitive to the limitations of the evidence, training them to conduct meaningful critical appraisal, and enhancing their communication skills so that they can effectively summarize and discuss medical evidence with patients to improve the decision-making process. Patients, journalists, policy makers, the lay public and all other healthcare stakeholders would benefit from such efforts as well, which is a point made by the HealthNews Review and will be discussed later in this section.

While there are many causes for inappropriate care and waste in the healthcare system, Ioaniddis et al. (2017) contend that much of it may be attributed to the poor quality of information that clinicians and patients rely on to make decisions about the services they deliver or receive. In fact, the influx of medical information has heightened the need for both physicians and patients to be discerning consumers of research and medical information.

Back to the Basics / Foundational Skills

A number of programs, interventions, educational offerings, and educational resources came to light throughout this study, although I did notice several common themes that emerged with respect to this topic. Most notably, there is a central message which flags the value of applying a systematic approach to all aspects of research-related work. The idea is to follow an established process for developing research questions (using PICO, FINER, or other criteria) (Aslam & Emmanuel, 2010), or conducting a critical review of an article (Schwitzer, 2014), or adopting a systematic approach when assessing the levels of evidence, or utilizing a checklist to determine whether or not the principles of good research were applied.

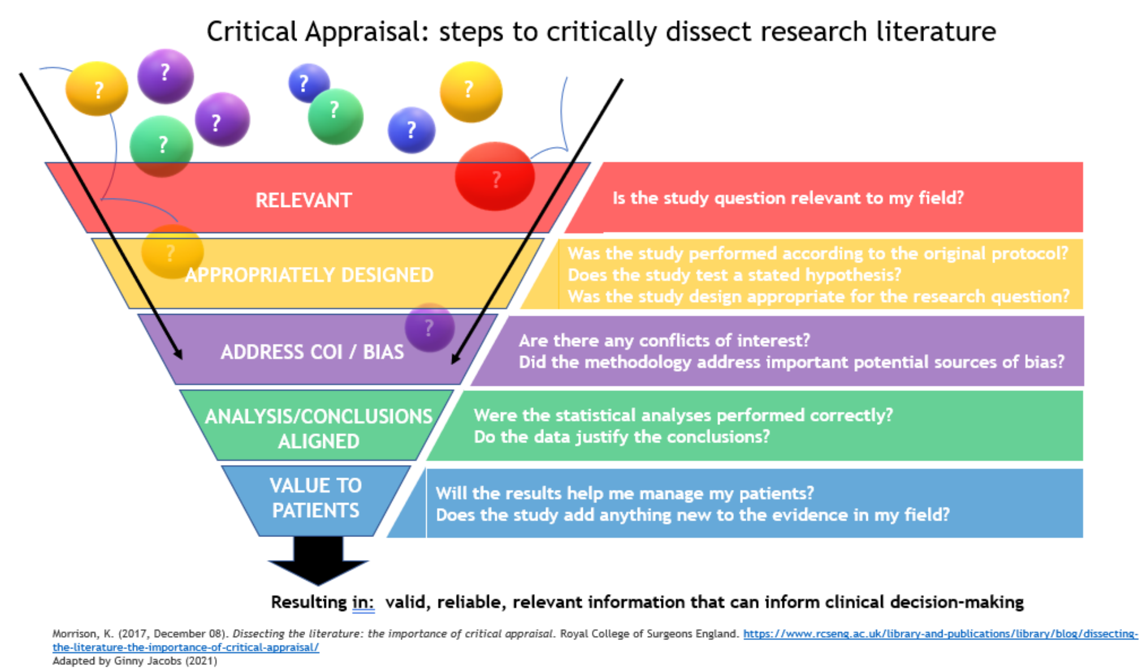
A researchable question is an uncertainty about a problem that can be challenged, examined, and analyzed to provide useful information (Wood & Ross-Kerr, 2006). The health science librarians I interviewed highlighted the importance of the training that they provide which is designed to help learners develop strategies to ensure they properly frame their research question with the goal of finding an answer based on evidence or initiation of a new research project. A well-formulated research question needs extreme specificity and precision which guides the implementation of the project. That is also a core concern when assessing other studies and examining their research question, keeping in mind the identification of variables and population of interest.

Being a Critical Consumer of Literature / Medical Information

Burls (2015) described ‘critical appraisal’ as the process of carefully and systematically examining research to judge its trustworthiness, and its value and relevance in a particular context. That concept is at the core of being a critical consumer of literature. Morrison (2017) offers a guide to the steps needed to critically dissect research literature (Figure 17).

Figure 17

Critical Appraisal – Steps to Critically Dissect Research Literature



Source: Adapted by G. Jacobs from K. Morrison, 2017, Royal College of Surgeons, England.

Two of the programs represented by those I interviewed had extensive curriculum delivered through their health science library. Training modules were offered online and left to a learner's discretion to fit into their self-study plans. There was not protected time made available to ensure completion of the training, but in one case, the library established a one-on-one coaching session for all incoming students with the intention that the personal connection would serve them well over the course of their studies.

It was encouraging to hear the pride the librarian had in the program they had developed, although that individual candidly described the fact that, in spite of the wonderful resources being made available to residents, only one-third (on average) appear to take advantage of the full services being offered. The majority just complete the requisite tasks and do not appear to pursue anything more. Knowing what potential rests within those individuals who have developed an expertise for navigating mounds of information and identifying credible sources to answer questions, I was disheartened to learn about the staffing level at one of the academic institutions. One health science librarian was dedicated to the entire medical school, which meant there were 700 potential customers from within that pool. Apparently, that ratio was quite common, although, that capacity issue did explain why the library did not have resources to dedicate to any type of public relations campaign to highlight their value.

There is an abundance of health-related information being published in news media and the same concept applies in terms of needing to be a discriminant reader. Schwitzer (2014) developed a guide to reading healthcare-related news stories (Figure

18) which is intended to provide a framework for critically reviewing the foundational aspects of a published piece.

Figure 18

Review Criteria for Medical and Health-related News Media Coverage

Review criteria for medical and health-related news media coverage

A set of criteria was developed to help readers (physicians and the public) better understand the strengths and weaknesses of news media coverage of medical and health topics. When reviewing an article or news story, one should confirm the story met the following criteria:
1) Adequately discussed the costs of the intervention;
2) Adequately quantified the benefits of the intervention;
3) Adequately quantified the harms of the intervention;
4) Evaluated the quality of the evidence;
5) Widened the diagnostic boundaries of illness and promoted public awareness of these widened boundaries, which may expand the market for treatments, a practice that has been termed disease mongering;
6) Quoted independent sources and identified the conflicts of interest of sources;
7) Compared the new approach with existing alternatives;
8) Established the availability of the intervention;
9) Established whether the approach was truly novel; and
10) Appeared to rely solely or largely on a news release as the source of information.

Schwitzer, Gary. (2014). A Guide to Reading Health Care News Stories. *JAMA Internal Medicine*, *174*(7), 1183-1186.

Source: Schwitzer, 2014.

Barriers to Clinical Information Access

A collaborative environment can be found with those advancing the Medical Library Association's InSight Initiative which is designed for library and industry partners to discuss challenges and find solutions to better serve their users (Laera et al., 2021). A recent summit focused on understanding how users discover and access information in the clinical environment. At the end of the summit, participants established a framework for understanding users' pain points (Figure 19), discussed possible solutions to those points. Understanding the issues learners face can help libraries develop training modules to improve the discovery process. My interviews specifically with two health sciences librarians demonstrated the critical nature of their work and the power they potentially can wield by driving learners to participate in impactful curriculum on literature search strategies and critical appraisal skill development.

