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Brenda Linares, MLIS, MBA, AHIP, Medical Library Association President, 2024-2025

Annabelle V. Nuñez; Kate Flewelling, AHIP; Emily Vardell, AHIP; Kristine M. Alpi, AHIP

See end of article for authors' affiliations.

In this profile, Brenda M. Linares, AHIP, Medical Library Association (MLA) president 2024-25 is introduced through a discussion of her contributions and commitment to growing the next generation of Latina library leaders. As the first Latina immigrant MLA president, she partnered with colleagues to build organizational structures to strengthen diversity, equity, and inclusion in multiple regional chapters of MLA. In addition to her focus on integrating her family into her professional engagements, Linares brought a strong business orientation from her bachelor's degree in Finance and her Master of Business Administration to her MLA leadership and to her professional role as Associate Dean of Library Services, University of Missouri- Kansas City (UKMC) Libraries.

Keywords: Biography; MLA President; Latina; Latinx

Brenda Marisol Linares was born on Christmas Day 1978 in Jutiapa, Guatemala. She immigrated to the United States at the age of ten and grew up in the San Fernando Valley, California, with her parents Rogelio and Leticia and her sister Iveth. As a non-native English speaker, she faced barriers when beginning school in the United States, but her 5th grade teacher Dr. Deborah Neal (with whom she is still in touch!) recognized her intelligence and hard work. Dr. Neal helped Brenda apply to the Magnet program in her school. This early recognition of her talents is one example of the mentors in Brenda's life who have supported her in achieving her dreams and her path to success.

BRENDA LINARES' PROFESSIONAL JOURNEY

Brenda's first introduction to working in libraries was as a student library assistant at California State University, Northridge (CSUN) while pursuing her undergraduate degree in finance. Through this work, she met Dr. Karin Durán, Head of the Teacher Curriculum Center (TCC) in the CSUN University Library. After graduation, Brenda was considering meaningful career pathways when Karin encouraged her to consider pursuing her Master of Library Science. Karin's example and mentorship paved the way for Brenda's passion for working in librarianship.

Brenda completed her Master of Library & Information Science in the UCLA School of Education & Information Studies. In her final semester as an MLIS student, Brenda worked as a graduate library assistant in four separate university libraries, including a semester-long internship at UCLA's Louise M. Darling Biomedical Library, where her interest in medical librarianship blossomed.

After graduating in 2007, Brenda began her career in the competitive National Library of Medicine (NLM) Associate Fellowship program, which changed her life professionally and personally. In the first year of the fellowship, she learned all aspects of NLM and conducted independent projects, including an Assessment of the Central American Network for Disaster and Health Information (CANDHI). It was in the NLM Associate Fellowship that she met her future wife, Emily Vardell. Their career paths grew together over the years through several moves.

In 2008, Brenda moved to the University of Miami for the second year of the fellowship. Her acumen in outreach, instruction, and operations led to her being hired as Administrative Librarian and Manager, Finance. She was later promoted to Head of Library Outreach and Community Engagement, in recognition of her work as project manager of the library's National Network of Libraries of Medicine (NNLM)-funded outreach project in the Department of Community Service engaging in health fairs across south Florida communities [1]. After working at the University of Miami, Brenda and Emily moved to Chapel Hill, North Carolina, where Brenda worked as Librarian and Outreach Liaison at the Health Sciences Library at the University of North Carolina at Chapel Hill, liaising to the Institute on Aging, providing outreach services to Area Health Education Centers (AHEC), and supervising library and information science graduate student field experiences. Committed to lifelong learning, she simultaneously pursued her Master of Business Administration (MBA) through the Working Professional Online MBA program at the Jenkins School of Business at North Carolina State University.

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In 2017, Brenda and Emily moved to Kansas, where Brenda began her position as Research and Learning Health Sciences Librarian at the A.R. Dykes Library at the University of Kansas Medical Center. As liaison to the School of Nursing, she brought her expertise and passion for outreach to underserved populations by spearheading an NNLM funded project that developed health-related podcasts for the Latinx community in Kansas City [2,3]. In 2022, she was tapped for the role of Associate Dean of Library Services at the University of Missouri-Kansas City UMKC Libraries, where she supervises seven professional librarians and oversees six library departments, including the UMKC Health Sciences Library.

LEARNING ALONGSIDE AND LEADING ASSOCIATION COLLEAGUES

Brenda joined the Medical Library Association (MLA) in 2008 and advanced to Distinguished Membership in its Academy of Health Information Professionals (AHIP) in 2019. Brenda is passionate about continually learning new things, works with her fellow librarians to share knowledge, and is a terrific teammate. She applies her outreach librarian skills frequently, helping ensure that MLA members and other librarians have collaborators and do not feel alone and isolated. She looks to her community of practice to contribute her expertise and grow her skills through volunteering on projects that advance our profession. Brenda is persistent and encourages others to persevere. She had volunteered to work on one of the MLA Research Agenda systematic reviews on the topic of librarian impact on informatics education for health professions. In 2014, when many people had to step away from the project, Brenda remained committed and alternated leadership with the first author in scheduling meetings and keeping us together which ultimately led to the paper being published in 2021 [4].

Since Brenda's career began in 2007, she has led the profession in expanding opportunities for all members through multiple diversity, equity, and inclusion (DEI) programs. Two years before MLA created a Diversity, Equity and Inclusion Task Force (now the Community Building and Belonging Committee [5]), Brenda served as the inaugural chair of the MidAtlantic Chapter (MAC) Diversity Task Group [6]. In 2018, MAC received the MLA Chapter of the Year award for the Task Group's efforts, and, in 2020, the Task Group received the MAC Marguerite Abel Service Recognition Award. By then, Brenda had moved to the Midcontinental Chapter of the Medical Library Association where she was the inaugural chair of that chapter's Diversity and Inclusion (D&I) Task Force [7]. In 2021, Brenda was awarded the MLA President's Award for efforts on the MLA Spanish-Language COVID-19 Resources Page. Her expertise developing chapter level DEI task forces led to her involvement in supporting the creation of the third DEI-related committee she has helped establish - the JEDI (Justice, Equity, Diversity, and Inclusivity) Committee in the South Central Chapter of MLA.

Brenda's commitment to diversity, equity, and inclusion has never been something she "adds on" to her work; it's the throughline. Long before DEI initiatives gained broader momentum, she was already working to break down barriers to health information access, asking who gets left out and who is expected to navigate complex health systems as an outsider.

When beginning her path to librarianship in 2005, Brenda was selected to participate in the American Library Association (ALA) Spectrum Scholars Program. This two-year program is geared toward library students and is foundational in preparing library and information professionals. It is where she found both community and purpose. That experience grew out of her deeply rooted belief that representation and opportunity are not abstract values, but critical to the infrastructure of an equitable profession. Soon after, it was both fortuitous and fitting that she was selected for the NLM Associate Fellowship Program, intentionally designed to cultivate future leaders from diverse educational and cultural backgrounds. The fellowship didn't just sharpen her skills; it expanded her platform. Brenda continued her relationship with ALA after time as a scholar and became a presenter, returning repeatedly to share what she had learned, open doors, and build real connections with new and emerging librarians who needed to see themselves in the profession.

By 2012, recognizing that MLA had few visible representatives from the Latinx community, Brenda's advocacy took on a collective form. She worked tirelessly alongside Diana Almader-Douglas and Annabelle Nuñez to establish the MLA Latinx Special Interest Group (now Caucus) in 2014. The aim was to create space for building a network when isolation was common and to ensure that Latinx voices could gather, lead, and be heard. That work was more than organizational; it was an act of embracing belonging, and it continues to ripple outward in MLA, as evidenced in the continuation of this group. In 2021, the collective momentum helped inspire members of the caucus to publish the JMLA commentary, "¡Presente: Affirming Latinx voices with health sciences library scholarship", which outlines a call to action to "empower Latinx and BIPOC to have their voices heard, supported, and cultivated." [8]

Brenda's leadership is marked by progression and continuity; she has been involved in different capacities within MLA with committees, national program committees (NPCs), juries, and other leadership roles. While wrapping up her term as Past-Chair of the Leadership and Management Caucus (then Section), she transitioned immediately to being elected to the Board of Directors starting May 2020. Whenever she joins a new community, she volunteers for service leader roles at the state and regional level. In the Association of North

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Carolina Health and Sciences Libraries (ANCHASL), she chaired the Membership Committee and then progressed to Secretary before moving to Kansas and then becoming active in Midcontinental Chapter activities, where she was recognized in 2023 with the Bernice M. Hetzner Award for Excellence in Academic Health Science Librarianship. Embracing state and regional leadership roles, as well as championing leading from the middle are hallmarks of Brenda's contributions.

Brenda's approach to leadership has also been profoundly shaped by an unwavering belief that health information should never be a privilege reserved for the few. This guiding principle became a consistent thread in her guest lectures across multiple Library and Information Science (LIS) courses at the University of North Carolina's School of Information and Library Science and Emporia State University's School of Library and Information Management, as well as in her outreach and leadership activities as she has moved all across the United States from California to the east coast (Washington DC, Florida, and North Carolina) and then settling in Kansas.

REPRESENTING HEALTH SCIENCES LIBRARIANS AT THE HIGHEST LEVEL

Kristine Alpi, MLA President from 2021-22 and chair of the Nominating Committee that invited Brenda to the MLA Presidential election slate, recalled thinking that it was not the right time, that Brenda needed to take a break after coming off an intense time on the Board of Directors with many challenging issues. There was also Brenda's new job and new daughter, Clara, to be considered. Still when invited to be a candidate, Brenda was courageous and wanted to make the most of the opportunity. One of her special gifts is figuring out how to bring all the facets of her life together. She transformed a "not ideal" time into the right time to lead.

Brenda has always integrated her family life into her work life in a way that inspires and lowers the barrier for others who struggle to balance both. Kate Flewelling recalls meeting Brenda, her parents and sister in tow, the day before they both started their Associate Fellowship at NLM. The next day, Brenda met fellow Associate and her future wife, Emily Vardell. Over the years, Brenda and Emily have supported each other's careers, served as co-authors on multiple publications, and grown their family to include two daughters [9] (Vardell & Linares, 2025). Their older daughter Clara regularly attends MLA conferences. One of Kate's favorite memories is watching three-year-old Clara watching her Mamá on stage as President, awe in her eyes and wearing a "First Daughter" t-shirt. Just as they were on Brenda's first day at NLM, Brenda's parents and sister were in the audience.

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AUTHORS' AFFILIATIONS

Annabelle V. Nuñez, MA, https://orcid.org/0000-0001-6418-8717, Director, Health Sciences Library, University of Arizona Health Sciences Library, Tucson, AZ

Kate Flewelling, MLIS, AHIP-D, https://orcid.org/0000-0001-6335-1586, Director, Library Services, Medical Campus, Boston University, Boston, MA

Emily Vardell, MLS, PhD, AHIP, https://orcid.org/0000-0002-3037-4789, Associate Professor, School of Library and Information Management, Emporia State University, Emporia, KS

Kristine M. Alpi, MLS, MPH, PhD, AHIP-D, https://orcid.org/0000-0002-4521-3523, Associate Dean of Libraries and Information Sciences, Scholarly & Research Technologies, Icahn School of Medicine at Mount Sinai, New York, NY

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ORIGINAL INVESTIGATION

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Comparing five generative AI chatbots' answers to LLM-generated clinical questions with medical information scientists' evidence summaries

Mallory N. Blasingame; Taneya Y. Koonce; Annette M. Williams; Jing Su; Dario A. Giuse; Poppy A. Krump; Nunzia B. Giuse

See end of article for authors' affiliations.

Objective: To compare answers to clinical questions between five publicly available large language model (LLM) chatbots and information scientists.

Methods: LLMs were prompted to provide 45 PICO (patient, intervention, comparison, outcome) questions addressing treatment, prognosis, and etiology. Each question was answered by a medical information scientist and submitted to five LLM tools: ChatGPT, Gemini, Copilot, DeepSeek, and Grok-3. Key elements from the answers provided were used by pairs of information scientists to label each LLM answer as in Total Alignment, Partial Alignment, or No Alignment with the information scientist. The Partial Alignment answers were also analyzed for the inclusion of additional information.

Results: The entire LLM set of answers, 225 in total, were assessed as being in Total Alignment 20.9% of the time (n=47), in Partial Alignment 78.7% of the time (n=177), and in No Alignment 0.4% of the time (n=1). Kruskal-Wallis testing found no significant performance difference in alignment ratings between the five chatbots (p=0.46). An analysis of the partially aligned answers found a significant difference in the number of additional elements provided by the information scientists versus the chatbots per Wilcoxon-Rank Sum testing (p=0.02).

Discussion: Five chatbots did not differ significantly in their alignment with information scientists' evidence summaries. The analysis of partially aligned answers found both chatbots and information scientists included additional information, with information scientists doing so significantly more often. An important next step will be to assess the additional information, both from the chatbots and the information scientists for validity and relevance.

Keywords: Large Language Models; LLMs; generative AI; chatbots; artificial intelligence; evidence synthesis; library science; information science; biomedical informatics

See end of article for supplemental content.

INTRODUCTION

Generative artificial intelligence (AI) tools are increasingly embedded into the systems and workflows used by experts and the general public to search for health information. In 2024, a Kaiser Family Foundation poll of 2,428 U.S. adults found that roughly 1 in 6 (17%) respondents used AI chatbots at least monthly to seek out health information [1]. Even when searchers do not directly query a generative AI tool, they may increasingly encounter large language model (LLM)-generated answers as they search for health information on the web [2] or in proprietary literature databases [3,4]. Google and Microsoft Bing are now providing generative AI answers in search results, including responses to medical queries [5]. National Center for Health Statistics data from 2022 revealed that 58.5% of adults surveyed had looked for health information on the Internet in the past year [9], and Google reported in 2025 receiving "100s of millions" of health-related searches per day [10]. Thus, it is likely that many people are encountering generative AI answers to their everyday health inquiries. These answers can provide users with quick, easy access to synthesized information, which may be useful for guiding conversations with clinical providers [6] but may also pose unforeseen risks [7,8].

Furthermore, with the increased integration of LLMs within the realm of searching and summarizing clinical information, evaluating how highly-used models' answers compare to those of the highly trained, trusted medical librarians/information scientists who commonly perform

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these tasks may greatly help our understanding of their utility, limitations, and risks. Previous studies have investigated LLMs' performance for answering medical questions using a variety of study designs and evaluation dimensions [11] and assessed their ability to aid with steps of the evidence synthesis process including search strategy development [12–14] and systematic review tasks such as citation screening and data extraction [15,16]. However, to fully understand the implications of LLMs to the medical library profession, additional investigation is needed into how AI chatbots' answers to medical questions compare to librarian-generated evidence summaries.

To address this knowledge gap, our team at the Vanderbilt University Medical Center (VUMC) Center for Knowledge Management (CKM) has embarked on a series of studies to investigate generative AI in the context of medical information sciences. Our team is composed of professional information scientists credentialed in medical librarianship and, in most instances, in one or more additional health sciences disciplines, e.g., medicine, public health, bioinformatics. In a previous study, we assessed the performance of VUMC's internally managed version of GPT-4 (aiChat) [17], using medical information scientists' evidence summaries as the gold standard for comparison [18]. In that initial study, we compared aiChat answers with summaries our team previously developed in response to a VUMC-proprietary set of questions received during rounds or from an electronic health record-linked message basket. The study revealed that 83.3% of aiChat responses included all the elements from the information scientist summaries that were identified as being most critical for answering the questions, while also reflecting known limitations of generative AI tools, including fabrication of references. We additionally observed that the well-organized, consistent formatting of the summaries was a strength of the LLM-generated answers. In a second study comparing search strategies generated by three publicly available LLMs with information scientists' expert searches, our team found the AI chatbots were able to generate Boolean search queries but missed many relevant keywords and often included inaccurate controlled vocabulary terms [19].

As part of our contribution and ongoing commitment to increase librarians' understanding on how to best integrate AI in our profession, our team has designed a series of evaluations that will, step by step, explore a variety of LLM-related research questions, thus increasing our overall knowledge on generative AI. The use in our first study of institutional proprietary data limited the study to a single large language model, aiChat. The current study extends the investigation of LLMs' performance in clinical question answering to additional tools. We aimed to build on the findings of the previous two studies by conducting a prospective, in-depth, detailed comparison between five generative AI chatbots' answers to clinical questions and medical information scientists' synthesized evidence summaries, focusing on tools that are widely available and likely to be used by the public. To avoid using proprietary questions originating from our medical center's clinical work environment in these publicly available systems, we prompted the chatbots to create the questions for the study, and information scientists developed new synthesized evidence summaries for each question to compare with the LLMs' answers. As the summaries created by the information scientists were not reviewed and validated by clinical experts, we did not consider them to be a "reference standard" for assessing accuracy but rather compared them one-to-one with the chatbots' answers. The study specifically investigated the following questions:

1) How do the answers provided by five publicly available LLMs compare to those of medical information scientists?
2) Are there differences in how the LLM answers compare with information scientist answers when the AI tools answer their own generated questions?

METHODS

The study received a non-human subjects research determination from the VUMC Institutional Review Board (IRB #241743). The reporting of this study follows the Chatbot Assessment Reporting Tool (CHART) guidelines [20,21]; the CHART Methodological Diagram and Checklist can be viewed in Appendix A.

