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The I's have it: everything needed to practice medical librarianship starts with an I

Jean P. Shipman, AHIP, FMLA

See end of article for authors' affiliations.

The medical or health sciences library professional vocabulary uses many words that start with an *I*. On the eve of the 60th anniversary of the Janet Doe Lectureship, this lecture highlights and summarizes the 15 lectures (27%) that have included an *I* in their titles. The most frequent *I* word was information; this word appeared in four lectures. Only one lecture used more than one *I* word in the title. A new *I* word incorporated in this lecture but not its title is Intelligence, Artificial. +Italics were used to emphasize I words within the lecture or titles of published works.

Keywords: Janet Doe Lectures; information; professional vocabulary; research; health sciences libraries

INTRODUCTION

Most Janet Doe lecturers have started with some *indication* of the thrill they experienced upon receipt of the notification letter from the Medical Library Association (MLA) stating they were being honored with the Janet Doe Lectureship Award. I too am pleased to be selected to give this *important* lecture. Thank you!

I always joked if I got selected, my lecture would center on how many *I* words exist within our professional vocabulary and jargon. Being the 2025 lecturer gives me the chance to elaborate on this theme.

As this is the eve of the 60th anniversary of the Janet Doe Lectureship, I surmised a review of the Doe lectures featuring an *I* word in their titles would be warranted.

MARK FUNK

First though, to offer a historical overview of the use of *I* words within our published literature, I consulted Mark Funk's *Journal of the Medical Library Association* paper resulting from his 2012 Janet Doe Lecture entitled "Our words, our story: a textual analysis of articles" published in the *Bulletin of the Medical Library Association/Journal of the Medical Library Association* (*JMLA*) from 1961 to 2010 [1].

His "lecture explored changes in the medical library profession over the last fifty years, as revealed by *individual* word usage in a body of literature" – our association journal.

In Funk's research findings, he noted ''information was the second most used word in the corpus, second only to library." He also *indicated* "with the *information* world more complicated now, we are doing more teaching, training, and *instructing*." No surprise, but starting in 1993, the word *Internet* appeared in many journal articles.

JANET DOE LECTURES

Back to the lectures. To date, there have been 56 Janet Doe lectures given, starting in 1967. Of these 56 lectures, 15 have had at least one word starting with *I* in their titles or 27%.

Before I provide *insights* into the previous use of *I* words within Janet Doe Lectureship titles, here's a short quiz. Match the Janet Doe Lecturer with the corresponding *I* word from their lecture title. As I give my lecture, you can self-correct your quiz. Go.

a. Louise Darling	1. Idea
b. Betsy Humphreys	2. Implications
c. Julia Sollenberger	3. Inspiring
d. Ana Cleveland	4. International
e. J. Michael Homan	5. Information
f. Sherrilynne Fuller	6. Investing
g. Nina Matheson	7. Index Catalogue
h. Alison Bunting	8. Inside
i. Erika Love	9. Interaction
j. Ursula Poland	10. Intermediary

Now, I will elaborate on each of the 15 Janet Doe lectures containing a title word beginning with an *I*.

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The *I* word used most often in Janet Doe Lecture titles is, not surprisingly, *information*. This word appeared in lectures by Jana Bradley, Ana Cleveland, Susan Crawford and Michael Kronenfeld.

Susan Crawford

When did the *information revolution* or *information society* start? When did it surpass the agricultural, industrial, and service economies? These were the questions addressed by Susan Crawford in her 1983 Janet Doe lecture entitled "The origin and development of a concept: the Information Society" [2].

Crawford's research found the first to discuss the concept of an *information* society was an economist, Fritz Machlup, in 1962, in his book *The Production and Distribution of Knowledge in the United States* [3]. For over thirty years, he *investigated* the production of knowledge and *information* services – a category including libraries and *information* centers. One of his findings was the US "aggregate knowledge production made up 29% of the adjusted gross national product (GNP)…"

In 1969, Peter Drucker continued the discussion with his book *The Age of Discontinuity* [4]. Basing his thoughts on Machlup's, he projected that by 1970, this knowledge sector would comprise 50 percent of the GNP. Crawford claimed this is when the term *knowledge or information society* was coined. The terminology soon appeared in our professional literature.

Jana Bradley

Jana Bradley offered a different perspective on the word *information*. In her 1995 Janet Doe lecture entitled "The changing face of health information and health information work: a conceptual framework [5], Bradley looked at how our profession was evolving through the lens of outside forces, such as environmental and technological ones, as well as from the viewpoint of other health care professionals – those who could compete for our roles as *information* mutated from print to digital format. She supplied many definitions of *information* and highlighted the many different professionals within health care who handle or manage *information*. She termed a professional as someone with a defined expertise or *identity*. Our profession was changing due to global networked *information* enabled by the *Internet* – making dissemination of *information* easier but also permitting a new composite of *information* of linked multimedia sources and direct connections to other content. The *Internet* allowed *information* to be locally created and published *immediately*. It encouraged simultaneous knowledge generation and publication. Preservation of such *information* was another story, as versioning appeared as a concept and frequent updating possible. What constitutes a document? was a posed lecture question.

The second major change *impacting* our profession at the time *included* the many new approaches to delivering health care. *Institutions* started to place emphasis on assessing their outcomes, competing with others for patients, and implementing *institutional* managed care and practice guidelines, clinical *indicators* and pathways. Many hospitals and centers underwent reorganizations and closures.

Bradley's stance can best be summarized by herself:

> Environmental forces such as global networking and changes in health care delivery are changing the cultural facts of health information and the values, practices, and patterns associated with it. Expert information work is changing; new tasks are emerging, and established tasks are changing or diminishing. The temporary balance of roles among the established health professions is being disrupted, and jockeying for jurisdiction will intensify, complicated by overlap of vocabulary, technology, and even some basic tasks. Over time, a new balance of health information professions will emerge, with new tasks, new roles, and new relationships.

Bradley offered *ideas* for how we could assimilate to the changes affecting us to redefine our expertise parameters, as others within the health *information* arena did theirs. She encouraged us to collaborate with other disciplines, but to also maintain and promote our "heartland concepts" and roles to remain vibrant and needed.

Ana Cleveland

Not surprisingly, Ana Cleveland's 2010 lecture entitled "Miles to go before we sleep: education, technology, and the challenging paradigms in health information" [6] focused on the education of health *information* professionals. As a faculty member of the College of Information, University of North Texas, Cleveland *inspired* us to take action with our education. She felt:

> Education for health information professionals must be based on a solid foundation of the changing paradigms and trends in health care and health information as well as technological advances to produce a well-prepared information workforce to meet the demands of health-related environments.

Cleveland believed we could create a new health *information* professional through *intelligent* design and evolution of curricula, framed by an *interdisciplinary* or *interprofessional* group of *instructors* and *individuals*. This meant being trained by those *inside* and outside of our *immediate* field.

Robert Frost's poem "Stopping by Woods on a Snowy Evening" *influenced* Cleveland's lecture title and her thinking that the educational strategy or journey for how future health *information* professionals should be *instructed* could follow four roads.

The first road encouraged us to *identify* what it means to be a health *information* professional. What are our

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responsibilities, our professional boundaries, and our areas of expertise? The second road emphasized the *importance* of observing changes in our field, as well as those with whom we practice. The third road *insisted* our professional education be based on sound fundamental philosophies. The fourth road was the sharing of Cleveland's *instructional* philosophy. The domain connecting these four roads was *information*.

Michael Kronenfeld

The 2022 Janet Doe Lecturer, Michael Kronenfeld, challenged us as medical librarians to evolve to assist with the creation, storage, manipulation, and adoption of digital *information* ecosystems, as health *information* professionals. His lecture was titled "2022 Janet Doe Lecture, health science libraries in the emerging digital information era: charting the course" [7]. This transition from object curators to content creators and curators required expanded skills and roles. He credited the National Library of Medicine (NLM), the Network of the National Library of Medicine (NNLM), and MLA for their educational support to enable us to be part of research and clinical teams. These teams assist with describing and managing generated data and evidence for placement into *interoperable* learning storage repositories and tools that guide clinical decisions and data-driven discoveries.

Kronenfeld foresaw an evolution in the development and use of computable biomedical knowledge tools that *integrate* data to analyze and synthesize multiple types and sources of content. These tools guide treatments and personalized medical care. He challenged us to develop *interfaces* to these multiple resources to enable easy access and usability, along with others such as bioinformaticians. A list of perceived new required skills and roles is included in his resulting *JMLA* publication.

Alison Bunting

Alison Bunting provided an extensive overview of the changes in our profession as reflected in four editions of the *Handbook of Medical Library Practice* and the then forthcoming eight-volume set *Current Practice in Health Sciences Librarianship* in her 1993 Janet Doe lecture (see Table 1). The lecture title was "From *Index Catalogue* to Gopher space: changes in our profession as reflected in the *Handbook* and *CPHSL*" [8].

My personal reflection upon reading Bunting's lecture is – my, how times have changed. In the fifty years covered by her lecture (1943-1993), there was a recognized ability to standardize many medical library practices and to define key areas of responsibility. I venture to say, post the digital transformation of tools and content, librarians have tended to differentiate their practices to fit their local *institution's* strategic directions. The library started to become the center for campus activities and *initiatives*. In addition, many of the key roles outlined in Bunting's lecture have been largely assumed by library technicians or paraprofessionals. Roles remaining constant – but assuming a greater *intensity* over time – include *instruction* and service.

Table 1

Sources Covered in Bunting's 1993 Janet Doe Lecture

1943 – 1st edition	*Handbook of Medical Library Practice*
1956 – 2nd edition	*Handbook of Medical Library Practice*
1970 – 3rd edition	*Handbook of Medical Library Practice*
1982 - 1988 4th ed.	*Handbook of Medical Library Practice*
1996 - 2000	*Current Practice in Health Sciences Librarianship, 8 vols.*

But what happened as far as practice transformations in the 50 years *investigated* by Bunting? I'll recap.

The overarching change over the years of the *Handbook* was the acceptance of the medical librarian as being the one to administer the library versus physicians. As the size of libraries grew, library directors became more *involved* with administrating libraries, and then they became more outwardly focused – with the technical work being completed by other hired librarians.

Collection selection progressed from the review of published bibliographies by professional organizations and large library acquisition lists to vendor support and approval plans. Over time, books became less important and journals more so. Cataloging changed. Instead of selecting subject headings from entries in the *Index Catalogue*, Medical Subject Headings (MeSH) and the NLM classification system offered authoritative vocabularies.

The amount of *Handbook* content dedicated to library administration *increased* over time. Personnel management *issues* first appeared in the fourth edition, including topics such as recruiting, *interviewing*, hiring, and assessing employee performance.

NLM was not given its own chapter until the third edition of the *Handbook*. The fourth edition included even more coverage of the Regional Medical Library (RML) network and *interlibrary* cooperation.

Reference services and *instruction* were covered in every edition. Focus shifted from print reference resources to the development of policies and discussions of *interview* styles, to how access to *information* was facilitated by

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electronic databases and how to conduct mediated searches.

The last areas of comparison in Bunting's lecture dealt with emerging technologies, *including* their *impact* on the sharing of journal articles through *interlibrary loan* and document delivery, and the tools used to deliver content, such as fax machines and photocopiers. Resource sharing tools, such as DOCLINE and the OCLC *interlibrary loan* system, appeared in the fourth edition of the *Handbook*.

Scott Adams

Ok, how many of you have done a PubMed search? How many of you have ever thought about MEDLARS's (MEDLINE) origin? I honestly have to say my energies were focused on how to effectively search this database of bibliographic citations and abstracts, and I never really thought about who or what occurred to *implement* this ubiquitous system.

To learn about the history of the creation of MEDLARS, I recommend reading Scott Adams's Janet Doe lecture given in 1972 "The way of the innovator: notes toward a prehistory of MEDLARS" [9] – over 50 plus years ago.

Several take aways for me from Adam's lecture include: 1) this was a great example of *industry*, government, and association collaboration, 2) it *involved* dedicated *individuals interested* in *indexing* and description to design the database *infrastructure*, 3) MEDLARS took over 15 years to conceive prior to its contractual development with *industry*, and 4) the *influence* Janet Doe and other MLA luminaries had with its *innovation*.

Janet Doe, you say? Yes, she served on three formative committees and Adams credits her for "the concept of publishing multiple specialized indexes from a common data base, which came to fruition in the MEDLARS recurring bibliographies..."

A partnership with the academy and government was achieved through a contract with the Army Research and Development Board and the Johns Hopkins University. This 1948 contract created the Welch Medical Indexing Project with this charge (see Table 2).

After receiving development funding of $500,000 from the National Heart *Institute*, NLM solicited proposals in early 1961 from *industry*, based on the final technical specifications. General Electric Corporation won the MEDLARS development contract, and MEDLARS was released three years later, in 1964, costing a total of $3 million.

Having worked directly with *innovators* at the University of Utah, I understand how difficult collaborations between different types of agencies can be and how long a product can take from *ideation* to *implementation*. MEDLARS proved to be no different. *Innovations* of this magnitude take years, but we can see how *influential* the MEDLARS development pioneers were to our profession. Their visions and efforts have survived the test of time and continue to serve health care well.

Table 2

1948 Welch Medical Indexing Project Charge

1. To explore the volume of medical literature
2. To determine the coverage of this literature by existing bibliographic resources
3. To note the commonalities and differences of subject descriptors among these existing resources, and
4. To determine if *indexing* could be automated

J. Michael Homan

It's a pleasure to *inform* you that J. Michael Homan wins the prize (pun intended) for using two or three *I* words (depending on how you want to "look" at it) with his 2009 Janet Doe lecture titled "Eyes on the prize: reflections on the impact of the evolving digital ecology on the librarian as expert intermediary and knowledge coach, 1969-2009" [10]

Homan believed medical librarians could efficiently and effectively contribute to the success of *individuals,* and *impact* their *institutions,* with their *intermediary* expert literature retrieval skills and ability to synthesis the literature. These roles resulted in time savings for other *institutional* health care experts, as they could apply supplied *information* to their decision making. The role also ensured a place at the table for librarians within committees and teams conducting research, patient care, and *instruction*. Homan provided evidence for his stance from his forty-year career.

Homan directly observed the *informationist* role – called an embedded analyst – at the Upjohn pharmaceutical company before the *informationist* word was coined by Davidoff and Florence in 2000 [11]. The request for a librarian to be a part of a drug development team was *initiated* by a library user.

Little did Homan know that the *informationist* concept would be a key topic of his MLA presidency. He appointed a task force to plan an NLM sponsored conference to explore the topic in 2002. I recall reading the MLA Board meeting preparatory documents to discover that I was going to be the chair of this task force. I walked the streets of Richmond, Virginia, in a daze thinking how in the world was I going to accomplish this task. With the help of many, the conference was a success.

Homan was one of the first MEDLINE trainers when he was employed by the University of California at Los

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Angeles (UCLA). The UCLA Biomedical Library served contractually as one of several MEDLARS search centers across the country and world. Users could submit their questions to a search center and a batch literature search would be conducted by NLM within a three-week time period. A printout of results would be mailed to the search center to be given to the requesting user. Training of staff for a search center took three weeks at NLM. Louise Darling, director of the UCLA Biomedical Library, felt that a training center should be established on the West coast to enable more librarians to obtain the necessary training. Funding for such a training center at UCLA was achieved through an RML contract.

We were worth our *institutional investment* in Homan's eyes, and he encouraged us to keep our eyes on this value as the digital ecology around us changed. He stated "Our experienced knowledge coaches are the marriage of librarian expertise and high-tech and soft touch personalized service. It will always be a winning combination."

Betsy Humphreys

In Betsy Humphreys' 2001 Janet Doe Lecture, she included the word *interactions* in her lecture title "Adjusting to progress: interactions between the National Library of Medicine and health sciences librarians, 1961-2001" [12].

This lecture reviewed two major changes to NLM's mission over a forty-year period affecting the relationship and *interactions* between NLM and health sciences librarians over a forty-year period. These two major changes included the *implementation* of the National Network of Libraries of Medicine (now the Network of the National Library of Medicine) and direct service outreach by NLM to *individual* health care providers.

The resulting JMLA publication abstract from Humphreys' lecture includes four *I* words – *implementation, individual*, *intermittent,* and *irritation*. The last *I* word, *irritation*, was the result often felt by librarians when NLM offered new, changed, or deleted services. Luckily, the *intermittent* word reflected that relationship woes between NLM and librarians were often short-lived and *issue*-specific. In fact, many past Janet Doe lecturers included sections within their talks about the relationship between MLA and NLM and about NLM's positive *influence* on our profession.

As I traveled across the country and globe when I was with the different RMLs, Elsevier, and also as MLA president, I learned of the jealousy existing among academic librarians for our deep connection to, *interaction* with, and dependency on the NLM. No such entity exists for academic librarians. NLM has enabled us to conduct our responsibilities with relevant technologies and has employed *individuals* who envision and create tools and knowledge to support our collective professional needs.

Erika Love

One of the many benefits of giving the Janet Doe lecture is taking the opportunity all of us have, but many of us don't accept, to read past Doe lectures. Of those I have read, there is one *individual* whom I regret never having met. I feel a bond to this *individual*, as I agreed with so many of her visionary comments. The difference is I agreed with many of her visions after they became reality. To have been able to perceive the future the way this librarian did is mind boggling to me. This person is Erika Love, past library director, Medical Center Library, University of New Mexico. Love's 1987 lecture was entitled "The science of medical librarianship: investing in the future" [13].

Most of Love's 1987 lecture focused on what medical librarianship and libraries should be in the 21st century. She wondered could we as a profession survive? Her fear was not based on libraries becoming extinct, even though she shared thoughts of others who felt so. No, her fear was we would not do enough *investing* in research to maintain a unique professional knowledge base, as others vied for the *information* arena.

She acknowledged several transitions *impacting* our future. First, the change in the type of work librarians performed – it became more managerial and *instructional* than clerical. The transfer of clerical duties to technical staff she felt warranted a review of our *identify* as librarians. She encouraged us to offer our technical staff more skill development opportunities and recognition. She also felt the name for technical staff should be standardized and research on training costs for them should be performed.

Second, there was a lot of discussion about who would be the *information* managers of the future – librarians or commercial employees. Love perceived a role for both, but felt librarians would be more *impartial*, as they would not be profit-driven. Librarians would be concerned about the quality of *information* and its preservation over time – ensuring the voices of many diverse *individuals* would be recorded. She was worried about deemphasizing the ownership of materials and expressed concern over who controlled the gateway to access to *information* in an electronic world.

Third, Love's vision of the library of the future was one that would collect fewer physical materials but exerted some control over access to digital *information*. Libraries would serve as a *social institution* where people gather to share *ideas*.

As the director of the health sciences library at the University of Utah, I often was asked "What is today's library?" especially since we had discarded most of our print collection to create space for a medical gaming lab and a center for *innovation*. My response was – We are in the business of collecting people; our physical space serves as a study space, a meeting center, and an i*deation* and

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prototyping space. Our *informationa*l content, once contained in physical books and journals, is mostly digital – permitting accessibility from office, home, or lab. Librarians are liberated and can engage with you within your context. We still provide *information* through what we license and make discoverable; but in freeing ourselves from a print collection, we are able to offer more *instruction*, outreach, and create digital educational and repository resources. In other words, we assist with knowledge creation as a peer.

I could go on about Love's lecture, but I will stop and suggest you *invest* time to read it. I will share a few favorite words I found within the lecture: *information* empires (libraries), *intellectual* leadership, geographical *immobility* (library handicap), technological *imperative*, and *intellectual* dependence (if we don't do research).

Sherrilynne Fuller

"Enabling, empowering, inspiring: research and mentorship through the years" [14] was the 1999 Janet Doe lecture given by Sherrilynne Fuller. I recall enjoying this lecture at the 99th annual meeting of MLA, but I also really enjoyed reading it as I prepared for this lecture.

I was employed by Fuller at the time at the University of Washington Health Sciences Library and Information Center in Seattle, Washington. I found Fuller's energy, passion, and *intelligence invigorating* and *indeed inspiring*. Through the efforts of Fuller, I learned how to license content as free-form *information* – not packaged within containers, such as journals or books. She was mining data before it was cool! I also witnessed her desire and ability to collaborate with others throughout the *institution*, not only with other librarians. She *illustrated* how *information* could permeate a campus and be accessed and applied outside library walls.

Via her lecture, Fuller challenged us to be researchers and practitioners; research was not just for "ivory tower academics." She shared how this concept was not really a new one, but one still needing to grab some traction and *implementation*. In fact, she believed our ability to *isolate* an *issue* of *interest* and conduct a scientific and *impartial investigation* of the *issue* was paramount to our profession's survival. We needed to demonstrate our value through conducting research and mentoring others to do the same. In her viewpoint, research and mentoring should be *interwoven* and equally *important*. Collaborative research by *individuals* within and across *institutions* was enthusiastically supported – team science as we term it today.

Nina Matheson

The 1994 Janet Doe Lecturer was Nina Matheson, who talked about "The idea of the library in the twenty-first century" [15]. Matheson shared her two main professional career *ideas*. "One idea is that librarians and libraries must be agents of change." She referenced her famous *IAIMS* model – the *Integrated* Advanced *Information* Management Systems – published in 1982 [16]. "The other idea is that the fundamental idea of the library must change, that our business should be the ownership and management of first-hand knowledge rather than the mere storage and dissemination of second-hand knowledge."

Unlike Fuller, Matheson was not convinced we should conduct research on operational library matters. While this was useful in an "*industrial* capitalism" world, it would not be viable in a "knowledge capitalism" era. "Knowledge in the next era is a capital resource. The talent and ability to apply knowledge to create knowledge and to organize it for useful purposes will be fundamental to the survival and growth of organizations as well as individuals."

Matheson looked to new *information* technologies such as Mosiac, the World Wide Web, and the *Internet* as game changers, as they offered the capabilities of linking different forms of *information* from around the globe to produce knowledge. She championed librarians to work collectively to not replicate digital libraries at the *institutional* level, but to think of what we could create to be shared. An example she offered was the Genome Data Base (GDB) – the effort to map the human genome. This human map could be federated with other living species genetic maps to formulate an *Encyclopedia of Life*. This to her would be a 21st century library – a viable, ever-changing database or knowledge base of first-hand *information* – a knowledge server. This is the library she envisioned for the future.

I worked with Matheson and could see the visionary she was up close and personal. She foresaw a different skill set for librarians, as she believed we could help to create and manage knowledge. The *IAIMS* model placed the library as central to campus – not physically, but philosophically. She encouraged health care professionals to consider *information* and knowledge as central to their work and advancement.

Ursula Poland

Many of you have heard of the Cunningham Memorial International Fellowship, but do you know of its origin? In her 1982 Janet Doe lecture "Reflections on the Medical Library Association's international activities" [17], Ursula Poland provided a historic overview of MLA's *involvement* with *international* libraries and cooperative programming. This topic was deemed appropriate as Janet Doe served as the first chair of MLA's Committee on International and National Cooperation formed in 1948. Doe was appointed by the MLA president, Eileen Roach Cunningham. Cunningham worked on MLA's behalf on *international* efforts with UNESCO and with a key *initiative* to train medical librarians from other countries. Through her estate, Cunningham left funding for such a program in

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1971, commonly known as the Cunningham Fellowship. Funds were provided to an *international* librarian selected by the International Cooperation Committee to travel to the US to spend time with a library and its staff to learn about medical librarianship, often with the requirement of the fellow presenting about one's experience at the annual MLA meeting. This program continues today.

The MLA committee dealing with *international issues* underwent several name changes from its beginning (see Table 3).

Table 3

Progression of International MLA Groups

1948 - 1950	Committee on International and National Cooperation
1950 - 1976	Committee on International Cooperation
1976 - 2019	International Cooperation Committee
2019 -	International Cooperation Caucus

A summary of activities of the existing International Cooperative Committee concluded Poland's lecture. This summary was accompanied by her plea to MLA to continue to be *involved* globally. She encouraged *individual* members to join other national library associations to learn of their *issues* and events and suggested medical librarians consider personnel exchange programs among countries.

Martha Jane K. Zachert

An *inquiry* into our professional values was conducted for the 1978 Janet Doe lecture given by Mary Jane K. Zachert. Her lecture title was "Books and other endangered species: an inquiry into the values of medical librarianship" [18].

To *identify* our shared values, Zachert reviewed 28 plus volumes of two of our field's journals and past Janet Doe lectures (see Table 4). She admitted however to letting her knowledge of the field, her *insights* from attending conferences and *interacting* with medical librarians, and her reviews of MLA actions as *impacting* her conclusions as well.

I'll summarize her findings; however, I do recommend a read of her lecture to glean all of the nuances. The most predominant value she discovered was "professionalism." Others included "cooperation, a sense of community with health sciences practitioners, and knowledge orientation."

Table 4

Sources Reviewed for Zachert Janet Doe Lecture

Medical Library and Historical Journal, 1903-1907
Bulletin of the Medical Library Association, every 4th year between 1911 and 1977
Janet Doe lectures

Cooperation occurred more among ourselves and not so much as partnerships or collaborations with others within our *institutions*. In early MLA years, many doctors were members and leaders of MLA. Later, health care providers became more our audience – or those to whom we offered resources and services. *Knowledge orientation* dealt with the *idea* we curated the health sciences' knowledge base by describing it, acquiring it, organizing it, storing it, and delivering it. In addition to providing a "keeping" function, she suggested we create knowledge by applying the scientific method to conduct our own research.

The profession started to explore certification as a means of creating some organization about what we do. Certification was one attempt to *identify* qualified professional librarians. At the time, MLA offered a certification examination, a precursor to the Academy of Health Information Professionals. Certification also encouraged education post the formal degree – aka continuing education.

Zachert ended her lecture by posing many questions and encouraging us to *inquire* about the answers. Many dealt with our self-*image* as a profession – what is our expertise and how do we differ from other librarians, if we differ? Do we need more rigorous scientific research performed about our values so we can indeed confirm them, commit to them, prioritize them, and deal with changing them over time, as warranted?

Louise Darling

Most of us have heard of AHIP or the Academy of Health Information Professionals (AHIP) which was *instituted* in 1988. But how many of us know the history of MLA's certification programs over the years and its *implications*? I was *intrigued* by the history given via Louise Darling's 1979 Janet Doe lecture entitled "The view behind and ahead: implications of certification" [19].

This lecture was given during MLA's 75th anniversary, 25 years into the MLA Certification program. It was dedicated to Janet Doe, as she was a major proponent for MLA to have some formal qualification recognition program. In fact, the Code for the Training and Certification of Medical Librarians was adopted during her presidency, at the 1949 annual MLA conference. This was the first professional association attempt at

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establishing criteria and competencies for medical librarians.

A walk down memory lane of how medical libraries came to be was fascinating and covered why there had not been a training or certification code to date. It also explained why such a code *initiated* controversy and concern among our profession.

MLA started its certification program with a three-tiered system governed by the Committee on Standards for Medical Librarianship in 1949. There was not wide consensus about the value of the program, and there was a lack of member *interest* to provide feedback about what should be *included* in such a program. Darling provided several reasons for this. She felt certification needed to be given due attention, as the number of health care facilities and medical libraries *increased*, along with the volume of health *information* published. She recommended a "fairly simple new code that will require a minimum amount of interpretation" be considered.

Julia Sollenberger

In 2017, Julia Sollenberger encouraged us to look *inside* ourselves with her Janet Doe lecture entitled "Looking inside ourselves: a culture of kindness [20]. *Inspired* by programs offered at the University of Rochester Medical Center, where she directed the library, Sollenberger reminded us if we take care of ourselves, we are much more likely to *improve* our *interpersonal* skills and to express kindness to others in our *interactions*.

Sollenberger reflected on a personal mindfulness training course, which made her more aware of her surroundings, others in the program, and of her own actions and thoughts. Many companies and large health care centers offer programs like the one she attended to encourage their employees and health care providers to communicate and listen *intently* to patients and clients with whom they *interact.* A key part of looking *inside* oneself *included* examining one's emotional and social *intelligence*.

I found numerous other words within Sollenberger's lecture starting with an *I* including: *integrity, isolated, illness, incident, impression, inadequacy, initiatives, invitation, intrigued, information, instructions, interpretations, innovative, insight, intensity*, and buttermilk *iced* cookies. Now you have to be *intrigued* by that last item!

QUIZ ANSWERS

It's time to assess your learning. Here are the answers to the earlier quiz. Did anyone get them all correct?

a. Louise Darling	1. Implications
b. Betsy Humphreys	2. Interactions
c. Julia Sollenberger	3. Inside
d. Ana Cleveland	4. Information
e. J. Michael Homan	5. Intermediary
f. Sherrilynne Fuller	6. Inspiring
g. Nina Matheson	7. Idea
h. Alison Bunting	8. *Index Catalogue*
i. Erika Love	9. Investing
j. Ursula Poland	10. International

Let's pause for a slight *intermission* as I transition from the historical part of my lecture to the philosophical portion. Take a minute to reflect upon the *I* words impacting you the most personally, and for the profession.

What *I* words do you think will comprise our future? What *image* do I wish to portray? What differences can *I* make as a medical or health sciences librarian? What is in our collective crystal ball?

As I peer into the future, I see *innovation, ideation,* and *imagination* still being major needs and characteristics of our profession. We will continue to adjust to changes in technology, curricula, research methodologies, and clinical care. I also see *intelligence* as being key, especially *artificial intelligence or AI.* AI will create a revolution in how *information* is created, managed, analyzed, and applied. In addition, basic *information* will remain vitally *important*, as well as the *intelligence* we gather from data *ingestion* and preservation.

For fun, I put Love's lecture into ChatGPT to see how an AI program's summary would compare with mine (abridged version):

This article highlights the evolving role of medical librarianship and the necessity for librarians to adapt in an increasingly digital and research-driven world.

Key Themes:

1. Libraries Will Endure, But Must Adapt
2. Ownership vs. Access – A Critical Battle
3. Librarianship as a Research Discipline
4. Professional Development & Training
5. Quality Assurance in Information Services [21].

Not bad!

Continuing to demonstrate our *impact* will ensure our vitality and our professional *identity* among those with whom we partner and our employers. We need to never lose sight of the *implications* of assessing our i*nstitutional* worth. We will *invest* time to *inventory* and develop

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identified skills, maintain our *integrity* and tenacity, and *immerse* ourselves within our *institutions* to provide quality health *information*. We will *interface* or *interact* with many *individuals* at their level of understanding and offer guidance in selecting accurate *information*. We will fight *illiteracy*, especially health *illiteracy*, and coach patients to comprehend their health care to make collective decisions with their providers.

I have emphasized the letter *I* throughout my lecture. I'd like to transition the many *I*s I see in this room (and virtually) to *we*. *We* collectively offer an *invaluable* service to others and to our *institutions*. *We* have transformed to adapt to the emerging trends of the day, new technologies, and new ways of developing and delivering our professional skills. I believe we can and will continue to transform and adapt, as we continue our professional journey.

Bunting summarized in her review of 30 years of past Janet Doe Lectures. "Overall, the opportunities, challenges, and changes described are welcome, presented in a positive light, and illustrate the adaptability of the profession" [22].

Quoting Matheson from her 1994 lecture when she referenced other Janet Doe lecturers, "All have written about what they hold nearest and dearest to their professional hearts, seeking to inform, to provide insight, to inspire, and even to entertain" [23]. I hope I have entertained you today.

We are the future, but only if we take care of *I* or *U* along the way. As Sollenberger recommended in her lecture – "compassion, kindness, thoughtfulness, caring and joy – these belong in our workplaces just as much, if not more, than searching skills, or strategic planning, or big-picture visions" [24].

My *instructions* for you are to be kind to each other, be kind to yourself, and be kind to mankind. An *interesting* and bright future awaits you. Embrace what is to come, maintain your *integrity*, your *initiative*, your *imagination* and your *intrigue*, and throw in some *innovative* fun along your *iterative* journey.

Thank you!

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AUTHORS' AFFILIATIONS

Jean P. Shipman, MSLS, AHIP, FMLA, retired, formerly Vice President, Global Library Relations, Elsevier; and Executive Director, Knowledge Management and Spencer S. Eccles Health Sciences Library, University of Utah, UT

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SPECIAL PAPER

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Revisiting we are MLA: an exploration of member engagement and commitment with the Medical Library Association's caucuses

Rachel Whitney, AHIP; Kimberly R. Powell, AHIP; Michelle Keba Knecht, AHIP; Rachel Lane Walden

See end of article for authors' affiliations.

In 2019 the Medical Library Association (MLA) transitioned to a community structure composed of caucuses. Four years after the transition, the 2023-2024 MLA Rising Stars cohort was asked to investigate how the caucuses were currently functioning and any challenges to their sustainability. This Special Paper will describe the study conducted by the Rising Stars cohort, and its research findings. Preliminary recommendations include greater standardization of annual reporting, additional guidance and discussion forums for caucus leadership, and an increase in events focused on professional development, networking, and information sharing such as those held during Experience MLA.

Keywords: Medical Library Association; Health Science Librarians; Community Engagement; Organizational Commitment; Professional organizations; organizational change; library association management

See end of article for supplemental content.

INTRODUCTION

The Medical Library Association (MLA) offers an annual leadership development program called the Rising Stars [1]. Consisting of a cohort of four MLA members, participants attend monthly meetings on a variety of leadership topics and are paired with a mentor. Each year the cohort is tasked with completing a group project which relates to current MLA initiatives. The 2023-2024 Rising Stars cohort was asked to investigate the MLA caucuses including challenges to sustainability and current functions. The overall goal of the project was to create a list of recommendations for leadership recruitment and member engagement with MLA caucuses.

Transition to Caucuses

To provide context for the current MLA caucus structure, prior to 2019, MLA had a two-tiered community structure composed of sections and special interest groups (SIGs). Members had to pay to join sections, and each section managed its own budget. Sections had a required leadership and reporting structure and participated in MLA's Community Council. SIGs were free to join, had minimal leadership, and were not required to report their activities to MLA, nor invited to participate in Community Council. MLA's Community Council served as the governing body for section leadership to advise the MLA Board of Directors and facilitate collaboration between groups. Following the transition, MLA Community Council continues as a representative body and offers a forum for collaboration among caucus leaders. The transition to caucuses was implemented in 2019 to increase member engagement, create more inclusive community structures, and reduce administrative overhead [2,3]. Prior to the transition, the 2019 MLA annual report listed twenty-six SIGs and twenty-one active sections. Based on the 2020 annual report, thirty-seven of those groups made the transition to become a caucus. As of the 2023 report, there were forty-two active caucuses, with eight having formed since the 2020 annual report. Following the transition to caucuses, two groups later elected to merge into other caucuses and one newly created caucus also disbanded within the four-year time frame.

Research Objective

The primary objective of this study was to determine ways to increase caucus engagement and sustainability by answering the question: "What factors influence member engagement and commitment to an MLA caucus?"

LITERATURE REVIEW

Four studies have examined membership engagement within MLA [3-6]. Two of these [3, 4] were previous Rising Star projects looking at aspects of MLA community

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engagement, though one predated the 2019 transition to the current caucus group structure [3]. The study conducted by the 2016-2017 cohort investigated ways to make sections and SIGs more effective and meaningful to MLA members [3]. The We are MLA study conducted by the 2019-2020 cohort sought to ascertain transition perceptions and change management feedback as groups moved to the current caucus structure by interviewing MLA members who held leadership roles in MLA committees, sections, or SIGs during the transition [4]. Both the 2016-2017 and 2019-2020 cohorts noted specific member concerns around organizational communication, change leadership, and time and financial burdens to member engagement. Specific barriers called out a lack of guidance, data tracking, or clear objectives when participating in community leadership. Similarly, a lack of member awareness of community activities and efforts as well as difficulty navigating the website were reported in both studies [3, 4].