Figure 19

Access to Clinical Information – Pain Points

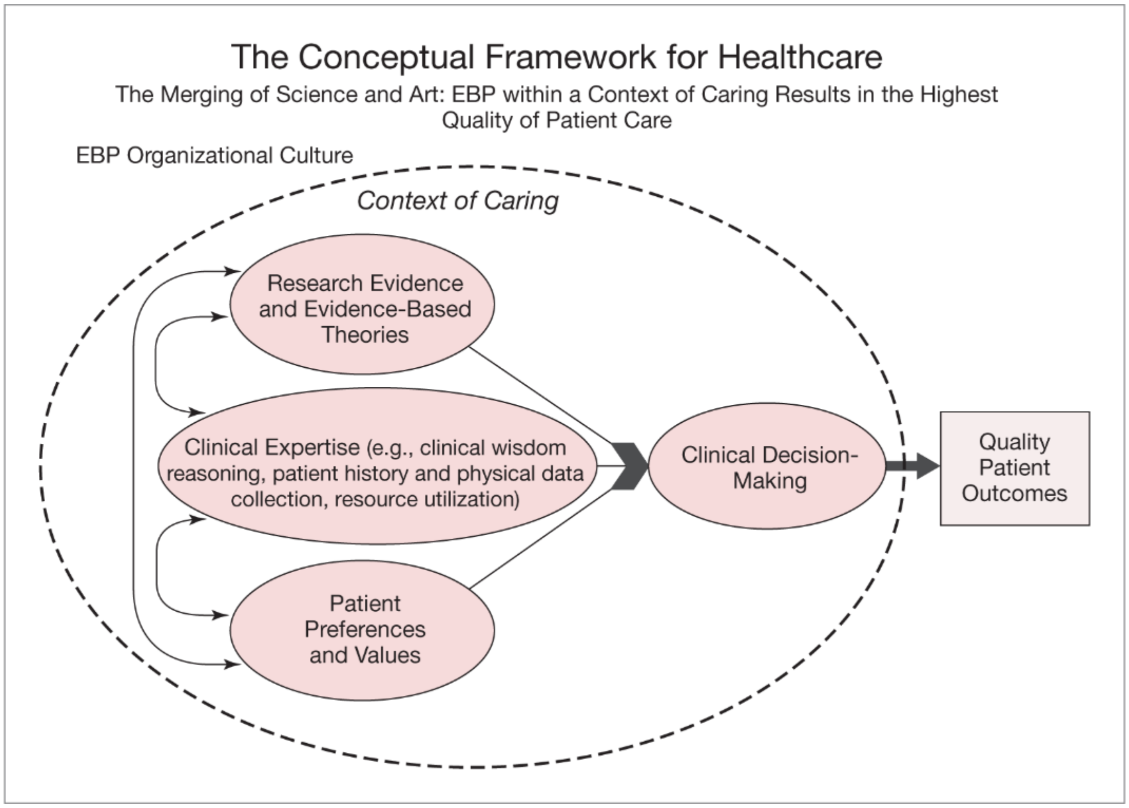
Source: Laera et al., 2021.

Conceptual Framework for Healthcare

The conceptual framework for healthcare (Melnyk, 2017) does an excellent job encompassing several of the critical elements that emerged from the interviews and the corresponding study of what constitutes EBP. This framework (Figure 20) illustrates the merging of science and art which requires the organizational culture which promotes a context of caring that combines evidence, clinical expertise, and patient preferences and values resulting in clinical decision-making that leads to quality patient outcomes.

Figure 20

The Conceptual Framework for Healthcare



Source: Melnyk, 2017.

Core Competencies in Evidence-based Practice for Health Professionals

There were many criticisms related to the need for the accreditation system to adopt standardized language and a consistent conceptual framework to promote sustained change in medical education aligned with the needs of the healthcare system.

The interviews I conducted across different health systems, both academic-based and community-based settings utilized different terminology and varying expectations about what components comprise research and scholarly activity. While EBP is commonly integrated into the curricula of UME, GME, and CME/CPD programs, there has again been much variation in how concepts are interpreted and addressed. In light of the fact that inconsistencies had been noted in the curriculum content of EBP teaching and learning programs, Albarquoni et al. (2018) conducted a systematic, multi-stage survey study to arrive upon a core set of competencies for EBP. Through their Delphi process and follow-up consensus meeting, a total of 68 competencies (clustered into six core categories) were included in the final set of EBP core competencies.

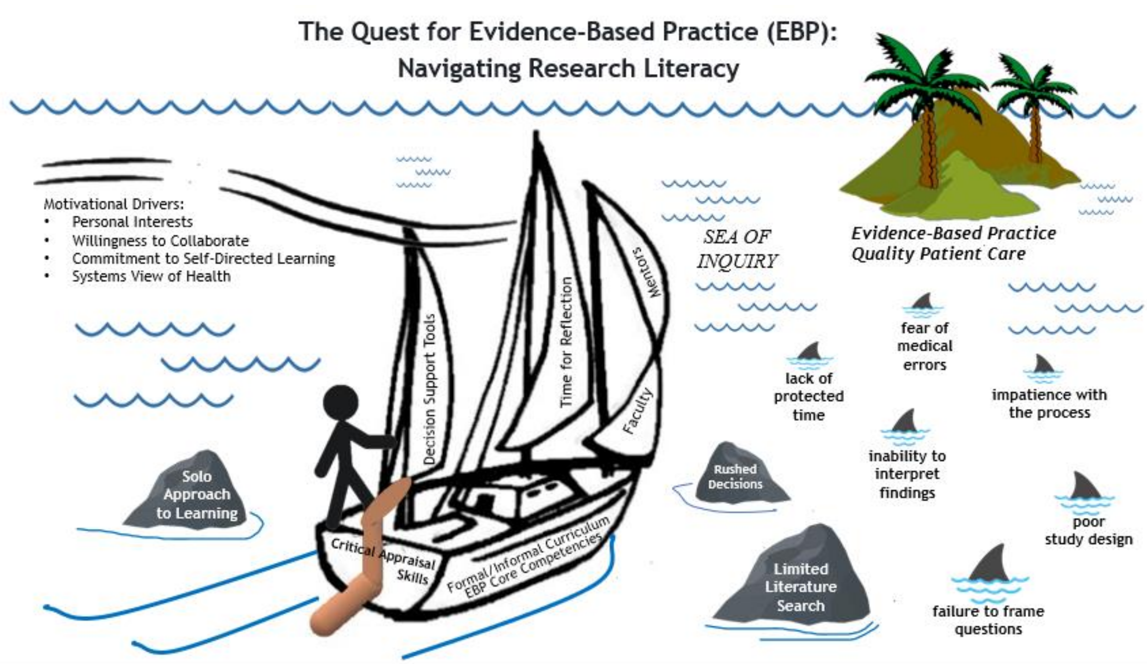
How Will We Know When We Get There?

Competency-based education (CBE) is an approach to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It de-emphasizes time-based training and promises greater accountability, flexibility, and learner-centeredness (Caraccio & Englander, 2012). Those sound like core principles that would be difficult to dispute, however, the introduction of CBME has generated rigorous debate around meaningful measures of performance.

The best analogy I could think of was that of an individual setting out to sea (Figure 21). The vessel represents the infrastructure that is in place for the learner (i.e., EBP core competencies, formal/informal curriculum, faculty, mentors, decision-support tools, critical appraisal skills, time for reflection). They are sailing in what could be labeled treacherous waters, as there are many forces and hazards at play (i.e., time constraints, poor literature, inability to accurately interpret findings, fear of medical errors). The winds represent the learners motivational drive spurred by their personal interests, commitment to self-directed learning, disciplined approach to their studies, and ability to see the big picture. Navigating the waters of inquiry which are a routine part of medical practice, it is imperative that the learner set a course for the achievement of EBP and quality patient care. It may not involve a straight path, but it is in the journey that a learner masters the research literacy skills necessary to fulfill their responsibility to their patients to engage in EBP to help arrive at quality clinical decisions.

Figure 21

The Quest for Evidence-Based Practice (EBP): Navigating Research Literacy



Source: G. Jacobs, gjacobs@umn.edu.

The ultimate goal has not changed, but the complexities of the journey have certainly grown more complex. In today's healthcare environment, a learner (sailor) must rely upon the tools and resources being made available. In addition, they must be committed to continually review the feedback that is provided to them and to be open-minded to the need to collaborate with others to address any gaps in knowledge, skill, or confidence.

Focus in the Curriculum on Evidence-based Practice

A foundational component of EBP is a spirit of inquiry in clinical practice. While that point was mentioned within only a couple of the interviews, it was more typical that the program directors referred to the resources or mechanical elements of curricula that were made available to complete the process of inquiry. All curricula should serve to ignite that spirit in its learners as that is the first step in the seven-step process which refers to the need to cultivate a spirit of inquiry, as outlined by (Fineout-Overholt et al., 2010). It is important to articulate the linkages that are present in the curriculum, so that all learners can see how the tasks at hand build the skills that are necessary to develop the competencies that are required to deliver the quality care you would want for you or your loved one.

Evidence-based practice is the integration of individual clinical expertise with the best available external clinical evidence from systematic research and patient's values and expectations into the decision-making process for patient care. It is a fundamental skill to be able to identify and appraise the best available evidence in order to integrate it with your own clinical experience and patients values (Al-Jundi & Sakka, 2017). There is rising concern that fundamental scientific principles critical to lifelong learning and scientific literacy are not sufficiently addressed during residency (Himelhoch et al., 2015). A formal training course in systematic reviews and meta-analyses offers a valuable learning experience, which enhances residents' research skills and academic productivity in a feasible and sustainable approach.

Finally, physicians' scholarly abilities allow them to contribute to the application, dissemination, translation, and creation of knowledge and practices applicable to health and health care (Frank, 2005). While research and scholarly activities fall under the PBLI competency for most countries, only one of the global competency models listed (Table 8) had a category specifically labeled 'scholar'. That was the CanMEDS competency which applies to physicians in Canada. As a scholar, CanMEDS notes that a physician demonstrates a lifelong commitment to excellence in practice through continuous learning and by teaching others, evaluating evidence, and contributing to scholarship. The ingredients align with what you would anticipate to be present in someone committed to lifelong learning. Learners accomplish this through reflective learning, as well as the creation, dissemination, application and translation of medical knowledge.

Theme Two Summary Discussion: How Do Curricular Decisions Contribute to the Ability to Sort Through Today's Information Overload Which is Central to Research Literacy?