Generative AI Chatbots

When the study was initially conceived in October 2024, ChatGPT (https://chatgpt.com/), Google Gemini (https://gemini.google.com/), and Microsoft Copilot (https://copilot.microsoft.com/) were selected for investigation based on their reported frequency of use in medical literature to date [22], and, in the cases of Gemini and Copilot, their increasing integration into highly used public search engines. In early 2025, as study activities were ongoing, the release of DeepSeek (https://chat.deepseek.com) and Grok-3 (https://grok.com/) for public use sparked a great deal of interest; thus, we decided to add them to the analysis to explore any differences in performance with these newer models. The free, public, web-based versions were used; in Google Gemini, DeepSeek, and Grok-3, logging into a free personal account was required. The versions used were the most current freely available, base models for each tool at the time: ChatGPT-4o [23], Gemini 2.0 Flash [24], DeepSeek R1 [25], and Grok-3 [26] with web search enabled; the particular model of Copilot was not specified in the system. DeepSeek defines itself as an open-source LLM; all other models used in this study are closed-source. Though Microsoft Copilot uses OpenAI's GPT as one of the base model options, given the differences in

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Microsoft's integration of the GPT model, combined with Microsoft Copilot's auto-routing to select a model based on the context of the user's input, the two LLMs were considered as independent for this investigation [27].

Prompt Engineering

Three prompts were used in the study: 1) a prompt to obtain the questions from the generative AI chatbots; 2) a prompt to obtain the *answers* from the LLMs; and 3) a prompt to submit each information scientist and chatbot answer to the generative AI tools to obtain lists of key elements for comparison. The prompt for obtaining the answers was reused from our previous study [18]. The other two prompts were newly created for this study by the co-authors, who include individuals with formal training and expertise in information sciences, medicine, public health, and biomedical informatics. The COSTAR framework [28] was followed, with each prompt including a section on Context, Objective, Style, Tone, Audience, and Response. When possible, elements of the original prompt were reused, with adjustments made to tailor the prompt to the specific task. The prompts were submitted to the tools for testing and revised as needed. In all cases, a new session was started with the chatbot for each individual prompt submitted.

Obtaining the Questions

In our previous study [18], we used questions received from clinicians based on actual clinical encounters; these questions are proprietary to our institution and thus could only be used with our organization's internally managed AI tool. For this study that uses publicly available LLMs, we intentionally used the chatbots to create non-proprietary clinical questions that could be input into the tools and publicly shared (see Appendix B). In evidence-based medicine, the use of well-structured questions can enhance precision and aid in establishing discrete concepts for search strategy formulation and information retrieval [29]. Since the 1990s, the PICO (patient, intervention, comparison, outcome) framework has been used by clinicians and information scientists to guide evidence searching, filtering, and selection in response to both clinical questions and inquiries from members of the lay public [30]. Thus, we leveraged the chatbots' ability to quickly and efficiently generate PICO-structured questions for use in this study. Each question was subsequently reviewed by an information scientist with formal education and training in medicine to ensure all questions generated were medically plausible, i.e., that the questions made medical and logical sense.

Forty-five questions were obtained in November 2024 by prompting ChatGPT, Google Gemini, and Microsoft Copilot to each provide five treatment questions, five prognosis questions, and five etiology questions in PICO format (Appendix B). DeepSeek and Grok-3 were not used to generate questions, as the tools were not yet widely available for public use. The treatment, etiology, and prognosis question categories were selected based on the most common types of questions our team has received in our history of providing clinical evidence services [18]. After initial prompt testing revealed that the tools tended to provide questions focused on treatment even when asked for prognosis or etiology questions, definitions of prognosis and etiology were added to the prompts for these categories (Appendix C). A definition of treatment was not added to the prompt, as the tools were able to provide questions in this category without the need for one.

The questions were obtained by two information scientists. When duplicate or non-medically plausible questions were generated, they were removed from the question pool and the tool that provided the question was prompted for an additional question as part of the same session. For example, one generated question asked about a patient population with Type 2 diabetes whose HbA1c level was within a "normal range at diagnosis"; given elevated HbA1c is a standard diagnostic criterion for Type 2 diabetes [31], we excluded this question and prompted the chatbot to provide another.

Question Assignment

Questions were assigned to four information scientists based on their effort assigned to the project. The questions were initially randomly assigned with stratification by question source and category. As efforts shifted throughout the project period, five questions were reassigned.

Developing the Information Scientist Evidence Summaries

Our team's standard practices for developing synthesized evidence summaries were followed. As often done at our center, information scientists individually developed comprehensive PubMed search strategies for each question and then met as a group to review the searches and provide feedback on areas for refinement. Once the searches were finalized, the information scientists completed evidence summaries for their questions, following the template used by our team for answering real-world evidence queries. The template reflected changes adopted by the team after our previous AI study [18] and includes the following sections: 1) an introduction, including a brief summation of findings, characterization of the state of the literature, and definition of key topics; 2) a summary of selected literature, including the design, publication year, aims, and results for each selected study; and 3) conclusion, with the "bottom line" of findings from the literature and a brief summary of strengths and limitations. After each summary was completed, it was stored in REDCap [32,33].

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Obtaining Answers from the Generative AI Tools

As the information scientists finalized each summary, a senior information scientist not involved in evidence synthesis submitted the corresponding question to each chatbot using a standardized prompt (Appendix D). In brief, the prompt asked the tools to provide an evidence summary in response to the provided clinical question in "the role of a medical librarian," with the answer limited to the information available up to the date the information scientist completed the summary. All information scientist summaries were completed and answers captured from the generative AI tools between January and April 2025. Each response was stored in full in the study database, along with references and any hyperlinks included with the response. Both the information scientist and generative AI answers are available in the complete study dataset (see Data Availability Statement).

Comparing the Information Scientist Evidence Summaries with Generative AI Answers

In our research assessments of generative AI tools, CKM recognized, although limitations were observed in the ability to verify LLM-provided references, there was value in the tool's capability to clearly and effectively summarize evidence in a well-organized written format and, when specified, organize the information into easy-to-understand key elements. Leveraging on this understanding and with the intent to remove human subjectivity, for the current study, the team decided to have each of the five tools automatically generate (Appendix E) the key elements for the 45 LLM-generated summaries and the 45 summaries generated by the information scientists. Each set of key elements from all the summaries, whether generated by the tools or written by the information scientists, was subsequently reviewed by information scientists to ensure the key elements accurately reflected the summary.

Because of the lack of direct involvement and interaction with clinicians, a decision was also made not to label the information scientists' summaries as "reference standards." Without the opportunity for consultation, we cannot assume that information scientists and clinical experts will agree on the answers to clinical questions [34]. Given the above consideration, agreement and disagreement among the key elements was used to determine the level of alignment between the answers of the LLMs and information scientists; the analysis was conducted by four unblinded information scientists. All key elements are available in the study data deposited to the Open Science Framework. A pair of information scientists reviewed and gathered consensus on whether the information included in the key elements from the answers of each of the five models – ChatGPT, Gemini, Copilot, DeepSeek, and Grok-3 – was a) totally aligned, b) partially aligned, or c) not aligned with the information expressed by the key elements from the information scientists' answers. In each of the above instances, one of the information scientists in the pair was the author of the summary compared.

We used the concept of *Total Alignment* when the information expressed by the key elements in each of the answers being compared was judged as being the same. Although the lists of key elements were numbered, the summaries did not need to have the same number of elements to be considered in Total Alignment. For example, a single key element from the information scientist's response could be determined to align with two or more elements from the chatbot's response, and vice versa. Additionally, differences in wording or data cited that represented the same concept or viewpoint were counted as in alignment. *Partial Alignment* included four sub-categories: 1) All key elements expressing the same concepts were in agreement, but the *tool's* answer included additional key elements; 2) All key elements expressing the same concepts were in agreement, but the *information scientist's* answer included additional key elements; 3) All key elements expressing the same concepts were in agreement, but *both* answers included additional key elements; or 4) The information scientist and LLM agreed on some but not all key elements expressing the same concepts, and one or both answers may have included additional key elements. For categories 1-3, we tabulated how many additional key elements were provided, meaning concepts not found in the answers used for comparison. *No Alignment* indicated that none of the key elements agreed.

Sample Size Determination

The sample size was informed by the need to obtain multiple questions from each of the three tools we originally intended to study (ChatGPT, Gemini, and Copilot) and the three categories selected for the questions (treatment, prognosis, and etiology). Consideration was also given to the estimated time (historically averaging about 8 hours per summary [35]) needed by the information scientists to generate summaries, a consideration largely dictated by their availability. All of this brought us to the final determination that using a minimum of five questions for each of the question categories (total of 15 questions) for each of the three tools could give us adequate data for our study, resulting in a final sample of 45 questions. A formal sample size calculation was not conducted.

Data Analysis

Descriptive statistics were used to report the frequency and proportion of responses assessed as in Total Alignment, Partial Alignment, or No Alignment for each of the tools in comparison with the information scientist responses, and to characterize the number and percentage of each type of Partial Alignment by tool. The average word counts for the narrative text, excluding the list of cited references, from the information scientist and chatbot answers were also calculated. A Kruskal-Wallis test was used to assess whether there was a significant difference in the five generative AI tools' alignment with the information scientists' responses, and in the types of partial alignment across the five tools. This test was selected as the comparison focused on multiple independent groups and the data were nonparametric.

For the partially aligned answers in categories 1-3 above, the median number and mean proportion of key elements identified as "additional" from the information scientist and LLM were calculated. A Wilcoxon Rank-Sum test was used to compare the two groups of data on the number of additional key elements from the information scientist summaries versus the chatbot summaries as another measure of content differences between the information scientist and LLM summaries. In a sub-analysis focused on the three generative AI tools that provided the PICO questions (ChatGPT, Gemini, and Copilot), a Friedman statistic test was used to assess whether there were any significant differences in each of the three tools' alignment based on whether they were answering their own questions or those provided by the other two chatbots. The Friedman statistic test was chosen due to the use of dependent groups and rank-based data. All statistical analyses were conducted in GraphPad Prism, and visualizations were created in Flourish and Microsoft Excel.

RESULTS

In total, 53 PICO questions were generated by ChatGPT, Gemini, and Copilot. During the process of generating each initial set of 15 questions from the three tools, eight questions were removed from the pool after review and eight new questions generated, resulting in the final set of 45 questions. Reasons for question exclusion included determination that the question was medically implausible (n=3; 2 from ChatGPT, 1 from Gemini), that the question was a duplicate of another question already in the pool (n=4; 2 from Copilot, 2 from ChatGPT), or that the question did not align with the requested category (n=1 from ChatGPT).

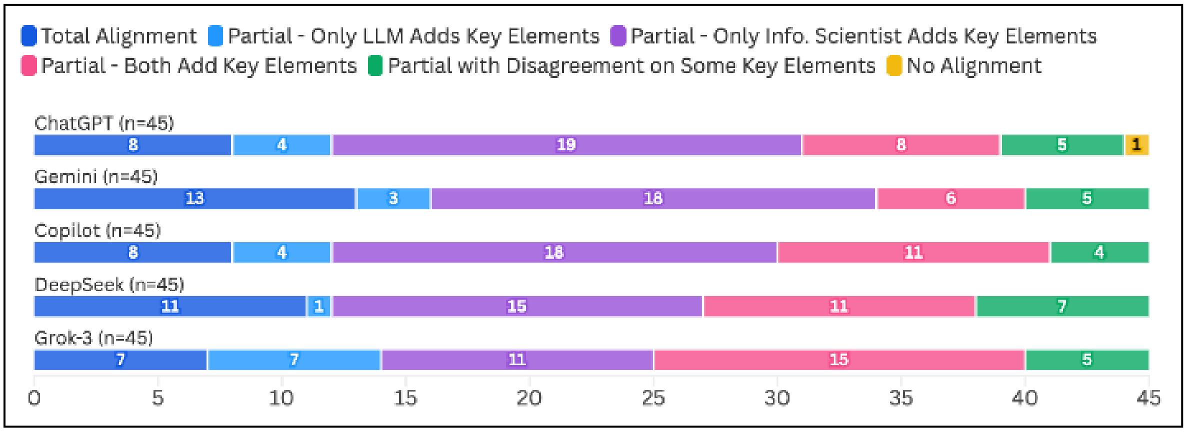
Alignment between the Information Scientist and Generative AI Responses

Across the 225 answers generated to the 45 questions by the five generative AI tools, 47 (20.9%) were in Total Alignment with the information scientist's response, 177 (78.7%) were in Partial Alignment, and one (0.4%) was assessed as having No Alignment. The response with No Alignment was from ChatGPT. Gemini had the highest frequency of Total Alignment ratings (13/45; 28.9%), while Grok-3 had the lowest frequency of answers in Total Alignment (7/45; 15.6%). A Kruskal-Wallis test revealed no significant differences in the alignment ratings between the five tools (*p*=0.46). The full alignment ratings for each chatbot can be viewed in Figure 1.

Analysis of Partially Aligned Responses

In the subset of 177 responses that we labeled as in Partial Alignment, 151 (85.3%) had all key elements expressing the same concepts in agreement, but the answers from the generative AI tool (n=19), the information scientist (n=81), or both (n=51) contained additional unique elements. The remaining 26 (14.7%) answers labeled as Partial Alignment agreed only on some of the key elements expressing the same concepts; in all cases in this category, there was only one concept identified as being in disagreement. Grok-3 had the highest frequency of responses in which only the LLM included additional key elements (7/45; 15.6%) or both the tool and the information scientist provided additional key elements (15/45; 33.3%). ChatGPT had the most answers for which only the information scientist included additional key

Figure 1 Alignment of Five LLMs' Answers to 45 PICO Questions Compared to Information Scientists' Responses (N=225 LLM answers)



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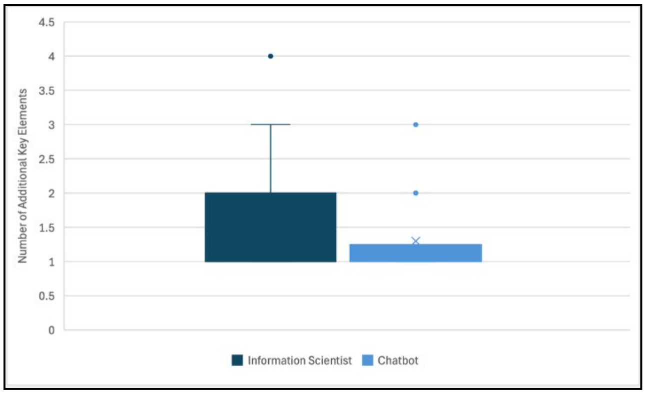
elements (19/45; 42.2%), and DeepSeek had the most answers that did not agree on all key elements in common with the information scientist's answer (7/45; 15.6%). However, a Kruskal-Wallis analysis found no significant differences in type of Partial Alignment among the five tools (*p*=0.78). Full Partial Alignment results by tool can be viewed in Figure 1.

Analysis of Additional Key Elements

The median number of total elements from the *chatbot* answers providing additional information (total of 70 answers) was 5.5 (range: 3-8). There was a median of 1 (range: 1-3) additional key element per answer. The median number of total elements from the *information scientists'* answers with additional key elements (total of 132) was 5 (range: 3-10). There was a median of 1 (range: 1-4) additional key element per answer. The distribution of the number of additional key elements identified in each information scientist and chatbot answer in this category is shown in Figure 2. A Wilcoxon Rank-Sum test found a significant difference when comparing the groups of additional key elements generated for the chatbot summaries versus the information scientist summaries (*p*=0.02).

Figure 2 Distribution of Additional Key Elements from the Information Scientist (n=132) and Chatbot Answers (n=70)



Alignment by Question Source

In the sub-analysis limited to the three LLMs that provided the questions (ChatGPT, Gemini, and Copilot), all three of the chatbots had the highest frequency of Total Alignment ratings when answering Copilot questions (Figure 3). However, per Friedman statistic testing, no significant differences in alignment ratings were found for any of the three tools when comparing the alignment ratings of their answers to their own questions against the alignment ratings of their answers to the other two tools' questions (*p*=0.24 for ChatGPT, 0.88 for Gemini, and 0.56 for Copilot). Full alignment ratings by question source for these three tools can be viewed in Figure 3.