The other two studies [5,6] did not examine section or caucus engagement directly, but their surveys provide important benchmarking data for membership demographics. Reporting on voter engagement survey data from 2017, Shedlock and McQuillen found that 76% of respondent members belonged to MLA Sections from a total number of 676 survey participants [5]. Reporting on the results of the 2019 survey from the Diversity and Inclusion Task Force, Pionke found that 69% of the 918 respondents either agreed or strongly agreed that they had found an MLA community or group in which to belong, though only 59% reported a sense of belonging within the larger organization [6].

Outside of MLA, two additional studies investigated membership engagement within library professional organizations [7, 8]. Publishing in 2014, Henczel noted the decline of membership in national library associations, citing in part increased member costs, growing demands of professional roles, perceived value, and irrelevancies [7]. Fifty-two semi-structured interviews were conducted across four national library societies: Australian Library and Information Association (ALIA), Library and Information Association of New Zealand (LIANZA), American Library Association (ALA), and Chartered Institute of Library and Information Professionals (CILIP) in the United Kingdom. Themes from participants highlighted the perceived benefits of professional membership in national library organizations as skills development, advocacy and professional standards, and providing a sense of belonging and professional community. However, respondents expressed concerns around the organizations' disconnect with recruiting and engagement with library schools and training programs, as well as with staying relevant with greater and evolving workplace demands.

Echoing concerns regarding membership decline among librarian professional organizations and a questioning of the value of these organizations, Garrison and Cramer surveyed 140 self-identified U.S. business librarians in 2019 for the defining characteristics of successful library organizations [8]. Respondents reported 'continued relevancy' and 'great programming' as their top criteria, with on-going training opportunities, good leadership, and reasonable membership fees as additional considerations. When asked to reflect on their disappointment with library professional groups, respondents selected poor communication from the organization to its members as the top reason.

Library organizations are not alone in reflecting on membership and engagement. Within the broader body of literature on volunteer engagement and organizational commitment, research has shown that member commitment is driven primarily by volunteer satisfaction and needs fulfillment. For example, one study of 245 volunteers across 5 organizations highlighted that volunteer satisfaction was a key variable for members' commitment and intention to remain in an organization [9]. Elements used to define volunteer satisfaction included alignment with personal values, professional training and career growth opportunities, and the perceived clarity, utility, and efficiency of task objectives. Another study of over 13,000 members from 18 professional organizations, found positive correlations between the perceived value of the organization and tangible organizational support with increased volunteerism and donation activities, most notably among junior members [10].

Together these findings helped build a framework for understanding the important aspects of MLA caucuses and methods for measuring participants' perceptions of value and belonging. Previous MLA membership surveys provided important baselines for participant demographics and engagement structures as well as persistent barriers to members' sense of commitment and satisfaction within the organization [5,6], but did not investigate how those factors have changed in the years following the transition to caucuses. The 2023-2024 Rising Star Cohort thus adapted the assigned leadership development topic into a specific investigation of "What factors influence member engagement and commitment to an MLA Caucus?"

METHODS

Following the completion of the literature search, the authors identified two key sources of data to inform their findings. First, they identified baselines of participation and perceived barriers to caucus engagement by surveying the MLA membership. Second, they reviewed the engagement opportunities offered by MLA caucuses through an analysis of the caucuses' annual reporting.

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Survey

The authors conducted an anonymous survey of all MLA members during November and December of 2023. When the survey was distributed, there were 2,497 MLA members. Members received the survey via email, and the authors also shared a survey link on the MedLib-L listserv. Because the survey focused on internal organizational practices and perceptions aimed at quality improvement within the Medical Library Association, it was ruled exempt by the Institutional Review Board at Florida Atlantic University (IRB2309125) and deemed quality improvement and therefore not subject to review by the other authors' institutions.

The twenty-question survey was hosted in RedCap and asked how and why members engaged with caucuses, their commitment as measured through perceived sense of belonging, barriers to getting involved with MLA caucuses, and basic demographic information. Using information gleaned from the literature review, the authors drafted survey questions, had them reviewed by the 2023 -2024 Rising Stars Program Directors and Mentors as well as MLA staff, and piloted the survey with MLA members. With permission, the authors replicated many of the demographic questions from the survey created by Pionke to validate the cross-section of member responses to our own survey [6]. Due to the limited timeframe of the Rising Stars program, open-ended questions were not included in the survey. The entire survey instrument can be found in Appendix A.

Thematic Analysis

The authors conducted a thematic content analysis of annual caucus reports from June 2019 - May 2023. The goal of the thematic content analysis was to determine the types of activities being reported by each caucus. The June 2019 - May 2020 reporting year marked the first annual report following the transition to caucuses and the June 2022 - May 2023 was the most recent annual report available at the time of this study. Every caucus submitted an annual report each year, though some missed the reporting deadline and were only available as supplemental documents.

Through the thematic content analysis, the authors produced a list of activity types that could be used to categorize and track the events and activities documented by each caucus in their annual report. The activity type categories were then used to create a caucus activities matrix in Excel with a row for each caucus and a column for each activity type. After pilot testing the matrix with the most recent reporting year, the authors narrowed the activity type categories to a total of ten, covering the full range of reported efforts included in the annual reports. A full list of these categories can be found in Appendix B.

Each report was read and documented on the matrix by two independent reviewers, with any disagreements settled by consensus of all four authors. Consensus was vital to this process because while there are specific sections required in the annual reports, there didn't seem to be consistency or guidelines about what needed to be included in each section and with what level of detail. Within the matrix, the authors only noted the type of caucus activities reported by each group rather than the frequency of the designated activity. For example, though a caucus may have reported two standing committees and one working group this would all have been noted once in the matrix under the single activity type "Working Groups, Task Force and/or Committees." Similarly, each reported activity was noted under only one activity type. For example, if a caucus hosted a discussion event that focused on networking this was noted once in the matrix under the "Networking Opportunities" activity type and was not noted simultaneously under the "Webinars and/or Discussions" activity type.

RESULTS

Caucuses Overview

A total of 44 caucuses completed annual activity reports from 2019-2023. Three caucuses disbanded or merged during this time period, and 4 caucuses were created. By member size, caucuses ranged from 59 members to 800, with a median membership of 227, as of October 2023. Groups that were created since 2019 had a median membership of 252 as of October 2023, while those that have disbanded or merged had a median membership of 127 at their final counts. Appendix C provides a full overview of each caucus and member size.

Demographics from Survey

The survey was completed by 317 people, for an estimated 13% response rate. Not all respondents answered every question. Nearly all respondents (97%, n=305/315) reported that they currently live, work, or study in the United States. When asked about their work setting, 62% (n=196/317) of respondents reported working in an academic environment, including institutions offering 2-year, 4-year, graduate, or postgraduate programs. This was followed by 24% (n=75/317) of respondents working in a hospital or healthcare system. When asked to indicate their racial or ethnic identity, most respondents (74%, n=228/310) identified as White or Caucasian. Other racial or ethnic groups represented include respondents who identified as Black or African American (6%, n=18/310), Multiracial (5%, n=16/310), Hispanic/Latinx (5%, n=14/310), and Asian or Asian American (3%, n=9/310). Most respondents were over the age of 40 (73%, n=230/315), followed by ages 30-39 (19%, n=61/315). When asked if they considered themselves solo librarians, 14% (n=42/303) indicated that they currently work as solo librarians, while an additional 18% (n=54/303) reported that they are not currently solo librarians but had

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previously worked as one. The complete demographic responses can be seen in Appendix D.

MLA Membership Information from Survey

Most respondents (98%, n=308/313) indicated that they were current members of the Medical Library Association (MLA) at the time of survey completion. Regarding the duration of their MLA membership, the largest group (21%, n=67/315) had been members for 5–9 years, followed by 18% (n=56/315) with 10–14 years of membership. Both those who had been members for 15–19 years and those with 25 or more years of membership each account for 15% (n=46/315).

When asked if their employer pays for their annual MLA membership, 39% (n=124/317) indicated that their employer does not pay for their membership. Conversely, 32% (n=100/317) reported that their employer fully covers the membership fee outside of any professional development funds, and 17% (n=55/317) noted that their employer pays the full membership fee if they choose to allocate professional development funds for it.

Leadership Information from Survey

In terms of leadership roles in MLA, 33% (n=105/314) indicated that they currently hold a leadership position in an MLA group or community, such as a caucus, committee, or jury. An additional 18% (n=57/314) reported that they previously held a leadership position between 2019 and 2023. However, many respondents (48%, n=152/314) indicated that they had not held any leadership position during this period.

Regarding respondents' current or past leadership roles, of the 162 respondents who currently or previously held a leadership position since 2019, the majority served in caucuses (62%, n=100), followed by juries (31%, n=51), and standing committees (29%, n=47). Other significant leadership areas included domain hubs (14%, n=23), task forces (10%, n=16), and editorial boards (6%, n=9). Smaller numbers held positions in the Chapter Council (4%, n=7) and Community Council (2%, n=4). A few participated in the Rising Stars Program (1%, n=2), while less than 1% served as MLA Fellows (n=1), in the Research Training Institute (n=1), or as Parliamentarians (n=1). Lastly, 6% had been members of the MLA Board of Directors (n=10).

Engagement and Sense of Belonging in Caucuses from Survey

While there are currently over forty caucuses for members to join, 33% (n=104/315) of respondents reported they were members in 3-5 caucuses, followed by 21% (n=65/315) in 1-2 caucuses, 18% (n=56/315) in 9-19 caucuses, and 15% (n=47/315) in 6-8 caucuses. 10% (n=31/315) of respondents were not a member in any caucus and 4% (n=12/315) were members in over 20 caucuses. Figure 1 displays how often respondents reported engaging with a MLA caucus ranging from daily to annually, regardless of the number of caucuses joined.

Figure 1 Frequency of engagement.

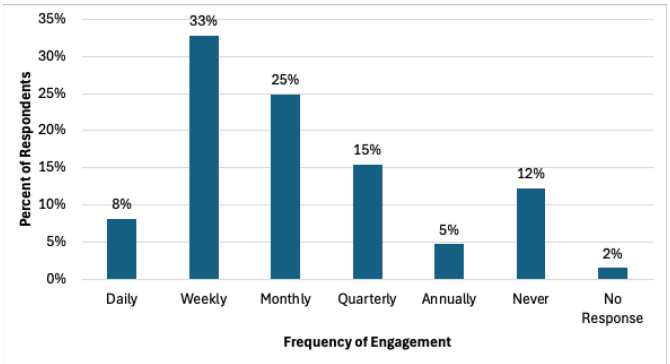

Table 1 displays the relationship between the number of caucuses respondents joined and the frequency of their engagement with those caucuses. Those in 3-5 caucuses and those in over 20 caucuses were most likely to engage weekly. However, respondents in 6-8 caucuses and 9-19 caucuses were about as likely to engage weekly as they were to engage monthly, and respondents in 1-2 caucuses were slightly more likely to engage monthly, closely followed by weekly and then quarterly.

Table 1

Number of caucuses joined and frequency of engagement.

	Daily	Weekly	Monthly	Quarterly	Annually	Never
None	0	0	0	5	2	23
1-2	4	15	18	14	6	6
3-5	9	43	25	18	4	5
6-8	5	18	17	3	2	2
9-19	7	20	17	8	1	1
20+	1	8	2	1	0	0

For the 284 respondents who engaged with at least one caucus, the most common way to engage was by reading emails or posts from the listserv (73%, n=206). The second most common way was to attend caucus meetings (55%, n=156), followed by posting or replying to the listserv (51%, n=145), and attending annual or mid-year caucus business meetings (50%, n=142). Outside of participating through the listserv or a variety of caucus meetings, many members (40%, n=113) engaged through attending caucus sponsored events. In addition to the ways members engaged with a caucus, the top 5 reasons for engagement with caucuses are displayed in Figure 2.

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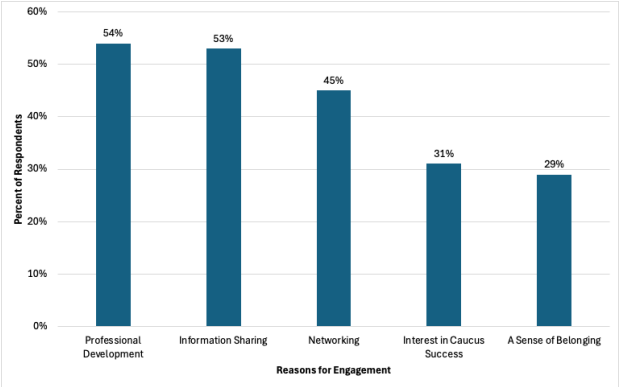
Figure 2 Top five reasons for engagement.



Respondents who identified as active members of a caucus were also asked if they felt a sense of belonging to that group. Feelings of belonging varied by caucus, ranging from 0% to 100% of active members. Of the 284 survey respondents who indicated they were an active member of at least one caucus, 77% (n=218) felt a sense of belonging to one or more of their caucuses. Appendix C provides a full overview of involvement and sense of belonging for all caucuses as well as member size, and annual reported activities.

When asked what barriers were experienced to limit the ability to engage in a caucus, the top response was lack of time (80%, n=251/314), which included respondents who felt they were receiving too many emails. Limited benefits and support was also a common barrier (28%, n=87/314), followed by website/caucus pages being too hard to navigate or out of date (20%, n=64/314). Limited benefits and support included respondents who did not see the benefits of joining caucuses, did not have employer support to be involved, and who felt a lack of in-person opportunities were a barrier.

Lack of time was the most common barrier to engaging in an MLA caucus regardless of the frequency of engagement (Table 2). The second most common barrier varied with frequency of engagement, but included limited benefits and support, difficulties navigating the website, lack of clarity on leadership expectations and opportunities, and lack of belonging.

Despite these barriers, the majority (63%, n=195/312) of respondents planned to remain an active caucus member, with 46% (n=142/312) planning to recommend caucuses to colleagues. Additionally, many respondents planned to volunteer for other communities within MLA (43%, n=133/312) and encourage others to participate in caucus activities (42%, n=132/312), while 22% (n=70/312) planned to volunteer for a caucus leadership position within the next 2-3 years. A full list of engagement activities, reasons for engagement, top barriers to engagement and future plans for engagement can be found in Appendix E.

Table 2

Frequency of engagement and barriers experienced.

	Daily	Weekly	Monthly	Quarterly	Annually	Never
No Barriers Experienced	4	12	8	3	1	2
Cost of MLA Membership	1	10	12	3	1	3
Difficulty Navigating Webpages	6	19	19	14	2	4
Too Many Caucuses	4	21	13	9	2	3
Lack of Time	24	93	69	37	11	17
Lack of Belonging	6	17	14	4	3	6
Limited Benefits and Support	6	20	18	15	10	18
Leadership Expectations and Opportunities	2	17	20	10	3	4
Lack of Awareness	2	10	12	9	4	7

Table 3

Number of caucuses joined and sense of belonging in MLA.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
None	1	5	16	7	2
1-2	2	9	20	27	7
3-5	2	11	21	58	12
6-8	0	3	13	23	8
9-19	2	0	11	29	14
20+	3	1	3	3	2

Sense of Belonging to the MLA Organization from Survey

When asked to respond to the statement 'I feel a sense of belonging in MLA', 61% (n=192/316) of overall respondents either agreed or strongly agreed that they feel a sense of belonging. In contrast, 12% (n=39/316) disagreed or strongly disagreed. A large portion (27%, n=85/316) responded that they were neutral on this statement. Similarly, of the 42 solo librarians who

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Table 4

Caucus involvement and belonging highlights.

Caucus Name	Reported Sense of Belonging*	Count of Annually Reported Activity Types**	Member Size***
Vision Science	100%	5	59
New Members	88%	3	800
Public Services	83%	4	215
Hospital Library	82%	5.5	594
Animal and Veterinary Information Specialist	80%	6	124

* Reported as percent of reported active
** Reported as median number of activity types offered per year
*** Member size retrieved on October 4, 2023

responded to the survey, 60% (n=25) agreed that they felt a sense of belonging in MLA, 12% (n=5) disagreed, and 29% (n=12) were neutral.

Table 3 illustrates the number of caucuses a respondent joined with breakouts by their reported sense of belonging in the MLA organization as a whole. Of the 104 respondents who were in 3-5 caucuses, 70 strongly agreed or agreed that they felt a sense of belonging, followed by 43 of the 56 respondents who were in 9-19 caucuses.

Reported Activities from Thematic Analysis

While ten activity types were identified through the thematic analysis, caucuses reported a median number of three activity types each year, with a range from zero to eight. The most commonly reported activity type was member engagement in subgroup work such as working groups, task forces, or committee efforts, with a median of twenty-nine caucuses each year. Tied for the next most common activities type, with a median of twenty-four caucuses each year, was hosting an Experience MLA event or business meetings each year. A median of twenty caucuses reported hosting a webinar or discussion event each year, while sixteen reported hosting a collaborative event or sponsored content at the MLA annual meeting. With the lowest reporting rate, a median of only three caucuses each year reportedly sought out in-person opportunities. The full list of activity types reported in caucus annual reports can be found in Appendix B.

Table 4 reports the top 5 caucuses organized by the reported sense of belonging. In each of these caucuses, at least 80% of respondents who reported that they were an active member of the caucus felt a sense of belonging to the caucus. The median number of activity types reported by the caucus and the total number of members for each caucus are also reported in Table 4 highlighting the top 5 caucuses' according to reported sense of belonging.

Appendix C provides a full overview of involvement and belonging for all caucuses as well as member size, annually reported activities, and survey results.

DISCUSSION

The results of this survey provide insight into the factors impacting member engagement and commitment to MLA Caucuses. In terms of member engagement with MLA Caucuses, the top reasons for engagement aligned with the reported reasons people join professional library organizations in general, namely professional development, information sharing, and networking [7, 8]. The majority of engagement activity occurred through caucus listservs followed by attendance at caucus meetings and sponsored events. Although a combined 58% of respondents engaged with caucuses either weekly or monthly, 2% of members who were in at least one caucus never engaged with them. These findings underscore the importance of utilizing caucus listservs to communicate targeted and relevant information, and for caucuses to schedule meetings and events, such as webinars, discussions, networking sessions, business meetings, or content sessions during annual meetings.

In alignment with previous findings [3,4], lack of time was the biggest barrier for all respondents This is not surprising, as previous studies [11,12] have shown that academic librarians experience role overload and increasing demands on their time as they are asked to do more with less. Tenure track librarians in particular experience additional stress related to expectations for research and service [13].

The second most common barrier was limited benefits and support, which included respondents who did not see the benefits of joining caucuses, did not have employer support to be involved, and who felt a lack of in-person opportunities. Limited benefits and support may also

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impact members who feel that the cost of MLA membership is too high, especially for members who do not have employer support to be involved.

Rounding out the top three barriers was the perceived difficulty of website and caucus page navigation, and the concern that content was out of date, which echoes results and recommendations from previous MLA findings [3,4]. This barrier is very closely related to lack of awareness of how to join or engage with caucuses, and the lack of understanding of leadership expectations and opportunities. While some of these barriers can be improved through guidance from caucus leadership, the organization website and caucus page navigation will require coordination with MLA organizational leadership. It is important to note that this survey was conducted six months prior to the launch of the new MLA site redesign in summer 2024. There also remains a need for increased awareness about the different caucuses, including how to join them and how to get involved, as increasing awareness may also increase the perceived benefit of caucuses.

Despite these barriers, the overall future plans for engagement in the survey were positive. This is important because past research has shown that engagement significantly explains commitment to an organization [9]. Most respondents planned to remain active with MLA caucuses in some form, and many of the survey respondents planned to recommend caucuses to colleagues, volunteer for other communities within MLA, and encourage participation in caucus activities. However, only 22% of respondents planned to volunteer for a caucus leadership position in the next 2-3 years. This may indicate the impact that barriers such as lack of time, unclear leadership expectations and opportunities, and limited benefits and support could be having on engagement.

Although the majority of survey respondents stated that they have either currently, or previously, held a leadership role, nearly half of all respondents indicated that they had not held any leadership positions since the transition to caucuses. This finding may be due to the high percentage of new members (23%) who responded but may also indicate the difficulty that these members have in identifying leadership expectations and opportunities. Given the large number of caucuses and the relatively low percentage of respondents who planned to volunteer for a caucus leadership position in the future, leadership development of current MLA members may be needed to keep caucuses sustainable.

While 40+ caucuses may seem like a large number of caucuses for members to join, each caucus serves a different function and meets the needs of different user groups. The number of available caucuses may actually increase member engagement and belonging if the variety provides more options for members to find a caucus of interest. This is supported by the 69% of respondents who felt a sense of belonging to one or more of their caucuses. Also of interest, the size of the caucus, or overall number of caucus members, did not seem to correspond with sense of belonging. This was demonstrated in both Table 4 highlights and the full data available in Appendix C.

It's important to note that the thematic review of annual reports showed that several caucuses have disbanded since 2019 due to waning interest or merger with another caucus with similar populations and functions. These included all caucuses that were reporting only one activity type per year. These mergers demonstrate a healthy fluctuation of member interests and consolidation of efforts allowing for increased engagement, activities, and membership.

A major limitation identified during the thematic analysis portion of this study was the difficulty of tracking what more than forty caucuses were doing. There seemed to be little to no standardization, guidelines, or support in annual reporting for caucus leadership and current chairs may have only had access to previously submitted reports for their own caucus as guidance. This led to a wide variation in what was reported and no information was reported regarding the rationale for why certain activities were selected over others For example, the authors expected to find that all caucuses were hosting at least one business meeting open to participation from all members, as this is required by MLA, but it was very difficult to uncover if and when those meetings took place and what they looked like. Though the ability to hold a wide variety of activities is a strength of the caucus structure and there is no one size fits all template, caucuses could benefit from additional guidance and a more structured reporting template so that members can have a better understanding of what each caucus is currently doing.

Another limitation of this study was the survey response rate and restriction of the data analysis to descriptive statistics. The low response rate compared to the total membership means the results might not fully represent the entire group. Our survey was distributed in late November and early December 2023 and collected 317 responses, for an estimated 13% response rate. This is lower than previously reported MLA engagement surveys which reported a 25% response rate from a January - February 2017 member survey [5] and a 34% response rate from October 2019 [6]. Due to the limited time frame of the project, the authors were unable to conduct inferential testing on this data which may limit the generalizability of results. Additionally, because the survey was comprised primarily of Likert style questions rather than free text responses, this study does not include a qualitative component exploring the rationale and affective feelings behind participants' responses.

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PRELIMINARY RECOMMENDATIONS

The goal of this study was to answer the question "What factors influence member engagement and commitment to an MLA caucus?" Based on these findings, the authors propose six preliminary recommendations to enhance leadership recruitment and member engagement with MLA caucuses. Recommendation one is drawn directly from the survey results. Recommendations two through six are drawn from the author's experience of analyzing the survey, conducting the thematic analysis of the annual reports, and visiting Community Council. The authors hope that these recommendations will be read and considered by the general membership of MLA as well as by MLA leaders and staff.

Recommendation One: Focus Caucus Activities Around the Top Reasons for Engagement

Caucus leadership should focus caucus activities around the top reasons that members engage with caucuses, such as professional development, information sharing, and networking. While annual reports show that many caucuses are already engaging in these activities, caucus leaders should consider surveying their membership about which specific types of professional development, information sharing, and networking activities may be of interest.

Recommendation Two: Create Caucus Specific Guidance Documents for Incoming Leaders

Caucus chairs should create caucus specific leadership guidelines to address the reported barrier of lack of clarity on leadership expectations and opportunities. These could include the responsibilities of past-chair, chair, and chair elect; deadlines for required documentation such as reports and nomination slates; how to request an MLA sponsored Zoom link; popular activity types with general descriptions, dates held, and historical participation numbers as well as brief charters, goals, and/or deliverables from standing subgroups and working groups.

Recommendation Three: Create Separate Leadership Introduction Meeting and Guidance Document for MLA Caucus Leaders

To address a lack of clarity surrounding leadership expectations it would be beneficial to have a guidance document outlining the reporting requirements and deadlines for MLA caucuses that is easily accessible for all MLA members. A template or suggested guidelines could be produced or maintained by the MLA Community Council to which all caucuses formally report. Additionally, a leadership introduction meeting for caucuses should be held separately from the leadership introduction meeting for committees and juries. MLA caucuses serve a different function than committees and juries, and caucus leaders would benefit from a leadership introduction tailored to the unique needs of caucuses such as how to host events and engage members.

Recommendation Four: Standardized Annual Reporting

Preliminary recommendations following this project are to standardize the caucus annual report form and make the final reports more transparent and easier to find. A task force could be appointed by the MLA Community Council to revise the current annual reporting form to include guidance about the types of information that should be included in each section. The task force could also investigate ways to make the information from the annual reports more transparent. Currently, the annual reports are only available as a single PDF document. It could be beneficial to create an interactive dashboard highlighting information from each caucus. Following the MLA website redesign, it is important for MLA staff and leadership to continue to address the difficulties experienced when navigating the website and caucus pages.

Recommendation Five: Use Community Council as a Discussion Forum

As the representative body of Caucus leaders, Community Council can provide a forum for caucus leaders to discuss what has been working for caucus engagement, rather than as a recap of what can be found in annual/mid-year reports. Alternatively, Community Council can meet once a quarter instead of biannually, allowing for two meetings for reviewing reports and two meetings for active discussion and action items. This would allow more time for caucus leaders to share ideas and strategize specific activities and efforts aimed to increase member engagement with both individual caucuses and through caucus collaboration.

Recommendation Six: Reinstate Experience MLA

Experience MLA was a popular program held from 2021 - 2023 that provided an opportunity for increased caucus engagement and networking, including no-cost activities and free MLA trial memberships. Over half of all caucuses emphasized their participation in Experience MLA, and annual reports from 2021 - 2023 showed that hosting an Experience MLA event was tied with business meetings for the second most common activity type. Though Experience MLA was initially focused on recruiting new members to MLA, it also allowed current MLA members to learn more about the different caucuses without being required to join the caucus. Experience MLA was not held in 2024 or 2025 which meant that there were less opportunities for general MLA members to engage with a variety of caucuses. The opportunity to participate in a variety of caucus events during this time may have provided additional value to existing members and may

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have increased engagement and retention of current caucus members.

CONCLUSION

Increasing member engagement and commitment to MLA caucuses, as well as reducing barriers for new and existing members, will require a joint effort from caucus leaders, MLA Community Council, and MLA staff. Individual caucus leaders can focus on creating caucus specific guidance documents and hosting activities around the top reasons for engagement. MLA Community Council will need to work with MLA staff to oversee systemic changes such as standardizing the annual reporting form, creating a guidance document for caucus leaders, reinstating Experience MLA, and addressing issues with navigating the MLA website and caucus pages. To foster sustainable engagement and commitment within MLA caucuses, members must find value in their participation, highlighting the importance of embracing that together, we are MLA.

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AUTHOR CONTRIBUTIONS

Rachel Whitney: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing- Original Draft, Writing- Review & Editing. Kimberly Powell: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing- Original Draft, Writing- Review & Editing. Michelle Keba Knecht: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing- Original Draft, Writing- Review & Editing. Rachel Lane Walden: Conceptualization, Methodology, Validation, Formal analysis, Investigation, Data Curation, Writing- Original Draft, Writing- Review & Editing.

DATA AVAILABILITY STATEMENT

Data associated with this article are available in the Open Science Framework at https://osf.io/7umfd/.

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SUPPLEMENTAL FILES

Appendix A: Survey Instrument
Appendix B: Reported Activities by Caucuses
Appendix C: Demographic Responses
Appendix D: Caucus Engagement

AUTHORS' AFFILIATIONS

Rachel Whitney, MLIS, AHIP, whitnera@musc.edu, https://orcid.org/0000-0002-9648-055X, Research and Education Informationist, MUSC Libraries, Medical University of South Carolina, SC

Kimberly R. Powell, MLIS, AHIP, krp0069@auburn.edu, https://orcid.org/0000-0002-3822-526X, Health and Life Sciences Librarian, Auburn University Libraries, Auburn University, Auburn, AL

Michelle Keba Knecht, MSIS, MSL, AHIP, kebam@health.fau.edu, https://orcid.org/0000-0003-1582-4339, Senior Medical Librarian and Head of the Medical and Health Sciences Collection and User Services Department, Charles E. Schmidt College of Medicine, Florida Atlantic University, Boca Raton, FL

Rachel Lane Walden, MLIS, rachel.l.walden@vanderbilt.edu, https://orcid.org/0000-0002-5998-2083, Assistant Director for Research and Education Services, Annette and Irwin Eskind Family Biomedical Library and Learning Center, Vanderbilt University, Nashville, TN

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Navigating unique challenges: librarian perceptions in supporting physician associate (assistant) programs

Megan Jaskowiak; Michelle Nielsen Ott, AHIP; Karina Kletscher, AHIP

See end of article for authors' affiliations.

Objectives: This study examines the experiences of librarians who support physician assistant/associate (PA) programs, describing the unique challenges of these programs and outlining strategies that librarians adopt to engage these programs.

Method: This mixed-methods study includes two phases: (1) a quantitative survey developed and distributed to library personnel in institutions with established or developing PA programs in the US and Canada, and (2) semi-structured interviews with fifteen selected survey respondents, focusing on their experiences and perceptions related to PA education support. The qualitative data were analyzed using thematic analysis.

Results: Seventy-five survey responses were collected. Key findings from the survey include: most respondents were from universities with health sciences programs, with nursing and physical therapy being the most common additional programs. Most library-led instruction occurred during the didactic phase and focused on search skills and evidence-based practice. PubMed and UpToDate were the most library-promoted resources. Two thematic elements discovered through the semi-structured interviews were "relationship building as paramount" and "impact of the learning curve on librarian workload."

Conclusion: Librarians who support PA educational programs face challenges related to relationship building, financial resources, workload, and steep learning curves. The findings underscore the need for targeted professional development programs to equip librarians with the necessary knowledge and skills.

Keywords: Physician assistant (associate) education; health sciences librarianship; resource management; library instruction; librarian workload

See end of article for supplemental content.

INTRODUCTION

Physician assistant or associate (PA) programs have rapidly expanded in response to the growing demand for advanced care providers in the United States [1]. According to the Bureau of Labor Statistics, this profession will grow 28% between 2023 and 2033 [2]. The growth of PA programs has outpaced many other healthcare professions, highlighting the need for comprehensive educational support systems for these clinicians [1,3]. In 2024 alone, 20 new PA programs were under development, adding to the 217 accredited programs already graduating thousands of healthcare professionals annually [4]. The emerging needs of these PA programs have created challenges for their parent institutions, including academic and health sciences libraries.

PA students may seem simultaneously similar and different from their other health professions counterparts. Like these peers, PA students complete a rigorous post-baccalaureate two-phase program consisting of didactic coursework followed by clinical rotations [5]. This education is on a compressed timeline, with some PAs earning their degree in as little as 12 months, notably shorter compared to the traditional four-year medical degree. Similar to doctors, PAs are educated as generalists in the medical model, with the exception of a second year of more specialized clinical rotations [5]. PAs may practice upon graduating and certification without additional training, such as fellowships or residencies. PAs may be seen as more akin to nurse practitioners (NPs) in terms of clinical settings and roles, but NPs are educated in the nursing model and must also complete advanced

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education and clinical training beyond their initial registered nurse (RN) education [6,7]. Outside of a bachelor's degree and prerequisites, PAs may come from any former career path or academic discipline. Additionally, as generalists, PAs do not earn certification in a particular population of focus as their NP colleagues, though PAs may certainly go on to gain additional education and practice in a clinical specialty [8,9].

In 2018, 222 libraries were identified as supporting PA programs [10]. Despite the increasing number of programs, there is a significant gap in the literature regarding the role of librarians in PA education. Since the PA curriculum spans multiple specialties and topic areas, librarians rely on each other because core authoritative resources and faculty information-sharing are inconsistent or wholly unavailable. [11]. Thanks to the work of library peers, the PA librarian can now refer to resources on PAs and evidence-based medicine (EBM) as well as full bibliographies to support collection development, resource management, and general reference [10–16]. Resource evaluations report that larger institutions, particularly those with existing medical programs, provided more materials and subscriptions applicable to their PA programs, indicating that a librarian building a collection from the ground up requires adaptability in negotiating costs and balancing freely available resources with subscriptions, if not a significant budget [10,12–16].

While the Medical Library Association (MLA) provides a framework of core competencies for health sciences librarianship, these guidelines cannot fully account for the distinct pedagogical, clinical, and accreditation contexts that shape PA education [17]. As a result, librarians serving PA programs often lack a clear avenue to explore how their professional skills translate into this specialized environment. Foreman and Baldwin captured librarians' experiences and perceptions of liaising to the relatively new profession in 1976 [18]. As both the PA and library professions have significantly evolved over the last 50 years, revisiting the role of PA librarians is essential to highlight the unique challenges and contributions of this role, foster a more informed and supportive professional community, and guide the development of targeted resources and training. In an effort to address this gap, this study explored librarians' perceptions of their own work and experiences with PA programs.

METHODOLOGY

This research project included two phases. In the first phase, a 10-question survey was developed in Qualtrics (Appendix A). The survey design was informed by the researchers' knowledge of PA programs and previous research on librarians working with health sciences programs. The survey was designed to collect baseline information about libraries and librarians supporting PA programs and to recruit participants for the semi-structured interviews in the second phase of the project. The survey was reviewed by librarians who were not part of the study before deployment. In March 2023, upon IRB approval from the Miami University Human Subjects Committee (Protocol ID# 04470e), an email invitation to participate in the survey was sent to the MLA mailing list and directly to 277 librarians listed on library websites at institutions with PA programs. The survey required respondents to be at least 18 years old and employed as a librarian or information specialist at an institution with either an established PA program or in the process of implementing a PA program in the United States or Canada. Descriptive statistical analysis was performed on the survey responses using Excel. The survey's final question asked the respondents about their willingness to participate in an interview.

The second phase consisted of semi-structured interviews. The 36 survey respondents who indicated willingness to be interviewed were categorized based on their institution type and the length of time since program accreditation. The interviewees were selected randomly from within these designations (Appendix B) to ensure representation in the two categories and institutions across the United States and Canada. Three of the initially selected interviewees did not respond to the interview request; three different interviewees were chosen from the original pool. The researchers were each assigned five people to interview based on their respective time zones for a total of 15 interviews, corresponding to standards of saturation [19]. Using a set of semi-structured interview questions devised by the research team, 15 semi-structured interviews were conducted between July and December 2023 (Appendix C).

The semi-structured interviews were conducted and recorded over Zoom. Interviewees had the option to have their cameras on or off. The Zoom-generated transcripts from these sessions were reviewed and edited by the interviewing researcher to ensure accuracy. Once all transcripts were edited and finalized, each researcher was randomly assigned five transcripts to begin the thematic analysis technique described by Braun and Clarke [20]. Taguette, an open-source qualitative research tool, was used for this analysis. As a web-server-based tool, Taguette provided a collaboration space for coding among the researchers [21]. To start the analysis, each researcher created concept keywords by reading the transcripts and noting common sentiments expressed by the interviewees. Then the researchers met and discussed the keywords and combined the concepts to create a set of data-derived codes with agreed-upon definitions. These codes were applied to the previously randomly assigned transcripts using Taguette. The researchers then identified patterns and developed, revised, and defined themes.