This is clearly a time to think differently about the usual pace of change in terms of the curriculum for residents. In the case of research literacy skills, this appears to be a topic that warrants a more rigorous set of requirements. While not all physicians will choose to produce research, all physicians must develop more sophisticated literature searching and critical appraisal skills.

Desperately Needed: More Than Minimum Level of Research-Related Skills. The ability to find, interpret and use information is a key skill in any clinician's portfolio. The program requirement bar must be set higher than it is currently in terms of what is considered the minimum threshold in order for physicians to be properly prepared to be critical consumers of the overabundance of medical information. In addition, there is an increased need to incorporate the fact that patients may also fall prey to false information or exaggerated claims. That suggests that some aspects of the training provided to physicians needs to be mindful of those difficult conversations that may occur when seeking to work with a patient who may or may not be well-informed to make a shared decision regarding their care.

Programs must provide learning opportunities and supportive curricula and resources to help physicians develop and maintain the basic skills necessary to navigate the huge amount of information (news media, public information, peer-reviewed published work) that is available in the field to be able to make well-informed clinical decisions. Plus, there must be skill building to address the need to ensure the patient knows to cautiously navigate medical information and health-related news stories. Program Directors described the challenges they face in establishing good research-related practices and not falling into patterns that come up short. Part of the discipline being taught along with these skills is to ensure self-reflection.

Approach to Training. In a 2010 Lancet article, Frenk et al. (2010) focused on what are considered to be critical elements for training future healthcare professionals, medical educators were said to have an obligation to begin early to provide balanced perspectives and meaningful context to their students' learning experiences in relevant research-related skills. Anyone who has participated in discussions about the curriculum for medical school students and/or residents is aware of the tension that exists with respect to carving out sufficient time for both basic science education and clinical experience. A balance must be maintained between the steps necessary to meet required program elements and providing a learning environment that fosters practice, continuous improvement and applied learning. Teaching residents to search for evidence in the literature in order to formulate clinical recommendations in the best interest of their patients is not something that should be considered a task. It is a skill that must be developed, refined, and retained through regular practice and reflection.

At the same time, it is not feasible to continually add material to the curriculum without revisiting how some topics may be treated with less priority. The development of research-related skills presents an excellent opportunity to collaborate across the medical education continuum. Drawing upon common experiences, assembling cohorts across different phases of their training, and fostering a longitudinal approach to research-related skill development would be ideal, especially in light of the fact that the level of skill is being raised. Unfortunately, even from just a logistics perspective, the effort required for that type of integration can make a complicated system even more complex. The challenging field of medicine which requires schools and residency programs to navigate rapidly-changing healthcare and complex accreditation landscape does not necessarily lend itself to incentivize institutions to broaden their lens when planning curriculum. Often the focus rests with milestones contained within each phase of training and those experiences or intentional skill refinement efforts are left to individual learners to pursue and they are not highly structured.

Given the world we live in and the rapid pace of change in terms of medical discoveries (e.g., new approaches, therapeutic options, medications, etc.), the curriculum must include focused training on the development of more than simple literature search. While not all physicians will aspire to conduct research, there is no question that all physicians must be research literate (e.g., hone their critical appraisal and critical thinking skills) and be provided ample opportunity to practice those skills so as to develop their own decision tree. Robin Sharma, a Canadian writer, said “Change is hard at first, messy in the middle, and gorgeous at the end.” One might hope that will be an apt description of the medical education arena as it transforms into a more sophisticated competency-based model. As with any important change, great resistance emerged when the ACGME and the ABMS adopted the ACGME competencies in 1999. As a result of that change, all GME training programs were required to phase in the teaching and assessment of the competencies within each of the six domains of patient care, medical knowledge, practice-based learning and improvement, interpersonal and communication skills, professionalism, and systems-based practice. While some regulatory bodies were mandating the competencies and many professional associations were embracing them, the medical education community was divided at best in its acceptance of this shift. Since that time, steps have been taken to further refine what the competencies mean, and determine how they can best be assessed. The list is at a fairly high level and there is a need within each of the competencies to be more specific. That is the case with research literacy skills which have only a hint of detail provided within one of the EPA's. It seems most likely that progress will be accelerated if groups take on a grass-roots approach to building those details in alignment with the overarching expectations.

A Guided Path – Not Left to Chance. The list of core competencies expected to be addressed in today's residency programs reflects a broad brush of clinical, interpersonal, and system-based skills. Achievement of those competencies requires an intense course of study. The explosion of medical information, which is not likely to subside, suggests that now, more than ever, it is necessary for physicians to be able to be critical appraisers of the literature that is being produced in order to make sound, evidence-based clinical decisions. Development of that skill has been incorporated into the curriculum and yet it is not enough to merely add another topic to the residents' full plate and expect it will be embraced.

There is already wide variability in the skill development pathway that is outlined, as well as the depth of resources and support that are made available to physicians as part of their training. In the past, it has been difficult on many of the competencies to assess what level of proficiency a physician must achieve during their training with respect to research literacy. That remains true to some extent when you drill down into specific elements within a competency. Understandably, some of that variance is driven by personal interest, pursuit of available opportunities and resources, the competing demands placed on the physician’s life, requirements of their role, and the culture of their practice setting and institution. Even so, as is being driven by the push for outcomes and milestones, there is a definite need for more structure around the expectations that accompany research-related training. The one EPA that has been mapped out is a good start, but it does not fully address the critical skills that encompass a research-literate physician. The directors and support staff I interviewed highlighted the importance of continual practice and refinement of literature search skills and critical appraisal. Merely completing a literature review does not indicate if the search strategies were optimal, or if the resulting clinical decision was evidence-based. It also does not facilitate a confidence that the skill is now something the resident owns and can build on for future searches. I should also add the power of the hidden or informal curriculum and the importance of context cannot be overstated. There must be a way to harness the energy that is being generated within those resident-faculty exchanges and, if at all possible, it would be beneficial to better understand those best practices to see if there is a way to share those insights with the broader community.

Context Matters. Having learned lessons from the previous ACGME initiative roll-outs, steps should be taken to gain agreement on standard definitions and consistent use of language which can be incredibly helpful to this movement. Involvement of the key stakeholders in understanding the importance of the requested change and making obvious the link it plays to overarching priorities are essential elements. Although the ACGME competencies are context-independent, the framework of competency-based education underscores the critical role that context plays, including the importance of the clinical settings in which a resident is trained. In a seminal study, (Asch et al, 2009) in which the authors retrospectively analyzed the 4,906,169 deliveries in New York and Florida between the years 1992 and 2007, it was determined that an inadequate clinical environment can thwart the professional development of its trainees even in the most well-fashioned competency-based education systems. The impact of the tone of the clinical environment was likened to imprinting during a critical phase of professional formation.

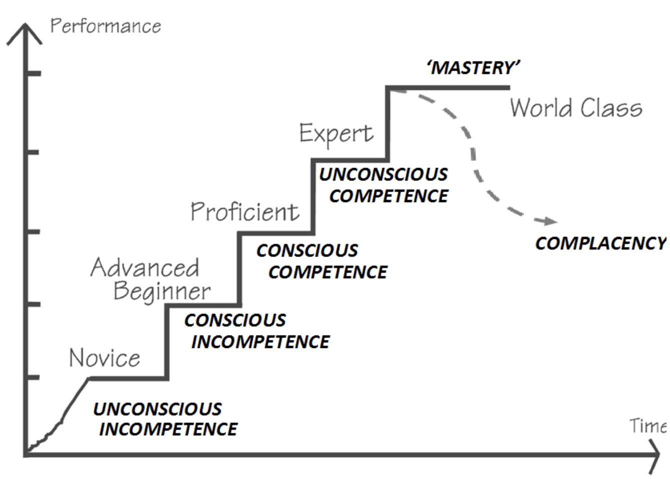
For that reason, I believe one of the most important strategies when considering how to incorporate research-related skills training into the curriculum, it is important to be specific in outlining what is expected, creative in thinking of how to best convey the importance of research literacy, and bold when highlighting those practices that result in the desired outcomes. The goal is to make a compelling case that spurs the engagement of all stakeholders in order to promote a learning environment brimming with continual enhancement and/or refinement of research literacy skills having made an obvious link to the impact that has on evidence-based practice and delivery of quality patient care.

Implications for Curriculum-related Research. So the challenge becomes a matter of how much can you build into the curriculum and what can you realistically expect in terms of outcomes, especially in light of the differences across specialties when it comes to an emphasis on scholarly work? For that matter, how will you be able to define what you have for expectations and how might you truly assess if the desired level of skill has been achieved? Of even greater significance, how will the training that is provided illuminate an awareness of the critical nature of a continual path of skill development, practice and refinement? The goal is to provide foundational skills and also instill in the learner an appreciation for the significance of research literacy skills as part of their on-going development. The goal of the structures that are in place are to respond to the need to continually absorb and critique new knowledge, determine its validity and applicability in specific practice settings with specific patient profiles, and use it to arrive at clinical decisions that result in optimal patient care.