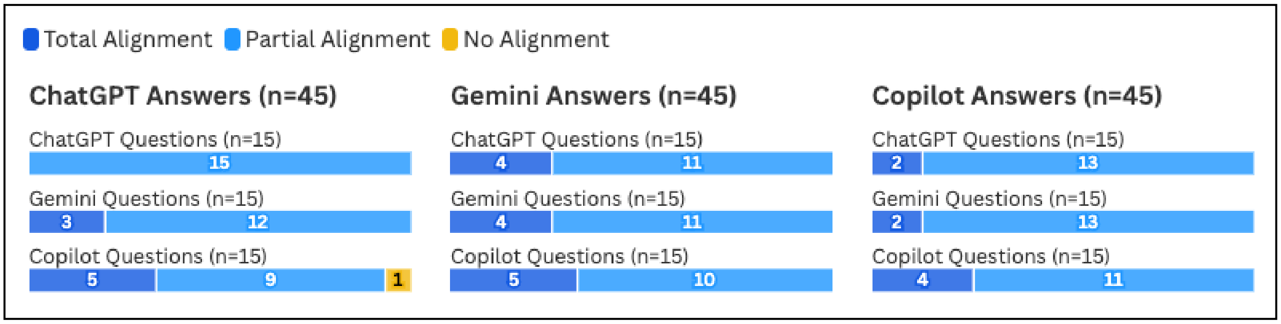
Descriptive Characteristics of the Information Scientist and Generative AI Summaries

On average, the information scientists' summaries were longer than the generative AI answers, with a mean of 1,668 words observed for the information scientists' answers compared with average word counts ranging from 286 (Copilot) to 497 words (Grok-3) for the generative AI tools' answers. The generative AI tools commonly included direct links to references cited in the summaries (100% of ChatGPT answers had linked references, 91% of Gemini answers, 84% of Copilot answers, and 60% of Grok-3 answers), except for DeepSeek, which did not provide direct links to cited references. Consistent with our team's standard practice, all 45 information scientist summaries included full references with hyperlinks.

DISCUSSION

This study is the second in what we envision being a step-by-step series to clearly investigate all elements of AI performance as applicable to the functional work of information scientists. Our comparison between information scientists' synthesized evidence summaries and five generative AI chatbots revealed that in most instances (20.9% total and 78.7% partial), there is a high level of alignment among the summaries evaluated, even

Figure 3 Alignment between Information Scientist and LLM by Individual Chatbot (ChatGPT, Gemini, and Copilot)



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though an in-depth analysis of the partial answers shows that information scientists are more likely to include additional information (key elements) in their answers. Central to this study is the reporting of additional key elements observed in either the large language models' or the information scientists' summary responses and the analysis comparing information scientists' answers to five distinct models. No significant differences were found in the degree to which the five generative AI tools' responses aligned with the information scientists' answers, and no impact on performance was observed when the tools answered their self-generated questions, suggesting that the study results were not influenced by whether the questions were based on the LLM's own training data.

It is worth noting that other studies have found significant differences in LLMs' answers to clinical questions, although variation in models, question types, and overall methodology makes it difficult to directly compare the existing literature [11]. For example, Lin and colleagues (2025) compared several ChatGPT, Gemini, and Copilot models' answers to questions on postmenopausal osteoporosis with guideline recommendations and found that ChatGPT-4o's answers were significantly more accurate than other models [36]. Flaharty et al. (2024) investigated several open- and closed-source models' performance (including Gemini and ChatGPT-3.5 and 4) in answering genetic questions and found that ChatGPT-4 had the highest performance in terms of correctly identifying a genetic condition, with significant differences observed in several models' performance depending on whether the question was asked in medical or lay language [37].

We conducted an in-depth analysis of the only "non-alignment" answer in the study (generated by ChatGPT). The answer addressed a question about the use of early ischemic changes for prediction of "functional outcomes" in acute ischemic stroke patients. In comparing the two responses, we noted that the ChatGPT answer included a reference supporting the opposite viewpoint from the information scientist's answer. The answer, although not aligned with the information scientist, was reported as one of the multiple viewpoints provided by the other tools, giving us a moment of pause and reinforcing our belief that all additional elements provided by LLMs deserve further investigation. Our study also found the information scientists' answers more commonly provided additional information than the generative AI chatbots' responses. This difference may be explained in part by the fact that information scientists' evidence summaries were longer on average than the LLMs'. It is however notable that, despite their shorter length, 70/225 (31.1%) generative AI summaries were found to provide key elements not present in the information scientists' summaries. This finding presents a potential for chatbots to serve a complementary role in evidence synthesis by surfacing additional supporting information and/or alternate viewpoints for the information scientist to investigate, verify, and consider for inclusion.

As noted previously, we intentionally did not make a judgment on which answer was correct but rather characterized the answers in terms of alignment between the chatbot and human, with no true "reference standard." Evidence synthesis is a complex task often involving interaction through the reference interview and ongoing consultation between the subject matter expert and information professional. Hripcsak and Wilcox (2002), in their discussion of reference standards for evaluations of informatics systems, state, "For more complex reasoning tasks, experts are needed to judge the appropriateness of system responses," and an answer may be assessed by a clinical expert as "appropriate even if it matches none of the comparison responses (e.g., a reasonable medication alternative)" [38]. When a true reference standard is lacking, answers prepared by a human can be compared with answers from the system for "similarity" instead of "performance" [38], consistent with the approach used in our study.

The need to carefully review LLM responses for accuracy is well-established and critical to their use [39]. As evidenced by the non-aligned example, chatbots may also introduce additional information from legitimate sources that cannot be assumed to be incorrect without further examination. Humans may also miss relevant information or have differing assessments of relevance depending on their role or area of specialization [37,40]. The focus on alignment and additional information provided by both human and chatbot in this study highlights the potential for LLMs to serve as an aid in a framework where the information scientist prepares an answer to an evidence inquiry but uses the chatbot to identify additional information for further investigation and inclusion in her citations and summaries.

These findings build on our approach, throughout our series of studies, of applying a "growth mindset" to the investigation of how AI can be applied to our workflows as information scientists [40]. Similar to the process of consulting a colleague and deciding if and how to incorporate their ideas and feedback, consulting a chatbot can help stimulate our thinking and uncover previous knowledge gaps. By identifying LLMs' areas of strength and applying them to our work as information scientists, we can begin to truly partner with AI to enhance our performance beyond only productivity gains [40].

Limitations

Limitations of the study include not assessing the chatbot answers for potential harm or misleading statements. The next planned phase – examining the additional information from the chatbots – will be an important step for further elucidating any potential unfounded

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information that may have been included in their responses.

Additionally, the information scientist who answered each question was included in the pair of reviewers who assessed the chatbots' answers. While this was done intentionally to leverage the information scientist's knowledge of the topic, it is possible this approach introduced cognitive bias.

As we wanted to create an optimal scenario for question answering, we intentionally had the chatbots generate PICO-formatted questions. However, the use of LLM-generated PICO questions may limit the study's generalizability to actual clinical scenarios. While the PICO format provides a useful and well-established framework to prompt LLMs to generate questions in alignment with prompt engineering techniques [41], it is not always characteristic of questions that arise in fast-track clinical settings. As illustrated by a study from Huang and colleagues (2006), clinicians' questions are often missing one or more of the PICO elements [42]. Nevertheless, the PICO format is one of the most common mechanisms librarians use to fully research and investigate questions they receive from their users, making this type of exploration highly relevant for understanding the potential role of AI usage in medical librarianship.

Four of the chatbots included in the study are closed-source models; thus, reproducibility is limited by the lack of transparency into the models' training sets and design. We did not conduct a formal investigation into reproducibility of chatbot answers. We also acknowledge that as time passes and models are updated, reproducibility may be limited as the chatbots have access to more data, due to both the emergence of new knowledge and additions to the LLMs' training sets. Stanford's Holistic Evaluation of Language Models for Medical Tasks (medHELM) Leaderboard demonstrates that performance on medical domain scenarios varies between model versions, with Gemini, for example, showing improved accuracy with 2.0 Flash versus 1.5 Pro [43]. We also acknowledge that the study, by design, was limited to five large language models and did not assess the performance of other models such as Claude or Perplexity. It is possible different results would have been observed for other models due to variations in training data or model design.

Finally, the comparison of the LLM and information scientist answers relied on the key elements selected by each tool. The information scientists agreed that the elements selected were appropriate, but we did not formally assess whether the lists of key elements for their summaries were consistent across all five tools.

Future Directions and Conclusions

In this study, submitting PICO questions to publicly available generative AI chatbots using a standardized prompt revealed that chatbots both added and missed key information relative to information scientists' answers. These findings provide insight into LLMs' capabilities and their potential utility to complement information scientists' evidence synthesis processes. On a practical level, chatbots have the potential to supplement information scientists' expertise in searching and filtering the literature by serving as an additional information source for consultation, as well as aiding with quick summarization and extraction of key elements of the narrative response for sharing with end users such as clinicians. We recognize that, given the rapid evolution of the field and emergence of new models, ongoing validation of LLM tools will be paramount. Full adoption in healthcare will additionally require a complete transparency of the data sources for evidence verification; issues of privacy and security will need to be fully addressed as well.

A critical next phase of this investigation will be to examine all the additional information provided by the chatbots to determine whether it can be validated and supported by the literature, as this will be especially essential for fully understanding the implications for their use by the public. When clinicians review an answer with unfamiliar or unexpected information, they can ask the information scientist and now chatbots for additional clarifying data and, in most instances, they are able to discern the added value of the information they receive. Still, it is important to note that chatbot users may be subject to what is commonly known as automation bias, the propensity to trust information from automated systems without further investigation [40]. Thus, the need to assess the validity of the entire content provided by the answers of the tools as well as the information scientists. Additionally, further investigation into how the public understands and interacts with LLMs to find health information may be needed, as studies have found that their performance in answering health-related queries was rated higher when prompted directly by researchers than when prompted by members of the public [44,45].

Although not formally analyzed in this study, we observed that four of the LLMs (all except DeepSeek) commonly included direct links to supporting articles and websites in their answers. In contrast, the answers we previously analyzed from VUMC's aiChat tool only included in-text references with no direct links, many of which could not be verified to exist [18]. Being able, with external and newer versions of the models that provide web search features, to directly access and consult cited references is an improvement in facilitating users' ability to verify chatbots' answers. A future planned analysis will conduct a more in-depth examination of the references cited by all five LLMs. As the adoption of AI becomes

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more widely accepted in healthcare, a blinded study assessing clinicians' preferences between information scientist and chatbot answers and a study comparing LLMs' answers to a gold standard vetted by expert clinicians could offer additional insight to clinical librarians engaged in evidence provision.

This study constitutes a key step in our series of investigations to understand large language models' utility in medical information sciences by revealing a lack of significant differences in five chatbots' alignment with medical information scientists' answers and demonstrating common overlap in key elements of the responses. While information scientists were significantly more likely to contribute additional information not included in the chatbots' answers, the fact that the LLMs also provided additional information not included by the information scientist suggests a potential framework in which these tools could play a consultative role in medical evidence synthesis.

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COMPETING INTERESTS STATEMENT

The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS STATEMENT

Mallory N. Blasingame: Methodology; investigation; data curation; formal analysis; visualization; writing–original draft; writing–review and editing. Taneya Y. Koonce: Methodology; investigation; data curation; formal analysis; writing–original draft; writing–review and editing. Annette M. Williams: Methodology; investigation; data curation; writing–review and editing. Jing Su: Methodology; investigation; visualization; writing–review and editing. Dario A. Giuse: Methodology; investigation; writing original draft; writing–review and editing. Poppy A. Krump: Methodology; investigation; writing–review and editing. Nunzia B. Giuse: Conceptualization; methodology; investigation; formal analysis; visualization; writing–original draft; writing–review and editing; supervision.

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DATA AVAILABILITY STATEMENT

Data associated with this study are available from the Open Science Framework at https://doi.org/10.17605/OSF.IO/BJ9TH.

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SUPPLEMENTAL FILES

Appendix A: CHART Checklist and Methodological Diagram
Appendix B: List of PICO Questions
Appendix C: Prompt for PICO Questions Generation
Appendix D: Prompt for Submitting the Questions to the LLMs
Appendix E: Prompt for Obtaining the Key Elements

AUTHORS' AFFILIATIONS

Mallory N. Blasingame, mallory.n.blasingame@vumc.org, https://orcid.org/0000-0003-0356-9481, Center for Knowledge Management, Vanderbilt University Medical Center, Nashville, TN

Taneya Y. Koonce, taneya.koonce@vumc.org, https://orcid.org/0000-0002-4014-467X, Center for Knowledge Management, Vanderbilt University Medical Center, Nashville, TN

Annette M. Williams, annette.williams@vumc.org, https://orcid.org/0000-0002-2526-3857, Center for Knowledge Management, Vanderbilt University Medical Center, Nashville, TN

Jing Su, jing.su@vumc.org, https://orcid.org/0000-0001-6699-6806, Center for Knowledge Management, Vanderbilt University Medical Center, Nashville, TN

Dario A. Giuse, dario.giuse@vumc.org, https://orcid.org/0000-0002-2677-6734, Department of Biomedical Informatics, Vanderbilt University School of Medicine, Vanderbilt University Medical Center, Nashville, TN

Poppy A. Krump, poppy.krump@vumc.org, https://orcid.org/0000-0002-3081-6487, Center for Knowledge Management, Vanderbilt University Medical Center, Nashville, TN

Nunzia B. Giuse, nunzia.giuse@vumc.org, https://orcid.org/0000-0002-7644-9803, Center for Knowledge Management, Department of Biomedical Informatics, and Department of Medicine, Vanderbilt University Medical Center, Nashville, TN

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Comparing the performance of narrow vs. broad search strategies when using machine learning-based software for title/abstract screening

Michelle Swab

See end of article for authors' affiliations.

Objectives: To retrospectively evaluate workload implications and recall performance of narrower or broader database search strategies when using active learning screening tools.

Method: A convenience sample of 10 completed reviews was used to assess search strategy performance in ASReview LAB, an open-source systematic review software tool. For each review, a single database search strategy was selected and then revised to either broaden (n = 9) or narrow (n = 1) the scope. Results from both the more sensitive (broader) and more precise (narrower) search strategies were labeled as relevant or irrelevant based on inclusion in the completed review. The labeled result sets were uploaded into the ASReview LAB simulation module, which mimics the process of human screening. Metrics such as number of records screened to reach recall of 95% or more were recorded. The effects of three different stopping rules on workload and recall were also explored.

Results: For quantitative systematic reviews, the difference in absolute screening time required to reach 95% recall between broader or narrower search strategies was minimal (≤35 minutes). In contrast, for qualitative systematic reviews and other review types, broader search strategies led to increased workload. With respect to stopping rules, the time-based stopping heuristic resulted in substantial workload increases when broader search strategies were employed.

Conclusion: Time savings achieved through the use of semi-automated screening tools may not always offset additional screening time required by broader, more sensitive search strategies. Librarians and information specialists should consider a variety of factors when determining the appropriate balance between search sensitivity and specificity in the context of semi-automated screening tools.

Keywords: AI; machine learning; evidence synthesis as topic; systematic review as topic; Screening Tools; search strategy development

See end of article for supplemental content.

INTRODUCTION

Evidence synthesis projects can be resource intensive, with many reviewers considering title and abstract screening to be particularly time-consuming [1,2]. Because of the substantial workload and perceived tediousness of manual title and abstract screening, many articles included in recent scoping reviews on evidence synthesis automation focus on this step [3,4].

A variety of automation tools and methods have been developed to reduce title and abstract screening burden. Some tools automatically identify certain study designs or types of studies, such as randomized controlled trials [5]. Others employ active learning algorithms that iteratively "learn" from reviewers' inclusion and exclusion decisions, using this feedback to reorder the records presented for screening [6]. This process of re-prioritization can improve efficiency by displaying the most relevant abstracts earlier in the screening process. Re-prioritization may occur continuously or after a predefined number of records have been reviewed.

In some systematic review software tools such as Covidence, records are re-prioritized through active learning algorithms; however, screening remains fully supervised by human reviewers [7]. This means that human reviewers continue to assess each abstract and make inclusion and exclusion decisions. In other software, stopping rules may be applied to automatically exclude a proportion of the re-

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prioritized records without human review. This kind of screening process is frequently described in the literature as "semi-automated" [8]. Estimates of workload savings achieved through active learning prioritization software and automated exclusions vary widely, ranging from 33-90% in one scoping review [9].

As of July 2025, active learning screening tools that automatically eliminate records are not recommended for Cochrane reviews. In the Cochrane Handbook, Lefebvre et al. note that “more work is needed to develop and validate safe stopping rules” so that no relevant studies are automatically excluded [10]. Additional barriers to adoption of automation tools in systematic reviews identified in the literature include lack of trust and setup challenges [11]. Nevertheless, active learning screening tools likely will achieve greater acceptance and uptake over time. Cochrane Handbook authors observe that stopping rule challenges are “not insurmountable” [10], and a new joint Methods Group between Cochrane, the Campbell Collaboration, JBI and the Collaboration for Environmental Evidence (CEE) is working to develop policies and guidance about the responsible use of AI in evidence synthesis studies. Additionally, the Guidelines International Network has recently published a set of principles for the use of AI in guideline development [12]. Lastly, a recent guidance paper on automation software in rapid reviews suggests that automatic exclusion of records may be acceptable for this review type [13].

Given the increasing acceptance and adoption of active learning screening tools in evidence synthesis projects, it is important for librarians and information specialists to understand the impact of database search sensitivity and specificity on title and abstract screening workload in semi-automated reviews. Search sensitivity (or recall) refers to the proportion of relevant articles retrieved as a percentage of all relevant articles; search specificity (or precision) refers to the proportion of relevant articles as a percentage of the number of articles retrieved [14]. While search sensitivity is traditionally prioritized in systematic reviews, the need for high recall tends to be balanced against the resources of the review team [15,16].

Developers of active learning prioritization tools argue that automating exclusions reduces screening workload, thereby allowing for broader database searches and minimizing the likelihood of missing relevant records [17]. An increased emphasis on broader database searches and improved search sensitivity may also help alleviate some of the burden on information specialists, particularly when addressing complex topics where achieving an optimal balance between recall and precision can be challenging and time-consuming. On the extreme end of the record retrieval spectrum, a preliminary study has assessed text mining prioritization of impractically large searches (>800,000 records) for two public health scoping reviews [18].