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RESULTS

Quantitative Survey Results

A total of 87 quantitative survey responses were collected, with 75 surveys containing at least one response to one of the questions. Twelve respondents opened the survey but answered no questions, while one respondent skipped multiple questions. Assuming one response per institution, this represents approximately 25% of institutions with accredited PA programs (219 fully accredited and 81 provisionally accredited). Although the survey sampling was self-selected, the respondents represented similar percentages in the categories of length of time since accreditation as the ACR-PA data at the time of survey data collection.

Most respondents were employed at a college or university with a dedicated health sciences/medical school or one with graduate programs. The rest of the respondents were from very diverse types of institutions, including hospitals, a liberal arts college, graduate health science schools, a community college, and an osteopathic school.

All respondents reported that their institutions supported additional health sciences programs either at the undergraduate or graduate level (Table 1). The most common other health science program supported was nursing, including undergraduate or graduate programs at 79%, followed by occupational/physical therapy programs with 75%. Overall, respondents indicated that other allied health programs were more common to have at their institution than having a medical school at their institution.

Table 1

Other Health Sciences/Medical Programs at the institutions (both absolute total respondents and percentages). The percentage totals will not equal 100% due to the nature of a multiple-response question. N=75

Other Health Sciences/Medical Programs	Totals (%)
Nursing	56 (79%)
PT/OT	53 (75%)
Public Health	45 (63%)
Biology/Biomedical Sciences	42 (59%)
Exercise Physiology/Athletics/Kinesiology	41 (57%)
Medicine	40 (56%)
Pharmacy	30 (42%)
Dentistry	21 (30%)
Osteopathy	12 (17%)

As for library-led instruction, respondents reported that these sessions most frequently occurred during the didactic phase of the PA program. The didactic phase of a PA program varies by institution and program. Sixty-five percent of the respondents indicated instruction occurring only in didactic classes, 18% indicated library-led instruction in both didactic and clinical rotations, and another 16% indicated either no instruction or not associated with a particular class (Table 2). For the institutions with library-led instruction, teaching general search skills and developing search strategies were the most frequent topics (83%). Respondents who indicated that they taught in didactic and clinical rotation classes were more likely to cover EBM topics in the instruction sessions.

Table 2

Library instruction responses were divided and categorized by location and type of instruction. Type of instruction totals will not equal 100% due to the nature of a multiple-response question. A single respondent indicated that they only did instruction in the clinical setting. This information has been incorporated into the percentage calculations but is not shown in the table. N=74

Types of classes	General search skills	Clinical health sciences tools	Developing search strategies	Evidence-based practice
Didactic: 48 (65%)	41 (85%)	35 (73%)	41 (85%)	29 (60%)
Both: 13 (18%)	12 (92%)	12 (92%)	13 (100%)	12 (92%)
Not specifically associated with a class: 12 (16%)	10 (83%)	10 (83)	8 (67%)	7 (58%)
Total:	63 (85%)	57 (77%)	62 (84%)	48 (65%)

When asked which library products/library resources are promoted to the PA programs, PubMed (94%) was the most common overall, as well as the most common article database. CINAHL was promoted by only 59.4% of the respondents. Seventy-two percent of the respondents indicated that they promoted AccessMedicine. As for clinical care tools, more indicated they had UptoDate (65%) compared to either Dynamed (27%) or Clinical Key (34%). Nine respondents indicated that they had Dynamed but neither UpToDate nor Clinical Key. Three institutions had both Dynamed and Clinical Key, and one institution had all three clinical care tools. VisualDx, Lexicomp, and StatRef were the least promoted products.

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Sixty-eight percent of the respondents indicated that the PA program at their institution includes a research component, while the rest responded that they were unsure or that there was no research component. Those who gave affirmative answers were prompted to provide open-ended answers about the research component and the library's participation (if any) with the students for the research component. Thirteen reported that students were required to complete a capstone project involving research or a review (such as literature, narrative, or 'mini' systematic review). Seven reported that librarians had minimal involvement in the research project, while 13 provided specific instruction sessions during the second year when students were actively conducting their research. Additionally, six respondents indicated that they offered consultations or workshops. Finally, nine respondents mentioned that they either led the course or were embedded in the course, where students conducted their research.

Qualitative Semi-Structured Interview Results

The thematic analysis of 15 semi-structured interviews revealed two main themes, each with two subthemes (Table 3 and Table 4). The first main theme, "relationship building as paramount," is supported by the subthemes "proximity has value" and "external perception of librarian/library affects the role of the librarian/library." The second main theme is "impact of the learning curve on librarian workload" accompanied by the subthemes, "PA programs/students as unique" and "financial barriers while trying to meet resource needs of PA programs." These overarching themes emerged across each of the interviews conducted, regardless of whether the participant: worked at a nascent or a well-established PA program; had limited or lengthy professional experience; or had a limited or robust collections' budget.

Table 3

Subthemes and exemplar quotes for Theme 1, "Relationship building is paramount." "Relationship building is paramount" describes how librarians that establish a working relationship with the PA programs experience more success broadly.

Subtheme	Exemplar Quotes
Proximity Has Value: building relationships with the PA programs feels easier when the library is co-located with PA students and faculty.	Proximity to students "[The library] is where the PA students live pretty much their entire students live pretty much their entire didactic year." Proximity to faculty "…we just have so much interaction with them because we're constantly going up and down that elevator and I'm just catching, I'm just I'm you know every chance I get I'm gonna share with them."
External Perception of Librarian/Library Affects the Role of the Librarian/Library: a PA program's prior held perceptions or beliefs affects a librarian's success at building relationships	Not valued or undervalued "The faculty would, quite honestly, to my face, tell me that they don't really use library resources… and they say the students have to find scholarly, peer-reviewed articles related to medicine [but] don't know [how] they find them." "They may already have a sort of perception about what the library does and then maybe that's so because of that and maybe the only reason they reach out to me is for what they expect the library does." Valued "My faculty colleagues gained a confidence and trust in my abilities. They've been really fantastic to collaborate with." "...any help that you can do with them in the accreditation process…I find that really builds a lot of goodwill. So. I think, I don't know, I just, it's a lot of work, but I think it's very rewarding"

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Table 4

Subthemes and exemplar quotes for Theme 2, "Impact of the learning curve effects on librarian workload." This theme describes how PA programs are distinct from other health sciences programs and how developing an understanding of their unique needs takes time and educational resources.

Subtheme	Exemplar Quotes
PA Programs and Students are Unique: PA students come from different bachelor's degree programs than other health sciences fields. Their compact schedule means they are often occupied during a librarian's traditional working hours.	Distinct among health sciences "And I don't think they liked being sort of lumped in with nurses, they didn't like being called 'Doctors-lite,' and it was more stuff that was started specifically for them…" "Because in PA they kind of cover everything. But they also have a unique identity and occupy this weird space." Scheduling conflicts "So the vast majority of times, I was helping students via email because they wouldn't be able to talk to me until 8 pm." Diverse students' backgrounds "It is really focused on the medicine and it's interesting so I would say like a lot of the PA students, their background is very different and they all come from very different backgrounds. And I've seen more and more people coming from nursing and from OT or PT backgrounds."
Financial Barriers for Meeting the Resource Needs of PA Programs: providing library resources to support PA programs often requires working within financial constraints.	No financial barriers "I feel like we because we have the medical program and really a lot of the resources that they use, the med students do too. So, in terms of [things] like funding and that sort of thing, that's fine." Funding issues "So like UpToDate, clinical consult tools, UpToDate, AccessMedicine, anatomical guides, these sort of things…they are owning and managing their own subscriptions or products for those" "…our new health sciences programs, they're not budgeted the same way as the rest of the university… They're coming out of special investment strategic funds…[they] have their own library budget, so the library does not pay for their resources unless we already had the resources." "We have cut things that are needed because our budgets can't absorb the inflation costs" "...Dynamed, which is less expensive…so we switched to that"

Theme 1.0 Relationship Building as Paramount

Building relationships between a library and a PA program can be fraught due to librarians and teaching faculty having different responsibilities and priorities. Librarians are often brokering acquisition and access as well as navigating requests from library users and administrators, or what one participant called "the business side of being a librarian." Interviewees described upholding relationships with PA faculty and students built in the classroom while maintaining library resources and services as a tricky balancing act of "trying to keep both sides happy." Another participant recounted an experience with a PA program director who was "wanting these things, and I'm like, at the time, I was told no because we didn't have the money…it got all sorts of uncomfortableness…we're just going to have to see what happens."

Interviewees' relationships with their PA programs varied. Several interviewees reported that they were able to slip easily into positive collaborations inherited from previous liaisons. In contrast, due to the rapid growth of PA programs, new and untested relationships often arose between the library and the emerging program when attempting to sort through accreditation requirements. Some interviewees established positive, professional relationships with their PA programs through accreditation (both provisional and continued statuses) and instruction.

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Interviewees indicated that leading library instructional programs was central to their relationship with the PA program. Library instruction opportunities varied in both delivery modes and course content, from multi-hour orientations to 60-minute one-shots to integrated scaffolded sessions. One participant shared their experience as a co-faculty in a PA research methods course, but they warned, "It's probably hard to talk your way into it [instruction]" without research-centric coursework or with faculty who are "skeptical about what I [the librarian] could do for them."

Interviewees discussed the pivotal figure of a library champion who refers colleagues and students, invites the librarian into classroom instruction, and collaborates in collection and resource development. They indicated the value and variety of library champions, including individual faculty, the program director, staff (e.g., the clinical coordinator or administrative assistant), and students. Interviewees expressed that library champions with word-of-mouth advertising catalyzed multiple collaboration opportunities. One participant shared how this phenomenon has become their general approach to relationship-building: "I almost feel like it's that snowball effect, like you get one or two people who are excited about how you supported them. They'll talk to their colleagues about how a librarian supported them in the classroom."

Another common experience, interviewees shared is the continued hope and perseverance to expand and increase relationships and opportunities with their PA programs. "I'm hopeful you know it's kind of a long game." As a different participant notes, "developing those relationships takes time and effort," a luxury not all librarians have. Still, participants shared that the investment pays off.

Subtheme 1.1 Proximity Has Value

Interviewees reported that the locations of the library and the PA program affected relationship building and student use of the library. Interviewees observed PA students' steady usage of physical library spaces when the library was conveniently located to the program (i.e., classes or residential housing). They also shared that physical library space – "outside of their normal classroom" – is valuable for PA students for quiet study or facilitating group work, particularly during evening hours when students are done with didactic or clinical work. As one stated, "[the library] is where the PA students…live pretty much their entire didactic year."

Interviewees working at libraries located further from the core class activity reported distance as a barrier. They observed how geographic hurdles, such as programs based in disparate locations or students who don't live in student housing, do not use the library's physical space; as one participant describes students in the PA program as "not that they're isolated, but they're in their own space." Another states, "[it] would be nice to change if they were physically closer, and so it was more convenient for me to be there and for them to be in the library." Similarly, interviewees felt that physical proximity to PA faculty and staff created more opportunities for personal connection and serendipitous liaising. For example, "...we just have so much interaction…going up and down that elevator…every chance I get I'm gonna share with them." Consistent facetime with program constituents can mitigate obstacles, concerns, and gaps, such as "what's working, what's not working, what changes might need to be made," as one participant listed, and is most helpful to understanding library resources.

Subtheme 1.2 External Perception of Librarian/Library Affects the Role of the Librarian/Library

The interviewees' perceptions of how the faculty/staff in their PA programs perceived their role in the program varied greatly. At one end of the spectrum were those who felt they were not valued at all, as one said, "the biggest detriment is the administration. They don't value the library or don't understand the value of the library…as a whole, there might be few people that do, but they don't have a loud enough voice." Another stated, "the faculty would, quite honestly to my face, tell me that they don't really use library resources and they say the students have to find scholarly, peer-reviewed articles related to medicine [but] don't know [how] they find them." Conversely, some felt like they were perceived as colleagues who could play a pivotal role in the program with one interviewee stating, "The library is seen as a key player…[and] I'm very well received over at the PA program." Interviewees noted issues regarding preconceived notions about library/librarian roles. One reported, "they may already have a sort of perception about what the library does…because of that, and maybe the only reason they reach out to me, is for what they expect the library does."

Theme 2.0: Impact of the Learning Curve on Librarian Workload

Interviewees discussed the added work and cognitive load associated with liaising with PA programs. As more PA programs are added to institutions across the United States and Canada, the work of providing library services and resources is added to the portfolio of health science librarians. Multiple interviewees reported fewer librarian positions at their institution but more programs and students to support. One interviewee expressed, "I find it's more demanding than the other health sciences programs…maybe it's because it's a new program." A learning curve was expressed by interviewees about starting a new health science librarian position that supports PA programs. As one recalled, "I didn't even know what a PA was, basically, until I took the job."

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Additionally, demonstrating competencies added to the workload of the interviewees who reported needing to prove their skills. One interviewee stated, "I think there was a healthy level of skepticism when I first started. But as I've demonstrated my skills and what a librarian can bring to the program and how we can support, they've been much more receptive."

Interviewees recounted that balancing the responsibilities from the business side and teaching sides of librarianship added a complicated layer to the librarian workload, status, and recognition. They commonly shared the difficulty of reaching and connecting with PA students inside and outside of the classroom. One said, "There's no bandwidth for anything extra right now. So it's interesting for me to figure out how to navigate so that I can provide the support that the program needs." One participant estimates that it "…is individual and group instruction that takes up probably 60% of my time." Another stated, "I need to figure out how to balance things." The need for more institutional support was also apparent, as one said, "I think it would be really wonderful if libraries also considered what kind of support the librarians need."

Subtheme 2.1 PA Programs/Students as Unique

PA programs are unique compared to other health sciences programs. Interviewees from institutions with medical schools reported that the PA program aligns closely with the medical school. However, for PA programs at institutions without a medical school, interviewees experienced PA programs and PA students inhabiting a space between medical and allied health programs.

Interviewees reported that their experiences with the compact curriculum of the PA program created a barrier for librarians to interact with PA students and faculty outside of the classroom. Due to the packed structure of the program, PA students and faculty spend much of the traditional working hours of a librarian (9 am to 5 pm) in class or on clinical rotations. This schedule makes matching availability for meetings and consultations difficult, especially in the clinical phase. Interviewees expressed the need to offer virtual appointments and instruction to accommodate busy schedules (including during evenings and weekends).

As discussed in the previous themes, the frequency with which librarians interacted with PA students through instruction or research depended on the institution. Some interviewees reported less contact with the PA faculty and students compared to other programs they work with. There is "not as much [contact] in comparison to nursing, for example". However, this was not the case for all interviewees. Some reported that PA students regularly use library resources and schedule consultations with librarians for research assistance, but the majority of these interactions occurred at specific times, for example, during orientation, in the research methods course, or for a capstone project.

Another unique aspect interviewees described about their interactions with PA students is the students' diverse educational and experiential backgrounds. Librarians usually experienced graduate students in allied health programs and medical schools with an educational background in their field from their undergraduate studies; this was not the case with PA students. The diverse backgrounds of students created a challenge for librarians to meet the instructional needs of the students. As one interviewee put it, "...the thing I find the most challenging with them is because they're mature students and they're coming from all these different backgrounds, trying to teach them at the start of the program. It's, you don't really know where they're at."

Subtheme 2.2 Financial Barriers While Trying to Meet Resource Needs of PA Programs

Not having the appropriate budget for the library resources needed (or wanted) by the PA program was mentioned frequently in interviews. Almost all interviewees spoke of some type of budgetary issue or financial support issue for access to resources. The few interviewees who did not express this issue were at institutions with a medical or osteopathic school, who spoke of financial issues that were ultimately related to how their budget was structured, instead of an affordability problem.

Of those interviewees who spoke about resource funding or budgetary issues, many described unique funding models. For example, one interviewee explained, "...we have an eclectic mix that's grown organically over the years as far as funding goes." At a number of these institutions, while the library budget paid for most resources, departmental funds were used to pay for specific items/resources but were managed by the libraries. One interviewee stated, "We're not [financially] associated with the main campus library at all [which] creates…a huge barrier." Other interviewees noted that the PA program paid for and administered the resources. Some worked at institutions where additional resources "are paid through student fees," and others were at institutions that used strategic investment funds for new health sciences programs or money from state or federal programs. These unique financial situations created extra worries expressed by multiple interviewees. Some interviewees had to cut access or choose between resources, like switching from UpToDate to Dynamed.

DISCUSSION

As PA programs have expanded rapidly, librarians have had to assume a greater responsibility for supporting these programs. Needing to build and maintain relationships, resource management challenges, and

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workload issues characterize the challenges of the PA librarianship.

Relationship building is an important aspect of all health sciences liaison positions [15]. This study finds that strong relationships with PA faculty enhance PA student education. PA librarians need to maintain a balance between business responsibilities and instructional responsibilities. Diverse instructional approaches, from multi-hour orientations to embedded co-teaching in research methods courses, demonstrate the need for flexibility in the challenge of supporting these programs. Interviewees who inherited positive collaborations from previous liaisons showed that established relationships can create lasting frameworks. For some, the physical proximity of librarians was a significant factor as library spaces located near PA programs were reported to be used more frequently, and faculty interactions were higher. In their study on faculty's perception of academic librarians, Weng and Murray also found that physical proximity had a positive effect on the faculty's perception of librarians [22].

PA programs occupy a unique niche in health sciences education. It's apparent from the interviewees that the medical education model influences every part of the experience for PA students, faculty, and librarians. However, they have unique needs even compared to medical schools or other allied health programs and understanding them is vital to effective librarianship. Librarians must contend with the intensive compressed curricula, creating scheduling and resource challenges as well as the diverse educational backgrounds of PA students, which complicates instructional design.

Most survey respondents reported library instruction only during the didactic portion, meaning PA students may not receive adequate support during their clinical phase. Some interviewees expressed interest in expanding their instructional reach, while others spoke of their satisfaction with the successful expansion, such as co-teaching in EBM classes. While the majority of respondents reported teaching general search skills, the opportunity to cover EBM topics was more common with respondents who taught in both didactic and clinical coursework. Involvement during the students' research component, which is typically toward the end of the program, varied significantly, ranging from minimal participation to leading instruction sessions, offering consultations or workshops, and full integration into research courses. While no study has examined the effects of multiple library instruction sessions across the PA curriculum, studies on other graduate-level medical and health science programs have concluded that the information-seeking skills benefited from this multi-level approach [23,24].

The reported financial barriers reflect broader trends in academic libraries. This situation is particularly acute at institutions without medical schools, where PA programs may represent the only program requiring high-cost resources, in particular, point-of-care tools. Studies have determined that institutions with a medical school have access to more resources [10,15]. With 28% projected growth in the profession [2] and 20 new PA programs under development in 2024 alone [4], more libraries will face increasing pressure to acquire specialized resources with limited budgets. The interviews also demonstrate the lack of standardization in supporting these programs. A core list for collection development has not been attempted since 2001 [16]. Johnson and Johnson attempted to fill this collection development gap by studying the LibGuides created by librarians for PA programs, concluding that they could be used to develop collections suitable for PAs [11]. However, Petersen [10] felt that Johnson and Johnson's list may be too limiting because it depended on programs that license Springshare software.

The "learning curve" described by many interviewees underscores a significant need for professional development opportunities to develop specialized knowledge. Many health sciences librarians do not have formal science or health science educational backgrounds [25]. This knowledge gap can create an additional workload for the librarians as they must pursue various avenues to gain the knowledge needed to understand these programs.

Library services are unevenly integrated within PA programs, ranging from librarians who feel unappreciated to those who are considered essential collaborators. Many factors contributing to this variability include the age of the program, the presence of library champions, involvement in accreditation processes, the individual librarian's approach to relationship building, and teaching faculty and student perceptions of librarians. Some interviewees suggest that librarians who actively participate in accreditation processes or who identify faculty advocates can significantly improve their integration within PA programs.

IMPLICATIONS FOR PRACTICE

Providing library support to PA programs presents challenges for librarians because it requires specialized knowledge, flexibility in service delivery, and strategic relationships. It is essential to understand the unique characteristics of PA education, develop appropriate professional expertise, and position library services as essential to program success.

PA librarians have found themselves needing to quickly acclimate to a curriculum that, while rooted in the medical model, often includes students without clinical backgrounds or faculty without research backgrounds. This has required a shift in communication strategies, particularly moving away from assumptions about prior knowledge and toward more inclusive, plain-language approaches. Many librarians described immersing

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themselves in academic catalogs, board exam structures, and online PA student forums to better understand the pedagogical and cultural context of PA education.

The demands of PA program support have prompted librarians to rethink and expand beyond traditional liaison models and practices. Librarians have pivoted toward more proactive and embedded approaches, initiating contact with program directors early in the program's development and maintaining visibility through faculty meetings, curriculum planning, and informal social gatherings from water cooler chat to mixers. These efforts reflect a shift from transactional service delivery to sustained, peer-like engagement often requiring librarians to move outside the library's spaces.

Similarly, physical and scheduling constraints have prompted librarians to rethink how and where they offer support. In response to PA students' limited presence on campus and/or in the library, librarians have shifted consultation hours, opted to travel to satellite locations, and leveraged asynchronous content in learning management systems or other accessible platforms. These adaptations reflect a broader trend toward meeting library users where they are – both literally and pedagogically – and aligning services to the structure of PA education. For example, librarians have adapted collection development by attuning to everyday signals from their PA communities; monitoring interlibrary loan requests, reviewing syllabi, or picking up on research topics and themes in faculty conversations. Without formal guides or centralized input, librarians anticipate needs in real time through benchmarking, informal feedback, and maintaining a presence in the academic space, underscoring the value of being immersed in the environment they support.

The challenges of supporting PA programs have highlighted the need for institutional and professional support for librarians themselves. As discussed, interviewees emphasized the impact of the learning curve in librarians' liaison workload. Through the conversations, they shared the importance of workload planning, targeted training, and peer networks, suggesting that professional organizations supporting health sciences librarians have opportunities to build on targeted professional development and networking. However, academic libraries must also be intentional about staff support, particularly workload distribution and professional development, ensuring that time, space, and resources are allocated to equip librarians whether they are launching a new academic program, are new to PA librarianship, or are new to the profession in general.

LIMITATIONS

Online surveys have many advantages, such as easy administration, quick distribution across platforms, and simplified data analysis. However, they can carry significant drawbacks; they are susceptible to selection bias due to a convenience sample, which may reflect non-response bias and does not represent the broader population accurately. Consequently, the findings may not truly reflect the diverse perspectives or experiences of the larger community.

Semi-structured interviews offer rich qualitative insights into interviewees' thoughts and perceptions. They are also susceptible to selection bias as well as researcher bias, and social desirability bias from the interviewees.

AUTHOR CONTRIBUTIONS

Megan Jaskowiak: conceptualization, methodology, investigation, formal analysis, writing - original draft, writing – review & editing; Michelle Nielsen Ott: conceptualization, methodology, investigation, resources, formal analysis, writing – review & editing; Karina Kletscher: conceptualization, methodology, investigation, formal analysis, writing - original draft, writing – review & editing.

DATA AVAILABILITY STATEMENT

Data associated with the semi-structured interviews in this article cannot be made publicly available because they contain personally identifiable information. Access to the survey data can be requested from the corresponding authors and may be subject to IRB restrictions.

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SUPPLEMENTAL FILES

Appendix A: Survey Questions
Appendix B: Interviewees' Type of Institution and Length of Time Since Accreditation According to ARC-PA
Appendix C: Initial Interview Questions

AUTHORS' AFFILIATIONS

Megan Jaskowiak, PhD, MLIS, jaskowma@miamioh.edu, https://orcid.org/0000-0003-4847-1242, University Libraries, Miami University, Oxford, OH

Michelle Nielsen Ott, MLIS, AHIP, mnielsenott@bradley.edu, https://orcid.org/0000-0002-2730-2928, Bradley University, Cullom-Davis Library, Peoria, IL

Karina Kletscher, MLIS, AHIP, karinakletscher@creighton.edu, https://orcid.org/0000-0002-1046-2415, Creighton University, Health Sciences Campus, Phoenix, AZ

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Navigating unique challenges: librarian perceptions in supporting physician associate (assistant) programs

Megan Jaskowiak; Michelle Nielsen Ott, AHIP; Karina Kletscher, AHIP

See end of article for authors' affiliations.

Objectives: This study examines the experiences of librarians who support physician assistant/associate (PA) programs, describing the unique challenges of these programs and outlining strategies that librarians adopt to engage these programs.

Method: This mixed-methods study includes two phases: (1) a quantitative survey developed and distributed to library personnel in institutions with established or developing PA programs in the US and Canada, and (2) semi-structured interviews with fifteen selected survey respondents, focusing on their experiences and perceptions related to PA education support. The qualitative data were analyzed using thematic analysis.

Results: Seventy-five survey responses were collected. Key findings from the survey include: most respondents were from universities with health sciences programs, with nursing and physical therapy being the most common additional programs. Most library-led instruction occurred during the didactic phase and focused on search skills and evidence-based practice. PubMed and UpToDate were the most library-promoted resources. Two thematic elements discovered through the semi-structured interviews were "relationship building as paramount" and "impact of the learning curve on librarian workload."

Conclusion: Librarians who support PA educational programs face challenges related to relationship building, financial resources, workload, and steep learning curves. The findings underscore the need for targeted professional development programs to equip librarians with the necessary knowledge and skills.

Keywords: Physician assistant (associate) education; health sciences librarianship; resource management; library instruction; librarian workload

See end of article for supplemental content.

INTRODUCTION

Physician assistant or associate (PA) programs have rapidly expanded in response to the growing demand for advanced care providers in the United States [1]. According to the Bureau of Labor Statistics, this profession will grow 28% between 2023 and 2033 [2]. The growth of PA programs has outpaced many other healthcare professions, highlighting the need for comprehensive educational support systems for these clinicians [1,3]. In 2024 alone, 20 new PA programs were under development, adding to the 217 accredited programs already graduating thousands of healthcare professionals annually [4]. The emerging needs of these PA programs have created challenges for their parent institutions, including academic and health sciences libraries.

PA students may seem simultaneously similar and different from their other health professions counterparts. Like these peers, PA students complete a rigorous post-baccalaureate two-phase program consisting of didactic coursework followed by clinical rotations [5]. This education is on a compressed timeline, with some PAs earning their degree in as little as 12 months, notably shorter compared to the traditional four-year medical degree. Similar to doctors, PAs are educated as generalists in the medical model, with the exception of a second year of more specialized clinical rotations [5]. PAs may practice upon graduating and certification without additional training, such as fellowships or residencies. PAs may be seen as more akin to nurse practitioners (NPs) in terms of clinical settings and roles, but NPs are educated in the nursing model and must also complete advanced

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education and clinical training beyond their initial registered nurse (RN) education [6,7]. Outside of a bachelor's degree and prerequisites, PAs may come from any former career path or academic discipline. Additionally, as generalists, PAs do not earn certification in a particular population of focus as their NP colleagues, though PAs may certainly go on to gain additional education and practice in a clinical specialty [8,9].

In 2018, 222 libraries were identified as supporting PA programs [10]. Despite the increasing number of programs, there is a significant gap in the literature regarding the role of librarians in PA education. Since the PA curriculum spans multiple specialties and topic areas, librarians rely on each other because core authoritative resources and faculty information-sharing are inconsistent or wholly unavailable. [11]. Thanks to the work of library peers, the PA librarian can now refer to resources on PAs and evidence-based medicine (EBM) as well as full bibliographies to support collection development, resource management, and general reference [10–16]. Resource evaluations report that larger institutions, particularly those with existing medical programs, provided more materials and subscriptions applicable to their PA programs, indicating that a librarian building a collection from the ground up requires adaptability in negotiating costs and balancing freely available resources with subscriptions, if not a significant budget [10,12–16].

While the Medical Library Association (MLA) provides a framework of core competencies for health sciences librarianship, these guidelines cannot fully account for the distinct pedagogical, clinical, and accreditation contexts that shape PA education [17]. As a result, librarians serving PA programs often lack a clear avenue to explore how their professional skills translate into this specialized environment. Foreman and Baldwin captured librarians' experiences and perceptions of liaising to the relatively new profession in 1976 [18]. As both the PA and library professions have significantly evolved over the last 50 years, revisiting the role of PA librarians is essential to highlight the unique challenges and contributions of this role, foster a more informed and supportive professional community, and guide the development of targeted resources and training. In an effort to address this gap, this study explored librarians' perceptions of their own work and experiences with PA programs.

METHODOLOGY

This research project included two phases. In the first phase, a 10-question survey was developed in Qualtrics (Appendix A). The survey design was informed by the researchers' knowledge of PA programs and previous research on librarians working with health sciences programs. The survey was designed to collect baseline information about libraries and librarians supporting PA programs and to recruit participants for the semi-structured interviews in the second phase of the project. The survey was reviewed by librarians who were not part of the study before deployment. In March 2023, upon IRB approval from the Miami University Human Subjects Committee (Protocol ID# 04470e), an email invitation to participate in the survey was sent to the MLA mailing list and directly to 277 librarians listed on library websites at institutions with PA programs. The survey required respondents to be at least 18 years old and employed as a librarian or information specialist at an institution with either an established PA program or in the process of implementing a PA program in the United States or Canada. Descriptive statistical analysis was performed on the survey responses using Excel. The survey's final question asked the respondents about their willingness to participate in an interview.

The second phase consisted of semi-structured interviews. The 36 survey respondents who indicated willingness to be interviewed were categorized based on their institution type and the length of time since program accreditation. The interviewees were selected randomly from within these designations (Appendix B) to ensure representation in the two categories and institutions across the United States and Canada. Three of the initially selected interviewees did not respond to the interview request; three different interviewees were chosen from the original pool. The researchers were each assigned five people to interview based on their respective time zones for a total of 15 interviews, corresponding to standards of saturation [19]. Using a set of semi-structured interview questions devised by the research team, 15 semi-structured interviews were conducted between July and December 2023 (Appendix C).

The semi-structured interviews were conducted and recorded over Zoom. Interviewees had the option to have their cameras on or off. The Zoom-generated transcripts from these sessions were reviewed and edited by the interviewing researcher to ensure accuracy. Once all transcripts were edited and finalized, each researcher was randomly assigned five transcripts to begin the thematic analysis technique described by Braun and Clarke [20]. Taguette, an open-source qualitative research tool, was used for this analysis. As a web-server-based tool, Taguette provided a collaboration space for coding among the researchers [21]. To start the analysis, each researcher created concept keywords by reading the transcripts and noting common sentiments expressed by the interviewees. Then the researchers met and discussed the keywords and combined the concepts to create a set of data-derived codes with agreed-upon definitions. These codes were applied to the previously randomly assigned transcripts using Taguette. The researchers then identified patterns and developed, revised, and defined themes.

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RESULTS

Quantitative Survey Results

A total of 87 quantitative survey responses were collected, with 75 surveys containing at least one response to one of the questions. Twelve respondents opened the survey but answered no questions, while one respondent skipped multiple questions. Assuming one response per institution, this represents approximately 25% of institutions with accredited PA programs (219 fully accredited and 81 provisionally accredited). Although the survey sampling was self-selected, the respondents represented similar percentages in the categories of length of time since accreditation as the ACR-PA data at the time of survey data collection.

Most respondents were employed at a college or university with a dedicated health sciences/medical school or one with graduate programs. The rest of the respondents were from very diverse types of institutions, including hospitals, a liberal arts college, graduate health science schools, a community college, and an osteopathic school.

All respondents reported that their institutions supported additional health sciences programs either at the undergraduate or graduate level (Table 1). The most common other health science program supported was nursing, including undergraduate or graduate programs at 79%, followed by occupational/physical therapy programs with 75%. Overall, respondents indicated that other allied health programs were more common to have at their institution than having a medical school at their institution.

Table 1

Other Health Sciences/Medical Programs at the institutions (both absolute total respondents and percentages). The percentage totals will not equal 100% due to the nature of a multiple-response question. N=75

Other Health Sciences/Medical Programs	Totals (%)
Nursing	56 (79%)
PT/OT	53 (75%)
Public Health	45 (63%)
Biology/Biomedical Sciences	42 (59%)
Exercise Physiology/Athletics/Kinesiology	41 (57%)
Medicine	40 (56%)
Pharmacy	30 (42%)
Dentistry	21 (30%)
Osteopathy	12 (17%)

As for library-led instruction, respondents reported that these sessions most frequently occurred during the didactic phase of the PA program. The didactic phase of a PA program varies by institution and program. Sixty-five percent of the respondents indicated instruction occurring only in didactic classes, 18% indicated library-led instruction in both didactic and clinical rotations, and another 16% indicated either no instruction or not associated with a particular class (Table 2). For the institutions with library-led instruction, teaching general search skills and developing search strategies were the most frequent topics (83%). Respondents who indicated that they taught in didactic and clinical rotation classes were more likely to cover EBM topics in the instruction sessions.

Table 2

Library instruction responses were divided and categorized by location and type of instruction. Type of instruction totals will not equal 100% due to the nature of a multiple-response question. A single respondent indicated that they only did instruction in the clinical setting. This information has been incorporated into the percentage calculations but is not shown in the table. N=74

Types of classes	General search skills	Clinical health sciences tools	Developing search strategies	Evidence-based practice
Didactic: 48 (65%)	41 (85%)	35 (73%)	41 (85%)	29 (60%)
Both: 13 (18%)	12 (92%)	12 (92%)	13 (100%)	12 (92%)
Not specifically associated with a class: 12 (16%)	10 (83%)	10 (83)	8 (67%)	7 (58%)
Total:	63 (85%)	57 (77%)	62 (84%)	48 (65%)

When asked which library products/library resources are promoted to the PA programs, PubMed (94%) was the most common overall, as well as the most common article database. CINAHL was promoted by only 59.4% of the respondents. Seventy-two percent of the respondents indicated that they promoted AccessMedicine. As for clinical care tools, more indicated they had UptoDate (65%) compared to either Dynamed (27%) or Clinical Key (34%). Nine respondents indicated that they had Dynamed but neither UpToDate nor Clinical Key. Three institutions had both Dynamed and Clinical Key, and one institution had all three clinical care tools. VisualDx, Lexicomp, and StatRef were the least promoted products.

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Sixty-eight percent of the respondents indicated that the PA program at their institution includes a research component, while the rest responded that they were unsure or that there was no research component. Those who gave affirmative answers were prompted to provide open-ended answers about the research component and the library's participation (if any) with the students for the research component. Thirteen reported that students were required to complete a capstone project involving research or a review (such as literature, narrative, or 'mini' systematic review). Seven reported that librarians had minimal involvement in the research project, while 13 provided specific instruction sessions during the second year when students were actively conducting their research. Additionally, six respondents indicated that they offered consultations or workshops. Finally, nine respondents mentioned that they either led the course or were embedded in the course, where students conducted their research.

Qualitative Semi-Structured Interview Results

The thematic analysis of 15 semi-structured interviews revealed two main themes, each with two subthemes (Table 3 and Table 4). The first main theme, "relationship building as paramount," is supported by the subthemes "proximity has value" and "external perception of librarian/library affects the role of the librarian/library." The second main theme is "impact of the learning curve on librarian workload" accompanied by the subthemes, "PA programs/students as unique" and "financial barriers while trying to meet resource needs of PA programs." These overarching themes emerged across each of the interviews conducted, regardless of whether the participant: worked at a nascent or a well-established PA program; had limited or lengthy professional experience; or had a limited or robust collections' budget.