In order to develop research-related skills, such as literature review and critical appraisal, it will be increasingly important to outline and provide deliberate longitudinal experiences for the learners to continually apply the principles they have learned to refine their critical appraisal skills. In so doing, in accordance with the four stages of learning new skills outlined in Figure 22 (Burch, 1970), it would also be best to identify specific tasks to correspond end with each stage, identify a method for assessing performance at that level, while engaging the learner in their self-reflection.

Figure 22

Four Stages of Learning Any New Skills



Source: Burch, 1970.

It would be wise to help the learner frame their experience by applying the Dreyfus model (1990) where the goals should be made clear in terms of skill acquisition expectations required to advance from novice to master.

The notion of a physician becoming complacent in their research-related skills is a frightening thought. For that reason, steps should be taken early in the training to establish the importance of research-related skills, to ensure that physicians do not view those portions of the curriculum as optional components or items to merely be checked off the list of assignments.

Research that would bring rigor to the assessment and outcomes components of specific educational interventions could serve the broader community by spotlighting best practices and inviting collaboration. Ideally, the pace of the changes currently underway would be stepped up. One way to achieve that is to conduct studies and gather data to be able to report on the effectiveness of particular curricular offerings. Often the level of evaluation is focused on participation levels and the level of satisfaction on the part of the learner. In the interest of building on those practices that are most effective, it would be very beneficial to know that what you are measuring is a true reflection of the competency that the program is seeking to advance and a skill that will serve a physician (and their patients) well over their career. Program curriculum committees should not rely upon anecdotal information about the value of particular educational resources and experiences, but rather there should be better, and more structured, methods of evaluating the true impact of those interventions. Programs must demonstrate whether or not their learners have achieved a level of proficiency, and yet to do that, there must be agreement on the appropriate metric and some mechanism to collect the data in an efficient and timely manner. Collaborative efforts in this regard across departments and institutions could prove fruitful as a way to help promote standard language and meaningful measures of success.

Since accreditation topics are often drawn to issues of remediation or efforts to address the needs of learners who are not keeping pace with their cohort, it would be wonderful to envision research opportunities that would leverage the structures in place with added emphasis on the positive assessment component on the other end of the spectrum. Facilitating studies that would be designed to highlight those educational strategies that are most impactful when attempting to build experiences to drive sustainable practices. There is a real case being made for a more rigorous requirement related to critical appraisal of literature. Currently, that is difficult to assess, however, perhaps centralized materials could be more readily shared and multiple sites could participate in a project designed to assess the impact on clinical decision-making which leads to optimal patient care.

New curricular approaches will require existing oversight agencies and institutions to explore innovative opportunities for collaboration, to agree on standard definitions and metrics, and establish adequate guidance and safeguards within the program requirements and accreditation system to continue to ensure public safety. Once again, the ability to demonstrate the value being added by a particular approach would go far with the community of healthcare providers, since they must often wrestle with staff shortages and constrained resources. A pilot group's experience can prove to more readily drive change. Creative approaches will also need to be developed to ensure there is a suitable assessment of the residents' skill levels. Providing physicians with tools to do a more robust self-assessment could serve to more effectively maintain and/or accelerate their skill development. It is understood that some physicians do not wish to pursue development of research, however, all physicians must be skilled in the area which could be labeled a consumer and critical appraiser of literature.

It is not realistic to expect residents to achieve mastery of all skills addressed during the residency training, however, it is imperative that expectations be made clear, that measures be well-aligned in a meaningful manner, and that the trajectory for continued refinement of those skills is deliberately outlined and not left up to chance. For example, relating back to research literacy and EPA #7, there are efforts to be more explicit in stated expectations describing how a practicing physician must be able to confidently locate and critically appraise literature as part of one's clinical evidence-based decision-making regimen. That is a positive step, although it still leaves one to question how that assessment will be made. In addition, it stresses the importance of having educational assessment tools that can help facilitate some of the learner feedback, as well as staff who are well-versed on the expectations, well-aligned with the institution or program priorities, and well-trained to participate in the formative review process as evaluators of learner's progress.

Drilling into Specific Program Requirements. In an *Academic Medicine* article, (Aschenbrener et al., 2015) two recent innovations introduced in GME were optimistically being touted as facilitating an important step forward with a positive impact on the use of GME training to contribute to achieving a true medical education continuum: 1) a widely-accepted competency model (Englander et al., 2013), which is designed to align all the varying models that exist and establish common language; and, 2) the introduction of entrustable professional activities (EPAs) (ten Cate, 2013), which are unique units of professional practice that allow faculty to make competency-based decisions regarding the level of supervision they need to provide to trainees. It is expected these benchmarks will serve to better link the phases of the medical education continuum. EPAs are unique units of professional practice that are "independently executable, observable, and measurable in their process and outcome" (AAMC, 2014). Thirteen EPAs have been developed to map out clear expectations for entering residency (Figure 23). Incidentally, while most items on the list are clinical or procedural in nature, one of the items (#7) does relate to Evidence-based Medicine, as it refers to the requirement that a learner be able to form clinical questions and retrieve evidence to advance patient care. That serves as a foundational skill for thinking in scholarly terms about the questions that are being raised and then navigating the massive amount of literature that exist.

A key component of the EPAC pilot rests on the Core EPAs as a common assessment framework. In that manner, the sponsoring institutions all focused on predetermined expectations of performance and transition criteria to ensure readiness to progress from UME to GME.

Figure 23

The 13 Core Entrustable Professional Activities for Entering Residency

The 13 Core Entrustable Professional Activities for Entering Residency (Core EPAs)[a]

1. Gather a history and perform a physical examination. (H&P)
2. Prioritize a differential diagnosis following a clinical encounter. (DDx)
3. Recommend and interpret common diagnostic and screening tests. (Tests)
4. Enter and discuss orders and prescriptions. (Orders)
5. Document a clinical encounter in the patient record. (Document)
6. Provide an oral presentation of a clinical encounter. (Present)
7. Form clinical questions and retrieve evidence to advance patient care. (EBM)
8. Give or receive a patient handover to transition care responsibility. (Handover)
9. Collaborate as a member of an interprofessional team. (IPC)
10. Recognize a patient requiring urgent or emergent care and initiate evaluation and management. (Emergent)
11. Obtain informed consent for tests and/or procedures. (Consent)
12. Perform general procedures of a physician. (Procedures)
13. Identify system failures and contribute to a culture of safety and improvement. (Safety)

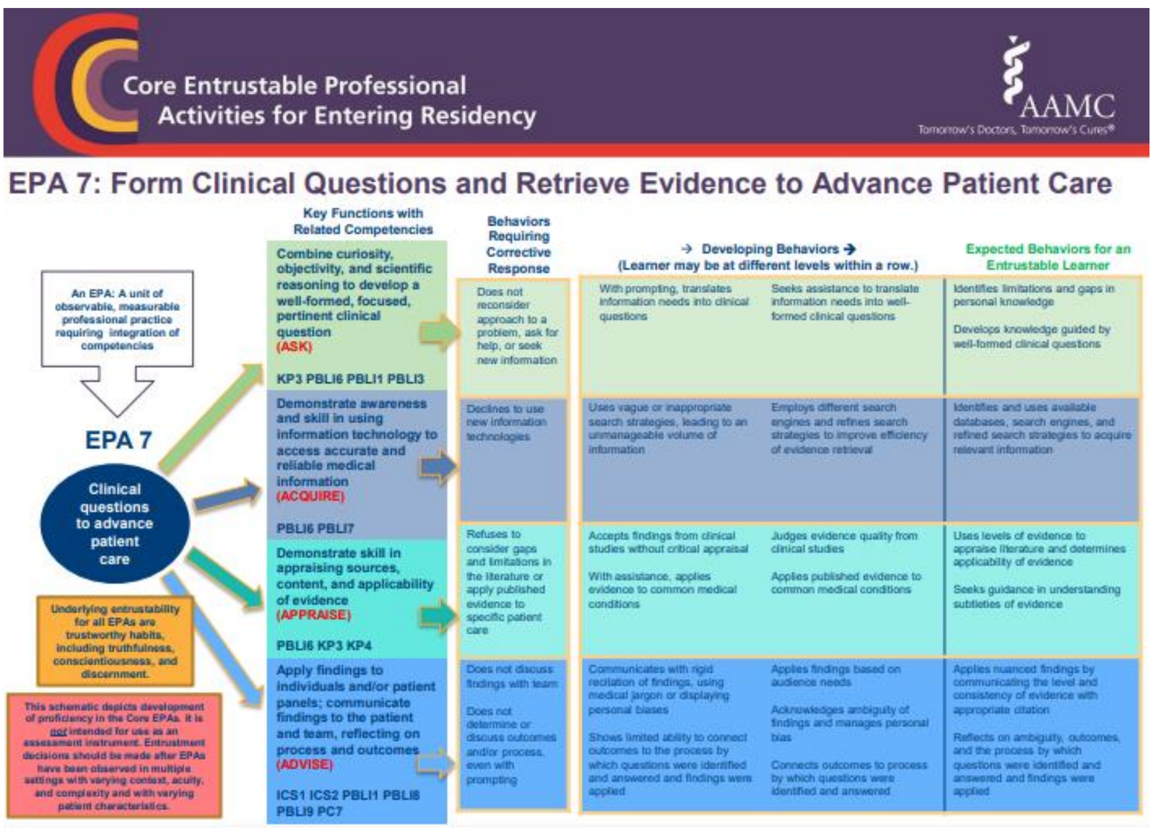
[a]Source: Association of American Medical Colleges. Core entrustable professional activities for entering residency: Curriculum developer's guide. https://members.aamc.org/eweb/upload/Core%20EPA%20Curriculum%20Dev%20Guide.pdf. Accessed October 20, 2018.