To date, there have been no published empirical studies about search strategy formulation in the context of active learning screening tools. One guidance article recommends performing the highest quality search strategy, “regardless of yield” [19]. However, this recommendation is not based on empirical evidence and does not address the complexities of balancing search recall and precision. This study explores how narrower or broader searches influence screening workload and recall when semi-automated active learning screening tools are used.

METHODS

A retrospective simulation study was performed in ASReview LAB [20] using a convenience sample of 10 previously conducted reviews. A convenience sample refers to a set of cases selected based on accessibility and availability rather than through random sampling. I collaborated on these reviews and received permission from all principal investigators to use the review data for this project.

ASReview LAB is a free, open-source machine learning tool developed by researchers at Utrecht University. Like other active learning screening tools, ASReview LAB prioritizes records based on a reviewer’s previous inclusion and exclusion decisions, enabling faster identification of likely included studies. No set stopping rule is applied by the software itself; review teams must decide when screening will be discontinued. ASReview LAB features a simulation mode, which was used for this study. Simulation mode allows researchers to estimate the potential time savings associated with various datasets and different active learning models.

The sample reviews varied in their methods, and included systematic reviews of quantitative studies, systematic reviews of qualitative studies, scoping reviews, and an integrative review (see Table 1 for review characteristics). For each review, I selected a single database search strategy based on which database was expected to retrieve the greatest number of articles included in the original systematic review, as well as the availability of database features. For example, Ovid Medline provides opportunities to adjust adjacency operators to broaden searches. I also considered database variety in my database selection

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decisions. The database search strategy was then revised to either broaden (n = 9) or narrow (n = 1) the scope of the search. Decisions regarding search modifications were made using a real-world approach; I made changes to the search strategies that I may have made if the team had more or fewer resources at the original time of screening. Original and revised search strategies can be found in Appendix A. Both the original and revised searches were run in the selected database, with both searches limited to the original search date.

Since the reviews evaluated in the present study used a multi-pronged search strategy and included multiple databases, it was possible for the expanded database search strategy to retrieve more included articles than the original search. For the quantitative and qualitative systematic reviews (n = 6), all of the included articles retrieved by the revised search were also captured in the original search. However, this was not the case for the scoping and integrative reviews, where the broadened search retrieved more articles than were included in the original search. Similarly, the narrowed AI ethics search retrieved fewer articles than were included in the original search (see Table 1).

RIS files for each search were downloaded, and each citation was labelled as included ("relevant") or excluded ("irrelevant") based on the list of studies included in the completed review. The labelled RIS file for each search was imported into the ASReview web app in simulation mode. Before a simulation is initiated, ASReview also requires that one relevant and one irrelevant article be identified to prime the model. The first randomly generated relevant and irrelevant article were selected for each simulation. The recommended default automated screening settings were used (Feature extraction technique: Term Frequency-Inverse Document Frequency; Classifier: Naive Bayes; Query strategy: Maximum; Balance strategy: Dynamic resampling, double). Once the simulation is started, articles are re-prioritized automatically and continuously based on what the software learns from each "relevant" or "irrelevant" label that it encounters. Each search simulation was run ten times in order to account for variance introduced by the articles used to prime the model.

Recall data from the completed simulation runs were downloaded and analyzed. Sample graphical and numerical data output from the ASReview LAB simulation module are available in Appendix B.

The number of results that needed to be screened to achieve recall of 95% or above for all included articles retrieved by the database search was determined for each simulation, with the results from each search averaged together. A 95% recall level is often used in machine-learning screening tool simulation studies, as it approximates rates of human error during screening [31,32]. In addition, the total screening time for each search was estimated using a rate of 1 record screened per minute [33]. This estimate is commonly cited in studies evaluating the performance of semi-automated screening tools.

In real-world review scenarios, the true number of included articles in any given result set is unknown prior to full-text screening. Accordingly, I also evaluated the number of results screened, included articles retrieved, and recall level when three different stopping rules were applied. Recall levels are difficult to compare for those projects where broader searches retrieved more included articles. In order to manage this issue, I also calculated an adjusted recall value that reflected all potentially relevant articles that could have been retrieved in the database, not just those that were retrieved by the narrower search.

Callaghan and Müller-Hansen identify a number of different types of stopping rules, including statistical, heuristic, automatic and pragmatic [34]. For the purposes of this study, I selected three stopping rules that were straightforward to perform and explain:

1) A data-based heuristic (Ros et al. 2017): Screening stops after *n* consecutive irrelevant records [35]. König et al. report that the value selected for *n* in published studies varied from 20-500 [36]. For the purposes of this study, I chose 50 irrelevant records.

2) A time-based heuristic (Wallace et al. 2010): Screening stops after 50% of the total number of records are screened [8].

3) A mixed heuristic called the SAFE procedure (Boetje and van de Schoot 2024): Screening stops when four independent conditions are satisfied, including one where a crude estimate of relevant records in the total dataset is calculated (the RR_T) [37].

For this study, I modified the SAFE procedure to stop screening when the following conditions were met: 1) twice the estimated number of relevant records were screened (2 x RR_T); to calculate this number, I followed the outlined estimation procedures which included random sampling of the citation dataset 2) a minimum of 10% of the records were screened; and 3) 50 consecutive irrelevant records were identified. The original SAFE procedure also requires that all key papers be identified; however, this criterion was excluded as selecting key papers in a retrospective study is challenging and likely to introduce bias.

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Table 1

Review project characteristics. Because these reviews used a multi-pronged search strategy and included multiple databases, it was possible for the expanded database search strategy to retrieve more, or fewer, included articles than the original search.

Review Project	Review Type	# of articles included in the completed review	Database	Search change	Original search retrieval for selected database (# of articles)	Included articles retrieved by original database search	Search strategy recall, original database search (%)	Search strategy precision, original database search (%)	Revised search retrieval for selected database (# of articles)	Included articles retrieved by revised database search	Search strategy recall, revised database search (%)	Search strategy precision, revised database search (%)
SGLT2 safety [21]	Systematic Review (Quantitative)	109	PubMed	Replaced precision maximizing with sensitivity maximizing methods filter	771	105	96.3%	13.6%	1709	105	96.3%	6.1%
Chronic pain peer support [22]	Systematic Review (Quantitative)	24	Embase	Changed major headings to regular headings	1421	23	95.8%	1.6%	3909	23	95.8%	0.6%
Cannabis purchase choice [23]	Systematic Review (Quantitative)	35	Ovid Medline	Removed concept group relating to purchase choice	2674	16	45.7%	0.6%	3311	16	45.7%	0.5%
Production effect [24]	Systematic Review (Quantitative)	26	APA PsycInfo	Removed concept group relating to methods	469	16	61.5%	3.4%	1557	16	61.5%	1.0%
Autism diagnosis experiences [25]	Systematic Review (Qualitative)	36	CINAHL	Removed concept group relating to methods	1248	16	44.4%	1.3%	3730	16	44.4%	0.4%
Chronic illness & workplace policy [26]	Systematic Review (Qualitative)	44	CINAHL	Removed concept group relating to methods	735	24	54.5%	3.3%	3879	24	54.5%	0.6%
ICU sustainability [27]	Scoping Review	99	Ovid Medline	Replaced adjacency operators with AND, included more keyword terms	412	53	53.5%	12.9%	13812	61	61.6%	0.4%

Reproductive coercion [28]	Scoping Review	28	Ovid Medline	Replaced adjacency operators with AND	904	4	14.3%	0.4%	2448	6	21.4%	0.2%
ED flow training [29]	Integrative Review	46	Ovid Medline	Removed concept group relating to interventions that improve flow	2565	38	82.6%	1.5%	4753	40	87.0%	0.8%
AI ethics [30]	Scoping Review	43	Scopus	Focused education concept groups to include postsecondary settings only	18663	36	83.7%	0.2%	9561	28	65.1%	0.3%

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RESULTS

For systematic review projects, the absolute increase in number of records required to be screened to reach 95% recall between narrower searches and broader searches was minimal in 4 out of 6 cases (see Table 2). Here, “absolute increase” refers to the raw difference in record counts, whereas “relative increase” expresses that difference as a percentage. Assuming a rate of 1 record screened per minute by a single reviewer, the time difference between broader and narrower searches was ≤35 minutes for the four quantitative reviews. In contrast, the impact was more pronounced in the qualitative reviews: the broader search for the autism diagnosis review required an additional 1 hour and 45 minutes of screening time to reach 95% recall, while the chronic illness and workplace policy review required 8 hours and 46 minutes more. If dual, independent screening is conducted, the broader search for the chronic illness & workplace policy review would result in an additional 17.5 hours of screening time.

It is more difficult to compare the differences in workload between narrower and broader searches for the scoping reviews and integrative review, as the broader searches also retrieved more included articles. For the scoping reviews, the absolute increase in screening time for a single reviewer ranged from 2 hours and 20 minutes to almost 30 hours. The relative increase in screening burden for the scoping reviews ranged from 327-875% (see Table 3). The difference in workload between the narrower and broader searches for the integrative review was less pronounced.

When examining the effectiveness and efficiency of broader and narrower searches when stopping rules were used, several trends emerge. First, many of the narrower and broader searches failed to reach 95% recall when the "50 consecutive irrelevant records" stopping rule was applied, although the absolute difference in the number of records screened between narrow and broad searches was minimal (Table 4). Second, recall was higher when employing the "screening 50% of records" stopping rule; all searches attained 95% recall or above when unadjusted (Table 5). As expected, though, this stopping rule substantially increases the time to screening completion for broader searches. In the case of the ICU sustainability project, for example, time to completion of screening by a single reviewer would increase by over 110 hours. Finally, under the SAFE stopping procedure, broader searches achieved higher recall with smaller differences in absolute number of articles screened (Table 6). Nevertheless, 3 out of 10 broad searches still failed to meet the 95% recall threshold.

Table 2

Average number of records screened to reach recall of at least 95%.

Project name	Review Type	Narrower search	Broader Search	Absolute increase (# of articles)	Relative Increase (%)
SGLT2 safety	Quant SR	225	247	22	9.6
Chronic pain peer support	Quant SR	159	185	26	16.3
Cannabis purchase choice	Quant SR	268	303	35	13.1
Production effect	Quant SR	125	149	24	19.5
Autism diagnosis experiences	Qual SR	342	447	105	30.7
Chronic illness & workplace policy	Qual SR	356	883	527	147.7

Table 3

Average number of records screened to reach recall of at least 95%.

Project name	Review Type	Narrower search	Broader search	Absolute increase (# of articles)	Relative increase (%)	Additional articles retrieved
ICU sustainability	Scoping	120	557	437	364.2	8
Reproductive coercion	Scoping	16	156	140	875.0	2
ED flow training	Integrative	997	1107	110	11.0	2
AI ethics	Scoping	549	2346	1797	327.3	8

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Table 4

Average number of records screened, included articles retrieved, and recall when applying "50 consecutive irrelevant records" stopping rule.

Project name	Records screened		Included articles retrieved		Recall (adjusted)	
	Narrow database search	Broad database search	Narrow database search	Broad database search	Narrow database search	Broad database search
SGLT2 safety	320	365	104	104	99.0%	99.0%
Chronic pain peer support	144	126	11	11	68.8%	68.8%
Cannabis purchase choice	118	116	16	15	71.7%	67.0%
Production effect	121	127	15	15	95.0%	92.5%
Autism diagnosis experiences	146	193	12	13	75.0%	79.4%
Chronic illness & workplace policy	253	237	19	16	78.3%	67.1%
ICU sustainability	177	285	52	54	97.7% (85.0%)	87.9%
Reproductive coercion	65	90	4	5	100% (66.7%)	85.0%
ED flow training	198	188	18	18	46.3% (44.0%)	44.8%
AI ethics	213	309	17	21	59.3% (46.1%)	59.2%

Table 5

Average number of records screened, included articles retrieved, and recall when applying "50% of total number of records" stopping rule.

Project name	Records screened		Included articles retrieved		Recall (adjusted)	
	Narrow database search	Broad database search	Narrow database search	Broad database search	Narrow database search	Broad database search
SGLT2 safety	386	855	105	105	100.0%	100.0%
Chronic pain peer support	1337	1656	16	16	100.0%	100.0%
Cannabis purchase choice	711	1955	23	23	100.0%	100.0%
Production effect	235	779	16	16	100.0%	100.0%
Autism diagnosis experiences	624	1865	16	16	100.0%	100.0%
Chronic illness & workplace policy	368	1939	23	24	95.4%	100.0%
ICU sustainability	206	6906	53	61	99.1% (86.1%)	100.0%
Reproductive coercion	452	1224	4	6	100% (66.7%)	100.0%
ED flow training	1283	2377	38	39	100% (95.0%)	97.5%
AI ethics	4797	9332	28	35	100% (77.8%)	97.2%

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Table 6

Average number of records screened, included articles retrieved, and recall when using modified SAFE procedure.

Project name	Records screened		Included articles retrieved		Recall (adjusted)	
	Narrow database search	Broad database search	Narrow database search	Broad database search	Narrow database search	Broad database search
SGLT2 safety	320	365	104	104	99.0%	99.0%
Chronic pain peer support	267	331	16	16	100.0%	100.0%
Cannabis purchase choice	247	391	21	22	90.9%	95.7%
Production effect	121	187	15	16	95.0%	98.8%
Autism diagnosis experiences	186	373	14	15	88.1%	93.8%
Chronic illness & workplace policy	253	394	19	20	78.3%	84.2%
ICU sustainability	177	1381	52	61	97.7% (85.9%)	100.0%
Reproductive coercion	200	245	4	6	100% (66.7%)	100.0%
ED flow training	340	507	27	31	72.1% (68.5%)	77.3%
AI ethics	959	1866	28	34	100% (77.7%)	95.3%

DISCUSSION

A range of complex factors impact screening workload and recall when active learning screening tools are used in evidence synthesis projects. The most widely studied factor is the screening tool itself [17,31,38–50]. The impact of different algorithmic models has received some attention [51–53], and two studies have evaluated the performance of various stopping rules [36,54]. However, the influence of dataset-related characteristics remains relatively underexplored. While some non-comparative studies have presented screening outcomes relating to specific topics [55–58] or types of evidence synthesis projects [59,60], features of the dataset associated with search sensitivity and precision have not been empirically studied. Moreover, few studies have examined the relationship among these factors, although König et al. [36] have noted interactions between "the performance of the stopping rules and the number of relevant studies" in the dataset.

Given that our understanding of how various factors interact to affect screening workload and recall is still evolving, recommendations to increase search sensitivity when using active learning screening tools may be premature. In this study, broader searches for quantitative systematic reviews tended to achieve high recall with minimal differences in absolute number of records screened. However, differences in workload and recall between narrower and broader searches were more pronounced for qualitative systematic reviews. Semi-automated screening of the broader chronic illness and workplace policy search would require more time than a full manual screening of the narrower result set. In other review types such as scoping and integrative reviews, broader searches retrieved more articles but also imposed substantial screening burdens.

These findings suggest that librarians and information specialists should consider multiple factors when determining the appropriate balance between search sensitivity and specificity in the context of semi-automated screening tools. For example, selecting a sensitive methods filter may not increase workload for quantitative systematic reviews of interventions. In contrast, a narrower search strategy supplemented by snowball searching [61] may prove more time-efficient for "fuzzy" topics or other types of reviews. In addition, it is important to consider the impact of stopping rules. Although screening 50% of the retrieved records yielded the highest recall among the stopping rules tested, applying this threshold in conjunction with broader searches led to considerable increases in screening workload.

LIMITATIONS

Although this study offers preliminary insights into the impact of search sensitivity and specificity in the context of semi-automated screening, its generalizability is limited by the small number of reviews analyzed. Consequently, definitive conclusions cannot be drawn from the findings.

It should also be noted that a single database was selected for each review, a choice that may bias screening

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workload results downwards. Furthermore, "included articles" were classified as those that were retained at the final stage of the review project. An alternative approach would have been to label articles retained after the title and abstract screening stage as "included". The implications of this decision are mixed. On one hand, restricting inclusion to final-stage articles reduces noise in the dataset and may result in relevant articles being identified more quickly. On the other hand, the resulting reduction in data points may have meant that it was more difficult for the software to learn what was relevant or irrelevant, particularly for reviews with few included articles.

Finally, the stopping rules used in this study were relatively simple to perform. The use of more sophisticated statistical stopping rules may have enhanced both recall and precision.

AUTHOR CONTRIBUTIONS

Michelle Swab: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing – Original draft, Writing – Review & editing.

DATA AVAILABILITY STATEMENT

Data associated with this article are available via the Memorial University Dataverse: https://doi.org/10.5683/SP3/TOLDSZ.

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SUPPLEMENTAL FILES

Appendix A: Original and Revised Search Strategies
Appendix B: Figures, Etc.

AUTHORS' AFFILIATIONS

Michelle Swab, mswab@mun.ca, Public Services Librarian, Health Sciences Library, Memorial University of Newfoundland, St. John's, NL, Canada

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Impact of health information prescription in thyroid cancer

Marta Bianchini; Giulia Puliani; Virginia Scarinci; Gaetana Cognetti; Rosa Lauretta; Marilda Mormando; Francesca Servoli; Marialuisa Appetecchia

See end of article for authors' affiliations.