Table 3

Subthemes and exemplar quotes for Theme 1, "Relationship building is paramount." "Relationship building is paramount" describes how librarians that establish a working relationship with the PA programs experience more success broadly.

Subtheme	Exemplar Quotes
Proximity Has Value: building relationships with the PA programs feels easier when the library is co-located with PA students and faculty.	Proximity to students "[The library] is where the PA students live pretty much their entire students live pretty much their entire didactic year." Proximity to faculty "…we just have so much interaction with them because we're constantly going up and down that elevator and I'm just catching, I'm just I'm you know every chance I get I'm gonna share with them."
External Perception of Librarian/Library Affects the Role of the Librarian/Library: a PA program's prior held perceptions or beliefs affects a librarian's success at building relationships	Not valued or undervalued "The faculty would, quite honestly, to my face, tell me that they don't really use library resources… and they say the students have to find scholarly, peer-reviewed articles related to medicine [but] don't know [how] they find them." "They may already have a sort of perception about what the library does and then maybe that's so because of that and maybe the only reason they reach out to me is for what they expect the library does." Valued "My faculty colleagues gained a confidence and trust in my abilities. They've been really fantastic to collaborate with." "...any help that you can do with them in the accreditation process…I find that really builds a lot of goodwill. So. I think, I don't know, I just, it's a lot of work, but I think it's very rewarding"

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Table 4

Subthemes and exemplar quotes for Theme 2, "Impact of the learning curve effects on librarian workload." This theme describes how PA programs are distinct from other health sciences programs and how developing an understanding of their unique needs takes time and educational resources.

Subtheme	Exemplar Quotes
PA Programs and Students are Unique: PA students come from different bachelor's degree programs than other health sciences fields. Their compact schedule means they are often occupied during a librarian's traditional working hours.	Distinct among health sciences "And I don't think they liked being sort of lumped in with nurses, they didn't like being called 'Doctors-lite,' and it was more stuff that was started specifically for them…" "Because in PA they kind of cover everything. But they also have a unique identity and occupy this weird space." Scheduling conflicts "So the vast majority of times, I was helping students via email because they wouldn't be able to talk to me until 8 pm." Diverse students' backgrounds "It is really focused on the medicine and it's interesting so I would say like a lot of the PA students, their background is very different and they all come from very different backgrounds. And I've seen more and more people coming from nursing and from OT or PT backgrounds."
Financial Barriers for Meeting the Resource Needs of PA Programs: providing library resources to support PA programs often requires working within financial constraints.	No financial barriers "I feel like we because we have the medical program and really a lot of the resources that they use, the med students do too. So, in terms of [things] like funding and that sort of thing, that's fine." Funding issues "So like UpToDate, clinical consult tools, UpToDate, AccessMedicine, anatomical guides, these sort of things…they are owning and managing their own subscriptions or products for those" "…our new health sciences programs, they're not budgeted the same way as the rest of the university… They're coming out of special investment strategic funds…[they] have their own library budget, so the library does not pay for their resources unless we already had the resources." "We have cut things that are needed because our budgets can't absorb the inflation costs" "...Dynamed, which is less expensive…so we switched to that"

Theme 1.0 Relationship Building as Paramount

Building relationships between a library and a PA program can be fraught due to librarians and teaching faculty having different responsibilities and priorities. Librarians are often brokering acquisition and access as well as navigating requests from library users and administrators, or what one participant called "the business side of being a librarian." Interviewees described upholding relationships with PA faculty and students built in the classroom while maintaining library resources and services as a tricky balancing act of "trying to keep both sides happy." Another participant recounted an experience with a PA program director who was "wanting these things, and I'm like, at the time, I was told no because we didn't have the money…it got all sorts of uncomfortableness…we're just going to have to see what happens."

Interviewees' relationships with their PA programs varied. Several interviewees reported that they were able to slip easily into positive collaborations inherited from previous liaisons. In contrast, due to the rapid growth of PA programs, new and untested relationships often arose between the library and the emerging program when attempting to sort through accreditation requirements. Some interviewees established positive, professional relationships with their PA programs through accreditation (both provisional and continued statuses) and instruction.

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Interviewees indicated that leading library instructional programs was central to their relationship with the PA program. Library instruction opportunities varied in both delivery modes and course content, from multi-hour orientations to 60-minute one-shots to integrated scaffolded sessions. One participant shared their experience as a co-faculty in a PA research methods course, but they warned, "It's probably hard to talk your way into it [instruction]" without research-centric coursework or with faculty who are "skeptical about what I [the librarian] could do for them."

Interviewees discussed the pivotal figure of a library champion who refers colleagues and students, invites the librarian into classroom instruction, and collaborates in collection and resource development. They indicated the value and variety of library champions, including individual faculty, the program director, staff (e.g., the clinical coordinator or administrative assistant), and students. Interviewees expressed that library champions with word-of-mouth advertising catalyzed multiple collaboration opportunities. One participant shared how this phenomenon has become their general approach to relationship-building: "I almost feel like it's that snowball effect, like you get one or two people who are excited about how you supported them. They'll talk to their colleagues about how a librarian supported them in the classroom."

Another common experience, interviewees shared is the continued hope and perseverance to expand and increase relationships and opportunities with their PA programs. "I'm hopeful you know it's kind of a long game." As a different participant notes, "developing those relationships takes time and effort," a luxury not all librarians have. Still, participants shared that the investment pays off.

Subtheme 1.1 Proximity Has Value

Interviewees reported that the locations of the library and the PA program affected relationship building and student use of the library. Interviewees observed PA students' steady usage of physical library spaces when the library was conveniently located to the program (i.e., classes or residential housing). They also shared that physical library space – "outside of their normal classroom" – is valuable for PA students for quiet study or facilitating group work, particularly during evening hours when students are done with didactic or clinical work. As one stated, "[the library] is where the PA students…live pretty much their entire didactic year."

Interviewees working at libraries located further from the core class activity reported distance as a barrier. They observed how geographic hurdles, such as programs based in disparate locations or students who don't live in student housing, do not use the library's physical space; as one participant describes students in the PA program as "not that they're isolated, but they're in their own space." Another states, "[it] would be nice to change if they were physically closer, and so it was more convenient for me to be there and for them to be in the library." Similarly, interviewees felt that physical proximity to PA faculty and staff created more opportunities for personal connection and serendipitous liaising. For example, "...we just have so much interaction…going up and down that elevator…every chance I get I'm gonna share with them." Consistent facetime with program constituents can mitigate obstacles, concerns, and gaps, such as "what's working, what's not working, what changes might need to be made," as one participant listed, and is most helpful to understanding library resources.

Subtheme 1.2 External Perception of Librarian/Library Affects the Role of the Librarian/Library

The interviewees' perceptions of how the faculty/staff in their PA programs perceived their role in the program varied greatly. At one end of the spectrum were those who felt they were not valued at all, as one said, "the biggest detriment is the administration. They don't value the library or don't understand the value of the library…as a whole, there might be few people that do, but they don't have a loud enough voice." Another stated, "the faculty would, quite honestly to my face, tell me that they don't really use library resources and they say the students have to find scholarly, peer-reviewed articles related to medicine [but] don't know [how] they find them." Conversely, some felt like they were perceived as colleagues who could play a pivotal role in the program with one interviewee stating, "The library is seen as a key player…[and] I'm very well received over at the PA program." Interviewees noted issues regarding preconceived notions about library/librarian roles. One reported, "they may already have a sort of perception about what the library does…because of that, and maybe the only reason they reach out to me, is for what they expect the library does."

Theme 2.0: Impact of the Learning Curve on Librarian Workload

Interviewees discussed the added work and cognitive load associated with liaising with PA programs. As more PA programs are added to institutions across the United States and Canada, the work of providing library services and resources is added to the portfolio of health science librarians. Multiple interviewees reported fewer librarian positions at their institution but more programs and students to support. One interviewee expressed, "I find it's more demanding than the other health sciences programs…maybe it's because it's a new program." A learning curve was expressed by interviewees about starting a new health science librarian position that supports PA programs. As one recalled, "I didn't even know what a PA was, basically, until I took the job."

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Additionally, demonstrating competencies added to the workload of the interviewees who reported needing to prove their skills. One interviewee stated, "I think there was a healthy level of skepticism when I first started. But as I've demonstrated my skills and what a librarian can bring to the program and how we can support, they've been much more receptive."

Interviewees recounted that balancing the responsibilities from the business side and teaching sides of librarianship added a complicated layer to the librarian workload, status, and recognition. They commonly shared the difficulty of reaching and connecting with PA students inside and outside of the classroom. One said, "There's no bandwidth for anything extra right now. So it's interesting for me to figure out how to navigate so that I can provide the support that the program needs." One participant estimates that it "…is individual and group instruction that takes up probably 60% of my time." Another stated, "I need to figure out how to balance things." The need for more institutional support was also apparent, as one said, "I think it would be really wonderful if libraries also considered what kind of support the librarians need."

Subtheme 2.1 PA Programs/Students as Unique

PA programs are unique compared to other health sciences programs. Interviewees from institutions with medical schools reported that the PA program aligns closely with the medical school. However, for PA programs at institutions without a medical school, interviewees experienced PA programs and PA students inhabiting a space between medical and allied health programs.

Interviewees reported that their experiences with the compact curriculum of the PA program created a barrier for librarians to interact with PA students and faculty outside of the classroom. Due to the packed structure of the program, PA students and faculty spend much of the traditional working hours of a librarian (9 am to 5 pm) in class or on clinical rotations. This schedule makes matching availability for meetings and consultations difficult, especially in the clinical phase. Interviewees expressed the need to offer virtual appointments and instruction to accommodate busy schedules (including during evenings and weekends).

As discussed in the previous themes, the frequency with which librarians interacted with PA students through instruction or research depended on the institution. Some interviewees reported less contact with the PA faculty and students compared to other programs they work with. There is "not as much [contact] in comparison to nursing, for example". However, this was not the case for all interviewees. Some reported that PA students regularly use library resources and schedule consultations with librarians for research assistance, but the majority of these interactions occurred at specific times, for example, during orientation, in the research methods course, or for a capstone project.

Another unique aspect interviewees described about their interactions with PA students is the students' diverse educational and experiential backgrounds. Librarians usually experienced graduate students in allied health programs and medical schools with an educational background in their field from their undergraduate studies; this was not the case with PA students. The diverse backgrounds of students created a challenge for librarians to meet the instructional needs of the students. As one interviewee put it, "...the thing I find the most challenging with them is because they're mature students and they're coming from all these different backgrounds, trying to teach them at the start of the program. It's, you don't really know where they're at."

Subtheme 2.2 Financial Barriers While Trying to Meet Resource Needs of PA Programs

Not having the appropriate budget for the library resources needed (or wanted) by the PA program was mentioned frequently in interviews. Almost all interviewees spoke of some type of budgetary issue or financial support issue for access to resources. The few interviewees who did not express this issue were at institutions with a medical or osteopathic school, who spoke of financial issues that were ultimately related to how their budget was structured, instead of an affordability problem.

Of those interviewees who spoke about resource funding or budgetary issues, many described unique funding models. For example, one interviewee explained, "...we have an eclectic mix that's grown organically over the years as far as funding goes." At a number of these institutions, while the library budget paid for most resources, departmental funds were used to pay for specific items/resources but were managed by the libraries. One interviewee stated, "We're not [financially] associated with the main campus library at all [which] creates…a huge barrier." Other interviewees noted that the PA program paid for and administered the resources. Some worked at institutions where additional resources "are paid through student fees," and others were at institutions that used strategic investment funds for new health sciences programs or money from state or federal programs. These unique financial situations created extra worries expressed by multiple interviewees. Some interviewees had to cut access or choose between resources, like switching from UpToDate to Dynamed.

DISCUSSION

As PA programs have expanded rapidly, librarians have had to assume a greater responsibility for supporting these programs. Needing to build and maintain relationships, resource management challenges, and

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workload issues characterize the challenges of the PA librarianship.

Relationship building is an important aspect of all health sciences liaison positions [15]. This study finds that strong relationships with PA faculty enhance PA student education. PA librarians need to maintain a balance between business responsibilities and instructional responsibilities. Diverse instructional approaches, from multi-hour orientations to embedded co-teaching in research methods courses, demonstrate the need for flexibility in the challenge of supporting these programs. Interviewees who inherited positive collaborations from previous liaisons showed that established relationships can create lasting frameworks. For some, the physical proximity of librarians was a significant factor as library spaces located near PA programs were reported to be used more frequently, and faculty interactions were higher. In their study on faculty's perception of academic librarians, Weng and Murray also found that physical proximity had a positive effect on the faculty's perception of librarians [22].

PA programs occupy a unique niche in health sciences education. It's apparent from the interviewees that the medical education model influences every part of the experience for PA students, faculty, and librarians. However, they have unique needs even compared to medical schools or other allied health programs and understanding them is vital to effective librarianship. Librarians must contend with the intensive compressed curricula, creating scheduling and resource challenges as well as the diverse educational backgrounds of PA students, which complicates instructional design.

Most survey respondents reported library instruction only during the didactic portion, meaning PA students may not receive adequate support during their clinical phase. Some interviewees expressed interest in expanding their instructional reach, while others spoke of their satisfaction with the successful expansion, such as co-teaching in EBM classes. While the majority of respondents reported teaching general search skills, the opportunity to cover EBM topics was more common with respondents who taught in both didactic and clinical coursework. Involvement during the students' research component, which is typically toward the end of the program, varied significantly, ranging from minimal participation to leading instruction sessions, offering consultations or workshops, and full integration into research courses. While no study has examined the effects of multiple library instruction sessions across the PA curriculum, studies on other graduate-level medical and health science programs have concluded that the information-seeking skills benefited from this multi-level approach [23,24].

The reported financial barriers reflect broader trends in academic libraries. This situation is particularly acute at institutions without medical schools, where PA programs may represent the only program requiring high-cost resources, in particular, point-of-care tools. Studies have determined that institutions with a medical school have access to more resources [10,15]. With 28% projected growth in the profession [2] and 20 new PA programs under development in 2024 alone [4], more libraries will face increasing pressure to acquire specialized resources with limited budgets. The interviews also demonstrate the lack of standardization in supporting these programs. A core list for collection development has not been attempted since 2001 [16]. Johnson and Johnson attempted to fill this collection development gap by studying the LibGuides created by librarians for PA programs, concluding that they could be used to develop collections suitable for PAs [11]. However, Petersen [10] felt that Johnson and Johnson's list may be too limiting because it depended on programs that license Springshare software.

The "learning curve" described by many interviewees underscores a significant need for professional development opportunities to develop specialized knowledge. Many health sciences librarians do not have formal science or health science educational backgrounds [25]. This knowledge gap can create an additional workload for the librarians as they must pursue various avenues to gain the knowledge needed to understand these programs.

Library services are unevenly integrated within PA programs, ranging from librarians who feel unappreciated to those who are considered essential collaborators. Many factors contributing to this variability include the age of the program, the presence of library champions, involvement in accreditation processes, the individual librarian's approach to relationship building, and teaching faculty and student perceptions of librarians. Some interviewees suggest that librarians who actively participate in accreditation processes or who identify faculty advocates can significantly improve their integration within PA programs.

IMPLICATIONS FOR PRACTICE

Providing library support to PA programs presents challenges for librarians because it requires specialized knowledge, flexibility in service delivery, and strategic relationships. It is essential to understand the unique characteristics of PA education, develop appropriate professional expertise, and position library services as essential to program success.

PA librarians have found themselves needing to quickly acclimate to a curriculum that, while rooted in the medical model, often includes students without clinical backgrounds or faculty without research backgrounds. This has required a shift in communication strategies, particularly moving away from assumptions about prior knowledge and toward more inclusive, plain-language approaches. Many librarians described immersing

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themselves in academic catalogs, board exam structures, and online PA student forums to better understand the pedagogical and cultural context of PA education.

The demands of PA program support have prompted librarians to rethink and expand beyond traditional liaison models and practices. Librarians have pivoted toward more proactive and embedded approaches, initiating contact with program directors early in the program's development and maintaining visibility through faculty meetings, curriculum planning, and informal social gatherings from water cooler chat to mixers. These efforts reflect a shift from transactional service delivery to sustained, peer-like engagement often requiring librarians to move outside the library's spaces.

Similarly, physical and scheduling constraints have prompted librarians to rethink how and where they offer support. In response to PA students' limited presence on campus and/or in the library, librarians have shifted consultation hours, opted to travel to satellite locations, and leveraged asynchronous content in learning management systems or other accessible platforms. These adaptations reflect a broader trend toward meeting library users where they are – both literally and pedagogically – and aligning services to the structure of PA education. For example, librarians have adapted collection development by attuning to everyday signals from their PA communities; monitoring interlibrary loan requests, reviewing syllabi, or picking up on research topics and themes in faculty conversations. Without formal guides or centralized input, librarians anticipate needs in real time through benchmarking, informal feedback, and maintaining a presence in the academic space, underscoring the value of being immersed in the environment they support.

The challenges of supporting PA programs have highlighted the need for institutional and professional support for librarians themselves. As discussed, interviewees emphasized the impact of the learning curve in librarians' liaison workload. Through the conversations, they shared the importance of workload planning, targeted training, and peer networks, suggesting that professional organizations supporting health sciences librarians have opportunities to build on targeted professional development and networking. However, academic libraries must also be intentional about staff support, particularly workload distribution and professional development, ensuring that time, space, and resources are allocated to equip librarians whether they are launching a new academic program, are new to PA librarianship, or are new to the profession in general.

LIMITATIONS

Online surveys have many advantages, such as easy administration, quick distribution across platforms, and simplified data analysis. However, they can carry significant drawbacks; they are susceptible to selection bias due to a convenience sample, which may reflect non-response bias and does not represent the broader population accurately. Consequently, the findings may not truly reflect the diverse perspectives or experiences of the larger community.

Semi-structured interviews offer rich qualitative insights into interviewees' thoughts and perceptions. They are also susceptible to selection bias as well as researcher bias, and social desirability bias from the interviewees.

AUTHOR CONTRIBUTIONS

Megan Jaskowiak: conceptualization, methodology, investigation, formal analysis, writing - original draft, writing – review & editing; Michelle Nielsen Ott: conceptualization, methodology, investigation, resources, formal analysis, writing – review & editing; Karina Kletscher: conceptualization, methodology, investigation, formal analysis, writing - original draft, writing – review & editing.

DATA AVAILABILITY STATEMENT

Data associated with the semi-structured interviews in this article cannot be made publicly available because they contain personally identifiable information. Access to the survey data can be requested from the corresponding authors and may be subject to IRB restrictions.

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SUPPLEMENTAL FILES

Appendix A: Survey Questions
Appendix B: Interviewees' Type of Institution and Length of Time Since Accreditation According to ARC-PA
Appendix C: Initial Interview Questions

AUTHORS' AFFILIATIONS

Megan Jaskowiak, PhD, MLIS, jaskowma@miamioh.edu, https://orcid.org/0000-0003-4847-1242, University Libraries, Miami University, Oxford, OH

Michelle Nielsen Ott, MLIS, AHIP, mnielsenott@bradley.edu, https://orcid.org/0000-0002-2730-2928, Bradley University, Cullom-Davis Library, Peoria, IL

Karina Kletscher, MLIS, AHIP, karinakletscher@creighton.edu, https://orcid.org/0000-0002-1046-2415, Creighton University, Health Sciences Campus, Phoenix, AZ

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CASE REPORT
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What factors influence vocational medical students' self-perceived utilization of library resources?

Shanshan Li; Wei Jiang; Xiaoli Dai

See end of article for authors' affiliations.

Background: Numerous studies have emphasized the crucial role of library resources in improving educational outcomes. However, there is a significant gap in research on how vocational medical students, a key group in the healthcare workforce, utilize these resources. This gap in the research highlights the need to further investigate the unique challenges and factors influencing library resource utilization in vocational medical students.

Case Presentation: One hundred and seventeen vocational medical students from a medical vocational college were assessed what influenced their library resource usage. An online survey was conducted to collect data on usage patterns, satisfaction with library resources, and satisfaction with self-reported retrieval abilities. The sample included 48 males and 69 females, with an average age of 19.1±0.7 years. Of the participants, 38.5% (45 students) reported effective library resource utilization. Lasso regression and logistic regression analyses identified two key predictors: satisfaction with library's space capacity (OR 4.26, 95% CI 1.438~12.622) and satisfaction with resource retrieval ability (OR 7.362, 95% CI 1.311~41.341). ROC analysis revealed a high predictive value, with an area under the curve (AUC) of 0.866 (95% CI 0.796~0.936).

Conclusions: This study identified satisfaction with library's space capacity and satisfaction with resource retrieval ability as key factors influencing library resource utilization by vocational medical students. To enhance library resource utilization, targeted strategies such as strengthening library infrastructure and improving students' information literacy should be considered.

Keywords: Library resource utilization; influencing factors; vocational medical students; regression analysis; bootstrap; space capacity; retrieval ability

See end of article for supplemental content.

INTRODUCTION

Vocational medical colleges play an important role in the primary healthcare system in China. The educational model and objectives of vocational medical colleges differ significantly from those of traditional medical universities. Traditional medical universities aim to cultivate physicians equipped with fundamental clinical competencies, the ability to adapt to various medical specialties, and a strong capacity for lifelong learning [1]. In China, these programs typically span five years, and graduates are required to pass the national physician licensing examination. In contrast, vocational medical colleges offer three-year programs focused on the diagnosis and treatment of common diseases in primary care, essential clinical skills for grassroots healthcare, emergency medical techniques, and basic public health services. The curriculum emphasizes hands-on skills and vocational training, incorporating a substantial amount of laboratory work, clinical practice, and project-based learning. Upon graduation, vocational medical students take the assistant physician licensing examination and typically become assistant general practitioners or village doctors, serving primarily in community and rural healthcare institutions and providing basic health services [2]. In China, assistant general practitioners usually work in urban community health centers, while village doctors serve in rural clinics. Compared with students from traditional medical universities, vocational medical students undergo a shorter training period and generally exhibit lower levels of information literacy and lifelong learning ability [3,4,5].

Library resources are crucial for supporting medical education [6,7]. In the digital age, effectively utilizing library resources to enhance information literacy has become an important challenge for vocational medical students. Information literacy, defined as the ability to recognize when information is needed and to locate, evaluate, and use effectively the needed information, is

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considered a lifelong learning skill [8]. It is vital for medical students' education and professional preparation [9,10]. In the context of vocational medical education, libraries play a distinctive role by supporting students' acquisition of practical clinical competencies and exam-related knowledge. Library collections in vocational medical colleges often emphasize practical resources, such as guides for basic diagnostic and treatment procedures, clinical skills manuals, and materials related to the assistant physician licensing examination. Moreover, libraries may provide tailored instructional services, including training sessions on how to locate and use clinically relevant information, aiming to compensate for students' generally lower levels of information literacy and to support the development of essential lifelong learning skills. How vocational medical students perceive and engage with these library resources may influence their ability to acquire such skills. Information literacy training is another key area supported by libraries [11,12]. By integrating information literacy instruction into medical education, medical school libraries can contribute to improving public health education and enhancing students' information literacy and lifelong learning competencies [10,13,14].

The level of information literacy among medical students is often reflected in their use of library resources [15]. However, most existing research on library resource utilization has primarily focused on general medical students [16,17,18], often neglecting the unique characteristics and educational context of vocational medical students. This study seeks to address this gap by identifying the key factors that influence self-perceived library resource utilization and providing targeted insights into the specific needs and experiences of vocational medical students.

CASE PRESENTATION

This survey was conducted at a vocational medical college in China that trains healthcare providers for primary care settings. The college library is a central academic resource, offering physical study spaces, print and digital materials, and access to electronic databases. The library also provides occasional training sessions to improve students' information literacy. To better understand how vocational medical students perceive and utilize these resources, we conducted a survey focusing on their self-perceived satisfaction with various aspects of library services and facilities. The aim was to identify key factors influencing resource utilization and to inform evidence-based improvements in library support for vocational medical education.

The survey questionnaire covered the following topics: age, gender, weekly hours spent in the library (<1 hour, 1~6 hours, >6 hours); satisfaction with the library's space capacity (dissatisfied, neutral, satisfied); satisfaction with the library's physical resources (dissatisfied, neutral, satisfied); satisfaction with the library's electronic resources (dissatisfied, neutral, satisfied); satisfaction with library services (dissatisfied, neutral, satisfied); satisfaction with resource retrieval ability (dissatisfied, fair, satisfied); participation in library training or lectures (no, yes); and self-perceived library resource utilization (poor, average, good). A three-point Likert scale was used in the questionnaire to assess relevant items. The Cronbach's alpha coefficient for the questionnaire was 0.868, indicating good internal consistency. The library's space capacity refers to the availability, adequacy, and distribution of physical study spaces within the library [19,20,21]. Resource retrieval ability refers to the students' proficiency in locating, accessing, and effectively utilizing both physical and electronic resources within the library [22].

In this study, data collection was conducted using an electronic questionnaire. The questionnaire was generated as a Quick Response (QR) code using the "Questionnaire Star" online platform. The QR code was distributed to students through class WeChat groups, inviting them to scan the code and complete the questionnaire. Students were able to access the questionnaire via smartphones or other internet-connected devices. The researchers maintained communication with class representatives to ensure timely completion of the questionnaire by the students. From May 7, 2024, to June 16, 2024, a total of 144 vocational medical students from Jiangsu Medical College were invited to participate in this study, and 117 valid responses were received, resulting in a response rate of 81.25%. The sample consisted of 48 males and 69 females, with an average age of 19.1 ± 0.7 years. The study was approved by the Ethics Committee of Jiangsu Medical College. (Approval No. 202404-PJ-002).

The case study involved constructing a lasso regression model to select variables for subsequent logistic regression analysis of self-perceived library resource utilization. The outcome variable was a binary classification of self-perceived library resource utilization (moderate or low utilization vs. high utilization). In the original questionnaire, students could select "good," "average," or "poor" to describe their resource utilization. However, only 5 students selected "poor," while 67 chose "average" and 45 chose "good." To avoid statistical instability due to the small size of the "poor" group and to enhance model interpretability, we combined the "average" and "poor" responses into a single group labeled "moderate or low utilization". This is a statistically valid approach when dealing with sparse categories in categorical variables [23].

Nine potential independent variables were initially considered: weekly hours spent in the library, satisfaction with library's space capacity, satisfaction with the library's physical resources, satisfaction with the library's electronic resources, satisfaction with library services, satisfaction with resource retrieval ability, participation in library

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training or lectures, gender, and age. To choose the most relevant variables while avoiding overfitting, we used a statistical technique called lasso regression. This method helps narrow down which variables are most useful by shrinking less important ones toward zero. We used a tool called the Bayesian Information Criterion to select the best penalty level, which controls how strongly unimportant variables are reduced [24]. To make sure our results were stable, we also applied a cross-validation process. In the end, we kept only the variables that remained important after this selection process and used them in the next step of our analysis.

After selecting the important variables using lasso regression, we ran a logistic regression analysis to examine how these factors were related to self-perceived library resource utilization. To test how reliable our results were, we used a method called bootstrapping. This involves creating many new samples by randomly re-using the original data and repeating the analysis 1,000 times. This gave us more stable and trustworthy estimates of the relationships we observed.

Within the high utilization group, 51.1% were female, compared to 63.9% in the moderate or low utilization group. There was no statistically significant difference in gender distribution between the two groups. Additionally, no significant age difference was observed. However, significant differences were found regarding weekly hours spent in the library, satisfaction with the library's space capacity, satisfaction with the library's physical resources, satisfaction with the library's electronic resources, satisfaction with library services, satisfaction with resource retrieval ability, and participation in library training or lectures (Table 1).

We found that people who spend more time in the library each week were more than twice as likely to report higher self-perceived resource utilization (OR 2.707, 95% CI 1.096-6.682). Additionally, those who were more satisfied with the library's space capacity were over four times more likely to report self-perceived high resource utilization (OR 4.26, 95% CI 1.93–9.399), and those who were more satisfied with their ability to retrieve resources were over seven times more likely to report high self-perceived utilization (OR 7.362, 95% CI 2.618–20.705). Bootstrap analysis further confirmed that satisfaction with the library's space capacity (OR 4.26, 95% CI 1.438–12.622) and satisfaction with one's resource retrieval ability (OR 7.362, 95% CI 1.311–41.341) were significant factors contributing to higher perceived resource utilization (Table 2).

The reliability of these findings was confirmed using the Area Under the Curve (AUC). An AUC of 0.866 suggests that our findings are reliable and the identified factors are effective predicators of self-perceived library resource utilization (Figure 1C).

Table 1

Descriptive statistics for the study variables.

Factor	Self-perceived library resource utilization		*p*-Value
	High %(n=45)	Moderate or low %(n=72)	
Gender			0.12
Male	48.9 (22/45)	36.1 (26/72)	
Female	51.1 (23/45)	63.9 (46/72)	
Age, years			0.313
(M±SD)	19.2±0.7	19.1±0.7	
Weekly library hours			0.032
<1 hour	35.6 (16/45)	51.4 (37/72)	
1-6 hours	53.3 (24/45)	47.2 (34/72)	
>6 hours	11.1 (5/45)	1.4 (1/72)	
Space capacity satisfaction			<0.001
Dissatisfied	8.9 (4/45)	29.2 (21/72)	
Neutral	11.1 (5/45)	54.2 (39/72)	
Satisfied	80 (36/45)	16.6 (12/72)	
Physical resources satisfaction			0.002
Dissatisfied	0.0 (0/45)	5.5 (4/72)	
Neutral	17.8 (8/45)	43.1 (31/72)	
Satisfied	82.2 (37/45)	51.4 (37/72)	
Electronic resources satisfaction			
Dissatisfied	2.2 (1/45)	5.5 (4/72)	<0.001
Neutral	13.3 (6/45)	55.6 (40/72)	
Satisfied	84.5 (38/45)	38.9 (28/72)	
Library services satisfaction			<0.001
Dissatisfied	2.2 (1/45)	4.2 (3/72)	
Neutral	8.9 (4/45)	52.8 (38/72)	
Satisfied	88.9 (40/45)	43.0 (31/72)	
Resource retrieval ability satisfaction			<0.001
Dissatisfied	0.0 (0/45)	9.7 (7/72)	
Fair	17.8 (8/45)	65.3 (47/72)	
Satisfied	82.2 (37/45)	25 (18/72)	
Training/lecture participation			<0.001
No	44.4 (20/45)	88.9 (64/72)	
Yes	55.6 (25/45)	11.1 (8/72)	

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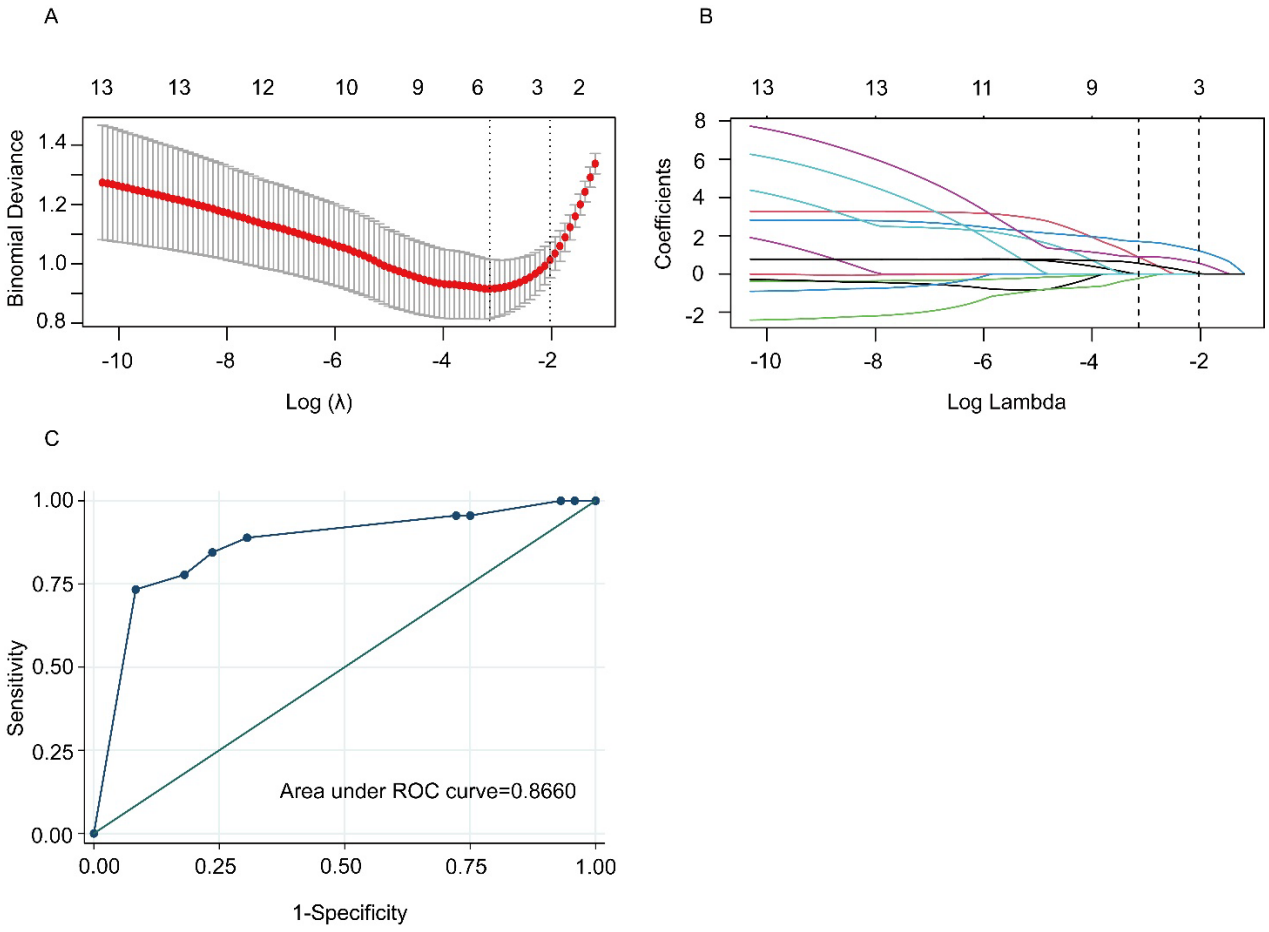
Table 2

Influencing Factors of Self-perceived Library Resource Utilization.

Factor	OR (95% CI)	*p*-Value	Bootstrap	
			OR (95% CI)	*p*-Value
Weekly library hours	2.707 (1.096~6.682)	0.031	2.707 (0.531~13.799)	0.086
Space capacity satisfaction	4.26 (1.93~9.399)	<0.001	4.26 (1.438~12.622)	0.006
Resource retrieval ability satisfaction	7.362 (2.618~20.705)	<0.001	7.362 (1.311~41.341)	0.001

Figure 1 Selection of influencing factors and their predictive value



(A) Identification of the optimal penalization coefficient lambda (λ) of the library resource utilization according to Bayesian information criterions. (B) A vertical line was drawn at the optimal λ value, resulting in 5 non-zero coefficients of the library resource utilization. (C) Receiver Operating Characteristic curve (ROC) for factors influencing library resource utilization, AUC = 0.866.