Source: Association of American Medical Colleges (AAMC). Curriculum developer's guide. 2018. https://www.aamc.org/media/20211/download

Figure 24 provides greater detail into what lies behind EPA #7. It demonstrates the linkages between the expectation, the related competencies, and the corresponding behaviors that must be achieved by the learner as a way to display their readiness for a transition to the next phase of training. This provides a glimpse into potential opportunities for better metrics and clearer directions in training physicians to be research literate. However, it is evident that much more is needed and that multiple stakeholders must be involved in the process to develop solutions. Without that type of coordinated, multi-layer planning, the gap will only widen with physicians lacking the depth of knowledge or possessing the necessary information searching skills required to provide their patients with evidence-based care. It is unreasonable, and for that matter unfair, to expect that a regulatory agency or accrediting organization would single-handedly be able to drive the type of change that is needed in terms of promoting research literacy at a greater depth. As noted, crediting organizations tend to establish the minimum threshold for learner performance, it is becoming increasingly more apparent that learners who have chosen to be physicians must commit to lifelong learning and, aspire to be high-functioning research-literate professional.

Figure 24

Entrustable Professional Activity for Entering Residency, EPA7: Form Clinical Questions and Retrieve Evidence to Advance Patient Care



Source: Association of American Medical Colleges (AAMC). Curriculum developer's guide. 2018. https://www.aamc.org/media/20211/download

Theme Three: How Does Lifelong Learning and the Learning Environment Contribute to the Development of Research Literacy Skills?

Organizational structures and curricular decisions are obvious foundational components when mapping out a path for physicians to become research literate. A key ingredient in following that map obviously rests within the individual learner and their level of motivation to adopt a lifelong learning mindset. Within the ACGME core competencies, the Practice-Based Learning and Improvement (PBLI competency) is the one competency that most closely aligns with the principles of research literacy and EBP. This competency states that residents must demonstrate the ability to investigate and evaluate their care of patients, to appraise and assimilate scientific evidence, and to continuously improve patient care based on constant self-evaluation and life-long learning.

Personal Commitment to Lifelong Learning

Practicing physicians have a societal obligation to maintain their knowledge and skills through lifelong learning activities (Cruess, 2006). To guide these activities, physicians set goals for learning, assess their own understanding, and then close any gaps by acquiring or updating the appropriate competencies. Often described as self-regulated learning (Zimmerman, 2001), these types of behaviors, which some have contended are critical for safe and effective practice (Brydges & Butler, 2012), are not explicitly assessed or taught in most medical schools. The type of assessment this step requires is not something that was mentioned by the program directors. Rather, the curricular components were designed to align with the institutional expectations and the learners were left to do their own assessment of need. There was a stellar example shared by one of the program support staff, whereby a self-assessment component was built into a patient encounter. In that instance, a health science librarian literally accompanied residents on rounds and used selected cases as teaching tools in a session specifically dedicated to walking through the steps involved with formulating a good research question and conducting a thorough literature search. This hands-on experience provided a meaningful opportunity to demonstrate (and transfer) effective search strategies, while making it real as it was running in parallel with the patient interaction and the results were linked to clinical decision-making for that particular case.

When I relate that list to the items that were discussed with the interviewees, it highlights the issues that have been noted in terms of resident's determining their own course of action once they meet the minimum threshold of a particular Program Requirement. The ability to fully achieve the goals that are mapped out by the ACGME will require a much more deliberate plan for one's own development. Learners must adopt a systematic way of conducting self-assessment and reflection. They must analyze their practice using quality improvement (QI) methods (with the goal of practice improvement), plus locate, appraise and assimilate evidence from scientific studies related to their patients' health problems (evidence-based medicine).

Creative Problem-solving

The days of memorizing information merely for purposes of testing are gone. Today's learner must develop critical thinking skills to be much more adaptive as they translate their understandings as they address their patients' problems and health concerns. Regulation of problem-solving in the medical domain is guided by the declarative and procedural knowledge that is inherent to the specific tasks (Poitras and Lajoie, 2014).

Self-regulated problem solvers engage in a recursive cycle of forethought, performance, and reflection (Zimmerman, 2000).

Achievement Goal Structures

It would be remiss for this discussion not to acknowledge the importance of the learners' environment as it impacts their level of motivation. Given the fact that the core skills required for self-assessment and self-regulated learning are not routinely addressed in medical schools, a study conducted by Artino et al. (2012) was designed to explore how students' perceptions and behaviors correlate with performance and change across medical school. In terms of the theoretical framework, a key factor in most models of self-regulation is the learning environment (Zimmerman & Schunk, 2001; Brydges & Butler, 2012). Researchers outside of medical education have focused considerable effort developing theoretical models to explain the relationships between the learning environment and student outcomes. One such model formed the theoretical foundation of the Artino et al. (2012) study. Drawing upon the principles of social cognitive theory (Artino et al., 2010), this model proposes that students' perceptions of the learning environment are associated with their use of various learning strategies, some of which are adaptive (e.g., students' awareness of their own thinking, referred to as metacognition) and others which are not (e.g., procrastination). It also looked at avoidance-of-help seeking behaviors and how these behaviors had an overall influence on academic outcomes, including achievement and performance.

A Practical Adaptation of the Findings from Themes Two and Three

Scholarship is an important activity for any academic health professional, and it can certainly be relevant for others in non-academic settings as well. Many national outcome frameworks (OF) call for a sound scholarship education and scholarly behavior of physicians (Hautz et al., 2016). Medical educators are known to interpret the scholar role in different ways, even though there may be general agreement on the primary areas of focus.

It was encouraging to see the modification of Boyer's definition of scholarship (1990) expand to include lifelong learning. The category that was added was expanded to acknowledge the significance of an individual's attitude toward continued learning, in addition to seeking ways to enhance a physician's self-assessment skill. Figure 25 lists each of the components and then describes more specifics regarding what goes into that category. You will see the newly-added lifelong learning category makes reference to knowledge and attitude about lifelong learning and self-assessment in addition to learning activities.

Figure 25

Scholarship Reconsidered: Priorities of the Professoriate

Component	Specification
Common Basics	Attitudes
	Information Search
	Critical Appraisal of Evidence
Clinical Application	Knowledge about Clinical Application
	Application of Evidence to Patient Care
	Evaluation/Quality Management
Research	Knowledge about Research
	Performing Research: Research question Methods/study design Analysis Dissemination Team Ethics
Lifelong Learning	Knowledge about and Attitude of Lifelong Learning
	Learning Causes inc. Self-Assessment
	Learning Activities
Teaching and Education	Knowledge about Teaching and Education
	Teaching Skills: Teaching Feedback Evaluation

Boyer EL. Scholarship reconsidered: priorities of the professoriate. Princeton, NJ: Carnegie Foundation; 1990.

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Source: Boyer, 1990.

Critical Elements of a Physician's Development Journey

The shifts necessary to ensure the consistent formulation of research literacy skills as part of a physician's development journey calls for a coordinated, committed effort that relies upon engagement of all stakeholders involved across the medical education continuum. The following principled, layered approach is recommended:

- Foundational – establish standard definitions and develop descriptions of how those terms will be interpreted and applied
- Motivational – develop and deliver consistent messaging that reinforces the full continuum of learning and highlights the need for a commitment to lifelong learning
- Operational – constantly pursue opportunities for shared programming, clinical contacts, etc.
- Collaborative – leverage shared curricula, resources
- Realistic - Create a sense of urgency regarding information overload
- Solution Oriented - Based on Continuous Quality Improvement

Proposed Theory: A Theoretical Framework for Developing Research-literate Physicians

The core research question for this dissertation was: What factors contribute to the development of a physicians' research literacy? To ensure adequate development of research literacy skills, the following elements are necessary:

Systematic Level. Supportive, well-aligned organizational structures with relevant learning opportunities plus clear and meaningful metrics.

Programmatic Level. Relevant and targeted curricular guidance to build skills that combat information overload which is a pervasive concern.

Medical Educator Level. Educational interventions and resources that are relevant, engaging, and whose impact can be measured.