Objectives: Information prescriptions consist in making specific health care information available to patients on their disease from accredited sources, in order to help them understand and manage their disease, stimulating informed participation in health care. In the literature, a few studies have investigated the real effectiveness of prescribing information on the health management of oncological diseases. The scope of our pilot study was to investigate the effectiveness of information prescription, evaluating both patient satisfaction and perception, but also its possible impact on adherence to follow-up programs.

Methods: Prospective pilot study enrolling patients with thyroid cancer. They received informative scientific material on thyroid cancer, dispensed by clinical librarians of the Institute's Library.

Results: 101 patients were enrolled (81% were women with a total mean age of 49.39 years). 26% of patients accessed the institute's library receiving patient information materials. Comparing data of people who completed the project with those who did not, no differences in sex, age and tumour characteristics were found. We found no statistical differences in terms of adherence to follow-up visits between the two groups of patients, but health information was able to effectively respond to the requests or needs of most patients. Participating patients have improved awareness and knowledge of their disease, patient-doctor relationships, adherence to treatment and communication with family members regarding their disease status, with a final positive impact on one's psychological well-being and global satisfaction obtained in 65% of people.

Conclusions: This is the first Italian study carried out in the field of oncological endocrinology, demonstrating the positive role health information has on patients' psychological health and thyroid cancer knowledge.

Keywords: Information prescription; thyroid cancer; hospital library; psychological health, mental well-being, disease self-management, health librarianship

See end of article for supplemental content.

INTRODUCTION

Health information prescription refers to providing specific evidence-based health information to patients with a diagnosed condition to help them understand and manage their own disease, thus stimulating informed participation in healthcare. [1-3] A health information prescription is written by the doctor, given to patients and/or family members, encouraging them to consult qualified and reliable scientific information on their diseases [4], based on the individual needs and specific requests of the patient [5].

This practice aims to inform the patient about their disease, allowing them to gain better knowledge of treatments and follow-up programs, with the potential to improve adherence and effectiveness. Furthermore, appropriate health information could change health behaviors and help patients make better, more informed healthcare decisions [6]. Knowledge is a critical factor in decision-making, it can improve patient health status and quality of life [7-10] and enhance doctor-patient communication [11, 12].

The practice of health information prescription has a long history [13, 14] but only recently, many governmental agencies across different countries have promoted models and materials for information prescription programs. [13] To date, most studies on health information prescription published in literature have mainly focused on chronic diseases, such as diabetes mellitus, hypertension or other metabolic diseases that can benefit from lifestyle modifications [15-18].

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Most studies on information prescription were small pilot projects or case reports aimed at investigating patient or physician satisfaction through the use of surveys [12, 13, 19-28], while other clinical outcomes have not been well studied. In particular, analysis of the effectiveness of information prescription on health improvement or changes in self-management of diseases are scarce [4]. A qualitative semi-experimental study on 61 women with breast cancer, showed that after providing health information prescriptions, women improved their self-care capacity according to a questionnaire given to patients [29]. In another study of 21 diabetic patients, it was shown that information prescription improved medical services utilization, patients' knowledge on their disease, and increased the capacity for self-care, enhanced disease management and strengthened the doctor-patient relationship [30].

Finally, some studies demonstrated that written information prescription is effective for minimizing healthcare costs [31-35]. A recent scoping review [4] published in 2022, reported that to date, there have been no studies conducted in Italy regarding health information prescriptions and that information prescription documents primarily address non-oncological health conditions. Furthermore, most of the studies published do not specifically report the exact steps involved in information prescription services, nor the specific roles of the members of the information prescription team, such as doctors, librarians and nurses.

To overcome these limitations, we conducted an Italian pilot study to evaluate the effect of providing health information prescriptions to thyroid cancer patients, since it is the most frequent endocrine neoplasia and it negatively impacts quality of life and psychological well-being [36-38]. This study aims to:

- identify any factors (demographic or disease-related) that could influence patient participation in a health information prescription program;
- evaluate whether health information prescription could increase patient adherence to follow-up programs;
- assess patient satisfaction and subjective perceptions of information prescription impact on psychological aspects.

MATERIALS AND METHODS

The present study was a prospective pilot study, that was conducted for patients with thyroid cancer at IRCCS Regina Elena National Cancer Institute of Rome, a Scientific Institute for Research, Hospitalization and Healthcare and one of the largest public Comprehensive Cancer Centres in Italy. The study was carried out in collaboration with the Oncological Endocrinology Unit and the Digital Library "R. Maceratini." People eligible for this study were patients aged over 18 years who were referred to our Oncological Endocrinology Unit and had received a new diagnosis of thyroid carcinoma within the past two months.

The study was conducted under the approval of the Local Ethics Committee of IRCCS Regina Elena National Cancer Institute (reference number: RS1035/17) and all patients gave their written informed consent to participate. Patients were consecutively enrolled between January 2020 and December 2021.

After receiving the signed informed consent, Endocrinology Unit clinicians provided health information through "prescriptive information certificates." Patients with this prescription form were then directed to first access the library, where medical librarians provided scientific and patient education material on thyroid cancer.

The material, which was previously validated by Endocrinology Unit clinicians, included brochures produced by scientific associations and societies, as well as relevant and current evidenced-based health information available from suggested websites, and scientific publications in Italian or English, including a clinical overview of thyroid cancer, its treatment options and its prognosis. Furthermore, patients had the opportunity to request additional information resources on topics of interest, either at enrollment or at a later time by directly contacting the library.

All librarians working at our Institute were trained on the type of materials to provide patients, according to protocol. Periodic meetings between librarians and clinicians took place to collect feedback and ensure consistent patient experience.

After accessing the library and reading the informative material, patients were asked to fill out a pilot-tested questionnaire on overall project satisfaction, subjective evaluation of the project's usefulness, quality of scientific material received, and self-reported emotions and psychological impact of information prescription, as well as possible impact of the information prescription project on self-management of disease. The questionnaire was created for this study and included both multiple choice and free-text questions (Appendix A, Supplementary Figure 1).

For each patient enrolled in the study, demographic and clinical data were collected from medical records and entered into a database for subsequent analysis. We also collected data on time from study enrollment to first accessing the digital library, topics of additional information requested by patients, and patients' evaluations captured from questionnaires.

After completing the study, participants were divided into two groups: Group A included patients who accessed the library to receive materials and read and completed the

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questionnaire; Group B comprised of patients who did not go to the library but received standard information only from their endocrinologist. At least 18 months after enrollment, data on follow-up adherence were collected. Adherence was determined based on the number of missed outpatient visits or cancellations.

Categorical variables of interest were expressed as frequencies and percentage values while continuous variables were expressed as mean ± standard deviation or median and minimum- maximum range, as appropriate. We used the Pearson's chi-square to assess categorical variables; for continuous variables the Shapiro-Wilk test was used, and the Mann-Whitney test was carried out for non-normally distributed variables via the Statistical Packages for Social Sciences (SPSS version 21.0). p values of <0.05 were considered statistically significant. Since this is a pilot study, no calculation for sample size was performed.

RESULTS

Patient Characteristics

In the recruitment timeframe, a total of 101 consecutive patients met inclusion criteria and were enrolled in the study. 82 patients were female (81%) and 19 were male (19%), with a mean age of 49.39 ± 13.59 years. Most patients were affected by papillary thyroid cancer. Most patients (98%) were staged according to TNM 8 edition as stage I. None of the patients had distant metastases at diagnosis.

After surgery (thyroidectomy or emi-thyroidectomy) only clinical and radiological follow-ups were suggested to 87 patients (86%), while for 14 patients (14%) radioiodine therapy (I-131 Therapy) was indicated, in accordance with current guidelines [39, 40].

Patient characteristics are summarized in Table 1.

Table 1

Patient characteristics.

	Total patients enrolled (n=101)	**Group A (n=26)**	**Group B (n=75)**	***p***
Age	49.39 ± 13.59	47.38 ± 13.65	50.08 ±13.6	0.386*
Sex	19 M (19%) 82 F (81%)	3 M (11.5%) 23 F (88.5%)	16 M (21.3%) 59 F (78.7%)	0.386§
Stage	Stage I: 99 (98%) Stage II: 2 (2%)	Stage I: 26/26 (100%)	Stage I: 73/75 (97%) Stage II: 2/75 (3%)	-
Histology	Papillary TC: 94 (93%) Aggressive tumors: -Aggressive Papillary TC: 3 (3%) -Follicular TC: 3 (3%) -Medullary TC: 1 (1%)	24 (92%) 2 (8%)	70 (93%) 5 (7%)	0.859§
T	1A:58 (57%) 1B: 34 (34%) 2:7 (7%) 3: 1 (1%) 4: 1 (1%)	1A: 15 (57.7%) 1B: 10 (38.5%) 2: 1 (3.8%)	1A: 43 (57.3%) 1B: 24 (32%) 2: 6 (8%) 3: 1 (1.3%) 4: 1 (1.3%)	0.842§
N	0: 86 (85%) 1A: 6 (6%) 1B: 9 (9%)	0: 22 (84.6%) 1A: 2 (7.7%) 1B: 2 (7.7%)	0: 64 (85.3%) 1A: 4 (5.3%) 1B: 7 (9.3%)	0.887§
Multi-focality of primary tumour	No: 80 (79.2%) Yes: 21 (20.8%)	No: 22 (84.6%) Yes: 4 (15.4%)	No: 58 (77.33%) Yes: 17 (23%)	0.578§
Therapy	Surgery: 87 (86%) Surgery + I-131:14 (14 %)	Surgery: 22 (85%) Surgery + I-131: 4 (15%)	Surgery: 65 (87%) Surgery + I-131: 10 (13%)	0.752§

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Follow up at our center	Yes: 91 No: 10	Yes: 20 No: 6	Yes: 71 No: 4	n. a.
All visits	76/91 (83.5%)	17/20 (85%)	59/71 (83.1%)	0.633§
Missed 1 app	12/91 (13.2%)	3/20 (15%)	9/71 (12.7%)	
Missed 2 app	3/91 (3.3%)	0/20 (0%)	3/71 (4.2%)	

Abbreviations: n: number; M: males; F: females; TC: Thyroid cancer; T: primary tumor size (T1A, T1B, T2,T3, T4 according to TNM classification 8 edition); N: lymph node involvement (N0, N1A or N1B according to TNM classification); I-131: radioiodine therapy; – test not performed. App: appointments * T-test; § Chi-squared test. Tumor stage was expressed in accordance to TNM 8 edition n/a: not applicable

Health Information-Seeking and Efficacy of Information Project

To assess the need for patient health information, we calculated the percentage of patients who completed all the steps of the health information prescription program.

Among the 101 patients enrolled, 26 patients (26%) visited the library and completed the questionnaire, suggesting a personal need for health information.

Regarding the time from enrolment to first library access, most patients first accessed the library on the day they enrolled (20/26 patients), while 3 patients accessed the library within a week and 3 patients within a month.

Considering gender differences, 23 women (28%) and 3 men (16%) accessed the library. People who accessed the library were younger (mean age of group A: 47.38 years; group B: 50.08 years), although this is not statistically significant.

In comparing the clinical data of people who accessed the library to those who did not, there were no differences between the two groups in disease characteristics with regards to histology, staging and prescribed treatment.

To assess follow-up adherence, we narrowed the analysis to patients with a minimum of 18 months of follow-up at our Oncological Endocrinology Unit (91/101 patients). Other patients were considered lost at follow-up.

Most patients (76/91, 83.5%) attended all scheduled outpatient visits, while a minority (15/91, 16.5%) missed 1 or more appointments. There were no statistically significant differences between the two groups: in group A, 85% of patients (17/20) attended all visits compared to 83.1% (59/71) of group B.

Patient satisfaction and subjective considerations

Regarding the type of information additionally requested by 18 of the 26 patients, the topics of greatest interest were: nutrition (8, 44%); complementary therapy or rehabilitation (5, 28%); prevention of disease and preventive health measures (2, 11%), rights and legal aspects of the oncological patients (1, 6%); psychological aspects (2, 11%), as reported in Supplementary Figure 2. From the results of the anonymous questionnaire regarding overall satisfaction, 65% (17/26) were very satisfied or satisfied, 23% (6/26) neutral and 12 % (3/26) dissatisfied with their involvement in the project. The information was able to respond effectively to the requests or needs according to most patients (65% of patients, 17/26). Moreover, 69% of patients (18/26) considered health information of good quality (completeness and clarity), 19% (5/26) deemed it sufficiently clear and complete while 12% (3/26) instead regarded it slightly clear and complete. 54% of patients (14/26) claimed the health information prescription was very useful, for 42% (11/26) it was quite useful and for 4% (1/26) a little useful.

In the free text for added patients' notes, it was observed that most scientific materials were clear and simple, except for the documents written in English.

For most patients (69%, 18/26), the prescription of health information increased awareness and knowledge of their condition and enhanced patient-physician communication, allowing them to ask more detailed questions. For a minority of patients (19%, 5/26), receiving clinical information improved adherence to treatment and enhanced communication with family members about their own disease status, as reported in Appendix A, Supplementary Figure 3.

Regarding the psychological impact, the main emotions felt after receiving information were comfort and encouragement for 69% of patients (18/26), safety and awareness for 88% of patients (23/26), 23% of patients (6/26) replied that information caused a little bit of anxiety and worry, and only 4% of patients (1/26) only a little bit of discouragement (Appendix A, Supplementary Figure 4).

Among personal comments in the free text field, most patients reported satisfaction with the project that

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enhanced awareness of their own disease and encouraged their health status. Many comments highlighted the project's utility on diagnostic-therapeutic pathways and disease self-management (Appendix A, Supplementary Figure 5).

DISCUSSION

Health information prescription belongs in patient-centered health care services; it is an innovative approach that allows to provide appropriate information at the right time to help patients in the management of the disease [41, 42]. Although health information prescription is commonly considered a good practice, objective demonstrations of its effectiveness are scarce.

Previous studies did not report the relationship between various demographic variables and participation in health prescription information. To identify the categories of patients who are most interested in the health information prescription project, we assessed both age and sex. We found that a higher percentage of women accessed the library (28% women versus 16% men) even if not statistically significant. This trend is expected if we consider that generally, women pay greater attention to their health compared to men [43], and have a higher rate of health information-seeking behavior [44]. The lack of statistical significance could be related to a small group of patients.

Socio-cultural factors could influence active participation in information prescription projects. Patients with a lower economic status and socio-cultural level generally seek information less frequently [45]. Unfortunately, data regarding the education level of patients are lacking in our study, albeit our patients reported the English language of scientific texts as a barrier to health information, which confirmed previous data present in literature [3, 46].

Unlike previous studies [47-51], we correlated the information-seeking behavior to the cancer histotype or stage. We found no differences and hypothesize that a tumour diagnosis has the same impact on the information-seeking behavior of patients, regardless of histotype or stage. We also investigated clinical consequences as the impact of prescription information on follow up adherence. The study did not demonstrate any significant changes between participating and non-participating patients in terms of adherence to follow-up care. This may be due the fear of neoplastic recurrence.

Our results, in alignment with previous studies [52], showed patient satisfaction and positive effect perceived by patients on self-care. The questionnaires illustrated that patients perceived an improvement in awareness and knowledge of their disease condition. This resulted in better communication with physicians, in alignment with previous studies[17, 29, 53]. Finally, from a psychological point of view, the main emotions generated from receiving information were comfort, encouragement, and safety, suggesting that, overall information prescription could have a favourable impact on the quality of life of patients affected by endocrine neoplasms.

The main limitations of our study are the small number of enrolled patients who accessed the library, which limits generalizability and may not be sufficient to identify the real effectiveness of the prescription on changes in patient adherence to follow-up programs. There are several possible reasons for low participation, including that the library is physically located outside the Hospital and that many patients were enrolled during the period of the Covid-19 pandemic where many measures greatly restricted access to the library. Another possible explanation is the growing spread of Internet usage in recent decades, [54, 55] including among the elderly, which could reduce interest in seeking other forms of information. As a single-arm study designed to assess patients' participation in an information prescription program, our study is not randomized.

Future research should consider focusing on other oncological conditions, controlling or adjusting for patients' education level, and using digital or remote delivery for improving adherence, in addition to having larger sample sizes and investigating other aspects of clinical management.

Nonetheless, the study also has important strengths: this is the first study evaluating the impact of information prescription on adherence to follow-up (instead of only the impact on satisfaction or psychological parameters) and that includes stratification of patients based on demographic and disease-related factors.

Moreover, for the first time, health information prescription study has been carried out in the Italian endocrine oncology setting. This pilot study allowed the research team to investigate the conceptual feasibility of health information prescription in patients affected by thyroid cancer and has contributed to understanding the impact of information prescription services on health-care outcomes. Our study demonstrated an overall satisfaction in thyroid cancer patients, who perceived to have greater understanding of their disease; better communication with physicians; and improvement in self-reported feelings of comfort, encouragement and safety. Based on these promising results, we encourage the application and widespread adoption of this good clinical practice tool in other medical fields, particularly in other cancers.