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DISCUSSION

This case report examined the self-perception of library resource utilization among vocational medical students and identified key influencing factors. Satisfaction with library space and self-perceived satisfaction with resource retrieval ability were significant predictors of self-perceived resource utilization.

In this study, the library's space capacity was identified as a significant factor influencing self-perceived library resource utilization. Prior research has demonstrated that seating availability, spatial layout, and the overall learning environment can greatly impact students' library experience [19]. A user-centered approach that offers multifunctional spaces—such as quiet study areas and discussion rooms—is recommended to better support student needs [20,21]. Our library currently provides various physical spaces, including the main stacks, reading cafe, makerspaces, general reading rooms, electronic reading rooms, and discussion rooms. A total of 2,500 seats are available, with 788 reservable through an online system or the university's app. The library operates 91 hours per week [25].

Despite these resources, some limitations in spatial usage persist. To improve space utilization, we are considering the removal or relocation of low-use print materials to create additional space; optimization of layout to increase quiet study zones; designation of more silent areas during peak periods such as final exams; addition of small study rooms to relieve crowding; extended opening hours or more evening study space; provision of dedicated rooms for clinical case discussions and simulation during skills competition preparation; enhancement of the seat reservation system for greater accessibility; and improvement of infrastructure to ensure sufficient seating, power outlets, and access to drinking water. These improvements could enhance student satisfaction with library spaces, particularly for vocational medical students who require focused and practical learning environments.

Self-perceived resource retrieval ability was also confirmed as a key factor influencing self-perceived library resource utilization. Students who felt they had stronger retrieval skills were more likely to believe that they could effectively access and use library resources, highlighting the importance of the ability to locate required materials. This finding is consistent with previous studies [22,26,27], which indicate that limited awareness of available resources and inadequate information literacy training can hinder optimal resource use [28,29]. To improve utilization, we are considering targeted interventions such as workshops, elective courses, and personalized training sessions to enhance students' information literacy, as well as the implementation of user-friendly retrieval systems [30].

In addition, several factors, though showing significant differences in initial analyses, were not retained in the final regression model. Weekly hours spent in the library, for example, was significantly associated with self-perceived utilization. Encouraging longer study durations and extending library access may help increase perceived resource utilization [27].

Higher satisfaction with physical and electronic resources was also linked to greater utilization. The library in this study provides a range of physical resources, including medical and general books and journals, as well as extensive electronic resources, such as SpringerLink, Wanfang Data, CNKI, EBSCO, Worldlib, and Superstar Digital Library [25]. Expanding practical resources aligned with vocational medical training--such as medical handbooks and clinical guidelines--and improving digital content (e.g., clinical case databases, telemedicine platforms) may further promote use. Similarly, library services and participation in training were associated with increased self-perceived utilization. Personalized support and retrieval guidance [27], along with orientation programs, hybrid-format workshops, and short videos, could help more students engage with library offerings. However, it should be noted that, although significant in initial analyses, these variables may not have remained significant in the final model.

Given the shorter training duration, practical orientation of vocational medical education, and the specific demands of the profession, vocational medical students have unique needs. These include greater requirements for extracurricular study time, access to practical learning spaces, and the development of information literacy to strengthen lifelong learning abilities [3,4,5]. One of the most important contributions of this study is its focus on vocational medical students, a population often overlooked in library resource utilization research. This case report offers valuable insights into vocational medical students' perceptions of how they engage with library resources, which may help improve the impact of library offerings and ultimately quality of vocational medical education and better prepare students for their future careers.

This case report found that satisfaction with library space capacity and satisfaction with self-perceived resource retrieval ability are significant predictors of vocational medical students' self-perceived library resource utilization. The predictive value of these factors suggests that improvements to space, layout, opening hours, and educational opportunities may enhance self-perceived resource utilization. These findings offer actionable strategies to better support the training and career development of vocational medical students.

AUTHOR CONTRIBUTIONS

Shanshan Li, Xiaoli Dai: Methodology; investigation; formal analysis; visualization; writing—review and editing. Shanshan Li, Wei Jiang: Conceptualization;

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methodology; investigation; software; data curation; project administration; formal analysis; visualization; writing—original draft.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author for academic, non-commercial purposes upon request, provided that the request complies with institutional and ethical guidelines.

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SUPPLEMENTAL FILES

Appendix A: Survey Instrument

AUTHORS' AFFILIATIONS

Shanshan Li, shanshanshsh@163.com, MD, Lecturer, Jiangsu Medical College, Jiangsu, China

Wei Jiang, jiangweicc233@163.com, Jiangsu Medical College, Jiangsu, China

Xiaoli Dai, daixl_jsyy@sina.com, Associate Professor, Associate Dean, School of Medicine, Jiangsu Medical College, Jiangsu, China

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CASE REPORT
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Usability and potential impact of a web-based literacy-oriented intervention for community-dwelling patients with complex care needs: a mixed methods case report

Pierre Pluye; Vera Granikov; Virginie Paquet; Francesca Frati; Fabio Balli; Jiamin Dai; Reem El Sherif; Quan Nha Hong; Roland M. Grad

See end of article for authors' affiliations.

Background: Community-dwelling patients with complex care needs (hereafter "patients") seek information to choose optimal care. However, patients with low ehealth literacy often have difficulty finding trustworthy, easy-to-understand information. Improving their ehealth literacy can lead to multiple positive health outcomes. This study aimed to describe patients' perceptions of the usability and potential impacts of a web-based, ehealth literacy–oriented intervention.

Case Description: To support patients in finding, appraising, and using online health information (the three core principles of ehealth literacy) we developed the Online Health Information Aid (OHIA), which includes a website, an educational video, and a game. An evaluation was conducted with five patients who received the intervention. Pre-intervention (Day 1) and post-intervention (Day 30) data were collected. Quantitative data were analyzed using descriptive statistics, and qualitative data were analyzed using content analysis. Quantitative and qualitative results were compared in a joint display. Participants included three women and two men aged 46 to 71 years (mean age: 62) with two to 11 chronic health conditions (mean: 5) and two to 20 medications (mean: 10). Participants found the website usable (e.g., "good tool"). For the video, usability scores were high (67%-96%; mean: 79%) with positive comments (e.g., "good and helpful"). However, the game's usability was lower (40%-78%; mean: 60%), and comments were negative (e.g., "complex and not readable"). For three participants, ehealth literacy levels (n=2) and/or knowledge for appraising online health information (n=2) increased post-intervention. However, they did not perceive any impact of the intervention.

Conclusion: These results suggest that the OHIA intervention, specifically the website and the video, is a promising approach to improving ehealth literacy among people with lower education, and a family income below or around the poverty line, including patients with complex care needs.

Keywords: Consumer health information; ehealth literacy; literacy program; online health information.

See end of article for supplemental content.

BACKGROUND

Patients with complex care needs (PCCN) often navigate fragmented care systems and face additional challenges when trying to access and assess reliable health information online. PCCN living in the community face multiple issues (e.g., multimorbidity, polypharmacy, mental health, social vulnerability) and barriers to optimal use of health and social services (e.g., limited awareness of available options, services, and treatments, paired with low motivation or confidence) [1-4]. Finding, evaluating, and using online health information is another challenge. As is the case for most, many PCCN have difficulty distinguishing trustworthy from misleading health information, and their information needs often remain unmet due to limited time and unclear communication from health professionals [5].

Online health information is generally associated with positive outcomes such as improved health literacy, empowerment, self-care, engagement in healthcare, quality of life, as well as decreased worries [6-12]. Being informed can decrease unnecessary calls and visits to health care professionals and optimize service utilization [12, 13]. Trustworthy information that is easy to read or listen to, for example narrated educational videos, can help reduce health information disparities by addressing gaps in access among marginalized groups [14]. In

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contrast, misleading information can increase anxiety, deteriorate relationships with health professionals, and cause unnecessary emergency department visits [15-20].

As the proportion of PCCN increases with the aging of the population and the rising prevalence of chronic disease, these individuals continue to face difficult decisions, unmet care needs, fragmented care, inadequate quality of care, and poor health outcomes [21-24]. Moreover, they and their caregivers have greater health information needs to support decision-making about treatment, manage behavioral and psychosocial issues, address concerns about quality of life and autonomy, and navigate the complexities of health and social services [4]. More than half of PCCN have a low level of health literacy across the 18 OECD countries. For example, in Canada, this includes about 60% of PCCN [25]. They face difficulties finding, evaluating, and using online health information that is easy to read, listen to, or watch [26].

Several randomized controlled trials showed that web-based interventions can improve health literacy on specific topics, and health education videos and games can improve the knowledge, attitudes, and behaviors of people with low literacy [27-33]. Videos are more acceptable in a low literacy population and may help reduce informational inequities related to health literacy [34]. Moreover, health education games can improve motivation, engagement, attitude, and learning [35, 36]. However, more research is needed to evaluate the effects of interventions designed to improve ehealth literacy among PCCN with low literacy levels, including the effectiveness of web-based tools such as videos and games for this population.

CASE PRESENTATION: THE ONLINE HEALTH INFORMATION AID (OHIA) WEBSITE-VIDEO-GAME INTERVENTION

Our team implemented an educational intervention that includes a website called Online Health Information Aid (OHIA) that promotes health literacy skills, accompanied by a video and a game, which aim to promote the use of the website [37]. Overall, this three-component intervention aims to improve ehealth literacy (i.e., skills and confidence for finding, assessing, and using trustworthy health information online). In this case report, we examine the usability of the intervention from the perspective of community-dwelling PCCN, explore the intervention's potential impact, and assess the feasibility of an experimental evaluation.

Our intervention has three components: a website, an educational video, and a game. The purpose of the website is to promote users' (a) ehealth literacy skills for finding, evaluating, and using trustworthy online health information (i.e., knowledge), (b) trust in this information (i.e., attitude), and (c) the use of this information in clinical encounters (i.e., behavior). The website was developed using a user-centered approach and is based on research evidence from a systematic literature review and a qualitative research study [20, 38, 39]. The website provides actionable recommendations and a list of trustworthy sources, in English and in French.

The educational video is a 6-minute animation integrated into the site's homepage, available in English and in French. Its development was informed by international best practice guidelines [40-43] and drew on the Theory of Reasoned Action [44]. This theory proposes that behavior is shaped by a person's knowledge, attitudes, perceived social norms, and sense of control, and it can be applied in studies of ehealth literacy and educational videos. The animated character in the video presents the sections of the OHIA website (i.e., core elements of ehealth literacy) and illustrates how the website can be useful.

The game aims to help users distinguish trustworthy from misleading information. Players are presented with several types of information and are asked to rank them on a scale from 0 (potentially misleading source and content) to 5 (trustworthy source and content). Informed by research evidence, the game uses engaging stories to share knowledge, presents problems for players to solve, and encourages repeated play [35].

Evaluation

After developing and implementing the OHIA website-video-game intervention, we performed a two-step evaluation to explore its usability and potential impact. These explorations allowed us to assess usability, a critical determinant of impact, as non-usable solutions are unlikely to achieve meaningful outcomes. The study was approved by the McGill University Research Ethics Office.

Through patient organizations and our networks, we recruited five PCCN who met two criteria: (1) a high school education or less, and (2) a family income below or around the poverty line, which is a combination associated with lower levels of ehealth literacy [45]. Although seemingly small, this number of participants is considered sufficient to uncover major flaws and over 80% of usability issues [46-49], as well as to explore a phenomenon and formulate hypotheses [50].

Data collection and analysis were guided by a conceptual framework that describes four levels of information outcomes [39]. Level 1, situational relevance, refers to whether a person finds the information relevant in their specific context. For example, PCCN will continue to read or listen to a webpage if it matches their needs but skip it if not. Level 2, cognitive impact, describes positive or negative cognitive effects of relevant information. For example, PCCN can either learn something new or not understand the information. Relevant information with positive cognitive impact is more likely to be used. Level 3, information use, includes conceptual, legitimating, symbolic, or instrumental uses. For instance, PCCN may

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use information to decide whether to consult a professional (instrumental) and share it with them (symbolic). However, information use does not necessarily lead to health outcomes. Level 4, health outcomes, refers to positive or negative effects on health and well-being, such as feeling reassured or more anxious after using the information.

Data Collection

Our evaluation followed a convergent mixed methods design [51]. Quantitative and qualitative data were collected in two steps: Step 1 (Day 1) and Step 2, one month later (Day 30). Our quantitative question was: To what extent can the intervention contribute to improving the level of ehealth literacy? Our qualitative question was: From the participants' perspective, what are the usability and potential impacts of the intervention? All participants participated in both steps. Each participant received a compensation of $100 Canadian.

On Day 1 (Step 1), we collected baseline quantitative data (see Appendix 1 for the tools and measures used), including sociodemographic information, comorbidities and medication use, ehealth literacy levels, and knowledge to distinguish trustworthy from misleading health information online. Questions related to health literacy were based on the Digital Health Literacy Instrument (DHLI), a validated tool that measures self-reported skills in computer operation, navigation, information searching, evaluating reliability, assessing relevance, creating content, and protecting privacy [52]. Questions assessing knowledge to distinguish trustworthy from misleading information were derived from a systematic literature review on trust and credibility in web-based health information seeking [53]. After the intervention, which involved visiting the website, watching the video, and playing the game, we also collected usability measures. Finally, we gathered qualitative data through semi-structured online interviews, which lasted an average of 82 minutes (range: 63-100 minutes).

On Day 30 (Step 2), to explore the potential impact of the intervention, we collected data about change in ehealth literacy and knowledge to distinguish trustworthy from misleading health information. During the interviews, a research professional asked each participant if the intervention influenced their information searches performed during the last month, if they experienced any benefits for themselves or their caregivers, and perceived risks or negative consequences (e.g., anxiety). The interviewer also asked what participants liked about the intervention and what could be improved. Each interview lasted on average 54 minutes (range: 41-75 minutes).

Data Analysis

The statistical analysis of quantitative data was descriptive and exploratory. The qualitative content analysis focused on usability of the intervention, its potential to improve ehealth literacy, and the influence of the video and the game on using the website. Interviews were transcribed verbatim and analyzed by two researchers. To compare Steps 1 and 2, quantitative and qualitative results were displayed in a single table, juxtaposing quantitative results on sociodemographic characteristics, contextual factors, ehealth literacy scores, and usability, with qualitative findings, thereby enhancing the interpretation of potential patterns.

RESULTS

Participants included were three women and two men, French-speaking, aged 46 to 71 years (mean = 62 years), with two to 11 chronic health conditions each (mean = 5), including chronic pain (n=5), diabetes type 2 (n=3) and hypertension (n=2). These problems required two medications per day for two participants, 10 to 15 for two participants, and about 20 for one participant. For three participants, these conditions limited their daily activities. Four participants reported significant problems in the past month such as health problems (n=4), social problems (n=2), and problems with health services (n=2). Three participants were retired and two were unemployed. All five participants were living with a partner. Three participants reported high social support (77-97%), and two reported moderate support (60-63%).

All participants had a computer, Internet access, and a tablet; four had a smartphone. Two participants reported that they use online health information with their family physician and other medical professionals. For example, one of them (P2) described searching for medication-related information and sometimes reading patient forums: "The Internet has been extraordinarily helpful in keeping me informed, talking with my doctors, and being less anxious." All participants received the three components of the intervention (i.e., OHIA website, video, and game), which they evaluated as detailed below.

Usability

Qualitative findings and quantitative results are presented in Table 1. All five participants found that the OHIA website and educational video were more usable than the game. Participants described the website as "good", "comprehensive", "helpful", "friendly", and "pleasant". The video was described as "excellent", "good", "helpful", with "nice role-playing situations". Regarding the game, all interviews revealed negative comments: "too complicated", "too fast", "incomprehensible", "unreadable", "confusing", and "uninteresting." The mean usability scores of the video and the game

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Table 1

The OHIA intervention: Usability of the three components

Participants	Website usability	Video usability	Score (%)	Game usability	Score (%)
	Interview	Interview		Interview	
P1	"Good tool with tips; quite comprehensive"	"Good; helpful; exemplar"	67	Complicated, too fast, characters too small: "you can't see anything."	40
P2	"Well done; this will help; this is 95% what I am doing"	"Difficult to find"	82	Complicated, difficult, characters too small: "boxes hard to open."	64
P3	"Good; with answers to our questions"	"Little slow beginning"	69	Complicated, incomprehensible, uninteresting: "unreadable, too much text."	44
P4	"Well done and friendly; this helps to understand"	"Great introduction and scenario"	96	Uninteresting: "difficult to see, too many indications" (instructions)	78
P5	"Very well done; easy and agreeable; well explained"	"Excellent, great pictures, well explained, but narration a little bit too slow"	82	Complicated, difficult, uninteresting: "statements too small, confusing game"	76
Mean score	-	-	79.2	-	60.4

Table 2

Potential impacts of the OHIA intervention (website, video, game)

Participants	ehealth literacy score (%)		
	Pre-intervention	Post-intervention	Difference
P1	71	85	+14
P2	86	81	-5
P3	71	77	+6
P4	80	86	+6
P5	66	82	+16
Participants	Knowledge score (%): capacity to distinguish trustworthy from misleading information sources		
	Pre-intervention	Post-intervention	Difference
P1	52	75	+23
P2	71	67	-4
P3	17	58	+41
P4	96	92	-4
P5	77	79	+2

corroborated the interviews. No participant reported intervention-related worries or stress.

Quantitative results are presented in Table 2. For two participants (P1 and P5), the intervention may have improved their ehealth literacy score (+14% and +16% respectively). For two participants (P1 and P3), the intervention may have improved knowledge to distinguish trustworthy from misleading health information (+23% and +41% respectively). These three participants had lower pre-intervention scores, indicating room for improvement.

Comparing quantitative results and qualitative findings revealed valuable insights; divergence was observed in four cases. Three participants improved their scores of ehealth literacy and knowledge for appraising information between the pre- and post-intervention period (Day 1 and 30) but did not qualitatively perceive any impact linked to the intervention (P1, P3 and P5). One participant's score did not improve, but they felt their ability to appraise information had improved after the intervention (P2). In contrast, qualitative findings supported the quantitative results for one participant who neither improved their score nor perceived any impact from the intervention (P4).

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DISCUSSION

Our intervention evaluation results are both encouraging and informative. First, regarding usability, participants unanimously praised the OHIA website and video, suggesting only minor improvements. In contrast, they all found the game difficult to use, highlighting the need for further user-centered design iterations. Second, three participants with lower pre-intervention scores (i.e., ehealth literacy and knowledge to appraise information) improved their scores one month after the intervention. This finding leads to the following hypothesis for future research: in a population with low ehealth literacy, the OHIA website and video can improve ehealth literacy, and knowledge to distinguish trustworthy from misleading health information. The divergence between the quantitative and qualitative results may be attributed to differences between individual perspectives and empirical measurements.

Our results build on existing literature that shows that online health information and web-based literacy-oriented interventions are typically beneficial to patients and caregivers by suggesting that this is the case for PCCN. The OHIA website and video may help patients, health professionals and health information professionals. Patients and caregivers can use the website and video as needed and share this information with their entourage, as demonstrated by two participants (P4, P5). Health professionals can use the OHIA website and video to find information for their patients and encourage their patients to use it. Health information professionals can recommend these resources to their users and incorporate them in educational interventions. The OHIA website and video have been referenced in academic library guides at McGill University and Université de Montréal, which indicates that these resources are accessible to a broad audience, including individuals with higher literacy levels.

Our results show that it is possible to improve ehealth literacy among people with lower education, and a family income below or around the poverty line, including PCCNs. In a growing population of PCCN, even a small improvement can have a meaningful impact. Such gains are important because ehealth literacy constitutes a major determinant of health and is the best predictor of health after smoking, ahead of low income and low education [54-56]. Low ehealth literacy has well-documented negative effects on care, health outcomes, and service use, contributing to higher healthcare utilization, increased costs, and greater health inequities [7, 25, 55, 57-77].

Multiple types of interventions are promising for improving ehealth literacy [33], and the OHIA website and video can contribute. Future research can assess whether the OHIA website and video can help improve ehealth literacy in the general population, and especially how to think critically about the information they encounter. The OHIA website and video can play a particularly important role in the current context of rapidly expanding, targeted, and convincing AI-generated mis- and disinformation, which often spreads with insufficient or no regulatory guardrails [78, 79].

LIMITATIONS

Our sample may have included 'ideal' individuals who are well-positioned to manage their care using trustworthy information that reassures them, as well as individuals who are inclined to resist care [80]. This heterogeneity could have enhanced the potential positive effects of the intervention relative to those that may be observed in a statistically representative sample of PCCN with uniformly low eHealth literacy. Nevertheless, this diversity enabled us to compare participants with lower and higher ehealth literacy, generating valuable insights.

In addition, two key limitations of case reports are the inability to statistically generalize findings and to attribute observed outcomes directly to the intervention. For example, the measured impacts might have resulted from a mere measurement effect or a test-retest effect [81]. Despite these limitations, case reports have merit when they suggest plausible hypotheses that can be tested in future research [82].

CONCLUSION

In today's context of rapidly advancing generative AI tools, and given the complexity of their needs, it is essential to continue supporting PCCN in acquiring trustworthy evidence-based information, thinking critically, and avoiding misleading content through literacy-oriented programs and educational interventions. The OHIA website and video have the potential to improve ehealth literacy for PCCN and the broader public, and should be promoted through varied media channels, with targeted outreach to health information professionals.

AUTHOR CONTRIBUTIONS

Pierre Pluye led the conceptualization, methodology, investigation, formal analysis, funding acquisition, supervision, and preparation of the original draft, which all authors reviewed and edited. All authors contributed to the study conception and methodology. Virginie Paquet was responsible for data collection, formal analysis, and project administration. Vera Granikov prepared the revised version of the manuscript. Virginie Paquet, Francesca Frati, Jiamin Dai, Reem El Sherif, Quan Nha Hong, and Roland Grad also contributed to writing—review and editing of the final manuscript.

Note: The authors would like to honour the memory of the late Pierre Pluye, whose vision, leadership, and dedication shaped this project and continue to have an invaluable impact on our work. He is deeply missed.

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DATA AVAILABILITY STATEMENT

Due to the small number of participants and participants' privacy concerns, data could be shared only after the principal investigator's rigorous revision of the justifications and circumstances, and the obtention of a formal agreement of the Research Ethics Office of the Faculty of Medicine and Health Sciences of McGill University, and ultimately the approbation of the participants themselves.

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SUPPLEMENTAL FILES

Appendix A: Measurement tools

AUTHORS' AFFILIATIONS

Pierre Pluye, https://orcid.org/0000-0002-9274-7720, Formerly of the Department of Family Medicine, McGill University, Montréal, Canada

Vera Granikov, vera.granikov@chairepartenariat.ca, https://orcid.org/0000-0003-0518-8850, Centre Hospitalier de l'Université de Montréal Research Centre (CRCHUM), Montréal, Canada

Virginie Paquet, virginie.paquet@umontreal.ca, https://orcid.org/0000-0002-4931-134X, Service des bibliothèques (Recherche et communication savante), Université de Montréal, Montréal, Canada

Francesca Frati, francesca.frati@mcgill.ca, https://orcid.org/0000-0003-4380-7958, Schulich Library of Physical Sciences, Life Sciences, and Engineering, McGill University, Montréal, Canada

Fabio Balli, info@fabioballi.net, https://orcid.org/0000-0002-4769-5810, Breathing Games Association, Switzerland

Jiamin Dai, PhD, jiamin.dai@mail.mcgill.ca, https://orcid.org/0000-0002-4934-2760, School of Information Studies, McGill University, Montréal, Canada

Reem El Sherif, reem.elsherif@mail.mcgill.ca, https://orcid.org/0000-0002-6392-517X, Department of Family Medicine, McGill University, Montréal, Canada

Quan Nha Hong, OT, PhD, quan.nha.hong@umontreal.ca, https://orcid.org/0000-0002-2576-5750, École de réadaptation de l'Université de Montréal, Université de Montréal, Montréal, Canada

Roland M. Grad, roland.grad@mcgill.ca, https://orcid.org/0000-0002-1591-613X, Department of Family Medicine, McGill University, Montréal, Canada

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Using andragogy and instructional design to teach workshops on systematic searching in an academic library: case report

Erin Roga

See end of article for authors' affiliations.

Background: Knowledge syntheses require complex searches of the literature, but many have poor quality, irreproducible search methods. Academic libraries support researchers conducting knowledge syntheses in many ways, including providing training such as workshops. However, for training to be successful, effective teaching theories and methods need to be used, such as andragogy and instructional design. These can help to develop learning strategies and experiences based on the needs of the learners.

Case Presentation: At Federation University Australia Library, in response to increasing requests for support from researchers conducting knowledge syntheses, a series of workshops on systematic searching was developed using adult learning methods. We aimed to deliver quality, engaging learning experiences to researchers, and using instructional design was likely to help us meet this goal. Learning outcomes were identified, followed by developing active, collaborative learning strategies and activities. After implementation, the workshops were evaluated informally, resulting in planned changes and improvements to future offerings.

Conclusions: Using andragogy and instructional design was a successful method of developing the workshops as it provided a structure to follow, and centered researcher needs. While positive feedback was received from workshop participants, there is a need to formally evaluate the learning outcomes to determine if the workshops resulted in improvements in systematic searching practices. The approach to developing the workshops can be adapted by other libraries delivering similar training on systematic searching. It is our aim that by promoting the use of effective teaching methods, the quality of search methods in knowledge syntheses will improve.

Keywords: Systematic review; knowledge synthesis; academic library; instructional design; searching; andragogy

BACKGROUND

Systematic reviews collect and synthesize evidence to provide clear answers on a research question, using a rigorous methodology to reduce bias [1]. This need for rigorous, unbiased synthesis has been adapted for a variety of aims and disciplines with at least 41 varieties of knowledge syntheses identified [2, 3]. These require complex, systematic searches of the literature to find all potential evidence [4]. However, many systematic reviews published in peer reviewed journals have significant problems with reliability and validity, with poor quality or irreproducible searches [5-7].

Libraries support researchers conducting knowledge syntheses by offering online material, consultations, training and co-authorship, and requests for support have increased over time [8-10]. Workshops have been used to meet this demand in a more sustainable manner, aiming to improve the ability of researchers to conduct high quality, reproducible searches [9]. For workshops to achieve this goal, the potential for learning needs to be maximized, which in turn requires using evidence-based teaching methods.

Unlike pedagogy, which addresses the learning needs of children, andragogy addresses the needs of adult learners such as researchers through the following principles:

- Adults need to know why they need to learn something
- Adults see themselves as autonomous and self-directed learners
- Adults use their prior life experience when learning
- Adults are ready to learn what they need for real-life situations
- Adults' orientation to learning is contextual and problem solving
- Adults are intrinsically motivated to learn [11]

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Andragogy has been successfully utilized when teaching information literacy to university students [12-14]. Learning Outcome 2.2 of 'The Australian and New Zealand Information Literacy Framework' states "the information literate person constructs and implements effective search strategies" [15]. As creating effective, sensitive searches when conducting knowledge syntheses requires a high degree of information literacy, it can be extrapolated that andragogy will also be successful when teaching systematic searching. To apply the principles of andragogy in practice, instructional design (ID), "deciding what methods of instruction are best for bringing about desired changes in student knowledge and skills", is a useful model, ensuring effective teaching methods for adult learners are used [16].

Johnson-Barlow and Lehnen [17] identified 16 different ID models used in academic library instruction, with ADDIE the most frequent. ADDIE uses the following five steps:

- **Analyze** what the learning needs are likely to be
- **Design** learning strategies to meet these needs
- **Develop** activities and learning experiences
- **Implement** the learning experiences
- **Evaluate** how effective these were at meeting learning needs [18].

These steps can then be used to guide the development of library instruction and the selection of teaching methods.

Teaching Methods

Analyzing anticipated learning needs and turning them into intended learning outcomes has been used by libraries when developing education for researchers. In their course for graduate students on systematic reviews, McGowan et al. [19] determined these from their experience conducting reviews and knowledge of the literature. Threshold concepts can also be useful to identify learning needs. These are transformative concepts which are challenging to understand, but once mastered, open new ways of thinking. They recognize that learning is an individual process, which aligns with the andragogical principle that learners build on their own unique prior experiences [11, 20]. In workshops on systematic searching, Poole [21] expected the threshold concepts to be subject headings, grey literature and search evaluation, and used these to plan learning outcomes, while recognizing that learning is an individual journey, and not all learners will reach the same outcomes from the same experiences.

Learning strategies and experiences need to be designed to meet learner needs. One such strategy is active learning, in which learners complete a task, think about it and make connections. This can aid engagement and promote deeper learning and higher order thinking [22]. However, this can be challenging to apply in online teaching. Methods such as break-out rooms, collaborative tools, discussions, and real-life tasks have been successfully used by the University of Sydney Library in online workshops on systematic searching, maintaining the engagement and interaction of in person workshops [10].

Another strategy is flipped classrooms, where students engage in online content through pre-reading or completing activities prior to attending a class, so class time can be used for active learning [23]. This strategy has been used in library workshops on systematic reviews to give learners a baseline understanding, with feedback from participants indicating the learning outcomes were met and their confidence at conducting systematic searches improved [21, 24, 25].

While adults use their prior experiences when learning, collaborative activities promote learning from peers' experiences. In peer learning, instructors and students learn reciprocally, empowering researchers to learn from each other in a safe, supportive manner and develop a sense of independence and confidence in their abilities and expertise [26]. Collaborative activities have been used to teach systematic searching, making the content more relevant and promoting peer learning as participants supported each other to solve problems related to their own reviews [10, 24, 27].

Andragogy states that adults are oriented to learn to solve real-life problems, and reflection is a learning experience which can lead to making connections between learning and practice [28]. Reflection is part of the experiential learning cycle developed by Kolb [29], in which after an experience, the learner reflects on it, develops new ideas and theories, and applies these to practice. Reflection as meta-cognition can also support solving complex problems, as it can result in knowledge becoming integrated with what is already known [30]. It has been explicitly built into library workshops on systematic searching by Lenton and Fuller [31] and Poole [21] in which participants reported increased confidence with systematic searching and recognized areas they wished to learn more about.

CASE PRESENTATION

Federation University Australia is a small institution in Victoria with a total of approximately 1300 FTE employees and 8700 FTE students as of December 2024, with campuses in regional towns and the capital city, Melbourne [32]. The library has eight liaison librarians, whose role is to support the teaching, learning and research in the university.

In 2020, there was a marked increase in research consultations relating to knowledge syntheses such as scoping and systematic reviews. It became evident that the researchers held many common misconceptions that have

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been previously identified [33, 34], for example the difference between systematic and scoping reviews, systematic searching methods, and the appropriate use of conduct and reporting guidance. To manage the volume of requests and more efficiently educate researchers, we decided to develop more comprehensive support for reviews.

The first resource created in 2022 was an online guide 'Reviewing the literature' [https://libguides.federation.edu.au/reviewingtheliterature], intended to provide information that could be accessed at point of need. While the guide was well used, there were still numerous requests for research consultations. This prompted us to run webinars providing information about knowledge syntheses and demonstrating search techniques. An Open Educational Resource (OER) 'Introducing scoping and systematic reviews' [https://oercollective.caul.edu.au/scoping-systematic-reviews/] was then developed, intended to be an interactive, easy-to-understand resource on conducting scoping and systematic reviews which both simplified and referred back to methodological and reporting guidance.

During this time, information literacy classes for undergraduates were being redesigned to include active learning and discussions to try and improve student engagement and better meet intended learning outcomes. This led us to consider how these strategies could be applied when supporting researchers conducting knowledge syntheses.

Our objectives were to provide quality learning experiences and facilitate improvements in participants' ability to conduct reproducible and high-quality systematic searches. We determined that a series of hands-on workshops was likely to meet these goals. We also needed to design them for online delivery, as researchers are located across Victoria.

Our process began by reading examples of how other libraries delivered similar training on systematic searching [9, 10, 19, 21, 25, 27, 31]. We also explored the theory of andragogy, how using ID aids applying these theoretical principles in practice and evidence for the effectiveness of ID. We then looked at models and frameworks we could follow and determined that ADDIE fit our purpose as it supports the principles of andragogy and has been used by many other libraries [17]. The following section describes in detail the process of using the ADDIE framework.

Analyze

The first step in designing the workshops was analyzing what the learning needs of researchers were likely to be. These were identified from challenges and misconceptions observed in research consultations, the steps taken in conducting knowledge syntheses, and feedback and observations from previous library webinars. The learning needs chosen were systematic searching techniques and appropriate use of reporting and methodological guidelines.

To meet these needs, we developed a series of five two-hour online workshops open to all staff, PhD, and Masters students pursuing research, regardless of discipline. The workshops are run by the specialist Liaison Librarian (Reviews Protocols) with a second librarian experienced in systematic searching also attending to provide additional support.

The learning needs were then turned into intended learning outcomes which stated what participants would know and be able to do at the end of each workshop (Table 1). They were limited to a maximum of three for each workshop to allow for in-depth exploration. From observing common challenges during previous webinars and research consultations, we determined that subject headings and search translation were likely to be threshold concepts for our participants.

Table 1

Workshop intended learning outcomes

Workshop	Intended learning outcomes
Planning the search	Creating relevant and appropriate search concepts from the review question
	Choosing appropriate limits and filters for the review question, and locating published search filters
	Using seed papers to identify relevant key words authors have used for each search concept
Developing the search	Finding relevant and comprehensive subject headings and keywords for search concepts
Putting together the search	Combining search terms correctly using wildcards, truncation, and Boolean and proximity operators
Testing and translating the search	Testing the search strategy in a database, and identifying and correcting errors
	Translating the search syntax, field codes and subject headings to run correctly in different databases
Extending and reporting the search	Understanding the importance of including grey literature in a review, choosing the most appropriate type, and searching for it
	Understanding the importance of reporting the search according to reporting guidelines and assessing the completeness of reporting in published reviews

Full lesson plans available CC BY-NC 4.0 on Open Science Framework [https://osf.io/cpqd2/].

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Design

The next stage was considering which learning strategies would address the intended learning outcomes in an online environment. We determined that active learning and a flipped classroom would be effective methods that aligned with the andragogical principles of adults as autonomous, intrinsically motivated learners focused on solving a real-life problem.

Our prior experience providing webinars on knowledge syntheses showed that delivering the content and demonstrating search techniques during the session took up a significant amount of time. We had identified a need for hands-on practice and discussion, so a flipped classroom was an appropriate strategy to achieve this. On registration, the link to 'Introducing scoping and systematic reviews' [https://oercollective.caul.edu.au/scoping-systematic-reviews/] was provided and participants asked to read the relevant section and complete the activities prior to the workshop. This was intended to provide an opportunity for participants to practice searching skills and have a foundation of knowledge to build on, which was briefly revised at the commencement of each workshop.

We chose the strategy of active learning as it helps relate abstract concepts to real-life situations. We applied this by developing activities about systematic searching and prompting participants to make explicit links with their own knowledge synthesis. We used a scaffolded structure in which a skill was modelled or practiced together, then small groups collaborated on a similar task, and finally the class discussed applying the skills to their own research.

Develop

Once the strategies were decided on, the next step was to determine which activities would be effective. We focused on including group tasks and reflection in each workshop, so that participants could learn from their peers' experiences and reflect on how what they learnt was applicable to their own knowledge synthesis.