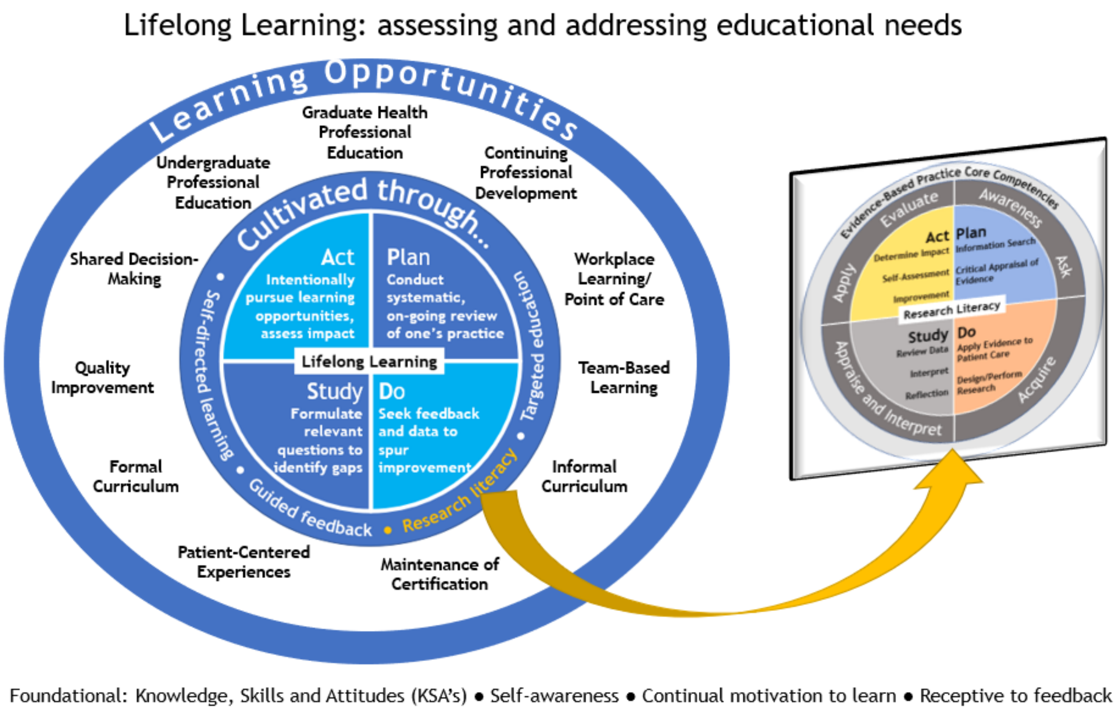
Individual Level. Personal accountability, self-directed learning, and a commitment to a lifelong learning mindset.

The ability of a physician to meet the demands of the public to deliver Evidence-Based Practice which leads to quality patient care (i.e., provide safe, effective, patient-centered, timely, efficient, and equitable care) is highly dependent upon their commitment to self-directed, lifelong learning, and continuous improvement. The key to facilitating the acquisition and maintenance of research literacy skills is through the following: 1) a coordinated view of research and scholarship requirements; 2) collaboration and consistency across the medical education continuum (to define and assess knowledge, skills and performance); 3) innovative research-related programming and measurements; and 4) a continuous learning mindset. That approach positions physicians to take personal accountability for their need to constantly build and sharpen their literature search and critical appraisal skills in order to be discerning consumers of medical information. Those skills will enable them to consistently make evidence-based decisions in the best interest of their patients.

This model (Figure 26) is designed to provide a meaningful context for learners across the continuum. In the spirit of continuing quality improvement (CQI), a Plan-Do-Study-Act approach is applied to any number of learning opportunities. The on-going self-assessment and review reflects the approach of a lifelong learner.

Figure 26

Lifelong Learning: Assessing and Addressing Educational Needs

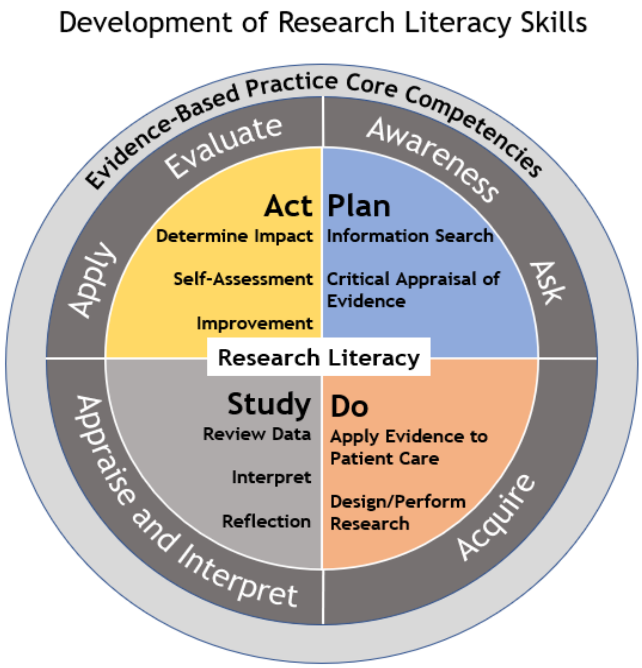


Source: G. Jacobs, gjacobs@umn.edu, utilizing the Plan-Do-Study-Act (PDSA) Directions and Examples. Content last reviewed September 20. Agency for Healthcare Research and Quality (AHRQ). https://www.ahrq.gov/health-literacy/improve/precautions/tool2b.html

The same type of CQI review process applies to learners as they aspire to achieve proficiency in all six competencies associated with EBP. A systematic review cycle allows the learners to continually assess their skills and seek ways to boost their ability to demonstrate research literacy in their clinical decision-making process (Figure 27).

Figure 27

Development of Research Literacy Skills



Source: G. Jacobs, gjacobs@umn.edu, utilizing the Plan-Do-Study-Act (PDSA) Directions and Examples. Content last reviewed September 20. Agency for Healthcare Research and Quality (AHRQ). https://www.ahrq.gov/health-literacy/improve/precautions/tool2b.html

Recommendations for Future Research

What future researchers will need to do to advance this line of inquiry? As noted by Milliken (2010), grounded theory can identify the situated nature of knowledge, as well as the contingent nature of practice and it is particularly good at producing a description that acknowledges areas of conflict and contradiction. That is well suited to the field of medical education and the efforts underway to promote a system-wide adoption of CBME.

The field of medical education would benefit from further examination of the basis for discourse that may surround the adoption of CBME and EBP core competencies in some settings, as well as identification of its potential utility and those best practices that have successfully employed CBME or outcomes frameworks within their residency programs. Further investigation could inform the discussion of how to optimally refine specific levels of expectations for scholarly activities and to determine how to assess the learners' level of proficiency, specifically in matters related to literature search and critical appraisal. It would be prudent to dedicate further scholarship to document the design, feasibility, acceptability, and impact of CBME curricula.

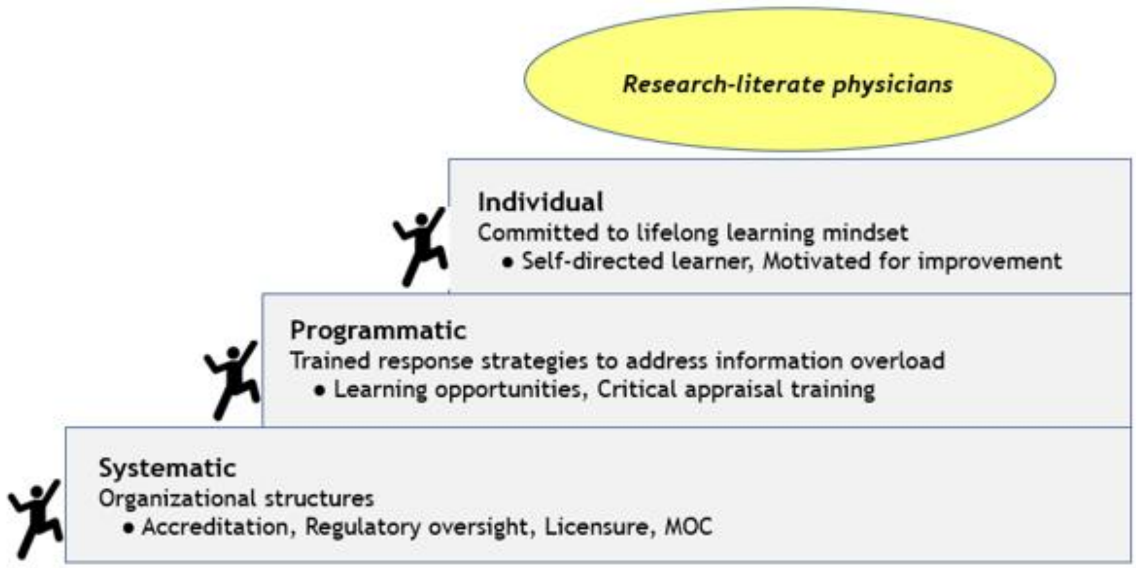
At the start of this study, it was discovered there are many different interpretations regarding what constitutes research literacy. The field would benefit from a more in-depth study designed to assess what characteristics of the learner are best suited to the adoption of research-related skills. Teaching strategies are most helpful when building research capacity within a resident population.

Implications for Practice

Several implications came to light through this study and they warrant further exploration. After reviewing the practice gaps that were revealed, my review of the research-practice gap indicated there is a need for more collaboration across the medical education continuum for faculty, learners, and educators. This connection would be in pursuit of standard definitions, consistent interpretations, and common messaging regarding a standard of care and emphasis on critical appraisal skills. This section outlines implications from this study at the system level, programmatic level, individual level and the role of the medical educator (Figure 28).