INSTITUTIONAL REVIEW BOARD STATEMENT

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Local Ethic Committee of IRCCS Regina Elena National Cancer Institute (reference number: RS1035/17, and date of approval: 12 December 2017).

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INFORMED CONSENT STATEMENT

All the participants signed an informed consent form.

DISCLOSURE STATEMENT

The authors report there are no competing interests to declare.

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AUTHOR CONTRIBUTIONS

Authors have contributed to the manuscript preparation as follows: M. Bianchini: conceptualization and design of the work, investigation, study conduction, data collection, initial data analysis, writing original draft; G. Puliani: data curation, formal analysis, statistical analysis and review of the article; R. Lauretta and M. Mormando: data curation and investigation, V. Scarinci: data curation and review & editing; F. Servoli: review & editing and validation; G. Cognetti: conceptualization; M. Appetecchia: study conceptualization and supervision, review & editing. All authors read and approved the final article.

DATA AVAILABILITY STATEMENT

All data generated or analyzed are included in this article. Further enquiries can be directed to the corresponding author. Data associated with this article area available at https://gbox.garr.it/.

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SUPPLEMENTAL FILES

Appendix A: Survey Questions & Figures

AUTHORS' AFFILIATIONS

Marta Bianchini, marta.bianchini@ifo.it, Oncological Endocrinology Unit, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Giulia Puliani, giulia.puliani@ifo.it, Oncological Endocrinology Unit, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Virginia Scarinci, virginia.scarinci@ifo.it, Digital Library R. Maceratini, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Gaetana Cognetti, gaetana.cognetti@ifo.it, Digital Library R. Maceratini, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Rosa Lauretta, rosa.lauretta@ifo.it, Oncological Endocrinology Unit, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Marilda Mormando, marilda.mormando@ifo.it, Oncological Endocrinology Unit, IRCCS Regina Elena National Cancer Institute, Rome, Italy

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Francesca Servoli, francesca.servoli@ifo.it, Digital Library R. Maceratini, IRCCS Regina Elena National Cancer Institute, Rome, Italy

Marialuisa Appetecchia, marialuisa.appetecchia@ifo.it, IRCCS Regina Elena National Cancer Institute, Rome, Italy

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Expert-recommended tasks for hospital librarians during a healthcare system merger or acquisition: an e-Delphi consensus statement

Stacy Posillico, AHIP; Jaclyn Morales; Saori Wendy Herman

See end of article for authors' affiliations.

Objective: Limited empirical research is available to guide hospital librarians through a healthcare system merger or acquisition. To address this knowledge gap, an e-Delphi research study was used to develop recommended tasks that librarians should consider when consolidating the delivery of library services to a newly merged, geographically distributed healthcare system.

Methods: This e-Delphi study was conducted and reported according to the Guidance on Conducting and REporting DElphi Studies (CREDES). The expert panel, composed of 29 hospital librarians, responded to four rounds of questionnaires during April to December 2022. In Round 1, the panelists' qualitative responses were collected and analyzed via thematic analysis to identify potential recommended tasks. In Rounds 2 through 4, tasks were eliminated or prioritized based upon the panelists' rating of each task using a seven-point Likert scale. Those tasks rated as 5, 6, or 7 by ≥75% of the panelists were included in the final consensus statement.

Results: The consensus statement identifies 330 recommended tasks. Highly prioritized tasks involve cultivating beneficial relationships with others throughout the merger, particularly newly blended library teams, finance and administrative leadership, information technology/services, and vendors. Marketing and outreach activities and physical library space management tasks were not prioritized. The panelists emphasized understanding organizational context and culture throughout any merger.

Conclusions: The recommended tasks can be used by hospital librarians to create an action plan for consolidating and delivering library services in the event of a healthcare system merger or acquisition. Future research on the utility of the recommendations is anticipated.

Keywords: Delphi method; Mergers; acquisitions; hospital libraries; hospital librarianship; hospital librarians; M&A; mergers and acquisitions; Consensus; leadership; management; administration; change management; Organizational Change

See end of article for supplemental content.

INTRODUCTION

It is often an isolating, disorienting experience: that moment when a hospital librarian learns their hospital or healthcare system is merging with another system or being acquired by another hospital [1-6]. Sometimes, the new addition to the system is nearby; other times the merger occurs between hospitals at a great distance from one another, both in miles and in organizational culture [4-11]. The story unfolds as the hospital librarian navigates the merger or acquisition with minimal structure to guide them [1-17]. Along the way, the hospital librarian tenaciously works to adjust and adapt the delivery of library resources and services over the months or years it takes for the hospitals to fuse into one newly reconstituted organization [1-17].

Medical librarians regularly manage the delivery of services to multiple geographically dispersed hospitals, and this responsibility has long been established as a core aspect of their role [2, 6, 8, 18]. However, since 2012, hospital librarians in the United States (U.S.) are increasingly required to navigate their libraries through the rising number of healthcare systems and hospital mergers and acquisitions [5, 6, 14, 19].

The COVID-19 pandemic briefly slowed down the need for hospital librarians to respond to the steady procession of merger activity [20]. By the end of 2023, however, this

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expansion by consolidation was on the rise again and is expected to continue [19, 21, 22], "leading the nation to a point where there will soon be very few small healthcare organizations left" [23].

Hospital librarians are faced with the continuing challenge of how to serve the information and education needs of library users within larger U.S. healthcare systems [24] that care for diverse patient communities, sometimes at a great distance from each other [19, 25-31]. For example, as academic medical centers are increasingly acquiring community hospitals for the talent and financial benefits they provide [19, 21, 22], hospital librarians must elevate their own skills in order to meaningfully contribute to advancements in the rigor and impact of scholarly activities within the growing healthcare system.

Hospital librarians may be required to advance their own education and knowledge as the clinical work at the newly merged system shifts and develops greater specialization and complexity [2, 3, 6, 8]. At the same time, hospital librarians must educate those community hospital clinicians who have little experience with access to library resources or assistance from librarians about the full range of services librarians provide [1, 2, 3, 7, 8, 17].

Throughout the merger process, hospital library budgets may be diminished by any reductions and eliminations needed to attain financial benefits for the merging system [23, 28-33]. Physical library spaces can be lost to new or reorganized staff that need space, particularly in healthcare systems where library users have mostly moved to virtual workspaces and using online information resources [34, 35]. Hospital librarians have long struggled with promoting and marketing their availability and value [35-37]. Once involved in a merger, they need to find new and creative ways to reassure current library users that the quality of services will be maintained and to raise awareness of their existence with newcomers to the system [7, 11, 33, 34, 37].

Coinciding with these challenges, little empirical research is available for librarians to use in these situations. In contrast to the well- researched and debated guidelines, legal requirements, and ethical standards available to hospital executives during a merger or acquisition [12, 21, 28, 32, 38-40], an extensive literature review revealed that there are no research-based models or validated guidance for how to consolidate, collaborate, and deliver library services across institutions that may be miles or states apart and differ wildly in culture and custom, despite the fact that medical librarians have called for such research [1, 3-5, 7, 8, 12, 13], The literature on this topic is found primarily in case studies or reports of the experience by hospital librarians who have been there and shared their experience in hopes that it will benefit a colleague faced with the same difficult choices and challenges to create a newly merged hospital library [1-17, 41]. This method of reconciling services and resources based on limited reporting in the literature can lead hospital librarians to make decisions that may not fully integrate library services and resources across the newly formed institution [3, 5, 7, 12-15, 41]. This can lead hospital libraries to forego the positive effects of full financial and cultural integration [28], although integration that prioritizes centralization has been shown to provide the most benefit to hospitals, staff, patients, and the communities served by a newly merged system [21, 23].

Because there is limited empirical research available to guide hospital librarians through a healthcare system merger or acquisition, the purpose of this modified e-Delphi study seeks to address this knowledge gap and create evidence-based recommendations for providing access to information resources and delivering hospital library services through one comprehensive, geographically distributed system following a healthcare system merger or acquisition.

METHODS

Justification for e-Delphi Research Method

This study utilized a modified electronic Delphi (e-Delphi) method to develop a consensus statement of recommended tasks (referred to as "consensus statement") [42-46]. This iterative process involves anonymous surveys emailed to experts to reach consensus [42, 43, 46, 47]. Given the complexity of hospital library mergers and acquisitions and the divergent literature [42, 43, 48, 49], the e-Delphi method allowed for a comprehensive understanding of hospital librarians' priorities [42, 43, 46, 47, 49-52] during mergers or acquisitions.

Experimental methods were impractical due to challenges in recruiting sample and control groups and the lack of a testable intervention [53]. The e-Delphi technique mitigated the limitations of the survey [46, 50] and interview methods where individual opinion is solicited without consensus. It also avoided the limitations of the focus group where psychological interference can lead to the potential for few individuals to overtake the group, thus suppressing valid opinion.

Study Design and Protocol

This research study was conducted and reported according to the Guidance on Conducting and REporting DElphi Studies (CREDES) [42]. An e-Delphi research protocol was designed that included: 1) a group of panelists that have clearly identified leadership experience with a merger or acquisition; 2) multiple rounds of questioning the panelists, allowing them to refine their opinion as the process proceeded; 3) anonymity among the panelists, so they could freely express opinion without the social pressures of conformity or fear that their responses would be made public to their employers; and

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4) statistical analysis of the final group response, having reached a level of consensus that was pre-defined by the researchers [42, 43, 45, 46].

Prior to designing the research protocol, a thorough literature search was conducted to identify published literature about hospital librarians' experiences in a healthcare system merger or acquisition. Based on the results of the literature search, a preliminary qualitative questionnaire was created.

To establish content and face validity [56, 57], the research team invited nine medical librarians who did not fully meet the pre-established expert panelist criteria but had experience with a hospital merger or acquisition or the Delphi method, to pilot the Round 1 questionnaire. The anonymous feedback received via a SurveyMonkey evaluation form was incorporated into the final Round 1 questionnaire. The pilot respondents validated the questionnaire but also suggested that definitions of specific terms and examples of tasks be added as an optional preview to minimize bias and to provide clarity [45].

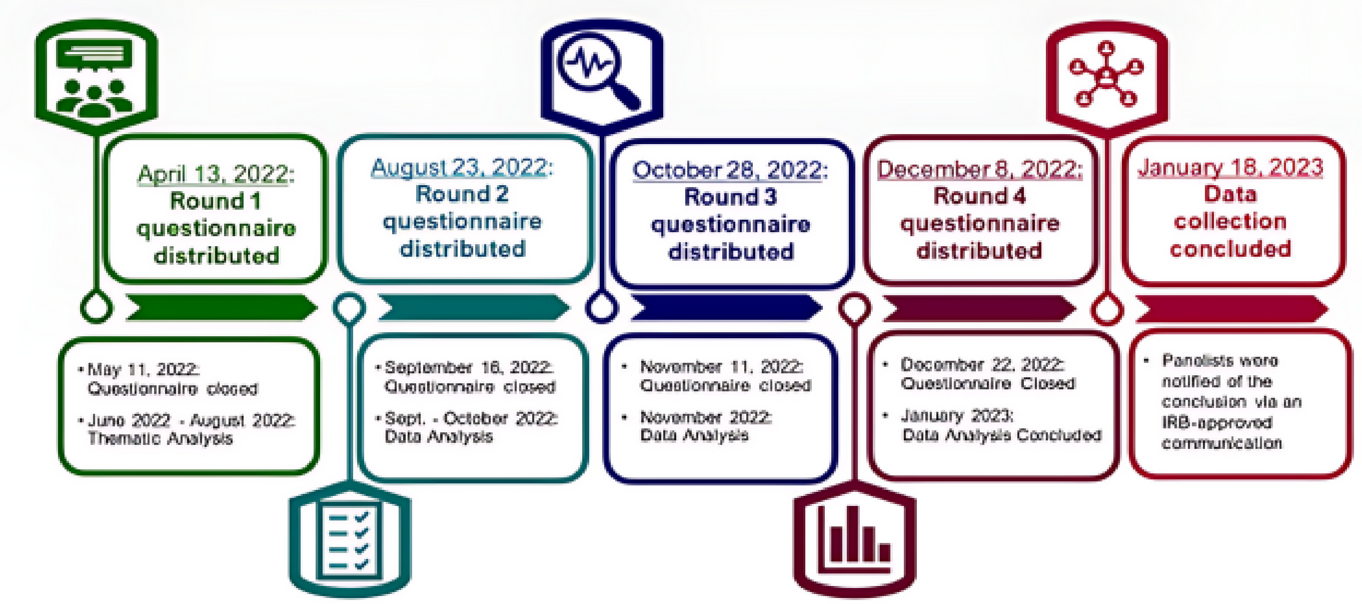
The research team deviated from the classic Delphi mail approach in order to efficiently communicate with the panelists [42, 43] and used a web-based method for collecting responses. All the questionnaires were created and distributed via a secure Internet-based survey using the Research Electronic Data Capture (REDCap) system managed by Northwell Health [58]. Responses to all the questionnaires received via REDCap were anonymized to the researchers, and the panelists were never identified to each other.

In planning the study, the research team anticipated a large dataset being produced from Round 1, which would require considerable and careful analysis to process the data into the Round 2 questionnaire. As a result, a research assistant was recruited to help with data organization and management. A research grant of $1,000.00 was awarded from The Liberty Chapter of the Medical Library Association in October 2021 and combined with funding from Hofstra University's Stuart and Nancy Rabinowitz Honors College Undergraduate Research Assistant program to support the research assistant's work over the course of three academic semesters in 2022. This research study received approval from the Institutional Review Board (IRB) of Northwell Health on January 18, 2022, as an exempt research study (Study ID No. 21-1336-EXT).

Panel Recruitment

The pre-established criteria for participating in this research study required that all accepted panelists have the prerequisite experience [43, 46, 50, 53] of being a hospital library professional who had either led or been actively involved in a non-leadership role during a U.S.-based hospital or healthcare system merger beginning 2010 through the date of recruitment. To ensure a geographically diverse panel, the researchers sought to empanel at least one participant from each of the seven regions of the Network of the National Library of Medicine (NNLM) [61]. The research team planned to empanel 23 to 30 hospital librarians in the study to produce reliable work [43].

Figure 1 Timeline of e-Delphi Research Study Rounds


April 13, 2022: Round 1 questionnaire distributed
August 23, 2022: Round 2 questionnaire distributed
October 28, 2022: Round 3 questionnaire distributed
December 8, 2022: Round 4 questionnaire distributed
January 18, 2023 Data collection concluded

- May 11, 2022: Questionnaire closed
- June 2022 - August 2022: Thematic Analysis

- September 16, 2022: Questionnaire closed
- Sept. - October 2022: Data Analysis

- November 11, 2022: Questionnaire closed
- November 2022: Data Analysis

- December 22, 2022: Questionnaire Closed
- January 2023: Data Analysis Concluded

- Panelists were notified of the conclusion via an IRB-approved communication

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Recruitment for panelists opened nationwide in February 2022 and was conducted through targeted emails to library professionals identified through the literature search and email campaigns through the Medical Library Association's caucus and chapter listservs. All interested persons were asked to complete a nine-question survey via SurveyMonkey. The interest form closed in March 2022. Each researcher independently assessed the de-identified responses using a rubric based on the predetermined eligibility criteria. The research team met and selected 32 prospective panelists. Twenty-nine expert panelists accepted the invitation to participate in the study. Among the accepted panelists, there were representatives from each of the seven regions of the NNLM network [61].

Study Timeline

The panelists completed four rounds of questionnaires from April to December 2022. Figure 1 portrays the research study timeline.

To ensure anonymity, individual panelists' responses in each round were not tracked, leading to slight variations in the total number of responses received in each round. All four questionnaires included a closing date, and at least two email reminders were sent before closure. Short extensions were granted during each round to maximize response rates while respecting panelists' time [45].

Round 1 of the e-Delphi Study

In Round 1, the panelists were asked to identify key tasks to be addressed during a merger. The questionnaire was divided into four sections: Tasks to be addressed prior to the merger or acquisition; tasks to be addressed regarding the hospital or healthcare system merger or acquisition; tasks to be addressed regarding centralization of library services; and questions regarding the panelists' experience with the merger or acquisition process within a hospital library. Panelists entered in the key tasks as free text.

The data collected in Round 1 was analyzed via Braun & Clarke's six-step process of reflexive thematic analysis [59]. The research team decided to use Braun & Clarke's reflexive thematic analysis approach for qualitative analysis to convert the open-ended responses into actionable tasks. This approach specifically allowed the researchers, all of whom are experienced medical librarians at a large academic healthcare system affiliated with a medical school, to bring their knowledge and understanding of the medical library profession to the analysis as a resource [59, 60]. Responses to each Round 1 question were divided equally amongst the researchers, and the researchers read and familiarized themselves with the assigned responses [59].

After the familiarization phase, codes were generated independently by each researcher via critical reflection on their own past librarian experiences and cultural position in this profession [59]. The team regrouped to consolidate the hundreds of generated codes into action-oriented tasks [59]. Employing a constructionist thematic analysis, the research team used both semantic and latent content analysis to create a list of action-oriented tasks [59].

Rounds 2 Through 4 of the e-Delphi Study

After the thematic analysis was conducted, the research team used its familiarity with the hospital librarian profession to reorganize the action-oriented tasks from the initial four sections into 15 categories for the Rounds 2-4 questionnaires. A 7-point Likert Scale, provided in Figure 2, was utilized by the panelists to reach consensus.