Whole class and small group collaborative activities were developed for each learning outcome. The class activity was led by librarians as we guided participants to complete the tasks, but in the group activities we aimed to act as facilitators to enable peer learning. In the workshop on planning the search, the class looked at an example knowledge synthesis question and identified the search concepts, discussing their reasoning. They then worked in groups to identify concepts from a different example question, then discussed as a class what the concepts for their own search would be. Discussions were a crucial part of the workshops, as they empowered participants to assist each other, rather than relying on the 'expert' librarian to provide answers. Break-out rooms and online collaboration tools optimized engagement and interaction, and these have also been used successfully in other training for researchers [25, 27, 35].

Reflection was explicitly encouraged in our workshops by asking prompting questions to aid participants to apply learning to their own knowledge synthesis. Andragogy states that adults build on prior experiences and by asking questions such as 'What do you know now that you didn't before?' and 'Have you changed your mind about anything?', participants were able to share their prior knowledge and misconceptions, how their thinking had changed, and how the skills would be used when developing their own search.

At the conclusion of each workshop, participants are given suggested homework to apply the knowledge and techniques learnt to their own projects.

Implement

To implement our workshops, we developed detailed lesson plans along with supporting material [https://osf.io/cpqd2/]. The two librarians who delivered and supported the workshops met to run through the content and activities and test the technology. The workshops generally ran smoothly, with the main issues around participants accessing shared documents, lack of familiarity with online tools or programs, or problems with their technology devices.

The benefits of the flipped classroom were possibly mitigated if participants did not complete the pre-reading. Although we did not formally assess this, informal feedback within the workshops indicated most had completed at least part of it. However, we found participants still had differing skills and knowledge. While Poole [21] managed this by requiring the successful completion of a quiz prior to enrolment, we did not take this approach. While we reminded people that they would gain the most out of the workshops if they engaged with pre-reading material, having this as a requirement is at odds with the principles of andragogy [11]. Instead, we adjusted the workshops to spend more time on discussions about the topics each class found challenging. This required constant monitoring of discussions and questions to make these decisions and meet participants' needs immediately. This was challenging in an online workshop as we could not observe facial expressions and body language, and therefore we frequently paused to ask if people had any questions.

Evaluate

The final stage of the ADDIE framework, evaluation, is an ongoing process. Internal library feedback surveys are routinely sent to webinar and workshop participants, but in this case, we did not receive enough responses for meaningful evaluations and did not apply for ethics approval to report on the few we received. Therefore, our evaluation is informal, based on our observations of the

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workshops, and librarian meetings to reflect on the workshops.

Like other programs which used formal participant self-evaluation and feedback, overall, we observed improvements in confidence, planned changes to practice and satisfaction in teaching strategies [19, 21, 24, 25, 27]. In meetings to reflect on the workshops, we observed that despite the flipped classroom, participants appeared to experience a high degree of difficulty with the threshold concepts of subject headings and search translation, and for a couple, a decline in self-confidence. We also observed participants had difficulty in areas we had not anticipated, such as documenting their search development and applying the learning to their own research question.

We found that using andragogy and ID provided a clear structure for us to follow when developing the workshops and kept us focused on the needs of learners. We also found our plans could not be static. Although we planned each workshop extensively, we often needed to adapt them in the moment to meet learner needs and to revise them for future iterations based on feedback and observations. While they were a significant time commitment, we found the workshops extremely rewarding to facilitate as we learnt about the diverse areas participants were researching, and through the ongoing interaction, our professional relationships with them were strengthened.

Our evaluation has led to changes in the next workshop series. To reduce the cognitive load of two-hour online workshops, we will trial ten workshops of one hour. We developed a search log template on which we will ask participants to record their research question prior to attending, allowing them to more explicitly relate the learning to their own research and build a draft search strategy over the series. We will continue to use a flipped classroom, but as participants have varying knowledge to build on or may not have engaged with the pre-reading, we will develop a more scaffolded approach for threshold concepts in which the content is broken into smaller chunks, so that participants fully understand one part before moving on to the next. For example, subject headings will be broken up into first understanding what they are and why to use them, then how to find and select them, and finally how to add them to the search strategy.

Perhaps the most significant observation was the dip in a couple of participants' self-confidence. While we reassured them that systematic searching is challenging and takes a lot of practice to master, this will need more consideration on how to address this. In the Information Search Process model, feelings of confusion, frustration and doubt are to be expected and common when learning to search, with reflection suggested as a strategy to manage this [36]. This indicates a need for us to encourage not only explicit reflection on the concepts, but also on the development of participants' understanding. One possible way to achieve this is using online polls or chat to ask participants to state what they have learnt, making their learning visible to themselves and their peers.

DISCUSSION

There have been previous reports and descriptions of library workshops for researchers conducting knowledge syntheses which mention the teaching strategies and methods used, including identifying learner needs, flipped classrooms, active learning, peer learning and reflection, [9, 10, 19, 21, 25, 27, 31]. Two reports mention that ID or adult learning principles were used to develop workshops but neither describes specific models [10, 25]. McGowan et al. describe their use of backwards design, however as their course was for credit, assignments and assessments were also part of their process [19]. This report differs in that it explicitly describes the complete process of using andragogy and ID to develop and deliver training without formally assessing learning.

Our aim was to improve researchers' ability to conduct quality and reproducible search strategies in practice. However, a limitation of this report is our inability to determine if the workshops achieved this goal. Through observations and participants' comments we can ascertain that in general, most felt more confident and competent, however this may not translate to real-life application of learning. These workshops are a substantial time commitment for both librarians and participants, and if they are not effective at improving searches in practice, then it is clear they need to be rethought and revised. For this reason, further research is currently underway to formally assess the effectiveness of the workshops at improving participants' systematic searching skills by looking at future knowledge syntheses they publish.

We expect the volume of consultation requests about knowledge syntheses will continue to increase, and if the workshops are effective, they have the potential to reduce this demand. They can also be adapted to provide instruction in the increasing number of Masters and Honors courses at Federation University Australia where students are given scoping or systematic reviews as assignments. Finally, this method of using andragogy and ID, including our lesson plans on OSF [https://osf.io/cpqd2/], could be adapted or reused by other institutions and libraries which provide similar support for knowledge syntheses, taking into consideration their own unique context, culture and researcher needs.

CONCLUSION

The well-documented phenomena of irreproducible, poor-quality searches in knowledge syntheses is a significant problem and librarians are in a position to help solve it. As requests for support are increasing, training for

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researchers needs to be both sustainable and effective. Using ID and models such as ADDIE can aid librarians to develop programs that provide researchers with the best opportunity for learning and although it can be a lengthy process, the potential outcomes make it worth investing the time. It is our goal that librarians are inspired by this report to use ID when designing researcher training, so that the quality and reproducibility of knowledge syntheses improve.

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AUTHOR CONTRIBUTIONS

Erin Roga: Conceptualization; Investigation; Methodology; Writing – original draft; Writing – review and editing; Project administration.

DATA AVAILABILITY STATEMENT

Lesson plans associated with this article are available in the Open Science Framework [https://osf.io/cpqd2/].

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AUTHORS' AFFILIATIONS

Erin Roga, e.roga@federation.edu.au, Federation University Australia, Australia

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CASE REPORT
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Introducing professional drug information resources to non-healthcare undergraduates: a case report on promoting drug information literacy

Hey Young Rhee; Kiyon Rhew

See end of article for authors' affiliations.

Background: Non-healthcare undergraduate students frequently seek drug-related information online, often relying on unverified sources such as Google or YouTube. Early exposure to professional drug information databases may promote evidence-based information-seeking habits.

Case Presentation: A one-hour training session on using Lexicomp, a professional drug information database, was conducted for 55 non-healthcare students and 58 pharmacy students at a women's university in South Korea. The session included live demonstrations and guided search tasks. Participants completed pre- and post-training surveys assessing their information-seeking behaviors, perceptions of source reliability, and intention to use Lexicomp. Students also ranked drug information types they typically searched for and anticipated using Lexicomp to find. Only 1.8% of non-healthcare students had prior knowledge of Lexicomp, compared to 100% of pharmacy students. After the training, 100% of non-healthcare students rated Lexicomp as more reliable than their usual sources, and over 90% expressed willingness to use it in the future. A marked shift in information-seeking priorities was observed, with greater emphasis on clinically relevant topics such as adverse effects and contraindications. Students reported increased confidence and found the platform easier to use than expected.

Conclusion: A brief educational intervention was effective in improving drug information literacy among non-healthcare students. Early training in professional resources may foster long-term adoption of evidence-based practices in personal health information use.

Keywords: Drug information database; non-healthcare students; health literacy; Evidence based practice; Health professionals

BACKGROUND

In today's digital environment, undergraduate students frequently seek health-related information through online platforms. While this increased accessibility can empower individuals to make informed health decisions, it also exposes them to significant risks associated with misinformation, particularly from unverified sources such as general search engines, social media, and generative AI tools [1,2]. Generative AI, in particular, has rapidly emerged as a popular tool for retrieving quick answers to health queries [3,4]. However, studies show that the reliability and accuracy of AI-generated health summaries remain inconsistent and potentially misleading [5,6]. In addition to generative AI tools, students frequently rely on general search engines (e.g., Google), video-sharing platforms (e.g., YouTube), and regional web portals (e.g., Naver) for drug-related information; however, these sources are also prone to misinformation and variable quality [7,8]

A growing body of research suggests that individuals tend to continue using the first information source they encounter, a phenomenon influenced by cognitive biases such as anchoring and source loyalty [9,10]. Over time, users may become accustomed to a particular level or quality of information, even if that source lacks scientific credibility [11]. This pattern is especially concerning among university students, who are at a formative stage in developing lifelong habits around information seeking and evaluation.

This concern is particularly acute when it comes to drug-related information, where inaccurate details about dosage, interactions, or contraindications may directly impact patient safety. Currently, most professional drug information databases, such as Lexicomp, are primarily used by healthcare professionals and students in related disciplines. However, at many institutions, non-healthcare students remain unaware of these resources despite having access through university subscriptions. Educating undergraduates, especially those outside healthcare

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disciplines, on how to navigate professional databases can enhance their ability to evaluate drug-related information critically and make more evidence-based health decisions during and beyond their academic years.

This case report describes an educational intervention conducted at a South Korean university, where a pharmacy program is the only health professional major. The goal was to assess whether a brief training in the use of Lexicomp could improve non-healthcare students' awareness, attitudes, and future intent to use professional drug information resources.

CASE PRESENTATION

This case report describes a single-session educational intervention designed to improve drug information literacy among undergraduate students, particularly those without a healthcare background. The intervention was implemented at a private women's university in South Korea, where the College of Pharmacy is the only health-related academic program. Other departments include disciplines such as humanities, social sciences, business, and natural sciences. As the university does not have medical or nursing schools, the study population consisted exclusively of pharmacy majors and students from non-healthcare departments.

A total of 113 undergraduate students voluntarily participated in the study. Of these, 58 were pharmacy majors, while 55 were non-healthcare majors. Most students were in their second to fourth year of study. Prior to the intervention, all participants had institutional access to Lexicomp Online, a widely used subscription-based professional drug information database, through the university library. However, nearly all non-healthcare students were unaware of the database or its potential use in verifying medication-related information.

The intervention consisted of a 60-minute in-person training session delivered by a faculty member specializing in clinical pharmacy. The session was conducted in a classroom setting equipped with a projector and internet access. The educational content was carefully tailored to introduce the concept of reliable, evidence-based drug information, to contrast it with unverified sources often used by the general public, and to provide practical instruction on how to navigate the Lexicomp platform.

The session began with a brief lecture highlighting common issues associated with relying on unverified or incomplete drug information. This included examples of misinformation from general websites and the potential risks of such reliance, particularly in the context of patient self-medication. This was followed by a live demonstration of the Lexicomp interface, during which the instructor showed how to search for a drug and locate specific types of information. Key sections introduced during the demonstration included drug indications, contraindications, dosage and administration, adverse effects, drug-drug and drug-food interactions, warnings and precautions, and patient education leaflets about medication or disease.

After the demonstration, participants were guided through a set of practice exercises using their own devices or shared screens. They were asked to search for information on commonly used medications, such as ibuprofen or loratadine, and to locate specific content such as appropriate dosing for different age groups, potential interactions with alcohol, or patient counseling points. The instructor provided real-time feedback and clarification as needed. This hands-on component was designed to reinforce the navigation and interpretive skills necessary to retrieve accurate drug information independently.

Although both pharmacy and non-healthcare students received the same training content, the focus of the intervention for non-healthcare students was to raise awareness and promote confidence in using professional-level drug information tools. The aim was not to train them as healthcare providers. Instead, the goal was to support safe and informed decision-making as health information consumers.

To evaluate the effects of the intervention, all participants completed an anonymous pre-training survey that assessed their prior awareness of Lexicomp, their usual sources of drug information, and their perceptions of reliability and usefulness. A post-training survey was completed within two weeks of the session, including parallel questions and additional items on satisfaction, future use intentions for Lexicomp, and the perceived value of resource access for non-healthcare students. The survey items used 5-point Likert scales, ranging from 1 (strongly disagree) to 5 (strongly agree), and included internal consistency checks. Although long-term outcomes such as retention of information or behavior change were not evaluated, the intervention aimed to assess the short-term shift in perceptions and attitudes following structured exposure to a professional database.

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Dongduk Women's University's institutional review board (IRB No. DDWU2403-01).

EVALUATION AND OUTCOMES

To evaluate the effectiveness of the educational intervention, participants completed a structured survey both before and after the training session. The pre-training survey assessed their prior experience with and awareness of professional drug information sources, typical information-seeking behaviors, perceived reliability of commonly used sources (e.g., Google, YouTube, Naver, generative AI), and general interest in drug-

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Table 1

The results of pre-training survey on the use of a drug information database

Questions		Non healthcare major students (n=55)	Pharmacy students (n=58)	p-value
How interested are you in health, medicine, and diseases in general?		3.8727 (0.7467)	4.1379 (0.9262)	0.0977
Compared to your peers, how much more interested are you in health, medicine, and diseases?		3.6909 (0.8579)	4.2241 (0.7503)	0.0006
Have you ever searched for information about your own health, the health of those around you, or medications they are taking?	No	0 (0)	0 (0)	N/A
	Yes	55 (100)	58 (100)	
If yes for above question, how frequently do you search for such information?	≥ once a week	9 (16.36)	6 (10.34)	0.0561
	≥ once monthly, < once a week	13 (23.64)	18 (31.03)	
	≥ once quarterly, < once monthly	31 (56.36)	24 (41.38)	
	< once quarterly	2 (3.64)	10 (17.24)	
What platforms do you use for information searches?	General portal websites such as Naver or Google	49 (89.09)	36 (62.07)	0.0005
	Media-sharing platforms such as YouTube	5 (9.09)	6 (10.34)	
	Professional drug information resources	1 (1.82)	16 (27.59)	
What sources do you use for information searches?	Personal channels run by healthcare professionals	29	17	0.0796
	Private organizations such as drug information centers	11	17	
	Government agencies such as the MFDS*	9	12	
	Specialized drug information database	6	12	
How satisfied are you with the sources of information you use?		3.6909 (0.6047)	3.7069 (0.4592)	0.8750
How much do you trust the health or drug-related information from your sources?		3.8182 (0.5474)	3.7931 (0.4086)	0.7840
Were you aware that you could use a professional drug information database through our school library?	No	54 (98.18)	6 (10.34)	<.0001
	Yes	1 (1.82)	52 (89.66)	
Have you ever felt the need for a more professional or reliable source of information when searching for health or medication-related information?	No	4 (7.27)	6 (10.34)	0.5655
	Yes	51 (92.73)	52 (89.66)	

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Table 2

The results of post-training survey on the use of a drug information database

Questions		Non healthcare major students (n=55)	Pharmacy students (n=58)	p-value
How interested are you in health, medicine, and diseases in general?		3.9091 (0.8449)	4.2586 (0.6898)	0.0174
Compared to your peers, how much more interested are you in health, medicine, and diseases?		3.8182 (0.9830)	4.1586 (0.8231)	0.04908
How satisfied are you with the training on the professional drug information database?		4.5091 (0.5733)	4.9138 (0.2831)	<.0001
How satisfied are you with the professional drug information database itself?		4.3273 (0.6953)	4.8103 (0.3955)	<.0001
Do you think the professional drug information database is more reliable than the sources you previously used?	No	0 (0)	0 (0)	N/A
	Yes	55 (100)	58 (100)	
Do you expect to use the professional drug information database, or have you already used it?	No	5 (9.09)	5 (8.62)	0.9299
	Yes	50 (90.91)	53 (91.38)	
Do you think the professional drug information database should be provided to undergraduate students outside of healthcare-related fields?		4.1455 (0.5584)	4.7759 (0.4207)	<.0001
Do you think there is a possibility that undergraduate students outside healthcare-related fields will use the professional drug information database?		3.8545 (0.9112)	4.5000 (0.5044)	<.0001
How frequently do you expect to use the professional drug information database?	≥ once a week	2 (3.64)	22 (37.93)	<.0001
	≥ once monthly, < once a week	25 (45.45)	24 (41.38)	
	≥ once quarterly, < once monthly	19 (34.55)	12 (20.69	
	< once quarterly	9 (16.36)	0 (0)	
Do you plan to inform your peers about the existence of the professional drug information database provided by the university library?	No	1 (1.82)	0 (0)	0.3023
	Yes	54 (98.18)	58 (100)	
Do you plan to recommend the use of the professional drug information database to your peers?	No	0 (0)	0 (0)	N/A
	Yes	55 (100)	58 (100)	

related topics. The post-training survey repeated several of the same items and added questions regarding satisfaction with the training, perceived ease of use of Lexicomp, and future intention to use the database (Table1).

Among non-healthcare majors, 1 out of 55 students (1.8%) reported having heard of professional drug information database such as Lexicomp prior to the training, and none had used it. In contrast, all 58 pharmacy students were already familiar with the database and had used it at least once for coursework or personal study. After the session, 100% (55 students) of non-healthcare students reported that Lexicomp was more reliable than the sources they previously used, and over 90% (50 students) expressed a willingness to use it in the future, especially when seeking information about drug side effects, dosage, or interactions.

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The post-training responses indicated a marked shift in attitudes among non-healthcare students. The average perceived reliability of Lexicomp was rated significantly higher than that of general internet sources, with a mean score of 4.49 out of 5 (standard deviation (SD) 0.61). In addition, non-healthcare students reported feeling more confident in their ability to locate and interpret drug-related information using a professional interface. When asked whether they believed it was valuable for students outside of healthcare fields to have access to such databases, the average Likert score was 4.15, indicating a high level of perceived relevance and benefit (Table 2).

This attitudinal shift was also reflected in students' prioritization of drug-related information types. As shown in Figure 1A, prior to the intervention, students most frequently searched for drug efficacy, followed by adverse effects and dosage. Before the intervention, students mainly relied on general platforms such as Google or YouTube, where information can be incomplete or inaccurate and sometimes provided by non-experts or community sources. After the training, as depicted in Figure 1B, however, they reported a stronger intention to search for clinically critical topics such as adverse effects, contraindications, and drug interactions using professional drug information resources.

While long-term outcomes were not directly assessed, this shift suggests the potential for students to develop stronger skills in evaluating information and may encourage more evidence-based approaches to drug information seeking in the future. Notably, the expectation to use Lexicomp for wellness or health information also emerged among non-healthcare students, suggesting a broader understanding of the database's scope. This comparison between actual past behavior and intended future use underscores the potential of even a short instructional intervention to recalibrate students' information-seeking behaviors toward more structured and evidence-based resources.

Satisfaction with the training session was also high. The overall satisfaction score for non-healthcare students was 4.51 out of 5 (SD 0.57), and qualitative feedback noted that the Lexicomp interface was easier to use than expected. Many participants appreciated the clarity and structure of the information provided and expressed surprise at the level of detail available in patient education materials.

Pharmacy students, who were included primarily as a reference group, showed little change between pre- and post-surveys, which was expected given their prior exposure to Lexicomp. Their survey data, however, provided a useful benchmark for interpreting the responses from non-healthcare students and highlighted the potential for convergence in information-seeking patterns when non-healthcare students are appropriately trained.

Reliability testing of the survey instrument showed acceptable internal consistency, with Cronbach's alpha calculated at 0.84 for repeated items assessing health interest and trust in information sources. To analyze changes in survey responses, descriptive statistics were used to summarize distributions, and independent t-tests were applied to compare post-training differences between healthcare and non-healthcare students. This suggests that the survey responses were stable and reflective of participants' attitudes.

Overall, the brief, single-session intervention resulted in substantial improvements in awareness, perceived usefulness, and intended use of Lexicomp among non-healthcare students, suggesting that even limited exposure can positively impact drug information literacy when supported by institutional access and guided instruction.

DISCUSSION

This case illustrates the feasibility and impact of providing structured training on a professional drug information database to undergraduate students without a healthcare background. The intervention demonstrated that even a single, brief instructional session can significantly improve non-healthcare students' awareness of high-quality drug information sources, their trust in those sources, and their willingness to use them in future information-seeking tasks. These findings support the idea that professional resources like Lexicomp, though originally developed for clinical use, can also be valuable tools for improving drug information literacy in the general student population when accompanied by guided instruction [12-14].

The results further highlight the underutilization of institutionally licensed databases by students outside of the health sciences, despite their availability. Prior to training, nearly all non-healthcare participants relied on general search engines or social media platforms to obtain drug-related information. This pattern reflects broader trends in consumer health information-seeking behavior, where convenience and familiarity often outweigh concerns about accuracy or source credibility. As noted in prior cognitive science and information behavior research, individuals tend to stick with information sources they have used before, a tendency reinforced by anchoring effects, source loyalty, and cognitive effort minimization [9,10].

Introducing high-quality, structured databases like Lexicomp early in students' academic experience may help to counteract such patterns by establishing higher standards for what constitutes credible information. When students are given the opportunity to interact with professional-level tools in an accessible, low-stakes environment, they are more likely to incorporate these resources into their regular information-seeking behaviors [15,16]. This may have broader implications for public health, as young adults increasingly manage aspects of

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their health independently and make decisions regarding self-medication, over-the-counter drug use, and interpreting medical advice found online [17,18].

Importantly, this intervention was not intended to train non-healthcare students as clinicians, nor to promote Lexicomp as a consumer resource. Rather, the goal was to support informed and safe health-related decisions by improving students' ability to recognize, access, and evaluate professional drug information. The overwhelmingly positive reception from participants, along with the measurable increase in awareness and trust, suggests that similar interventions could be implemented at other institutions with minimal cost and high potential impact.

Several limitations must be acknowledged. The study involved a single institution with a relatively small and homogenous sample (i.e., students from a women's university in South Korea). The evaluation focused on short-term perceptual changes immediately following the intervention, and no follow-up was conducted to assess retention, continued use, or changes in actual behavior. Additionally, the study used self-reported measures, which may be subject to response bias. Future research could benefit from longer-term tracking of student behavior and comparisons across institutions or educational formats (e.g., online vs. in-person training). Nonetheless, the findings underscore the value of integrating drug information literacy training into general education curricula, particularly at universities with access to high-quality resources. Expanding these efforts may help bridge the information gap between healthcare professionals and the general public, reduce reliance on unreliable sources, and promote more evidence-based decision-making in everyday life.

This case highlights the value of introducing professional drug information databases, such as Lexicomp, to undergraduate students early in their academic journey. Even a brief, structured training session helped students, particularly those without a healthcare background, develop greater awareness of reliable sources, improved trust in evidence-based content, and a stronger willingness to use professional tools when seeking drug-related information. Equipping students with the ability to navigate clinically grounded resources may shape their long-term information-seeking behaviors, encouraging them to make health decisions based on credible evidence rather than unverified online content. As students increasingly manage aspects of their own health and support others in doing so, early education in drug information literacy can serve as a foundation for safer, more informed use of health information in the future.

ETHICS STATEMENT

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Dongduk Women's University's institutional review board (IRB No. DDWU2403-01). Written informed consent was obtained from all participants prior to their involvement.

FUNDING

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data supporting the findings of this study are not publicly available due to privacy considerations but are available from the corresponding author on reasonable request.

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AUTHORS' AFFILIATIONS

Hey Young Rhee, jonju@dongduk.ac.kr, College of Social Sciences Div. of Library & Information Science, Dongduk Women's University, Republic of Korea

Kiyon Rhew*, kiyon@dongduk.ac.kr, College of Pharmacy, Professor, College of Pharmacy, Dongduk Women's University, Republic of Korea

*The corresponding author and serves as the primary contact for data access and any future inquiries related to the manuscript.

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CASE REPORT
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Changing minds and methods: providing health sciences faculty with alternatives to systematic reviews assignments

Laura Lipke; Neyda Gilman

See end of article for authors' affiliations.

Background: Health sciences librarians frequently engage in discussions about the appropriate assignment of evidence synthesis reviews (ES) for graduate students as course, thesis, or capstone projects. Such reviews are often assigned to build the research skills needed in a clinical environment. In the assignment of these reviews, it has become apparent that health sciences faculty are often not familiar with required standardized methodologies. Incorrect methodologies can contribute to research waste and produce evidence that cannot be applied for its intended purpose.

Case Presentation: Health sciences librarians at an R1 institution ventured to address the ES review knowledge gap through a continuing education webinar for health sciences faculty and graduate students. The webinar provided guidance on systematic review (SR) methodology, optional alternative research assignments, and discussions encouraging the use of these assignments. The alternative assignments were developed based on those presented by Lipke & Price (2025), each with specific learning objectives and grading rubrics. Pre- and post-webinar surveys were conducted to gauge any changes in participants' knowledge, skills, or abilities related to the presented information.

Conclusions: Study participants included six faculty and a graduate student. Survey results showed that participants had an improved understanding of, and placed increased importance on, ES method guidelines, with an equal understanding of the need for alternative assignments. The authors of this study will further evaluate the impact of this webinar and assess its effectiveness in changing health sciences research assignments.

Keywords: Health Sciences; Evidence Synthesis; Systematic Review; Research Instruction; Graduate assignments; Cognitive load theory

See end of article for supplemental content.

BACKGROUND

Concerns regarding the quality and sheer number of published evidence synthesis (ES) reviews, especially systematic reviews (SR), in the health sciences is well documented in recent scholarship [1–10]. There are also a number of publications supporting and refuting the inclusion of ES reviews as graduate and doctoral program capstone or thesis projects [11–16]. Those that refute the inclusion of reviews highlight the lack of knowledge, skills, and mentoring in the rigorous methodology required to conduct the reviews and suggest that faculty need to update their knowledge of these methodologies prior to incorporating such assignments into the curriculum [11–19]. Although the skills learned from conducting ES reviews are essential to students, alternative learning methods are clearly needed due to inconsistent levels of mentorship available [12,14–16,19–22]. The field of health sciences librarianship is well aware of the obstacles faced by these students when assigned such reviews and the frustration involved with balancing deliverable requirements set by faculty and the expectations established by standardized conduct guidelines [23].

In response to their concerns and the growing popularity of ES in general, health sciences librarians often provide ES review methodology consultations and instruction sessions. While many versions of these are provided in the scholarship, the majority are developed for students with fewer developed for practitioners or instructors [24–27]. A review of the literature identified that even fewer, if any of the ES information sessions, were specifically focused upon educating the faculty that assign these reviews to their students. Of closest note was a three day seminar provided by an academic library to improve reproducibility and a librarian-led webinar on data literacy for a faculty learning community [28,29].

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Building off of this research, in an attempt to remedy the issues the methodology knowledge gap and the assigning of ES reviews in health sciences curriculum, the authors of the article Rethinking Systematic Review Assignment Design in Graduate Health Sciences Education from Librarians' Perspectives presented modified ES assignments, based on the Cognitive Load Theory (CLT) of Chunking, to guide faculty and students through the process in a manageable fashion [30]. The authors suggested that future research surrounding these modified ES assignments be conducted through information sessions such as webinars where health sciences faculty are introduced to the assignments. It was recommended that this webinar begin by providing the faculty with an overview of the standardized methodology for ES reviews in order to facilitate their understanding of the complexities involved. The modified assignments could then be introduced as a way to provide students with research experiences that are achievable and promote learning [30].

Providing such webinars would be an opportunity for librarians to broaden their faculty outreach initiatives. While general librarian-faculty outreach is a common practice in academic librarianship that benefits both the faculty members and the librarians, few, if any, outreach initiatives document instructional sessions specifically designed for faculty [29,31]. Despite this, recent research has found that many Nursing faculty researchers are interested in attending research related webinars [31].

This case study evaluated the effectiveness of combining outreach and education through a webinar designed for health sciences faculty. The webinar provided attendees with the knowledge of standardized ES conduct guidelines and methods, helping them to provide students with achievable research assignments in lieu of the full systematic reviews regularly assigned in graduate programs. Pre and post webinar surveys were used to measure the change of faculty participants' knowledge, skills, and attitudes toward the adoption of alternative modified systematic review assignments in the health sciences graduate program curriculum.

CASE PRESENTATION

Binghamton University is an R1 state institution with health sciences programs of nursing, physical therapy, occupational therapy, speech and language pathology, health and wellness, public health, and pharmacy. Two librarians share liaison responsibilities for these programs and both have noted that students and faculty frequently confuse the methodologies of various types of reviews and are unaware of the standardized methodology guidelines (eg. Cochrane or JBI) required for SRs. To address these issues, they were inspired by an experienced SR librarian and author to use the method of chunking to develop alternative assignments that could be completed by a single student or group of students, within the time span of a semester [32]. These chunked assignments provide students and faculty with projects that would challenge the students to learn the necessary SR methodological guidelines in a way that encourages a successful experience. The information provided with these assignments includes learning objectives and standardized forms to use as rubrics.

Alternative Assignments

The alternative assignments to be presented in this webinar are based on those designed by Lipke and Price, the Cochrane and JBI guidelines, and the reporting standards of PRISMA [30,33–35]. Each assignment may be applied to build a completed review or used as independent assignments. First is a narrative review which through its objectives encourages the understanding of the purpose of this type of review and how it provides topic background and identifies scholarship surrounding the topic with the intent of identifying a research gap.

The peer review assignment may be used with the narrative review or protocol assignments. The peer review assignment prepares students for scholarly publishing and how to incorporate critique into their final manuscript. The objectives for this assignment guide the student to learn about the peer review process, grow from constructive feedback and learn the required elements of PRISMA-P [36].

The protocol assignment, associated objectives, and grading rubric follow the PRISMA-P reporting standards [36]. The purpose of a SR protocol is to establish a detailed plan for the review project and to reduce bias during the screening and data extraction phases. This assignment introduces the learner to the steps of a SR, the requirements of PRISMA-P and encourages them to thoughtfully plan the details of the review.

The search methods exercise and its objectives are based on the PRISMA-S [37]. The purpose of this assignment is to introduce the development of search strategies combining keywords and controlled vocabulary, the required reporting standards, and how these standards improve the transparency and reproducibility of the review. The PRISMA-S may be used as a grading rubric.

The critical appraisal assignment emphasizes the importance of unbiased and reproducible SR methodology and introduces the critical appraisal stage of SRs. The JBI or Critical Appraisal Skills Programme (CASP) critical appraisal checklists are used to guide the learner to critique a review and meet objectives such as the importance of critical appraisal, methodological rigor and critical thinking skills. These checklists may also be used as grading rubrics [38,39].

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The data extraction exercise is based on chapter 5 of the Cochrane handbook and can be completed with qualitative and/or quantitative data [33]. Student learning objectives are developed on the requirements of using the pre-established inclusion/exclusion criteria to guide the extraction phase of a review as well as the importance of transparent and reproducible methods.

The last three alternative assignments, a systematized review, updating an existing review, and a rapid review require the learner to complete all steps of a review but in modified fashions. A systematized review includes all of the elements of SRs, but does not meet all requirements for rigorous evidence evaluation or publication [40]. Updating a SR requires an initial critical appraisal of the review to ensure a rigorous methodology baseline then continues from the last date of the previous search, with fewer results and less screening and data extraction than a full review. The rapid review modifies some stages to shorten the timeline. These modifications are documented in detail to ensure transparency. The objectives of these assignments follow the guidelines for conducting such reviews as documented in the Cochrane handbook [33].

Further details of each assignment have been published elsewhere [30] and can be found in osf.io: https://tinyurl.com/ChangingMindsMethods.

Webinar

The health sciences librarians designed a webinar for faculty and graduate students to promote the alternative SR assignments and provided continuing education credits for Nursing faculty. The primary goal of the two-hour webinar was to encourage the use of alternative assignments by enhancing attendees' knowledge, skills, and attitudes toward ES methodologies and educate faculty researchers.

With IRB approval, the librarians developed pre and post surveys to measure the webinar's effectiveness on participant's perceptions of the SR process and adoption of the alternative assignments. The pre survey was sent to registrants via a Qualtrics email and the post survey was provided at the end of the webinar via a link and QR code. The surveys featured a series of two demographic questions, eleven Likert-type questions related to pre and post knowledge, skills, and attitudes toward the standardized methodologies of SRs, participant opinions about the use of SRs as assignments, and one open-ended question [40].

The webinar was designed to have three phases: an introduction to ES definitions and methodologies, small group discussions about the pre-webinar learning activity and an introduction to the alternative assignments. Prior to the webinar, participants were provided with a SR and a critical appraisal worksheet as a pre-activity. The purpose of the activity was to introduce the required elements of SRs through critical appraisal and demonstrate the learning benefits of a chunked activity. Small group discussions allowed participants to discuss their appraisals and how they might do things differently. Lastly, participants were introduced to the chunked alternative assignments. All materials related to the webinar can be found in the osf.io repository files: https://tinyurl.com/ChangingMindsMethods.

Workshop Evaluation Results

There were 7 participants in the webinar, 6 full time faculty (4 nursing, 1 physical therapy, and 1 occupational therapy) and 1 graduate nursing student. Data was tallied from 7 pre-surveys and 7 post-surveys (Table 1). The post survey was only shared in the webinar; it is therefore probable that the webinar participants are the same 7 who completed the post survey. However, due to the anonymity of the surveys, the authors are unable to match the pre- and post-surveys.

All participants indicated a desire to learn more in the pre-survey open ended question. Reasons included wanting to gain "more knowledge of systematic reviews and their place in the curriculum," getting "a better understanding of how to perform a systematic review," or simply "more options." While participants consistently rated the importance of following SR guidelines as extremely important, opinions on matching research questions to review types and the appropriateness of SRs for a 12-week student assignment shifted post-webinar, with more participants emphasizing the need to match questions and reviews and questioning SR's suitability for such assignments. Discussions during the webinar suggest confusion and misunderstandings about SRs, and ES more generally, that became better understood by the end of webinar. One example of this included confusion as to why dates of searches need to be documented with participants noting that the searching would be done, and updated, over time. After discussions, everyone understood the importance of documenting the date of the final searches. Similar discussions occurred around the various types of reviews, use of grey literature, protocol registration, PRISMA, and inclusion and exclusion criteria.

To further evaluate participants' thoughts, they were asked how they would apply what they had learned. Responses included applying this new knowledge to future research and course development and others wanted to expand their learning of the guidelines and grey literature.