Figure 28

Implications for Practice (Multi-Layered)



Source: G. Jacobs, gjacobs@umn.edu.

Systematic

Through an intentional alignment of GME and CME efforts, the complementary threads of accreditation requirements, expertise, resources, and scholarship can be tied together to foster lifelong learning and an integrated learning continuum. The most obvious opportunities relate to educational resources and common themes across accreditation requirements.

Consistently demonstrating the value of scholarship well beyond formal training is a critical element (Murdoch-Eaton & Whittle, 2012; Slotnick, 1996). Instilling in all learners the need for self-directed learning and reliance on lifelong learning mindset are critical.

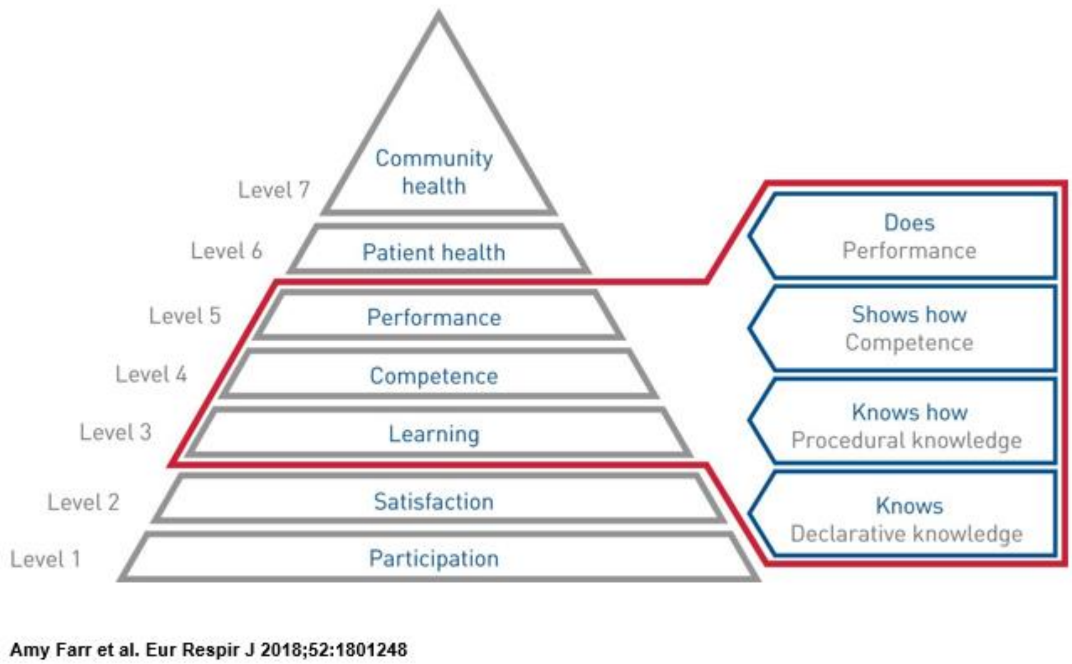
Programmatic

GME advances lifelong learning by preparing resident physicians to embrace continual development, and equipping residents with tools for self-directed learning (Whitehurst et al., 2019). UME and GME can contribute to the development of research-literate physicians by identifying and deliberately delivering curricula that specifically aligns with the EBP core competencies (i.e., awareness, ask, acquisition, appraise and interpret, apply, evaluate). While the structure can help by providing a context, the messaging can be better mobilized if programs directors and staff elect to collaborate with other programs/institutions to determine appropriate measures for assessing whether or not the learner has reached a proficient level of performance. Figure 30 describes the pathway to research literacy and offers some description of key purpose of each stage through the application of the EBP core competencies.

There is a growing interest in developing more rigorous program assessments. The evaluation/outcomes pyramid (Figure 29) reflects the various levels one can achieve through learner feedback. It is no longer acceptable to merely assess a program or educational activities on the merits of its level of participation or satisfaction scores. There is a push for outcomes that are impactful and measurable.

Figure 29

Model of Continuing Education Outcomes



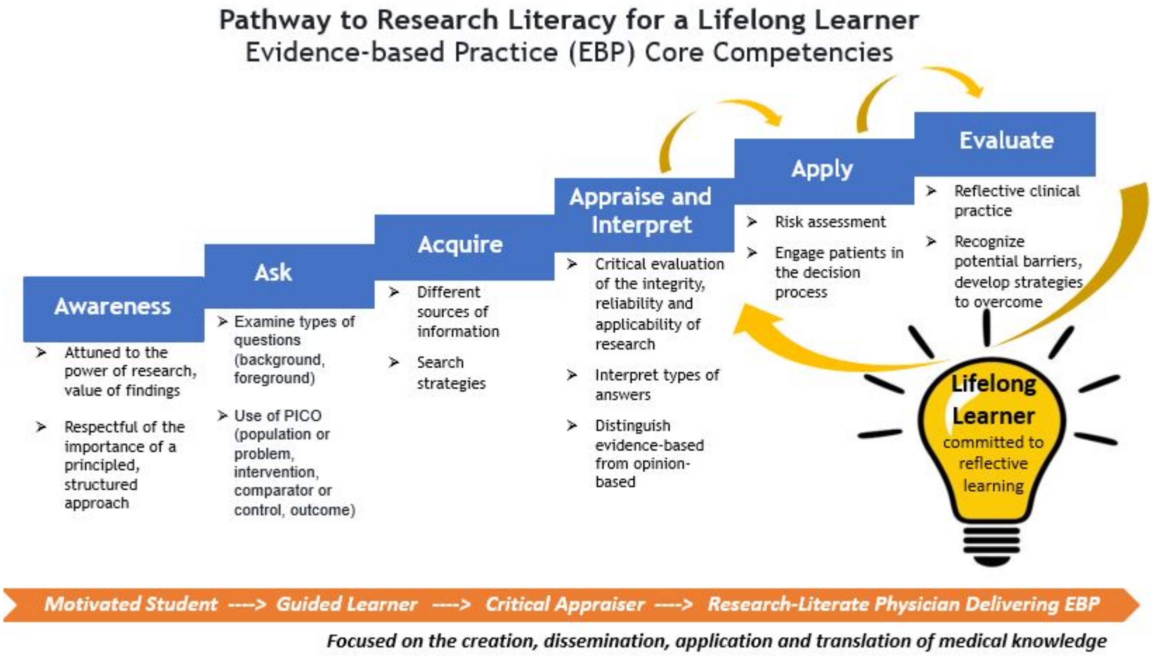
Source: Adapted by Farr et al., 2018, from Moore et al., 2009.

Individual Learner

Learners are guided through various research-related activities to achieve the EBP core competencies outlined in the model (Figure 30) below. Their commitment to lifelong learning becomes especially evident with what is a continuous loop that occurs between appraise and interpret, apply, and evaluate.

Figure 30

Pathway to Research Literacy for a Lifelong Learner



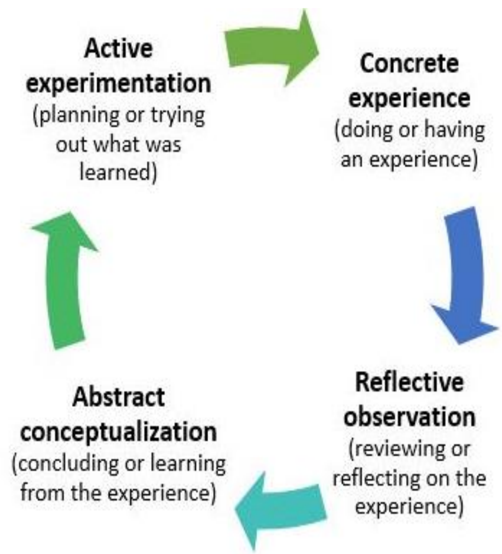
Source: Adapted by G. Jacobs from Albarqouni et al., 2018.

Medical Educator

There has been increased attention paid to how to best deliver educational content to learners. One learning theory that closely resembles a patient care model is the Kolb (1984) experiential learning theory. The main message that transfers is the notion that you must present learners with real opportunities for learning (consisting of concrete experience, reflection observation, abstract conceptualization, and active experimentation).

Figure 31

Kolb's Experiential Learning Theory



Source: S. Kurt, (8 December, 2020) Educational Technology
https://educationaltechnology.net/kolbs-experiential-learning-theory-styles/; Kolb, 1984.

Limitations of the Study

There are several limitations inherent to this study. In general, it should be acknowledged that qualitative and interpretive data collection and analysis, particularly grounded theory studies, pose limitations. As is known to be true of grounded theory, there are no standard rules to follow for the identification of categories. Lehmann's description (2001) was accurate in that it was a labor-intensive process that involved collecting 'slides of data', which were then codified and categorized in a continuous process that moved toward saturation and resulted in the theoretical densification of concepts represented by a substantive theory.