Figure 2 Likert Scale Used by Panelists in Rounds 2 to 4

Not Recommended	Low Recommendation	Somewhat Recommended	Moderate Recommendation	Recommended	Highly Recommended	Essential Recommendation
1	2	3	4	5	6	7

Each questionnaire was approved by the IRB as a modification to the exempt research study before distribution. The researchers consulted with two statisticians on all quantitative analysis processes used during and after these three rounds.

A consensus threshold of ≥75% was determined prior to data collection based on the literature review. The tasks rated as 5, 6, or 7 by ≥75% of the panelists at the conclusion of each round are included in the final consensus statement. The tasks rated as 1 by ≥75% of the panelists at the conclusion of each round were automatically removed from future questionnaires and were not included in the final consensus statement. Any remaining tasks that did not meet the ≥75% threshold were placed in the subsequent questionnaire for a second review. If a task did not reach consensus for inclusion in the consensus statement after the second review, the item dropped out of further consideration.

Although controlled feedback is traditionally provided to panelists after each round during a Delphi study [42], aggregated results and trends were not reported to the panelists after each round in this study. By withholding accumulated results after Rounds 2 and 3, the researchers aimed to minimize social desirability bias and reduce the pressure panelists might feel to adjust their responses to align with the group rather than express their individual evaluations of the identified tasks [43]. Moreover, the considerable number of categories and individual tasks listed within each of them warranted providing the panelists with an opportunity to conduct an impartial second review in a subsequent round.

The protocol initially planned for only three rounds of the e-Delphi process, but a technical issue in REDCap removed the Collection Development (29 tasks) and Vendor Relations (29 tasks) categories from the Round 2 review. Panelists first reviewed these two categories in Round 3, after completing their second review of the other 13 categories. Round 4 consisted of the second review for only those two categories.

Furthermore, the Round 4 questionnaire included an optional open-ended comments section for the participants, allowing them an opportunity to provide future users of the consensus statement with informed commentary that would be beneficial to consider. The comments collected in this section were assessed via the same reflexive thematic analysis processes used for the Round 1 response analysis [59].

RESULTS

A total of 29 panelists had the opportunity to participate in all four rounds; however, not everyone completed each questionnaire by the specified deadline. In consultation with a biostatistician, the slight variation in the number of participants for each round did not affect the statistical reliability of our results.

Over the course of four rounds, 1,393 open-ended responses were developed into a consensus statement of 330 recommended tasks. The consensus reached in each of the rounds is described in Figure 3.

Round 1

Twenty-five of the 29 panelists (86%) completed the questionnaire, and a total of 1,393 open-ended responses were collected. After thematic analysis, the 1,393 responses were developed into lists of action-oriented tasks. The research team identified 439 tasks and thematically organized the tasks into 15 categories for the panelists to consider in the Round 2 questionnaire. The categories that had the largest number of recommended tasks to consider were: Interpersonal Wellness; Library Policies, Procedures, and Job Responsibilities; and Information Technology and Services. The categories that had the smallest number of tasks to consider were: Physical Library Spaces, System Organizational Structure, and Library Staff Training and Development.

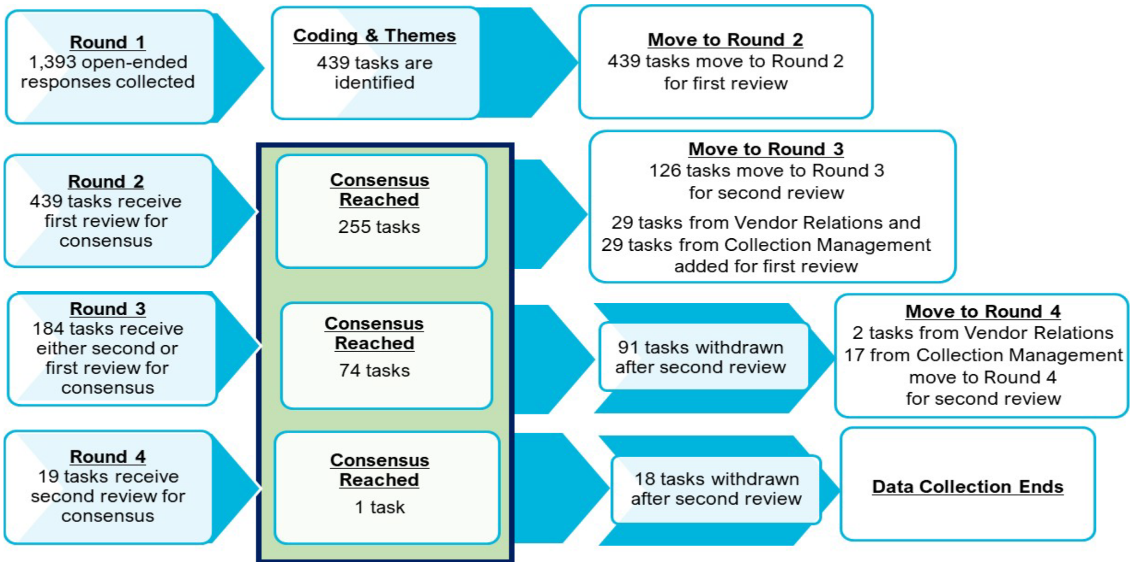
Round 2

Twenty-two panelists completed the Round 2 questionnaire. Two panelists formally withdrew from the study after the Round 2 questionnaire was distributed. A total of 255 tasks from 13 categories reached consensus as recommended by at least 75% of the panelists' rating the task as 5 ("Recommended"), 6 ("Highly Recommended") or 7 ("Essential Recommendation") on the Likert scale. None of the tasks reviewed received a consensus rating of 1 ("Not Recommended") by 75% or more of the panelists. A total of 126 tasks from the 13 categories did not reach consensus and were moved to the Round 3 questionnaire for a second review by the panelists.

Round 3

Twenty-three panelists completed the Round 3 questionnaire, which asked them to review task lists for all fifteen categories. None of the tasks reviewed in any category received a consensus rating of 1 ("Not Recommended") by 75% or more of the panelists. The panelists' second review in 13 categories led to an additional 35 tasks reaching consensus and inclusion in

Figure 3 Consensus Reached in Each Round



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the consensus statement. Ninety-one tasks from 13 categories were eliminated because they did not reach consensus at the end of this second review. Fifty-eight tasks in the Collection Management and Vendor Relations categories received their first review during this round. Twenty-seven of the 29 tasks from the Vendor Relations category reached consensus, and two tasks moved over to the Round 4 questionnaire. Twelve tasks from the Collection Management category reached consensus, and 17 moved over to the Round 4 questionnaire.

Round 4

Twenty-four panelists completed the Round 4 questionnaire. Only one task from the Collection Management category was added to the consensus statement, with the remaining 18 tasks from the two categories eliminated. None of the tasks reviewed received a consensus rating of 1 ("Not Recommended") by 75% or more of the panelists.

Additionally, 18 open-ended responses were collected from the 24 panelists to capture any insight about the merger or acquisition process that was not reflected in the list of recommended tasks. These responses were analyzed using the same reflexive thematic analysis used for Round 1. The theme of understanding organizational context and culture throughout the merger process was recognized in many of the responses, and the researchers noted that this theme was incredibly important to the panelists.

Additionally, partnering with administration and leadership was noted as an important theme to consider when using the consensus statement. The theme of finding value in digitizing the collection and eliminating print holdings was also identified.

The Consensus Statement of Recommended Tasks

From the 1,393 open-ended responses received in Round 1 and the 439 tasks reviewed by the panelists in Rounds 2 through 4 questionnaires, there are 330 action-oriented tasks presented in the final consensus statement. The consensus statement is provided in full in Appendix A. It is also available online at: https://libguides.hofstra.edu/ConsensusRecsHSLMA.

The tasks were organized into four major categories: Library Administration, Library Collections and Information Systems, Library Staff Integration and Interconnection, and Healthcare Organization. Each major category was then divided into subcategories, as visualized in Figure 4.

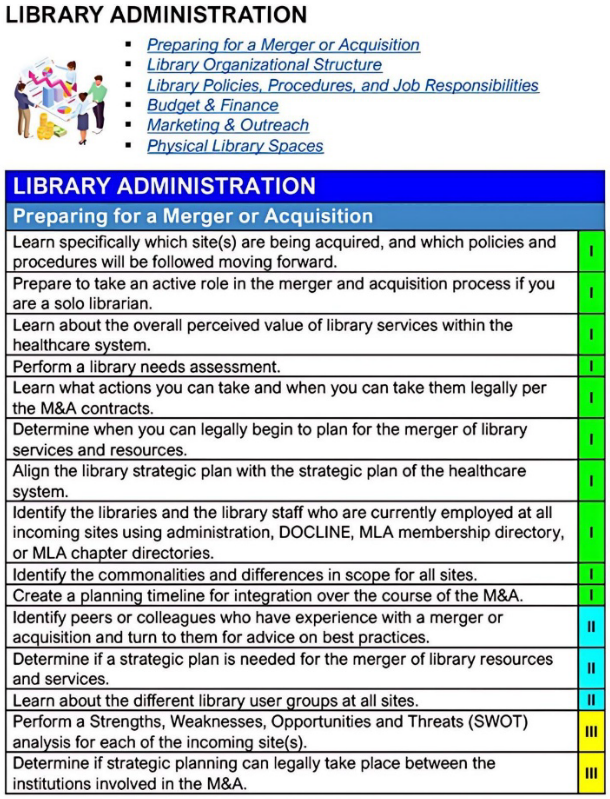
Each of the tasks that reached consensus were assigned a level of recommendation, which was determined according to the mode for each task. A Level 1 recommended task represents an essential task (a mode of7) that a librarian should consider addressing immediately during a hospital merger or acquisition, whereas tasks

Figure 4 Summary of Consensus Statement of Recommended Tasks

assigned a Level 2 are highly recommended (a mode of 6), but not essential, to undertake during the merger process. Level 3 recommended tasks (a mode of 5) are those that may be considered at a later time. Of the 330 recommended tasks, 141 (43%) were assigned to Level 1 as an essential task; 123 (37%) were assigned to Level 2 as highly recommended; and 65 (20%) were assigned to Level 3 as a recommended task.

A snapshot from the main category of *Library Administration*, and a snippet of the first of its subcategories *Preparing for a Merger or Acquisition,* is provided as Figure 5 to demonstrate the look and feel of the consensus statement.

Figure 5 Library Administration-Preparing for a Merger or Acquisition in the Consensus Statement of Recommended Tasks



LIBRARY ADMINISTRATION

- Preparing for a Merger or Acquisition
- Library Organizational Structure
- Library Policies, Procedures, and Job Responsibilities
- Budget & Finance
- Marketing & Outreach
- Physical Library Spaces

LIBRARY ADMINISTRATION	
Preparing for a Merger or Acquisition	
Learn specifically which site(s) are being acquired, and which policies and procedures will be followed moving forward.	I
Prepare to take an active role in the merger and acquisition process if you are a solo librarian.	I
Learn about the overall perceived value of library services within the healthcare system.	I
Perform a library needs assessment.	I
Learn what actions you can take and when you can take them legally per the M&A contracts.	I
Determine when you can legally begin to plan for the merger of library services and resources.	I
Align the library strategic plan with the strategic plan of the healthcare system.	I
Identify the libraries and the library staff who are currently employed at all incoming sites using administration, DOCLINE, MLA membership directory, or MLA chapter directories.	I
Identify the commonalities and differences in scope for all sites.	I
Create a planning timeline for integration over the course of the M&A.	I
Identify peers or colleagues who have experience with a merger or acquisition and turn to them for advice on best practices.	II
Determine if a strategic plan is needed for the merger of library resources and services.	II
Learn about the different library user groups at all sites.	II
Perform a Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis for each of the incoming site(s).	III
Determine if strategic planning can legally take place between the institutions involved in the M&A.	III

DISCUSSION

This e-Delphi research study equips hospital librarians with the evidence-based recommendations they need to manage the challenges of a hospital or healthcare merger or acquisition, particularly as the consolidation trend continues across the United States [22, 23]. The tasks recommended by panelists include a particular focus on building collaborative relationships outside the library and nurturing library staff wellness. Additionally, they reflect the evolution of hospital libraries to online environments and underscore the importance of organizational context and culture.

Primary Tasks Recommended by The Panelists

A review of the consensus statement reveals that, from the panelists' experienced perspective, hospital library leaders must prioritize creating beneficial, cooperative relationships with key executives, financial team members, IT/IS departments, and vendors.

Almost all the Level I recommended tasks in the Executive & Leadership Relations subcategory pertain to creating connections with the administration that allows for productive conversations about library budgets, payment responsibilities, and cost allocations. The Budget and Finance subcategory encompasses many Level I recommended tasks that address library leaders becoming knowledgeable about budgets and finance so that they can have well-informed conversations with the library's internal and external stakeholders.

The prioritization of these tasks reflects the ongoing discussion in our profession about maintaining sufficient budgets, especially during times of change, to continue providing library access and services to existing and incoming users [1-3, 9, 12, 14, 17, 23, 28, 33, 34, 41]. Establishing beneficial relationships with key financial decision-makers is fundamental to sustaining operational funding for the library throughout the merger process [1, 3, 7, 12, 15, 17, 33].

Creating relationships with the IT/IS department for a newly merged system was similarly at the forefront of the panelists' recommendations. The fact that 61% (20/33) of the Information Technology and Services tasks are a Level I recommendation aligns with published literature [33, 34] that highlights the need for partnership and collaboration with the IT/IS team to maintain current service levels and to expand access to incoming sites [4, 7, 9, 16, 17].

Collection development and vendor relations are traditionally closely associated in the library nomenclature. However, the consensus statement did not reflect that. Many of the Collection Development subcategory tasks are logistical undertakings that can be quickly accomplished, while the entirety of the Vendor Relations subcategory emphasizes the need to build trustworthy and reliable relationships with vendors who provide library information resources [4, 7, 9, 12, 17, 33].

While developing relationships with external departments and vendor partners may allow the hospital library to grow during the merger or acquisition process, the Interpersonal Wellness subcategory emphasizes another priority of paramount importance to the panelists: the need to nurture the internal relationships among the librarians who will be working together as the merger progresses. This subcategory has the highest number of

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recommended tasks among all the subcategories and includes tasks such as:

- Ensure you are sensitive and considerate to how people adjust to change in different ways. (Level I)
- Acknowledge the frustration that comes when you and others do not feel heard during the M&A process. (Level I)
- Acknowledge the transformational nature of the change an M&A brings, and that such change takes time. (Level II)

The recommended tasks presented in this subcategory correspond closely with the published literature that explores the sometimes frightening and disorienting experience of going through a healthcare system merger or acquisition when you are a hospital librarian [2, 3, 13-15, 17]. Accordingly, the panelists provide a compelling guide for hospital librarians leading or actively involved in a merger or acquisition to address the complex array of emotions stemming from negative feelings such as fear, trepidation, insecurity, vulnerability, and stress, along with potential positive feelings of excitement, a renewed sense of purpose, or possibly optimism for the future.

Taken as a whole, the consensus statement embodies the idea that the best available action that any hospital librarian can take during a merger or acquisition is to develop and maintain healthy relationships, particularly with library colleagues, key finance team members, IT/IS department associates, and vendor representatives.

Peripheral Tasks Recommended by The Panelists

Marketing tasks were a surprisingly low priority for the panel, possibly reflecting the long-standing challenges hospital librarians face in demonstrating their value [1, 3, 4, 36, 37]. It is curious that more marketing tasks did not make the final consensus, because as healthcare systems merge, hospital librarians must reach out to new user communities, and at the same time, reassure existing users that library access and services will not be interrupted [1, 4, 7, 11, 12, 15, 33, 37]. However, because the panelists prioritized tasks related to relationship-building in every category, this suggests that pursuing those types of tasks as outlined in the consensus statement could naturally increase the library's visibility, discoverability, and value, potentially replacing traditional marketing efforts. Furthermore, there are recommended tasks within the consensus statement that offer opportunities for marketing and outreach campaigns to involve hospital librarians in a system's academic and scholarly activities, given that enhanced teaching and publishing efforts are a key driver of mergers and acquisitions [1, 3, 19, 21, 22, 35, 41].

Physical library space was also not a concern for the panelists. Only ten tasks were created in this subcategory for Round 2, and only four were included in the consensus statement. This relatively low number of tasks in the smallest of all the subcategories aligns with the movement of many hospital library resources and services to the online environment [4, 7, 16, 33-35, 41]. Our analysis of the Round 4 responses further highlighted this theme. As one of the panelists stated, "[i]n our current environments, print is used less often these days, so the priorities in a merger should be merging online collections. Our mergers involved wide geographic regions, with many locations never having a library on site. The focus was to develop online collections to meet people where they were – online."

The Importance of Understanding Organizational Context and Culture

"The specific context and politics of your setting will influence which and whether all recommended practices should apply," one panelist shared in Round 4. In no other area is context and culture more important than when hospital library leaders pursue opportunities to centralize library access and services.