DISCUSSION

The assignment of systematic reviews within health sciences graduate programs, especially as a course deliverable, is a clear indication of the faculty knowledge gap regarding the complexity of ES review methodology. Although literature equally supports and refutes the inclusion of SRs for graduate capstone or thesis projects,

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Table 1

Pre- and Post Survey Results, n=7

Survey Question	Pre-Survey			Post-Survey		
Have you authored a published systematic review?	No:	5	(71.4%)	No:	6	(85.7%)
	Yes:	2	(28.6%)	Yes:	1	(14.3%)
How would you rate your knowledge of systematic review methodology?	No Knowledge:	0	(0.0%)	No Knowledge:	0	(0.0%)
	Some Knowledge:	6	(85.7%)	Some Knowledge:	5	(71.4%)
	Expert Knowledge:	1	(14.3%)	Expert Knowledge:	2	(28.6%)
How would you rate your skills in performing a systematic review?	No Skills:	0	(0.0%)	No Skills:	0	(0.0%)
	Some Skills:	6	(85.7%)	Some Skills:	5	(71.4%)
	Expert Skills:	1	(14.3%)	Expert Skills:	2	(28.6%)
How important do you think it is to use the standardized guidelines to conduct and report a systematic review?	Not Important:	0	(0.0%)	Not Important:	0	(0.0%)
	Moderately Important:	0	(0.0%)	Moderately Important:	0	(0.0%)
	Extremely Important:	7	(100.0%)	Extremely Important:	7	(100.0%)
How would you rate your knowledge of matching the type of research question to the type of literature review?	No Knowledge:	0	(0.0%)	No Knowledge:	1	(14.3%)
	Some Knowledge:	6	(85.7%)	Some Knowledge:	4	(57.1%)
	Expert Knowledge:	1	(14.3%)	Expert Knowledge:	2	(28.6%)
How would you rate your skill level of matching the type of research question to the type of literature review?	No Skills:	0	(0.0%)	No Skills:	1	(14.3%)
	Some Skills:	6	(85.7%)	Some Skills:	5	(71.4%)
	Expert Skills:	1	(14.3%)	Expert Skills:	1	(14.3%)
How important do you think it is to match a specific type of research question to the research methodology?	Not Important:	0	(0.0%)	Not Important:	0	(0.0%)
	Moderately Important:	4	(57.1%)	Moderately Important:	2	(28.6%)
	Extremely Important:	3	(42.9%)	Extremely Important:	5	(71.4%)
How would you rate your knowledge of how to critically appraise a systematic review?	No Knowledge:	0	(0.0%)	No Knowledge:	1	(14.3%)
	Some Knowledge:	5	(71.4%)	Some Knowledge:	4	(57.1%)
	Expert Knowledge:	2	(28.6%)	Expert Knowledge:	2	(28.6%)
How do you rate your skills of how to critically appraise a systematic review?	No Skills:	1	(14.3%)	No Skills:	0	(0.0%)
	Some Skills:	5	(71.4%)	Some Skills:	6	(85.7%)
	Expert Skills:	1	(14.3%)	Expert Skills:	1	(14.3%)
How important do you think it is to critically appraise a systematic review before applying the conclusions of that review?	Not Important:	0	(0.0%)	Not Important:	0	(0.0%)
	Moderately Important:	2	(28.6%)	Moderately Important:	1	(14.3%)

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Do you think that a systematic review is appropriate for a single student, 12-week assignment?	Extremely Important:	5	(71.4%)	Extremely Important:	6	(85.7%)
	Definitely Not:	1	(14.3%)	Definitely Not:	5	(71.4%)
	Might or Might Not:	6	(85.7%)	Might or Might Not:	1	(14.3%)
	Definitely Yes:	0	(0.0%)	Definitely Yes:	1	(14.3%)

anecdotal evidence experienced daily by health sciences librarians supports the need for further education for those mentoring graduate students through the review process [11–16]. Many librarian-led ES methodology instruction sessions are specifically designed for students [24–27]. Although Nursing faculty have expressed interest in research webinars when surveyed and a large percentage stated that they interact with the library for their research needs [31], we know of no publications describing ES methodology webinars for health sciences faculty. In an effort to further engage with the health sciences around ES, librarians at this institution reached out to faculty proposing an ES methodology continuing education webinar, which they accepted.

The webinar was designed to enhance faculty understanding of rigorous ES methodologies and promote alternative SR assignments. Positive movement was made on both of these goals. One note of interest is that the pre- and post-surveys showed a decrease from two to one in the number of people indicating they had published a SR. This may be due to different individuals filling out the polls or could demonstrate improved understanding of SRs. The discussions and results of the study highlighted the willingness of health sciences faculty to consider alternative ES assignments when educated in required methodologies. The number of participants who thought SRs were appropriate for a single student, 12-week assignment decreased after the webinar. The open-ended survey responses included desires to learn more about SRs and to apply the lessons from the webinar to future curriculum and research. Overall, participants showed an increased understanding, positive shift in perceptions, and readiness to implement the assignment alternatives suggesting a promising approach to improving ES educational practices within graduate programs.

LIMITATIONS AND FUTURE PLANS

The primary limitations of the study are its small sample size from one institution, the majority of nursing participants, and its inability to measure specific participant responses from anonymous surveys. Future webinars will link pre- and post- surveys, tying responses together. Despite these limitations, the study provides a stepping stone for health sciences librarians to suggest and promote the use of alternative SR assignments.

Based on the discussions within and around the webinar, and the open-ended survey responses, the authors are encouraged to continue this work. The authors will reach out to the participants after a full academic year through an anonymous survey designed to assess participants' claimed plans to apply what they have learned. This would be beneficial to see if the lessons from the webinar have been maintained, and to further promote the alternative assignments. Continued engagement with participants could strengthen the already solid relationship between the programs and the library and help the authors improve future webinars and communications around ES.

The webinar occurred during a spring semester and the authors intend to offer the same webinar again in a fall semester then offered annually and adjusted to fit the growing needs of the health sciences programs. The collaboration with nursing in providing accredited continuing education credits will continue as feasible. These credits were likely an additional motivation for participants to attend. The authors will work to expand the reach of this webinar to other departments and explore additional promotional avenues. Faculty/liaison interactions will continue to address SR related assignment and methodology questions. Increased promotion of the recently created ES LibGuide (https://libraryguides.binghamton.edu/literaturereview) is also planned. Future research will explore sustained implementation and broader impacts across diverse educational settings to further validate this study's findings and inform best practices in health sciences education.

CONCLUSION

The challenges created by the rapid growth of ES products, including the quality of published SRs, have been a growing concern of health sciences librarians. Librarians frequently support individuals who may not be familiar with the complexities of ES or the importance of adhering to proper methodologies. Academic librarians can work towards improving the ES knowledge and skills of the faculty and students at their institutions through webinars, library guides, and alternative assignments similar to those discussed in this article.

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The growing demand for SRs as capstone projects in health sciences graduate programs underscores the need to equip both students and faculty with alternative methods to learn how to conduct rigorous, evidence-based research. This study demonstrates that faculty gained a better understanding of SR methodology through a targeted webinar, revealing a positive shift in attitudes and a desire to incorporate proposed alternative assignments into future curricula. The findings suggest that health sciences faculty are open to collaborating with librarians to redesign SR assignments, provided they receive guidance on best practices and methodological rigor.

Looking ahead, ongoing faculty engagement, webinar expansion, and research on long-term impacts will refine ES education to better prepare students for evidence-based healthcare research. Future work will focus on further developing the alternative assignments, assessing their impact, and promoting their adoption across health sciences programs. This study provides a foundation for future librarian-driven efforts to enhance the quality and effectiveness of ES education in graduate curricula through the application of cognitive load theory and engagement with faculty.

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AUTHOR CONTRIBUTIONS STATEMENT

Both authors have equally contributed to the conceptualization, data curation, formal analysis, investigation, methodology, project administration, visualization and writing of the study and subsequent manuscript.

DATA AVAILABILITY STATEMENT

All data associated with this study are available in the Open Science Framework at: https://osf.io/pnjsf/.

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SUPPLEMENTAL FILES

Appendix A: A recording of the webinar can be found in the Binghamton University institutional repository: (https://orb.binghamton.edu/library_resources/31/).

AUTHORS' AFFILIATIONS

Laura Lipke, llipke@binghamton.edu, Binghamton University, Binghamton, NY

Neyda Gilman, ngilman@binghamton.edu, https://orcid.org/0000-0003-0447-1443, Binghamton University, Binghamton, NY

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CASE REPORT
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Information mastery skills among pre-clerkship students in a problem-based learning curriculum: a case report

Christopher Duffy; Tovah Tripp; Ezra Schneier; Margaret Dreker; Miriam Hoffman; Joshua Josephs

See end of article for authors' affiliations.

Background: Use of evidence-based medicine (EBM) can improve patient outcomes, but translating classroom learning of EBM to clinical practice is challenging. Training students to utilize and apply principles of EBM is critical but data and methods for evaluating students' EBM skills are lacking.

Case Presentation: The Hackensack Meridian School of Medicine has early curricular introduction of information mastery techniques to combat these challenges. Students create research presentations related to the weekly problem-based-learning (PBL) case to practice applying EBM skills. Medical librarians developed and utilized an assessment tool to evaluate students' weekly presentations. Librarian staff reviewed 595 presentations during the first year of the pre-clerkship curriculum using five criteria: (1) appropriate scope of presentation (2) correct categorization of the question based on the finding information framework (3) appropriate resource used (4) search strategy and (5) bibliographic citations according to American Medical Association (AMA) guidelines.

Conclusions: Of the evaluated presentations using these criteria, the majority of students routinely and reliably applied EBM skills in their case-based presentations. Further studies will need to look at continued development of these skills throughout other phases of training.

Keywords: Evidence-based medicine; problem-based learning; assessment; health systems science

BACKGROUND

Healthcare quality in the United States, despite its advanced technologies and substantial healthcare spending, continues to lag behind other developed nations in key areas such as patient outcomes, access to care, and cost effectiveness [1]. Fragmented care and inconsistent clinical practice are among the causes of these disparities [2]. Evidence-based medicine (EBM), which emphasizes integrating research evidence, clinical expertise, and patient values into clinical decision making, has the potential to address the aforementioned challenges [2,3]. While the principles of EBM have been part of medical education for over two decades [4], translating EBM knowledge into clinical practice is inconsistent [5]. Differing teaching methods, varied clinical exposures, and lack of standardized assessment all contribute to difficulties in application and translation of EBM from the classroom to clinical practice [2,4].

In the pre-clerkship setting, students primarily ask background questions—those aimed at understanding general concepts—because their limited medical knowledge as first-year students often leads them to focus on foundational topics such as physiology. Unlike clinical questions which can be asked and answered narrowly using the PICO (patient, intervention, comparison, outcome) format [6,7], no format exists for asking clinical background questions. Various methods for teaching and evaluating pre-clinical students' evidence-based medicine (EBM) skills have been explored in the literature. Approaches such as flipped classroom models—which combine asynchronous modules with in-person teaching sessions—have been studied and shown to be effective. Early instruction and assessment of EBM skills have demonstrated measurable benefits regarding student's confidence in forming clinical questions and critically appraising medical evidence. [5,8,9] However, we have not found any studies that describe a longitudinal integration of medical librarians into a pre-clinical curriculum that teaches and assesses medical students' EBM skills.

CASE PRESENTATION

At the Hackensack Meridian School of Medicine (HMSOM), we sought to bridge the gap between EBM knowledge, application and evaluation using our modified Problem-Based Learning (PBL) curriculum,

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Patient Presentation Problem-Based-Learning Curriculum (PPPC)[10]. This longitudinal course spans the entirety of the pre-clerkship curriculum and is integrated with the basic science and systems courses.

Each week, students are presented with a case that integrates basic, clinical and health systems science. Students engage in a self-directed learning process related to the clinical case that requires them to identify a knowledge gap, create a research question, and then use appropriate resources to research and present the answer to that question. Utilizing the Finding Information Framework (FIF) [11], students identify and categorize their knowledge gaps, formulate their research questions, and explore their findings. Students are taught these skills of information management and information mastery [12] early on in their pre-clerkship curriculum within the Health Systems Science (HSS) curricular thread. Incorporating these research presentations in PPPC met two needs in our curriculum: early incorporation of practice and application of emerging EBM skills, and meeting the LCME requirement for students to engage in regular self-directed learning [10].

A distinctive feature of PPPC is the active integration of the health sciences librarians [13]. Librarians provide individual feedback to students on the quality of the research questions they formulate, their search strategies, and the quality of the evidence they find.

Our study investigates our medical students' abilities to apply the information mastery and EBM curriculum using this librarian feedback. In conjunction with our librarians and health systems science faculty, a standardized rubric was created to provide structured feedback to our students to assess their skills (Table 1).

Given the early introduction of this curriculum and the ease with which 21st century students utilize technology, we anticipated that students can effectively locate resources and information, but had concerns over the quality of information resources used due to their reliance on google, AI search engines and other non-vetted sources [14].

First year medical students were introduced to the Patient Presentation Problem Based Learning Curriculum (PPPC) via a lecture during their medical school orientation and were given an example PowerPoint research presentation and a template. This template guides the creation of their presentations and includes the assessment components. Students learn information mastery in our longitudinal HSS curriculum in 6 distinct 2-hour sessions, starting within the first few weeks of medical school. The first of these sessions teaches students about the appropriate EBM information resources to use for PPPC presentations. The additional 5 information mastery sessions are given throughout the remainder of the pre-clerkship curriculum and are co-taught by librarians. These cover instruction on searching techniques, using FIF [11], asking PICO questions, and evaluating resources and information. Students begin applying these skills regularly in PPPC during their first weeks of medical school and create a presentation approximately once a month based on the weekly PPPC case. Students receive verbal feedback during class from faculty and peers, as well as written feedback from librarians and one peer reviewer.

There were 861 student presentations reviewed by our librarians for two cohorts of students from August 2022 through December 2023. The data showed that all presentations used the provided PPPC presentation template. Librarians reviewed student presentations from PPPC during the first 5 courses of the pre-clerkship curriculum, which span the first year of medical school. These courses included two foundational courses, Molecular and Cellular Principle (MCP), Structural Principles (SP) and three systems courses, Infection Immunity & Cancer (I2C), The Developing Human (TDH), and Homeostasis & Allostasis (HA).

The study was approved via the Hacken Longitudinal Outcomes of Medical Education (longMED) Hackensack Meridian Health IRB protocol number Pro2018-0308. All feedback data about student presentations was sent to the "honest broker", a neutral third party who de-identifies the data and ensures that student information is stripped of direct identifiers, making it less likely that individuals can be identified. Students who opted out of longMED were not included in the study. Student's question categorization skills were assessed after learning about the FIF in a large-group classroom session held during the first weeks of medical school. A total of 595 presentations were assessed over the course of the pre-clinical curriculum.

We specifically looked at 5 components on the rubric that we felt best analyzed our students' abilities in information mastery and self-directed learning. These included: appropriate scope of the question, is the question correctly categorized as a background or foreground question utilizing the FIF, appropriateness of information resources used, search strategy and correct citations using the American Medical Association (AMA) Manual of Style [15]. Statistical analysis was conducted using Stata 18 (Stata Corp, College Station Tx). Percentages of correct answers were calculated, and the trend of the percent correct over time was calculated using the Jonckheere's non parametric test. We also performed the Friedman test of differences across category since the high initial performance perhaps made detection of trend using Jonckheere's test inappropriate. All statistical tests were two sided and a p-value of 0.05 was considered statistically significant.

Results from the librarian review are demonstrated in Table 2. After being introduced to the PPPC curriculum, the introductory information mastery curriculum, and

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Table 1

Standardized Assessment Rubric

Category	Excellent (4.0)	Good (3.0)	Fair (2.0)	Poor (1.0)
1. Was the research question relevant to this week's classes and patient?	Accurately identifies and prioritizes knowledge gaps, correctly categorizes and structures questions, and addresses educational needs of the team and/or the patient in the case.	Accurately identifies and prioritizes knowledge gaps and correctly categorizes and structures questions.	Identifies and prioritizes knowledge gaps but does not categorize and structure question to match identified gap.	Unable to articulate specific knowledge gap and/or inaccurately categorizes or structures questions.
2. Correctly categorized question using FIF	Critically evaluates the clinical question using the FIF and identifies background or foreground questions and identifies the resources to use.	Evaluates the research question using the FIF, but may not fully consider all aspects of quality and relevance. Selects mostly appropriate resources.	Demonstrates basic understanding of the FIF and which resources to use. Uses resource evaluation criteria but applies them inconsistently.	Struggles to evaluate the type of clinical question using the FIF.
3. Used appropriate information resources?	Synthesizes information from multiple sources to provide a comprehensive and nuanced answer to the clinical question or research problem. Clearly articulates the strengths and limitations of the evidence.	Synthesizes information from multiple sources, but may miss some key connections or nuances. Applies the evidence to the clinical scenario with some limitations.	Synthesizes information from a limited number of sources. Application of evidence to the clinical scenario is basic and may lack depth. Selection of resources may include some irrelevant or lower-quality items.	Struggles to find information from EBM resources to synthesize information and unable to locate information from multiple sources.
4. Clearly described search strategy or keywords?	Organizes and manages information effectively using appropriate tools and techniques. Uses advanced Search techniques MeSH terms and Boolean operators effectively.	Organizes and manages information adequately. Uses MeSH terms and filters but the search is not well structured.	Demonstrates basic information management skills with limited search refinement	Struggles to organize and manage information. Struggles to construct meaningful search
5. Were all materials properly cited?	Accurately cites all sources using a consistent and appropriate citation style including images.	Some materials were cited but not all. Cites most sources correctly, but may have minor errors in formatting or consistency.	Less than half of materials are cited. Lacks consistency in citing information resources used in presentation. Citation accuracy and consistency need improvement.	Struggles to understand the necessity of citing materials used in student presentations. Citations are incomplete, inaccurate, or inconsistent.
6. Did the student presentation mention Social Determinants of Health?	These questions are required and tracked in the rubric but were not assessed.			
7. Which Social Determinants of Health are mentioned?				

Table 2

Percentages of presentations that met the five studied rubric components.

	Appropriate Scope	Correctly Categorized Question	Appropriate Information Resources	Search Strategy	Accurate Citations
Yes	592 (99.5%)	527 (88.6%)	562 (94.5%)	568 (95.5%)	577 (97.0%)
No	3 (0.5%)	68 (11.4%)	33 (5.5%)	27 (4.5%)	18 (3.0%)

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reviewing their expectations via a rubric, the majority of students (99.5%) were able to propose a research question with an appropriate scope. Most students (88.6%) were also able to incorporate the FIF into their presentation, describe their search strategy and keywords (95.5%), as well as find reliable sources via the FIF (94.5%). Nearly all of the students included a bibliography with proper citation (97%).

The test of trend over time using Jonckheere's non-parametric test was not statistically significant with a P value 0.13. Change over time is included in Table 3 and Figure 1. Testing using the Friedman test across the variables also did not reveal a statistically significant change over time.

Table 3

Change over time from the first pre-clerkship course (MCP) thru the fifth pre-clerkship course (HA). Acronyms stand for MCP (Molecular & Cellular Principles), SP (Structural Principles), I2C (Infection, Immunity, & Cancer), TDH (The Developing Human), HA (Homeostasis & Allostasis).

Course	Appropriate Scope	Correct Categorization	Appropriate resource use	Appropriate Search Strategy	Accurate citations
MCP	100%	78%	95%	92%	96%
SP	100%	86.7%	94.7%	95.6%	96.4%
I2C	96.7%	98.9%	94.6%	97.8%	97.8%
TDH	100%	91.3%	95.7%	97.8%	95.7%
HA	100%	95.3%	91.9%	94.2%	100%

The librarian response form had a section for free narrative response. The most common comment of feedback was related to the use of images to convey information. Other comments included suggestions on slide design and layout, as well as time management during presentations. The other most common comment was regarding the relevance and date of publication of resources used. Some examples of these narrative comments can be found in Table 4.

Table 4

Representative example of narrative comments from librarians.

Examples of Narrative Comments
I really like using the learning objectives so the group knows exactly what will be covered. Be aware of the publication dates of the articles you are using. The Nature article was published in 2000 which makes it 23 years old. The 2007 article makes the information older than 16 years! When using reference materials you try to keep the publication date no older than 5 years..to be sure it is current. Your presentation was well researched and very well organized. The CDC stats also were very useful. Nice job!
Beginning with definitions of dizziness is very useful so the group know exactly what you will be discussing. Be sure to cite any images on the slide on which they appear. You can just use a brief citation, where the slide was from and put the full citation on the last slide. Very useful to explore the History & Evaluation importance. Really well researched and well organized.
Starting your presentation with definition is a good way to be sure everyone knows exactly what you will be covering. The images you included really added to the content since they were all well labelled. Really well researched and organized in such a clear manner would be a good study tool for your group members. Nice job!
Be aware of the publication dates articles would are using as materials: An article published in 2010 is over 13 years old and dated. Look at article published in the last 5 years to be sure you are presenting the latest information. This was a really excellent presentation. Choosing a topic that discuss' social inequities and healthcare is so relevant in this case. Your presentation was very well researched and well organized. It was all tied to this weeks patient too.
This was really well done. The images really added to the content. It was well researched and well organized. Your group questions were thoughtful and I had the same questions about vaping and cardiovascular disease! Really well done and very relevant to the case of Mr. L.
Aesthetically lovely presentation. Looks clear and concise, but I worry about the scope of the presentation. Do you think you conveyed the proper amount of information in the time provided?

Librarians rated the scope of the clinical question as appropriate the majority of the time. However, comments

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suggested that particularly early in the curriculum, questions remained too broad to be answered effectively. Librarians would supplement the assessment rubric with a narrative to the student with suggestions to further focus the clinical background questions they are developing in early stages of PPPC. Examples of this can be found in Table 3. PPPC facilitators also gave feedback; however, we do not have this data as feedback was given verbally in real time. Because they are clinicians, PPPC facilitators may be better able to formulate narrower questions and thus give more focused feedback.

The appropriate categorization of the question had the most change over time from the first course to the last course assessed (MCP to HA) but overall scored the lowest across all skills assessed. The improvement likely occurred due to growing exposure and experience with the FIF [11]. At each of the information management and mastery teaching sessions, use of the FIF is reviewed. The overall percentage of presentations that appropriately categorized their questions was the lowest (<90%) than in any other category. Despite guidance to ask more background questions early in the pre-clerkship curriculum, students want to focus on clinical foreground questions about treatment of disease. However, due to limited content and medical knowledge, they may categorize their questions as foreground, but they are more likely to be background questions.

While we anticipated that students would utilize resources such as ChatGPT or Google, the majority of students utilized appropriate resources to find the answers to their clinical questions. This finding may be biased by the fact that students were aware that they would be assessed on resources used. It is possible that students used AI or Google in their initial search but were then able to reference appropriate resources. Furthermore, in our assessment, we did not distinguish between using evidence-based resources and patient-facing materials which may or may not be evidence-based.

Most students used an appropriate search strategy; however, this could be subject to the same bias as the previous category. Students again may have utilized Google or AI, but reported using search strategies that they knew evaluators were looking for. Citations were mostly done correctly, which is likely due to early and consistent exposure to free reference manager software (Zotero).

The students' skills were strong and remained strong, which we feel was helped by the consistent reinforcement from librarian assessment. However, there may be other factors that contributed to strong student performance that were not captured by the rubric, such as prior knowledge, faculty support, or informal learning experiences.

Librarians were available and widely used, particularly early on in the curriculum, to assist students with preparing their research presentations. The curricular integration of the librarians is one of the major strengths of the evidence-based medicine and information mastery curriculum [13].

We evaluated presentations over the course of the first year of medical school, and we imagined that skills in information mastery and management would grow over time; however, our rubric did not change to assess advancing skills. Since performance was very high to begin with, there was a limited range for possible growth. Because of this, and due to limitations in librarian resources, the decision was made to only evaluate presentations during the first 12-months of the 16-month pre-clerkship curriculum. A future opportunity would be to modify the rubric as the students' progress in their pre-clerkship curriculum to assess their growth, which could capture the evolution of their skills in the final four months prior to the start of clerkships. Additional skills in information management such as resource assessment or quality of evidence were not evaluated by our rubric. Utilizing these skills in the future may better assess how our students' skills develop over time.

We briefly reviewed the narrative comments from the librarians that were sent to the students with their feedback. While this was not a structured analysis of the content in the comments, common themes regarding the use of images to strengthen the presentation and the use of outdated articles did come up. Future studies could closely look at the narrative themes and their evolution over the course of the students' development through the pre-clerkship curriculum. Future research should look at assessment of these skills in students in the clinical learning environment. There is the potential for these skills to lapse as there are competing educational and clinical priorities; alternatively, these skills may be carried forward effectively into clerkships.

An additional benefit of this program was to enhance the student/librarian relationship. Students become very familiar with their librarians and are comfortable reaching out for assistance as they continue into their advanced years as medical students. Likewise, the relationship between the librarian and PPPC faculty has grown stronger as part of this collaboration; faculty get to know the librarians and see them as peers. A limitation of this program is the time commitment for librarians. The workload associated with assessment and feedback is significant and should be accounted for should other libraries implement a similar program as their institution.

CONCLUSION

With early integration of librarians into an information mastery and information management curriculum, medical students participating in this program were able to successfully formulate clinical questions, correctly categorize them, and utilize appropriate resources to find

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evidence-based answers. The longitudinal integration of librarians into the PPPC program - where librarians provide weekly feedback to students for 12-months, reinforces the information management, mastery and EBM skills developed throughout the pre-clerkship curriculum. Narrative comments from the librarians were overwhelmingly positive, and particularly focused on the use of images to convey information. Comments also touched upon the use of outdated resources. Growth of the assessment rubric over time to meet the needs of students' developing skills is necessary. Further studies can look at standardizing assessment of students' EBM skills in the clerkship curriculum to see if these skills remain strong as students move from the classroom to the clinical learning environment, as competing interests in learning and clinical practice happen.

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DISCLOSURE STATEMENT

The authors have no competing interests to declare.

CLINICAL TRIAL REGISTRY

Not applicable, this is not a clinical trial.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Study was compliant and adhered to the Helsinki Declaration. Study received ethical approval by the Medical School's (IRB) via IRB Pro2018-0308 (Longitudinal Outcomes of Medical Education Database or longMED database). Data from students who did not consent for use of their data in medical education research was not utilized. Data was reviewed by the study investigators only after approval by the Medical School's Governance Committee and after de-identification by the School of Medicine Honest Broker. There are no identifying images or other personal or identifying details of participants that would compromise anonymity in the study.

AUTHOR CONTRIBUTIONS

JJ and TT wrote the initial draft of the manuscript and developed both the PPPC and information mastery curricula and guided the integration of librarians into the program; ES, JJ and TT performed statistical analysis of the data. ES performed the background literature review and helped with preparation of the manuscript. MH provided guidance and support for this initiative and developed the concept of the PPPC program and the information mastery curriculum; CD and MD added and updated the manuscript and helped to develop the project.

DATA AVAILABILITY STATEMENT

Repository of data from reviewed research presentations are not publicly available as these are student assignments. All data generated and analyzed are included in this article. Further examples of librarian feedback are available from the corresponding author upon request.

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AUTHORS' AFFILIATIONS

Christopher Duffy, christopher.duffy@hmhn.org, https://orcid.org/0000-0001-5485-8625, Associate Dean, Medical Library, Hackensack Meridian School of Medicine, Nutley, NJ

Tovah Tripp, tovah.tripp@hmhn.org, https://orcid.org/0009-0002-6902-461X, Internal Medicine Clerkship Director, Hackensack University Medical Center, Department of Internal Medicine, 30 Prospect Ave, Hackensack, NJ

Ezra Schneier, ezra.schneier@hmsom.edu, https://orcid.org/0000-0002-9396-6845, Resident Physician, Internal Medicine, Hackensack University Medical Center, Nutley, NJ

Margaret Dreker, margaret.dreker@hmhn.org, https://orcid.org/0000-0002-6163-4803, Medical Librarian, Hackensack Meridian School of Medicine, Nutley, NJ

Miriam Hoffman, miriam.hoffman@hmsom.edu, https://orcid.org/0000-0002-1277-8173, Vice Dean for Academic Affairs, Hackensack Meridian School of Medicine, Nutley, NJ

Joshua Josephs, joshua.josephs@hmhn.org, https://orcid.org/0009-0000-3589-2991, Director of Health Systems Science Curriculum, Hackensack University Medical Center, Department of Internal Medicine, 30 Prospect Ave, Hackensack, NJ

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David Ingram, **Health Care in the Information Society, Vol. 1: From Adventure of Ideas to Anarchy of Transition**, 2023, Cambridge, UK, Open Book Publishers, 2023, (Open Book Series), 480, $52.95, ISBN: Digital (PDF): 978-1-80064-954-5.

Health Care in the Information Society, Vol. 1: From Adventure of Ideas to Anarchy of Transition is a sprawling, multifaceted examination of the development of health care systems and of the information revolution more generally. Scalable Innovation: A Guide for Inventors, Entrepreneurs, and Innovation Enthusiasts is a history of technological progress that meditates on progress and how this When you can't quite Unpacking these ideas is the ambitious Scratch book, containing little to no consumer product innovations. It is in essence a meditation on the role of information systems as instrument of reform and object of frustration -- more especially, in the chaotic transformations that we are living through in the Information Society.

Ingram follows the trajectory from early medical and social ideas of computing to the current revolution in medical computing which will transform medicine and healthcare for good and ill. The book includes a deep personal story of Ingram's journey in health informatics and the development of technology for health, and of Ingram himself.

This volume, the first of three in a series, lays the groundwork for understanding the historical origins, as well as the current turmoil, of the entire industry, before we move to the more concrete, actionable recommendations in the subsequent volumes.

1. Introduction – Connecting for Health

The book begins by considering the essential relationship between health care and information. It's Ingram's approach to understanding that medicine and health of the future will be tied at the hip with digital information systems. He examines how the future of health care rests on forging a seamless connection between professionals, patients and digital technologies. The intro as a quick summary of what you can expect.y history, philosophy, and technical details.

2. Knowledge, Language, and Reason – From Ancient Times to the Information Age

Ingram explores the philosophical and historical origins from which contemporary health care systems formed. He links ancient notions of knowledge and reason, as conceptualized at the time of Hippocrates and Galen, to the digital information age. Ingram uses the development of medical language and transition from oral to written knowledge as a point of departure to situate contemporary informational systems in medicine.

3. Observation and Measurement – From Cubits to Qubits

A particularly useful chapter explaining how medicine progresses with the ascertainment of measurement and observation in technological history. From the standard measure of cubits to more exacting, digitally-rooted measuring devices (in quantum computing, Qubits), Ingram relates how an elevation of observational skill butts into the art of diagnosis, with the digital era straining these borders ever more.

4. Models and Simulations – The Third Arm of Science

This chapter considers how models and simulations are used in contemporary health care. "It helps clinicians make decisions from a traditional perspective, wherein the model outcome can be used in predicting disease" Ingram says, noting that models and simulations increasingly make "a signal contribution" in predicting health outcomes, advancing medical research, and even informing surgery. This chapter demonstrates how digital systems serve as the third arm of science and engineering, with capacities no-one could ever have dreamed 20 years ago.

5. Information and Engineering – The Interface of Science and Society

The chapter is concerned with the ways in which engineering, and especially information technology, have influenced what gets discovered scientifically as well as how healthcare is delivered. Ingram explores the cross-section of these fields, and how computing power has transformed the health industry, from the development of electronic health records (EHRs) to the automation of basic administrative tasks within hospitals.

ANALYSIS OF USEFULNESS

Health Care in the Information Society is a significant new book in the prestigious series Studies in Health Technology and Informatics. One of its great virtues is that it interconnects history, philosophy, technology and medicine to give a full picture of the information technology and health care partnership. What distinguishes this from Ingram's article is that it is a more reflective piece, and the personal story and hence their "view from the inside" is one of a mover and shaker in [health informatics over the years.

Ingram's perspective is one meant to urge you to question for yourself what the cacophony of information that is generated, used, translated to everyday healthcare, and considered within medicine does to you and your own practice and provision of care.

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POTENTIAL READERSHIP

This book is intended for a broad and diverse audience:

- Health Informatics Professionals and Researchers: Providers of health systems, digital information systems, and data management-based healthcare services can read about past experiences and future possibilities when learning from the history of these technologies in health care.
- Interdisciplinary scholars who work in technology, medical ethics, sociology and philosophy will be interested in Ingram's broad analysis of the growth of health care and its connection to technology.
- Health Care Policy Makers: Ingram's experiences with facing the positives and negatives of reform will be of interest to those involved in establishing healthcare policy and policy about the role of technology in public health structure.
- General Readers Interested in Technology and Society: For readers who are interested in how society grapples with the intersection of technology and health, this title offers an accessible but deep dive into the future health care.

CONCLUDING THOUGHTS

David Ingram's *Health Care in the Information Age, Vol. 1* is a must-read for those who wish to comprehend the influence of information technology on the future of health care. It is a broadly balanced assessment of the opportunities and challenges which the digitalization of health introduces. By interlacing anecdotes, history, and bleeding-edge tech, Ingram presents an essential guide to the continuing revolution in health care.

No better resource exists to become informed about the history and philosophy of the health care-IT interface. - The book is however also a cautionary story, reminding us to always complement the wonders of technology with the verocity of the human in care. The reflective nature and cross-disciplinary sweep of the book ensure that it is compelling reading for not only a group that is broader than might be assumed.

Muhammad Taufan Umasugi,, *umasugi53@gmail.com, https://orcid.org/0000-0002-3958-0239, Doctoral Program in the Faculty of Medicine, Public Health & Nursing – Gadjah Mada University, Yogyakarta, Indonesia*

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Henk ten Have, **Color, Healthcare and Bioethics**, Edited by: Endah Fitriasari, First Edition, Cambridge, UK, Open Book Publishers, 2025, Bioethics Series, 215, ISBN: PDF: 978-1-80511-484-0, DOI: 10.11647/OBP.0443.

In *Color, Healthcare and Bioethics*, Henk ten Have presents a groundbreaking and profoundly interdisciplinary examination of the role of color in medicine and bioethics. Far from being a mere aesthetic detail, color is revealed as a critical element in diagnosis, treatment, and our broader understanding of health. Ten Have expertly weaves together scientific, philosophical, and ethical threads to demonstrate how color, in its physiological and symbolic forms, holds deep implications for healthcare. The book's central contribution is its argument that color is not a passive visual cue but an **active force**, influencing human psychology, societal structures, and moral judgments particularly in discussions of race and equity within healthcare systems. This work offers an unprecedented perspective that challenges the traditional, often narrow, view of bioethics.

1. Introduction: Color, Healthcare, and Bioethics

The introductory chapter meticulously frames color as a neglected but powerful influence in both healthcare and bioethics. Ten Have argues that while objective data is paramount in medicine, color's subjective experience and cultural weight carry immense, often unseen, significance in diagnostic and therapeutic settings. By discussing the historical and cultural connotations of color, he makes a compelling case for its inclusion in serious academic discourse. This chapter successfully re-situates healthcare, moving beyond a purely scientific paradigm to one that acknowledges the human element and the non-obvious ways that visual phenomena shape medical practice and ethical debate. It serves as a powerful call to action, urging a more holistic and nuanced approach to bioethics.

2. The Nature of Color

Chapter two delves into the complex nature of color itself, bridging philosophy and science. Ten Have guides the reader from classical understandings, such as those of Newton, to modern neurophysiological theories, which posit color as a construct of the visual system rather than an inherent property of objects. This discussion is foundational, as it establishes color as a phenomenon that exists at the intersection of the objective and subjective. The most compelling aspect of this chapter is its exploration of phenomenological realism, which portrays color not as an abstract quality but as a relational property integral to the lived, immediate world a concept that resonates throughout the book and strengthens its central thesis.