Here are the main limitations to the study:

Generalizability of findings – Given that GME programs are quite varied, institutional interpretation of the requirements for residents represents a broad range, and the specific focus for each of the specialty boards also varies greatly. By choosing an inclusion criteria that narrowed the field to primary care practitioners (family medicine, internal medicine, and pediatrics), I was able to ensure that the scholarly activity requirement in terms of years and depth of training was relatively consistent. (A surgical or orthopaedic residency would have spanned a much longer period of time and it would have set a more rigorous expectation in terms of completion of research and scholarly activities.)

Replicability – An individual would not be able to replicate this study, given the diversity of the candidate pool and the fluid nature of their training and administrative roles.

Size and characteristics of the sample population – The study involved a relatively small number of individuals (n=22, consisting of five current or recent chief residents and 17 program directors or planners).

Limited knowledge of the interviewees' background – The interviews were arranged through a brief email exchange and they typically lasted 40-60 minutes in length. In spite of my project description being shared in advance, some time was devoted to framing up the topic (i.e., clarify my interest in examining the challenges faced by consumers of research, and not just producers of research). As a result, it was not possible to explore details regarding the interviewee’s background and pursue hints of any attitudinal issues surrounding research training experiences in-depth, as I had wished.

Self-selection bias – I cast a much larger net of prospective interviewees and it should be noted that those I spoke with were the individuals who followed up on the invitation.

Role of the researcher – I acknowledge that my involvement in this study can be a limitation as well. I was able to draw upon my extensive experience as an interviewer, as I intentionally adopted a structured approach that made me less likely to take the interviewee down a pre-determined path via leading questions. Despite attempts to maintain a neutral position in the process of gathering and analyzing data, the subjectivity of the researcher cannot help but to influence the direction or, at minimum, the interpretation of the data generated from the study. There is still no denying that as a medical educator, I remain a subjective and biased instrument for data collection and analysis.

Conclusion

In general, medical education has struggled to develop clear measures of impact. While initially slow to be embraced, the move towards competency-based medical education has gained traction of late. One challenge continues to be related to specific outcomes measurement. We are at a critical juncture as medical educators, residency program directors, and all leaders within healthcare institutions need to step up the pace of change and identify collaborative opportunities to accelerate the training. Previously the siloed approach to medical education has only served to slow progress and treat each phase of medical education as its own self-contained unit. There are some encouraging signs of increased collaborative ventures, but the complexity of healthcare and its accrediting bodies have made progress forward challenging.

The field of medicine is complex and the stakes are high. In that spirit, I do not wish to sound completely negative about the structural elements that exist in support of the medical education continuum. The accrediting organizations and regulatory bodies do play an important role focused on patient safety and they should not be dismissed. While the system continues to evolve, however, most would agree that there is significant administrative burden associated with much of the tracking and reporting that accompanies ACGME Program Requirements. That expenditure of administrative energy and educational resources is not well spent if the requirement does not align with a meaningful measure of monitoring and performance. The pace of change has been slow and the current healthcare environment and information explosion clearly demands a more rapid response - one that promotes a longitudinal lens and states a need for clear definitions and meaningful metrics to assess true progress.

The link to patient outcomes remains central to a physician’s pursuit of lifelong learning. The critical qualities of a research-literate professional rest with their ability to demonstrate that they are able to confidently locate, appraise, interpret, apply, and evaluate literature in order to arrive at evidence-based clinical decisions to provide optimal patient care.

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Appendix A

Recruitment Language / Invitation

Research Study: Research Literacy - Core to a Physician's Development? (HRP #587)

You are invited to participate in a research study that interviews practicing physicians regarding their learning journey pertaining to research literacy. You qualified as a possible participant because you are a physician, who completed their residency within the past one to three years. We ask that you read this form and ask any questions you may have before agreeing to be in the study.

This study is being conducted by Ginny Jacobs as part of her dissertation for a Ph.D. in Organizational Leadership, Policy, and Development at the University of Minnesota. Her advisor is Professor Alexandre Ardichvili.

Background Information:

The purpose of this study is to gain insight into how to best develop research-savvy physicians, both as critical consumers of peer-reviewed journal articles and scientific conference presentations and knowledgeable producers of research and scholarship. This study will seek to understand which factors were most helpful during a resident's learner pathway as it relates to the development of their research skills.

Procedures:

If you agree to be in this study, participation would require the following three things:

1) Read the consent information
2) Review the interview questions prior to the interview (see attached)
3) Participate in a 30–45-minute interview by (DATE)

Risks and Benefits of Being in the Study:

The study has minimal risks. There is a risk the participant may be identifiable due to specific institutional affiliations or information shared through the interviews, regardless of the steps taken to protect confidentiality, anonymity, and privacy.

The direct benefit of participating in the study is to receive a summary of the findings with shared implications for reflecting on one's development of research literacy skills. An indirect benefit is related to the contribution to current research on this topic and its potential implications for improved development of residency training focused on the development of research literacy skills.

Confidentiality:

In order to assure confidentiality, the interviews will be digitally recorded and uploaded to a secure server only the researcher has access to. They will be kept completely confidential and will be destroyed after three years. If the research is terminated for any reason, all data and recordings will be destroyed immediately. Furthermore, participants are given the option to remove themselves from the study at any point and to omit one or more questions while still participating in the study. Transcriptions will be used for analysis purposes only. Also, each participant will be randomly assigned a pseudonym, for use in discussing his or her interview, to assure anonymity.

Voluntary Nature of the Study:

Your decision whether or not to participate will not affect your current or future relations with the University of Minnesota or the researcher. If you decide to participate, you are free to withdraw at any time without affecting those relationships and may also choose to skip/not answer questions during the interview.

Contacts and Questions:

The researcher conducting this study is Ginny Jacobs. If you have questions, you may contact her at gjacobs@umn.edu or 612-419-1695.

Her advisor is Alexandre Ardichvili, University of Minnesota, Professor at: ardic001@umn.edu

You will be given a copy of this form to keep for your records.

Appendix B

Interview Outline / Preparation (Program/Organizational Perspective)

Please reflect on the training you have helped develop and/or deliver to medical students and/or residents to help them develop their skills as a producer and/or consumer of research. More specifically, please be prepared to discuss the factors that contributed to the development of research literacy during a physician's training.

NOTE: For purposes of this discussion, we will make reference to 'research literacy', which is defined as –

- the ability to access, interpret, and critically evaluate primary medical literature (Senders, et al., 2014).
- the cognitive and social understanding of the basic purpose, process, and value of research and research participation (Hines, 2016).

****

1) Briefly describe your experience as a program developer and/or educator who helps residents create and/or review published studies or research and also explain what role research plays in your practice.

2) What best describes your current relationship/role as it relates to research:
   a) I am a producer of research; b) I am a consumer of research; c) I am both; or, d) I am neither (Please explain.)

3) What have you found to be the greatest motivator or deterrent for physicians in training in terms of their ability to access, critique, and/or produce research?

4) What research training do you provide to residents within your program? How much emphasis is placed on the research skills portion of the curriculum? (e.g., Required or elective courses? Informal or formal training?)

5) What (if anything) do you consider to be most helpful regarding the research training program made available by your institution during residency programs?

6) How confident are you in your ability to equip residents to critically review a peer-reviewed research journal article? Please explain your answer.

7) What educational resources do you make available to your residents to support their ability to make evidence-based clinical decisions?

8) How do you stay apprised of developments in your field / specialty?

9) What advice do you offer to incoming residents and/or incoming practitioners to help prepare them to be research literate professionals? What changes would you make (if any) for improvements in your residency program?

Appendix C

Interview Outline / Preparation (Individual Perspective)

Please reflect on the training you have received to help you develop your skills as a producer and/or consumer of research. More specifically, please be prepared to discuss the factors that contributed to your development of those research skills during your medical school and residency training.

NOTE: For purposes of this discussion, we will make reference to 'research literacy', which is defined as –

- the ability to access, interpret, and critically evaluate primary medical literature (Senders, et al., 2014).
- the cognitive and social understanding of the basic purpose, process, and value of research and research participation (Hines, 2016).

****

1) Briefly describe your experience as a physician who creates and/or review published studies or research and explain what role research plays in your practice.

2) What best describes your current relationship/role as it relates to research:
   b) I am a producer of research; b) I am a consumer of research; c) I am both; or, d) I am neither (Please explain.)

3) What has served as the greatest motivator or deterrent for you in terms of producing, accessing and/or reviewing available research?

4) What research training did you receive over the course of your development to become a physician? How much emphasis was placed on the research skills portion of the curriculum? (e.g., required or elective courses?) During residency, was it a matter of formal or informal training?

5) What (if anything) was most helpful regarding the research training program made available to you by your institution during your residency?

6) How confident are you in your ability to critically review a peer-reviewed research journal article? Please explain your answer.

7) What educational resources do you currently rely upon when making clinical decisions? What concerns (if any) do you have regarding those resources reflecting fair, balanced, reliable information?

8) How do you currently stay apprised of developments in your field / specialty?

9) In retrospect, what do you wish you had known earlier regarding skills required to produce or review research? What suggestions would you make (if any) for improvements in physician training programs?

10) What advice would you have for others following the physician development path to help ensure they are critical consumers of the research being produced and distributed?