3. The Power of Color

This chapter transitions to the psychological and emotional impact of color. Ten Have masterfully integrates scientific research with insights from the arts to illustrate how color affects human emotions and behavior. He cites research showing that specific colors, like red and blue, evoke predictable psychological responses that have direct implications for patient environments and therapeutic outcomes. For example, blue often promotes a sense of calm, while red can signify urgency or danger. By incorporating the views of artists such as Henri Matisse and Wassily Kandinsky, the book highlights color as a potent emotional and psychological force, making this chapter a valuable resource for anyone involved in healthcare design or patient-centered care.

4. Color and Healthcare

Here, the book provides a robust and practical examination of color's application in medical settings. Ten Have offers concrete examples of how doctors use visual cues such as cyanosis (blue skin) or jaundice (yellow skin) for critical diagnoses. Beyond diagnosis, the chapter explores the therapeutic uses of color, from color therapy to the creation of healing hospital environments. This emphasis on tangible applications of color in medicine constitutes one of the book's most significant contributions, demonstrating how a deeper understanding of color can tangibly enhance both diagnostic accuracy and patient well-being.

5. Color and Bioethics

This chapter represents the ethical core of the book. Ten Have confronts the ethical dimensions of color head-on, particularly its entanglement with race and social justice. He meticulously deconstructs how color, especially in the binary of black and white, has been used historically to create racial hierarchies and how this legacy persists in contemporary healthcare disparities. By examining the subtle and not-so-subtle racial biases in treatment, the book issues a powerful call for bioethics to expand its framework to address these deeply ingrained prejudices. This timely analysis provides a moral compass for navigating the complex social justice issues that plague healthcare today.

6. A Colorful Bioethics

In the concluding chapter, Ten Have proposes a truly visionary paradigm shift: the integration of color as a central component of bioethical discourse. He argues that color should be recognized as a key element in ethical deliberations, especially in matters of race, identity, and healthcare access. This call for a "colorful bioethics" challenges

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the field's traditional, rigid frameworks, advocating for a more inclusive understanding that embraces the emotional, cultural, and symbolic power of color. It is a thought-provoking conclusion that invites scholars and practitioners alike to re-examine how bioethics can better address the nuanced and deeply human realities of healthcare.

COMPARISON WITH SIMILAR PUBLICATIONS

Color, Healthcare and Bioethics distinguishes itself from other works by introducing the under-explored concept of color into the bioethics and medical fields. Ten Have's work broadens the conversation to include a more holistic, philosophical, and aesthetic dimension of color itself. His integration of color theory into ethical considerations is unprecedented. While many bioethics texts rely on objective rationality, Ten Have's approach is more expansive, inviting cultural, emotional, and aesthetic perspectives into the dialogue, making the book particularly relevant for scholars interested in the intersection of healthcare, race, and ethics.

POTENTIAL READERSHIP

This book is an essential read for a diverse audience, including bioethicists, medical professionals, sociologists, philosophers, and students of medicine and healthcare. Its interdisciplinary nature also makes it valuable for those interested in color theory, race studies, and cultural analysis. Given its focus on social justice, the book will also resonate with a wider audience, including activists and policy reformers working to address racial inequalities in healthcare.

CONCLUSION

Color, Healthcare and Bioethics is a groundbreaking work that successfully bridges philosophy, bioethics, and color theory. Ten Have's comprehensive examination of color's power and ethical implications provides an innovative and timely contribution to the field. The book not only challenges conventional thinking but also offers practical insights into how color influences health, behavior, and moral decision-making. It is essential reading for anyone seeking a deeper understanding of the profound role of color in healthcare and the ethical issues surrounding it.

Endah Fitriasari, *https://orcid.org/0000-0001-8580-0266, Program Studi Ilmu Keperawatan, STIKes Maluku Husada, Jl. Lintas Seram. Kairatu SBB*

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bims: Biomed News. February 5, 2017–Present. https://biomed.news, Created by Thomas Krichel and directed by Gavin P. McStay. Free. Accessible via any web browser.

DESCRIPTION

bims: Biomed News is a free weekly newsletter report creation system based on PubMed. The newsletters contain selected recent PubMed records that pertain to the report's topic. Therefore, bims can be categorized among the tools that provide Selective Dissemination of Information (SDI).

USERS

bims community has two types of users: editors and readers. No criteria need to be met to become a reader or an editor.

Editors select the papers for the weekly report issues. Most editors appear to be biomedical researchers or systematic reviewers. Some are patients, staff, or patient support organizations. This is typically the audience that health librarians serve. Therefore, a review of this tool seems pertinent.

Readers can subscribe to weekly issues of any report. The reports are listed at https://biomed.news/reports. Each report has a "Sign Up" button. When you sign up, you get the weekly issues of the report in your inbox.

COST

bims is an open and free tool with no monetary or non-monetary barrier to becoming an editor, nor to becoming a reader.

HOW TO CREATE AND MAINTAIN A BIMS NEWSLETTER REPORT

Opening a new newsletter report. To become an editor, you need to open a report. This is done at https://biomed.news/open_a_report. This opens a simple form. It requires you to enter a title for the report, your name, your email address, and at least one PubMed paper that you think is relevant. Upon submission, the form data is sent to bims management. They create the report and assign a six-character identifier. They then send you credentials. For example, the author launched bims-arines (ARtificial INtelligence in Evidence Synthesis). Its first issue was released on September 29, 2024.

Maintaining the newsletter report. When the report is opened, a weekly process starts. On Sunday at midnight UTC, you get an email alert that a new report issue, containing a list of possibly relevant new papers, is available for you to choose from. The new papers in PubMed are sorted by the likelihood that they are relevant to your topic. You select the relevant ones. The ones that you don't select are considered irrelevant. This data is fed into a bespoke AI tool. Thus, each week's data is used to improve the new selections. Over time, this leads to a selection of papers that is both more precise and more flexible than the ones found by searching tools (**Figure 1**).

Output. The relevant records selected by the editor are sent to the subscribed readers in the form of an email newsletter. The emails contain no advertisements. Each report issue is also published on a dedicated web page. At the time of writing, the author has published 44 weekly issues of bims-arines, reaching 83 subscribers. Every week, the author spends five minutes screening the received records, selecting them, and submitting them, ensuring subscribers stay up to date on the topic. The latest issues are found at http://biomed.news/bims-arines/latest.

HOW TO USE THE EXISTING BIMS NEWSLETTER REPORTS

Readers use the site: https://biomed.news.

Cookies. The site does not request permission to use cookies. Presumably, the site does not use cookies. It respects users' privacy. This is an important issue for librarians when recommending a tool.

User interface. The site does not use gratuitous graphics or meaningless marketese. Instead, the homepage tries to convey the site's purpose through simple factual statements.

Newsletter reports. From the homepage, the most important link is the one to the reports, https://biomed.news/reports. The reports page lists all the active reports. Inactive reports can still be accessed. Next to each report, there is the title of the report. The title is an anchor to the latest issue of the report. Then, there is the editor's name. Usually, the name serves as the link to the editor's homepage. After the name, for most editors, the editor's affiliation appears, always with a link to the homepage of the organization, giving credit to both the editors and their organization.

Sign Up. Readers can sign up for the reports on https://biomed.news/reports or each report's page (bims-arines). The editors cannot see the list of subscribers, which is another positive privacy point.

Unsubscribe. Another user-friendly feature is that any report issue that readers receive includes an unsubscribe link, both in the email header and at the end of the email body, making it effortless to unsubscribe.

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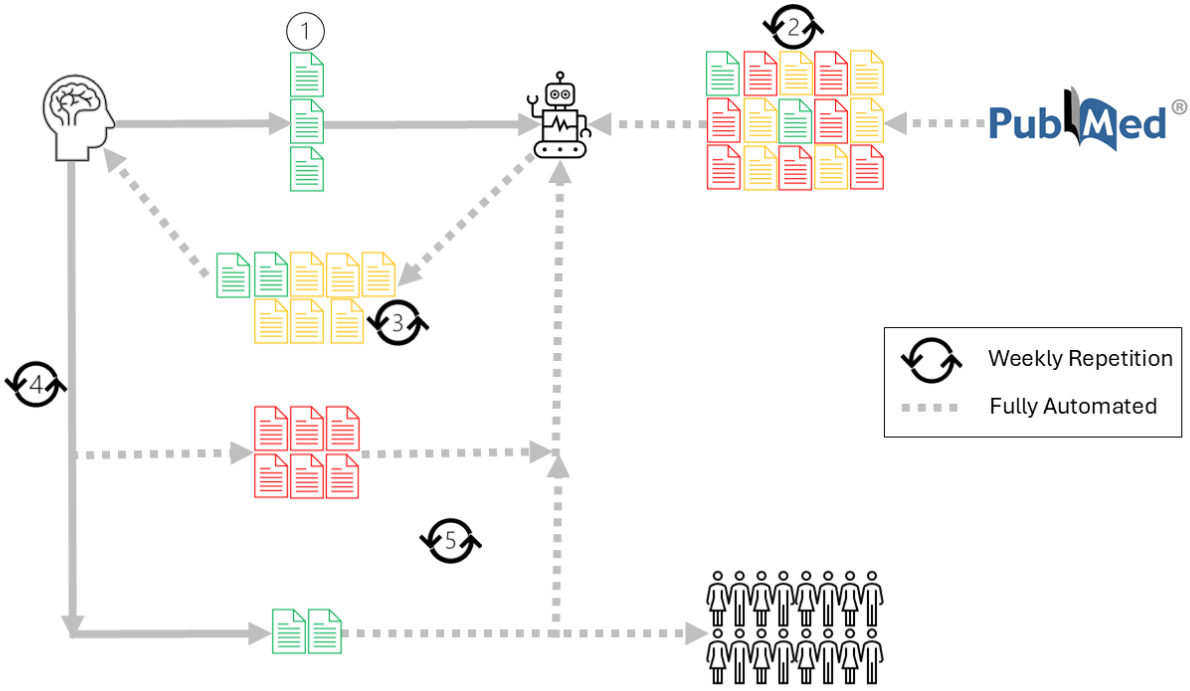
Figure 1 bims: Biomed News editors' workflow.



1. Editor gives PMIDs of relevant records to bims. 2. bims automatically receives weekly records from PubMed. 3. bims automatically selects the possibly relevant records, sorts them based on relevancy, and sends them to the editor. 4. The editor selects the relevant ones; the rest of the records are automatically considered irrelevant and fed back to bims to improve its performance. 5. The relevant records are automatically sent to the editor, the readers, and bims to improve its performance.

Table 1

Comparing Selective Dissemination of Information (SDI) Methods

Method / Features	Email Alerts or RSS			bims
	New Article	Table of Contents	Saved Boolean Search	
Frequency	ASAP	ASAP	Varies	Weekly
Specificity	✗	✗	✗/✓	✓
Output selectivity	✗	✗	✗/✓	✓
Output relevancy	✗/✓	✗/✓	✗/✓	✓
Machine learning	✗	✗	✗	✓
Human-in-the-loop	✗	✗	✗	✓
Community service	✗	✗	✗	✓

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COMMUNITY BUILDING AND ENGAGEMENT

Timesaving through expertise-sharing. An expert can create a newsletter on a specific topic of interest, and community members can subscribe to it, receiving updates every week. This way, rather than all community members searching for papers on the topic, only one expert member spends little time selecting the papers, and all community members benefit. Thus, bims is an expertise-sharing system.

Crediting the editors. Many social media platforms prevent or discourage linking one's profile or affiliated organization on the platform because such links direct readers away from the platform. Social media platforms all try to keep users on the platform. bims management credits the editors by mentioning their names and allowing them to link to their personal profiles and affiliated organizations.

Free and open, shareable, and reusable reports. The readers can use the report issue data in any way they see fit. For example, the weekly issue of the Biomed News report bims-librar on "Biomedical librarianship" is distributed to the MEDLIB-L mailing list, a community of over 1000 members.

COMPARISON TO OTHER SDI SERVICES

While libraries and users have been utilizing binary SDI tools, such as email alerts for saved searches, new articles, or journals' table of contents, bims offers a unique platform for leveraging machine learning to capture non-binary and fuzzy relevant papers that would otherwise be missed in a search. The author has summarized the key differences in **Table 1**.

ADVANTAGES

Unprecedented performance. bims has incomparably better performance compared to saved Boolean search email alerts. The author has set a saved Boolean search alert as well as a bims report on the same topic. bims outperforms in finding unique, new, relevant records.

Users first. Not using cookies or advertisements, offering an easy 'unsubscribe' option, and not sharing readers' email addresses, even with the editors, demonstrate respect for users' privacy and preferences.

Expertise-saving. In any other SDI methods, the expertise put to sort records as relevant and irrelevant at each email alert or RSS feed goes to waste. bims collects feedback from experts' choices to improve its performance and save the editor's time in the next rankings.

Ease of use. Creating and maintaining the report, and subscribing and unsubscribing, are easy. All technical and complex aspects are left behind the scenes. Shortcut keys enable rapid movement across records for the editor without requiring the use of the mouse.

User support. bims management is directly and rapidly available via email. There are no chatbots or layers of bureaucracy.

Potential use cases. While the focus of this review was on using bims to keep the community up to date, it can also have other use cases, such as focusing on machine learning, including systematic review updates.

LIMITATIONS

Search facility. bims lacks a search feature to locate and retrieve records on its website.

Source of data. Currently, PubMed is the only source of records for bims; however, the name 'Biomed News' suggests its possible generalizability to other accessible sources.

Dependency on editors. bims is not a regimented service. Editors can produce report issues at their leisure. Some may be very punctual, and others less so. Thus, subject report issues may appear at irregular intervals. Although it has been functioning well since 2017, community editors are crucial to the creation and maintenance of the reports. Reports can become inactive if the volunteer editor decides not to select the relevant records every week.

Long-term interest. Creating newsletter reports is suitable only for topics with long-term interest, where the editor is willing to invest a few minutes of their time per week in the topic.

Subject coverage. Uptake of bims varies across subject areas of PubMed. Some readers may not find a report on their topic of interest to sign up for.

Quality control. There is no quality control over the editors. A report can be created by anyone, including those who are completely unfamiliar with the topic. However, since maintenance of a report requires weekly action, the author presumes that inept editors would drop out quite soon.

Specificity. bims, as an SDI tool, may be unsuitable for broad topics (e.g., stroke, cancer); however, it works best with more specific topics and serves as a complementary tool to the existing Current Awareness Services (CAS) in libraries.

Lack of email confirmation. Upon signing up, users do not receive a confirmation email to verify their address. Thus, if you enter an invalid address, you will not see any report issues.

CONCLUSION

bims is one of the rare modern and AI-based tools that advocates all Ranganathan's five laws of library science, making records usable, referring right records to the right readers, saving readers' and editors' time, and saving the expert knowledge through feedback to the bims machine learning feature, improving its performance as an evolving and growing organism.

With knowledge of its use, advantages, and limitations, library and information science professionals can introduce bims to expert potential editors and readers with no concerns about the commercial use of their data or privacy issues.

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Farhad Shokraneh, *farhad.shokraneh@nottingham.ac.uk, https://orcid.org/0000-0001-9687-8560, Evidence Synthesis Manager, the University of Oxford; Research Fellow, the University of Bristol; and Post-Doc Research Associate, Cambridge University, UK*

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Covidence. Covidence Pty Ltd, Level 10, 446 Collins ST, Melbourne VIC 3000, Australia; support@covidence.org; https://www.covidence.org/; pay per review.

Rayyan. Rayyan, 1 Broadway, 14th Floor Cambridge, MA, 02142 USA; https://www.rayyan.ai/; pay per user.

EPPI Centre. EPPI Centre, Social Science Research Unit, UCL Social Research Institute, 10 Woburn Square, London WC1H 0NS; eppisupport@ucl.ac.uk; https://eppi.ioe.ac.uk/cms/; pay per user.

Distiller SR. DistillerSR Inc, 505 March Road, Suite 450, Ottawa, Ontario, Canada, K2K 3A4; support@distillersr.com; https://www.distillersr.com/; contact for pricing.

RevMan. The Cochrane Collaboration, 11-13 Cavendish Square, London, W1G 0AN, United Kingdom; https://revman.cochrane.org/info; pay per user.

Systematic reviews are critical in evidence-based medicine, yet their execution demands substantial resources in both time and personnel. The growing volume of scientific publications, the adoption of increasingly rigorous methodological standards, such as PRISMA [1,2], the use of evidence-quality assessment tools [3] and the need of conducting exhaustive searches across multiple databases [4] have amplified their complexity and workload. This complexity underscores the need for specialized tools to optimize the review process. This analysis summarizes and compares the leading software for systematic reviews and meta-analyses, showing how an informed choice can enhance both efficiency and quality. To this end, we conducted a targeted literature review of the most commonly used software for systematic reviews and meta-analyses followed by a critical evaluation of their features to guide researchers in selecting the tool best suited to their needs.

The most widely used softwares for conducting systematic reviews are Covidence [5], Rayyan [6], EPPI-Reviewer [7], DistillerSR [8], and Review Manager (RevMan) [9].

Covidence is widely recognized for its intuitive interface —usually associated with a shorter learning curve— and its capacity to streamline screening and data extraction. As a web-based platform, it facilitates real time collaboration among team members. Its pricing model is based on a per-review fee, allowing unlimited users per project, an advantage for teams with many contributors. Rayyan, in contrast, offers a basic free version (with optional paid) and leverages artificial intelligence to accelerate screening and duplicate detection. It is particularly accessible and integrates well with reference managers. Its paid model is user-based, making it potentially more cost-effective for smaller teams. However, Rayyan lacks built-in functionalities for data extraction and quality assessment, which limits its utility beyond the initial screening phases. Despite these limitations, both Covidence and Rayyan are excellent, low-cost solutions for researchers prioritizing efficiency and collaboration in the early stages of a systematic review. Neither, however, offers meta-analysis capabilities.

For more advanced requirements, platforms such as EPPI-Reviewer or DistillerSR provide extended functionalities, including machine learning tools and comprehensive process automation. These solutions offer greater power and flexibility but are generally more complex, with steeper learning curves and higher costs. Their ability to integrate with other systems and workflows varies by platform. RevMan, the reference software supported by the Cochrane Foundation, stands out for its user-friendly environment for data analysis and writing. Although it lacks automation capabilities and robust screening functionalities, it includes built-in meta-analysis functions and generates standard graphs such as forest plots. Its limited interoperability with external applications, however, may be a constraint in more integrated or customized workflows. A detailed comparison of the features, strengths, and limitations of these platforms is provided in Table 1.

While it is theoretically possible to conduct a systematic review without dedicated software, doing so is inefficient, time-consuming, and increases the risk of error. Critical stages such as duplicate removal, study screening and quality assessment, data extraction, and collaborative analysis can benefit substantially from the use of specialized tools. The selection of a specific platform depends on multiple factors, including the complexity of the review, team size, budget constraints, required functionalities, acceptable learning curve, and compatibility with the researcher's existing digital ecosystem.

Importantly, the choice of software does not have to be limited to a single tool. An optimal workflow may involve the combined use of several platforms —such as employing Rayyan for its efficient screening capabilities, followed by export to RevMan for meta-analysis and reporting. Therefore, prioritizing and tailoring tool selection to specific needs of each phase is essential. Ultimately, the strategic use of appropriate software is critical to enhancing the efficiency of research teams and ensuring the methodological rigor and overall quality of systematic reviews.

CONFLICT OF INTEREST

The authors declare no conflicts of interest related to the content of this letter.

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Table 1

A comparative analysis of the features, strengths, and limitations of leading software for systematic reviews.

Key feature	Covidence	Rayyan	EPPI-Reviewer	DistillerSR	RevMan
Referral Management	✓	✓	✓	✓	⚠
- Import (from databases)	✓ (Multiple)	✓ (Multiple)	✓ (Multiple)	✓ (Multiple)	⚠ (RIS)
- Import (from reference managers, etc.)	✓	✓	✓	✓	⚠ (RIS)
- Automatic deduplication	✓	✓	✓	✓	✗
- Assisted manual deduplication	✓	✓	✓	✓	✗
Screening					
- Title/abstract screening	✓	✓	✓	✓	✗
- Full-text screening	✓	✓	✓	✓	✗
- Blind screening (multiple reviewers)	✓	✓	✓	✓	✗
- Conflict resolution	✓	✓	✓	✓	✗
- AI assistance (prioritization, etc.)	⚠ (ranking beta)	✓ (ML-based)	✓ (Active Learning)	✓ (Prioritization)	✗
Data extraction					
- Customizable forms	✓	✗	✓	✓	⚠
- Extraction by multiple reviewers	✓	✗	✓	✓	✓
- Comparison of extracted data	✓	✗	✓	✓	✓
Quality/risk of bias assessment	✓	✗	✓	✓	✓
- Built-in standard tools	RoB (Cochrane)	✗	RoB-2, AMSTAR, JBI	RoB-2, AMSTAR, JBI	RoB-2
- Customizable Checklists	⚠	✗	✓	✓	✗
Synthesis and analysis					
- Basic meta-analysis functions	✗	✗	EPPI-Mapper integration	✗	✓
- Generation of graphics (forest plot)	✗	✗	Basic (via EPPI-Mapper)	✗	✓
- Structured data export	✓ (CSV, RevMan)	✓ (CSV)	✓ (CSV, XML)	✓ (CSV, RevMan)	✓ (CSV)
Collaboration					
- Multiple simultaneous users	✓	✓	✓	✓	✓
- User roles and permissions	Basic	Basic	Advanced	Advanced	Basic
- Change tracking/auditing	Basic	✗	✓ (Detailed log)	✓ (Detailed log)	✓
Reporting and transparency					
- PRISMA diagram generation	✓	✓ (Beta)	✓	✓	✗
- Detailed audit trail	Basic	Basic	✓	✓	✓
Usability and support					
- Intuitive	High	High	Medium	Medium	Medium-High
- Documentation and tutorials	✓	✓	✓	✓	✓
- Responsive technical support	Medium	Limited	Medium	High	Medium
AI integration (beyond screening)	✓ (dedup, extraction)	✓ (auto-tagging)	✓	✓ (dedup, extraction)	✗
- Live revision support	✓	✗	✓	✓	✓
- Other Feature	API REST	Export to RIS/CSV	XML/JSON Export	API REST	Cochrane ecosystem integration
Costs	$	$	$$	$$$	$$
- Free version	Basic functions	Basic functions	✗	✗	✗
- Paid version	Pay per review (unlimited reviewers)	Pay per user	Pay per user + extra payment for sharing review	Contact supplier	Pay per user

✓, Present functionality; ⚠, Limited functionality; ✗, Absent functionality
RoB, Risk of Bias; ML, Machine Learning; Dedup, Deduplication

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Juan José Serrano Silva, *MD, juanjo.serrano.silva@gmail.com, Cardiology Department, Hospital Universitario de Jerez de la Frontera, Jerez de la Frontera, Spain; Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid, Spain*

Sandra Fernández, *Biol. MSc, sandra.fernandez@cnic.es, Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid, Spain; Instituto de Investigación Sanitaria Hospital 12 de Octubre (i+12), Madrid, Spain*

Nicolás Rosillo, *MD, PhD, nicorora93@gmail.com, Cardiology Department, Hospital Universitario 12 de Octubre, Madrid, Spain; Instituto de Investigación Sanitaria Hospital 12 de Octubre (i+12), Madrid, Spain*

Héctor Bueno, *MD, PhD, hbueno@cnic.es, Centro Nacional de Investigaciones Cardiovasculares (CNIC), Madrid, Spain; Cardiology Department. Hospital Universitario 12 de Octubre, Madrid, Spain; Instituto de Investigación Sanitaria Hospital 12 de Octubre (i+12), Madrid, Spain*

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OpenEvidence. AI based Medical Information platform. Released 2023. OpenEvidence Inc. Cambridge. Massachusetts. https://www.openevidence.com/; Founder& CEO: DR. Daniel Nadler. Free of cost for Healthcare Professionals. Registration is required to use Open Evidence.

OpenEvidence, an artificial intelligence (AI) assisted medical platform, was founded by Dr. Daniel Nadler. OpenEvidence was developed in collaboration with a team of physicians and computer scientists with a mission to offer reliable, unbiased and validated medical information to healthcare professionals at no cost [1]. OpenEvidence (OE) is available through its website (www.openevidence.com) and features partnerships with prominent journals such as NEJM, JAMA and Lancet to ensure content of the highest quality. Since its launch in 2023, in collaboration with the Mayo Clinic Platform, it remains an essential and evident resource in the medical field. OE leverages natural language processing (NPL) to streamline research efforts, and deliver comprehensive evidence-based insights into diagnosis, treatment options, and overall patient care [1].

Artificial Intelligence is revolutionizing the healthcare industry, enhancing patient care, clinical decision-making, and professional development. There is increasing demand for trustworthy and easily accessible medical information among healthcare professionals. Open Evidence (OE) addresses this demand by systematically organizing global medical knowledge into an accessible and clinically useful format [1].

The Open Evidence browser-based search engine requires users to register to login with their professional ID credentials. However, currently, it is also available to medical students in the United States, who can access OE by using their medical school credentials [3].

FEATURES

OpenEvidence serves as a fast and reliable tool for answering clinical questions, such as inquiries regarding treatment options, drug dosing, drug side effects, drug interactions, labs to consider, alternative treatments, and updated guidelines. It can also handle more complex tasks, such as preparing for mock exams, conducting research on a specific topic, finding evidence, and developing appropriate treatment plans. A new feature of OE includes email notification, alerting users to updates on previously asked questions, and ensuring continuous access to the latest information. Additionally OE is available in multiple languages, further expanding its accessibility.

Unlike other medical websites and databases that offer pre-prepared information, OE allows users to directly request evidence without needing to spend hours sifting through articles. OE is an excellent resource for physicians at the point of care; it assists physicians to quickly obtain answers from the peer-reviewed materials, utilizing current research that is reliable for medical practice. OE has implemented specific strategies to incorporate evidence-based and peer-reviewed materials from reputable journals, such as the Lancet, JAMA, and the New England Journal of Medicine.

Open Evidence complies with the HIPAA [3]. Verified NPI users, identified as HIPAA-covered providers, can earn AMA PRA Category 1 credit. CME Credit is awarded after reviewing your previous open- evidence question and completing a brief learning assessment. CME Credit is accessible through their email, contact@openevidence.com [2].

OE is available through web browsers and as a mobile application on iOS and Android platforms, offering healthcare professionals a powerful resource for enhancing clinical decision-making and improving patient care outcomes [1]. OE is a free, accessible medical resource provided by the Mayo Clinic Platform that encompasses key medical journals, medical books, and authoritative sources [4]. Available exclusively to healthcare professionals, it offers 24/7 access with accuracy verification managed by OE developers. Medical students and clinicians can use OE to find answers quickly and perform differential diagnoses. The platform's ease of access and zero cost make it an invaluable tool for medical students, faculty members, and healthcare professionals. The OE's ability to handle direct questions and provide quick concise answers will assist medical students to use this tool as a personal tutor or study buddy. Medical librarians may recommend OE as the most suitable AI tool for healthcare professionals and faculty members, both for clinical practice and as a teaching assistant

OE is based on a large language model (LLM). Effective use of LLM-based AI tools requires precise queries and awareness of limitations, including "making things up" or hallucination. OE overcomes these limitations by using a retrieval-augmented generation-based Large Language Model that references established medical sources [6]. In addition, OE provides citation links, which allow users to verify information and reduce the risk of inaccurate information.

In this review, a few evidence-based questions were used to compare OE and ChatGPT. The findings indicate that both resources provide similar information; however, OE offers accurate, faster and concise responses. Given that healthcare relies not only on medical knowledge but also on trust, accuracy, authority, and currency, OE proves to be the superior option compared to ChatGPT.

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Table 1

ChatGPT vs OpenEvidence

Features	Chat GPT	Open-Evidence
Access	General Public & Subscription Option	Healthcare Professionals & US Medical Students
Adaptation	General Medical Knowledge	Clinical Decision Making & Evidence based
Cost	Free & Paid subscription	Free for US Healthcare Professionals.
Citation	Not Current	Current
Focus	Conversational	Reliable Medical Information.
Quality of information	Detailed, Potential for error and hallucination.	Concise, Accurate, Timely & peer reviewed articles.
Purpose	General AI tool	Specialized Medical AI tool
Training Data	Broad & General Data	Reliable Medical Knowledge from Medical Journals and Clinical Guidelines

LIMITATION

Like any AI-driven platform, OE has certain limitations. The accuracy and detail of responses depend on the clarity and specificity of user input. The OE website may experience occasional lag, but this issue does not affect the mobile application. Additionally, OE information is not peer-reviewed. Proper use requires human intervention, medical expertise, and specialized knowledge.

The company has also emphasized in the terms of use that "OpenEvidence does not offer medical advice, diagnosis, or treatment. Users must ensure that their questions do not contain protected health information (PHI) or any privacy-violating details" [1].

CONCLUSION

OpenEvidence summarizes medical knowledge for physicians and healthcare workers. Despite the challenges that remain, including issues surrounding data privacy and ethical considerations, the potential benefits of OE indicate that AI will play a pivotal role in the future of healthcare. According to OE, approximately 25,000 US doctors have been signing up monthly since the platform's launch in 2023. This adoption indicates a demand for accessible, evidence-based tools in medical practice [7]. OE's global accessibility and multilingual capabilities have ensured its widespread usability. As with any medical resource, human expertise and clinical judgment are essential for the proper use of OE. This AI-integrated medical search engine is highly beneficial because of its rapid access to authoritative medical knowledge, ability to provide targeted answers, free availability, and round-the-clock accessibility. Combined with human medical expertise, OE has the potential to enhance healthcare.

OE is available through web browsers and mobile applications for iOS and Android platform [5], offering healthcare professionals a powerful resource for enhancing their clinical decision making and improving patient care outcomes. Medical librarians can confidently recommend this authoritative, freely accessible resource to medical students and healthcare professionals.

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Suja Philip, *suphilip2001@gmail.com*, *University of the West Indies, School of Clinical Medicine and Research, Nassau, Bahamas*

Reghu Kurian, *reghuphilip@hotmail.com*, *Princess Margaret Hospital, Nassau, Bahamas*

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Gale G. Hannigan (1950–2024)

Janis F. Brown, AHIP

See end of article for authors' affiliations.

Gale Gabrielle Hannigan passed away on June 27, 2024, in Alburquerque, NM. Gale was born on October 9, 1950, at Flower Fifth Avenue Hospital in New York City. Gale enjoyed an idyllic childhood in Middletown, New Jersey, attending local schools during the winter and spending every day at the beach in the summer. She excelled in school, including winning the Betty Crocker Award. For college she chose the University of California, Berkeley, in the midst of its tumultuous Freedom of Speech Movement in the late 1960s. She convinced her parents that she would be safe, would not get involved: she was going to study pre-med. As soon as she got to Berkeley she registered as a philosophy major.

While at UC Berkeley, Gale received a bachelor's degree with honors in philosophy and English and then a master's degree in library and information science. She moved to Texas where she held her first professional position at the Houston Academy of Medicine-Texas Medical Center Library (HAM-TMC) from 1977 – 1982. After moving to the Midwest, she became the Head, Learning Resources Center, at the University of Minnesota from 1982 until 1986, and then the Manager, Medical Library Services, at the Upjohn Company. She returned to Texas in 1990 to be the Manager, Education and Information Services, at Texas A&M Medical Sciences Library.

In 1996, she held a joint appointment with the Texas A&M College of Medicine as the Director, Informatics for Medical Education. Her years in Texas included being an adjunct lecturer at the University of Texas School of Library and Information Science and later as adjunct faculty at the University of North Texas School of Library and Information Sciences. Always the lifelong learner, in May 2000, Gale earned her PhD in Information Science from the University of North Texas.

In 2011, after retiring from Texas A&M, she moved to Alburquerque, New Mexico, a place she loved for the majestic Sandia Mountains, the people, and the culture. Despite having retired, Gale continued her career on a part-time basis at the University of New Mexico Health Sciences Library & Informatic Center (UNM HSLIC), as a visiting professor and then as a research librarian allowing her to pursue her love of medical libraries while helping others and stretching her mind until the end of her life.

Gale married Steve Bartoldt while they were both at HAM-TMC, Steve as a medical resident and Gale as a clinical librarian. In the years that followed due to their careers, they moved to be together geographically, even if not in the same city and became collaborators writing several articles together, until they both retired in Albuquerque.

An important life event was her diagnosis of breast cancer in the late 1990's. She dealt with the diagnosis and treatment by using both her sense of humor and her information skills while seeing medical information from another viewpoint, as she described in a 1998 article in American Libraries [1]. She declared "war on cancer" and used a fried egg to describe her radiation treatment, as she navigated her way through treatment utilizing the information she gathered and the resources available to her.

Gale has always been an early adopter and committed to sharing her expertise with others. Early in her career at HAM-TMC, she was at the forefront of clinical librarianship publishing articles in the inaugural issue of the Journal of Clinical Librarianship [2] and the Journal of

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Family Practice [3]. Education also has been a consistent theme in her career. She had a passion for working with library school and medical students, mentoring colleagues, tutoring in local children's reading programs, and teaching English grammar online to a young family in Iran.

Throughout her career, Gale has been active in MLA and played many leadership roles serving on national MLA committees such as the Books Panel and the Nominating Committee, as well as being elected as chair of several sections including the Educational Media and Technology Section and the Medical Library Education Section. She used her warm and casual personality, her inclusiveness, and her creative ideas to be an effective leader. She was committed to her profession and to the Association. She continued to engage with MLA after her "retirement." In her role as co-chair of the task force reviewing competencies, she was instrumental in the development of the MLA 2017 Competencies for Lifelong Learning and Success [4]. As a fitting end to her long commitment to the profession, her final contribution was as a co-author to a key JMLA article [5] that was published posthumously.

Gale received many of the most prestigious MLA awards showing her value to the profession and her reputation within it, including the 1996 Estelle Brodman Award for Academic Medical Librarian of the Year, the 2011 Lucretia W. McClure Excellence in Education Award, and in 2023 she was elected as an MLA Fellow for her "sustained and outstanding contributions to health sciences librarianship and to the advancement of the purposes of MLA." She was also recognized by her colleagues at the UNM HSLIC with an Exemplary Service award, and by the University of North Texas Department of Information Sciences with its Outstanding Alumni Award. UNM HSLIC Executive Director Melissa Rethlefsen shared in her library's "Farewell to Gale Hannigan [5]" a testament to Gale's value, "I cannot really remember a time when I didn't recognize her name as one of the greats in our field. But, it wasn't until I got to work with her that I truly understood how great she actually was." Gale was also recognized by her community including an acknowledgement by the Navajo Nation for her public health outreach to them.

Gale had a beautiful spirit. She was always kind and giving to others, and she often became fast friends with those whom she encountered. During Covid as a way to keep connections with others and to remind us that we still lived in a world of beauty, Gale created a mailing list to share images of nature. At her passing, her mailing list included 75 people and became the vehicle for her sister Kathy to share the sad news about Gale. The list then became a spontaneous online memorial for all to share their love for Gale and her impact on their lives. Gale's friends included people from all parts of her life, including former and current colleagues, students, fellow charitable organization volunteers, her real estate agent, her cleaning professional, her oncology and end-of-life teams, and many others. She was an important person in the lives of many who will miss her greatly.

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AUTHORS' AFFILIATIONS

Janis F. Brown, MLIS, AHIP, jbrown@usc.edu, Associate University Librarian Emerita, Norris Medical Library, University of Southern California, Los Angeles, CA

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