Thirty-four of the 36 recommended tasks listed in the Executive & Leadership Relations subcategory are an "essential recommendation" (Level I) or "highly recommended" (Level II). Many of these tasks involve working with executive leadership to determine the extent to which library services will be consolidated and access to resources will be centralized as the merger proceeds. Hospital librarians should use these tasks to work towards acquiring the endorsement and support of executive leadership for full and complete integration, as similarly discussed in the published case reports [2, 4, 9, 13, 14, 17, 19, 41], which will lead to the greatest benefits for the library, its users, and the healthcare system itself [23]. As one of the panelists said in Round 4, "[m]any components addressed in the questionnaire discuss centralization of print collections, library administration, systems administration, etc. The preference and feasibility of centralizing versus independently operated library services is highly dependent on the type of arrangement between the healthcare systems…. The driving factor of course [is] the expectations of leadership for the acquiring and the acquired systems as to how much integration should occur."

Ideally, the culture and context of the merging or acquired hospitals and healthcare systems should determine the way any recommended task is carried out. As the consensus statement is used, hospital librarians would do well to remember these words of one of the panelists from Round 4: "No two mergers, downsizing, or whatever are the same. Take the recommendations and make them work for your specific situation."

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Limitations

This research was designed to protect the anonymity of the panelists and allow them to speak freely of their past or current employers, and thus the research team did not connect any of the responses received with any panelist's individual identity. We have no information about the size of the hospitals or healthcare systems involved, the type or location of the hospitals involved, the healthcare resources available, or the culture, government, and politics of the state where their merger experience occurred. Without this context, at times it may be difficult for users to discern whether a task is applicable to their own merger experience, even if it is highly recommended or an essential recommendation. Furthermore, this was a United States-based study and therefore cannot be fully generalizable to hospital libraries in healthcare systems located in other countries.

CONCLUSION

As US healthcare systems continue to pursue expansion through consolidation, this evidence-based consensus statement fills the knowledge gap and provides hospital librarians with a roadmap from their colleagues as they adjust and acclimate the delivery of library resources and services to a newly reconstituted organization. Rather than feel isolated, the consensus statement offers hospital librarians the opportunity to consult and act upon tasks recommended by the collective experience of hospital librarians who have been through the process and learned valuable lessons about how to successfully move forward.

Moreover, we look forward to future published reporting from our colleagues about their use of the consensus statement during their merger experience, as utilization will test the recommendations reached in this study, and over time, enhance this work with a kaleidoscope of perspectives beyond that of our original panelists.

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AUTHORS CONTRIBUTION STATEMENT

Stacy Posillico: Conceptualization; Formal analysis; Investigation; Methodology; Project Administration; Resources; Supervision; Validation; Visualization; Writing – original draft; Writing - Review and Editing. Jaclyn Morales: Formal Analysis; Funding Acquisition; Investigation; Resources; Validation; Visualization; Writing – Review and Editing. Saori Wendy Herman: Data Curation; Formal Analysis; Investigation; Resources; Validation; Writing – Review and Editing.

DATA AVAILABILITY STATEMENT

Data associated with this article cannot be made publicly available because they may contain personally identifiable information. Access to the data can be requested from the corresponding author and may be subject to IRB restrictions. Study instruments are available upon request.

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SUPPLEMENTAL FILES

Appendix A: The Consensus Statement of Recommended Tasks for Hospital Librarians Experiencing a Merger or Acquisition in Their Organization

AUTHORS' AFFILIATIONS

Stacy F. Posillico, MLS, JD, AHIP-D, sposillico@northwell.edu, https://orcid.org/0000-0002-7637-387X, Senior Librarian, Eastern Region Hospitals of Northwell Health, Office of Academic Affairs, Northwell, New Hyde Park, NY and Office of Academic Affairs, New Hyde Park, NY

Jaclyn Morales, jmorales31@northwell.edu, https://orcid.org/0000-0003-0228-7546, Senior Librarian, Northwell, New Hyde Park, NY and North Shore University Hospital, Manhasset, NY

Saori Wendy Herman, saori.w.herman@hofstra.edu, https://orcid.org/0000-0002-7086-1266, Assistant Dean of Library Services, Donald and Barbara Zucker School of Medicine at Hofstra/Northwell, Hempstead, NY, and Corporate Director of Libraries, Northwell Health, New Hyde Park, NY

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Implementing a Spanish Wikipedia elective for medical students

Juli McCarroll

See end of article for authors' affiliations.

Background: Individuals seeking health information often turn to the Internet for answers. Wikipedia is a dynamic, crowdsourced encyclopedia and one of the most accessed online sources for this content. However, the Spanish Wikipedia is not nearly as in-depth as the English version, creating a large disparity. Medical students with English and Spanish proficiency possess a distinct skill set that positions them to contribute timely, trusted, evidence-based content to the platform and reduce this inequity.

Case Presentation: This case study presents the implementation of a credit-bearing Spanish Wikipedia translation elective by the library for fourth-year medical students at Western Michigan University Homer Stryker M.D. School of Medicine, currently the only Spanish Wikipedia elective in a medical school in the United States. The purpose of the course is to increase the quality and readability of medical articles in the English and Spanish versions of the online encyclopedia using evidence-based medicine (EBM) principles.

Conclusions: The output from this elective demonstrates that medical students can use their medical knowledge and skills to create and improve articles in English and Spanish on Wikipedia and disseminate evidence-based information to millions of consumers worldwide seeking reputable health information. Learners can leverage their specialized training to minimize the gap between these versions and become active participants in global health. By using technology to their advantage, they provide enduring health information that impacts and reaches many more people in a virtual setting than in a traditional one-on-one clinical encounter.

Keywords: Spanish; medical students; medical education; medical school; curriculum; Wikipedia; consumer health; public health; global health; health information seeking; crowdsourcing; open educational resources

BACKGROUND

When people need information about health-related topics, they seek answers from healthcare providers, friends and family, advertisements, social media, and search engines [1]. The internet is a fast and convenient way for anyone, including medical students, physicians, and the public, to access health information. This is especially true for individuals that experience barriers to healthcare and have unmet health needs [2,3], including those with limited English proficiency who may experience language discordance with the providers in their area. This linguistic disparity becomes evident when analyzing census data. Although Hispanic people comprise nearly 20% of the population of the United States [4] and an estimated 12% of the US population speaks Spanish at home [5,6], only 6% of physicians identify as Hispanic, and 2% of non-Hispanic providers speak Spanish [7]. Of those providers who identify as Hispanic, data is not available for the number who speak Spanish [7]. There is a large discrepancy between the number of Spanish-speaking patients and providers which creates a need for resources that address and reduce these language barriers. Fortunately, most health information seekers have access to Wi-Fi, if not at home, then at work or in community spaces such as parks, restaurants, libraries, places of worship, and public transportation. Thus, the Internet can play a crucial role in mitigating linguistic divides, especially for Spanish-speakers, who use online medical resources three times more often than English-speaking, adults [8].

When multilingual individuals request information from a health sciences practitioner, it is often taken from two sources that offer patient-facing medical information in languages other than English, including MedlinePlus, which has websites in English and Spanish [9,10], and UpToDate [11]. The first is a free service administered by the National Library of Medicine, which is part of the National Institutes of Health, and provides a medical encyclopedia and information on genetics, health topics, medical tests, medications, and supplements. The second is a paid, subscription-based point-of-care tool, and while the majority of its core clinical topics are in English, some patient education materials are available in Spanish, as are searching and navigation.

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On the other hand, when patients look for information online instead of from a provider, they often turn to Wikipedia, which is one of the most highly-accessed resources external to medical databases. It is a free, online, multilingual, openly editable encyclopedia available in nearly 350 languages, with the English version being the largest. It contains nearly seven million articles and received 130-billion-page views in 2024 [12]. A survey of health professionals revealed that 16% had edited a Wikipedia article, while 67% of their patients had consulted the website for health information [13]. This demonstrates the clear need for easily accessible online medical information on Wikipedia. Owing to its size and popularity, it can serve as a bridge between the public and reliable health resources. Although comprehensive, some articles are incomplete, mistranslated, or outdated, contain misinformation or jargon, are written at grade levels that make them difficult to understand, or have references that are behind paywalls; therefore, they could benefit from updating and editing [14–16].

The Spanish edition is not as robust as the English edition, with over two million articles and nine-billion-page views in 2024 [17]. The large difference in the number of articles on the English Wikipedia versus the Spanish Wikipedia indicates that the resource is highly skewed toward articles in English. However, despite its smaller size, the Spanish Wikipedia is likely as important as the English version for consumers looking for answers to their medical inquiries [18].

Medical students have specialized training in the Five As of Evidence-Based Medicine (EBM), which Sackett defined as the "conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" [19]. This includes asking a clinical question; acquiring evidence from reputable sources and appraising its validity, reliability, and applicability; applying the evidence to make informed decisions; and assessing and adjusting as needed [20]. Therefore, learners are uniquely positioned to contribute up-to-date, evidence-based content to this public health platform and to bridge information gaps. They do this by searching biomedical databases and retrieving relevant citations and critically appraising and applying the literature. As a result, they improve the language, layout, and content of the encyclopedic entries.

When discussing Spanish-speakers in medical education and research, it is important to note that while the term Hispanic commonly refers to people who speak Spanish or are descended from any Spanish-speaking country, Latino describes those with ancestral ties specifically to Latin America. Although distinct, they are often conflated or used interchangeably [21] These diverse origins result in the use of Spanglish and a large number of dialects, accents, and regionalisms and currently there are no recommendations for whether or how these should be incorporated into medical language education [22]. However, students can learn and use a core set of medical terms and phrases that are common and understandable across different regions, providing a useful resource that the majority of Spanish speakers will understand. Although language variations exist, it is not possible to address them all in a single elective, but learners often have multiple Spanish experiences during medical school that will expose them to diverse linguistic and cultural contexts.

CASE PRESENTATION

Implementation

In 2018, a leader at Western Michigan University Homer Stryker M.D. School of Medicine approached the library director about the possibility of creating a flexible, credit-bearing elective that could be completed virtually, particularly for students who were off cycle or travelling for residency interviews. The leader and library director were familiar with WikiProject Medicine (WPM), a group formed by health professionals in 2004 to improve medical pages on Wikipedia. It works in conjunction with WikiEdu, a non-profit organization that helps advance the relationship between academia and Wikipedia. The director responded to this request by reaching out to WPM to gather details about running a course at the school and implemented the English version, which ten students completed during the 2018-2019 academic year.

In 2019, after a successful first year, some learners talked to the library director about the need for a similar course in Spanish. They had already taken other Spanish electives at the school and wanted to enroll in more, so the library director reached out to WPM and explored the feasibility of offering the elective in Spanish. With guidance from WPM staff and a bilingual medical student, the WikiProject Medical Translation-Spanish elective was adopted, which is available to all fourth year students at any time during the academic calendar. Although there have been thousands of Wikipedia editing courses in English in the undergraduate setting, there have only been a handful in medical and health professions schools, fewer in Spanish, and currently this is the only Spanish course at a medical school based in the United States. [23–27].

Objectives

The library director took guidance from the Liaison Committee on Medical Education standards described in the Functions and Structure of a Medical School document to create the course objectives, particularly Standard 6: Competencies, Curricular Objectives, and Curricular Design, and Standard 7: Curricular Content, including Communication Skills and Structural Competence, Cultural Competence, and Health Inequities [28]. Considering this direction, three objectives were developed: improving written communication skills and

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the ability to translate documents into plain language; identifying the appropriate Spanish vocabulary and grammar for a certain health condition and setting; and evaluating consumer health information for readability and bias.

Syllabus

The WikiEdu learning management system (LMS) has a built-in weekly timeline for students to follow, listing the tasks that need to be completed each week. The content of the online timeline was converted to a PDF copy to be filed with Educational Affairs and for students who preferred this format over the digital version. It was tailored to include information specific to the school, such as the course director's contact information, course objectives, and grading criteria.

Training

A bilingual librarian took over the role of course director for the elective and prepared by completing training provided by the LMS. It included working through the Instructor Orientation Modules and the Student Training Modules; viewing videos about how to create or edit content; reviewing templates for choosing, drafting, and evaluating an article and compiling a bibliography; and viewing guides on editing, evaluating, and illustrating Wikipedia, which required a time commitment of approximately ten hours.

Selecting a Page to Create or Edit

Approximately 300 active WPM editors continuously work to improve health-related pages and provide lists of articles that need to be updated or expanded [25]. Health- and medical-related articles maintained by WPM contain more content and links, are viewed more often, and are viewed for longer periods than other Wikipedia articles [29]. Consequently, the work that students put into these entries has a relatively high pay-off. During the 4-week course, students chose one of these or selected a topic of interest and located a primary article to create or edit in Spanish or to translate from English to Spanish or the reverse. In addition, they also performed light editing of a secondary article. The course director spent approximately one hour per week supporting and assisting learners.

Grading

Course directors decide how to grade student work, and WikiEdu provides a sample rubric that was used and can be copied or customized as needed [30]. Assessment was based on improving the content of the primary and secondary articles by including sources of high-level evidence and improving the readability of the articles so that they were aligned with the health literacy level of most consumers, regardless of native language. Since overall health literacy data is generally not broken down by native language, average levels of are used. With respect to readability, since most Americans read at the 6th grade level [31], learners avoided jargon and wrote in plain, lay language whenever possible. Students used an online English or Spanish readability calculator [32,33] or the Flesch-Kincaide Grade Level Formula built into Word to determine readability statistics and the reading level of their article and adjusted it if needed. Grading was based on five components: completing the Wikipedia training modules-15%, drafting the article-20%, evaluating the article-15%, editing the secondary article-20%, and finalizing the article and moving it to the live version of Wikipedia-30%.

DISCUSSION

Outcomes

From statements that learners made during weekly check-ins and the work they completed on the dashboard, it was apparent that completing the elective helped improve their written communication skills and their ability to translate health information into plain language for consumers and potential patients. As they progressed through the course, they became better able to identify appropriate Spanish vocabulary and grammar for a given health condition and to identify issues of readability and bias when critically evaluating medical information written for consumers. This helped expand their cultural humility, or self-awareness and a commitment to ongoing learning and growth with respect to other cultures, which should allow them to communicate more effectively and build and strengthen relationships with their future Spanish-speaking patients, families, providers, and staff.

The work that the students put forth and the reliable health information they provided on their pages during the one-month course are long-lasting and have the ability to reach and impact an exponentially larger number of people than they would eventually be able to see in their practices in the future. Table 1 presents a summary of the figures associated with the primary page created or edited by each of the ten students who completed the elective from 2019-2025. Numbers were provided by and pulled from the WikiEdu LMS, which stated that the added words were estimates and may not be exact. In total, learners added 35,359 words and 245 references to their primary articles, and their pages were viewed 17,773 times in the past 30 days as of April 3, 2025. Although pre-data was not collected to measure page improvement comparisons during these academic years, it will be recorded in the future.

Course Director Reflections

In the first check-in via Teams, observations revealed students' motives for enrolling in the elective which were similar those of other researchers who write about the growing inequality between the number of Spanish-

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speaking patients and providers that find increased patient satisfaction and outcomes when physicians communicate in Spanish [34]. The course director witnessed a strong social obligation to use their medical training and bilingual language capacity to engage in global health and make health information more available to the public [7,35,36]. She also sensed that due to the Internet's immediate reach and impact, this platform would facilitate the dissemination of information to a wider audience in a significantly shorter time versus waiting until they completed their medical degrees and could communicate with patients in the more traditional in-person or telehealth appointment settings.

Table 1

Summary of Wikipedia edits.

Student	Words added to primary article	References added	Page views in the past 30 days
1	4,020	38	5,492
2	2,022	16	2,527
3	13,811	75	369
4	81	14	2,307
5	4,877	19	615
6	2,051	12	292
7	1,720	14	806
8	2,498	19	1,248
9	3,427	30	1,728
10	852	8	2,389
Total	35,359	245	17,773

During the first check-in, the course director also noted learners' attitudes and reservations about the course. Most of them had not edited Wikipedia before and seemed to be doubtful that they would be able to effectively use the wikicode markup language to successfully create and improve articles and make them live on the site. It became apparent that they wondered if there was too much to learn in a short amount of time and whether the challenge and difficulty would be worth it. There was also a risk that they might accidentally plagiarize if they did not use the technology correctly to link to the source material and that it would be harder than anticipated to write about medical topics in lay language.

In subsequent check-ins, it became clear that they found it difficult to strike a balance between making articles more comprehensive and keeping them at an appropriate reading level and to find open-access resources. However, by referring back to the tools and training provided by WPM as often as needed and with guidance and assistance from the course director, students were able to successfully create or edit a page on Wikipedia and pass the elective.

Overall, it appeared that learners were able to overcome their initial uncertainties and nearly all of them experienced the same outcomes as others across the country who had taken a Wikipedia course, including increased confidence in locating information gaps, searching biomedical databases, and searching for and selecting trustworthy literature [37]. They seemed to appreciate that the format could be completed virtually, at their own pace, wherever they happened to be, and at a time that was convenient for them. In addition, the work required each week was evenly distributed, so they knew how to budget their time accordingly. Finally, as students in Wikipedia electives at other schools have reported, they demonstrated an appreciation for using their knowledge to contribute to public health on a global scale and gave the impression of satisfaction at being able to see their work available online and track their page views in real time [7,35-38].

The course shell in the LMS and the additional resources that WikiEdu and WPM have created made this elective simple to administer and worth the effort given the students' large amount of content added, its enduring presence, and the number of page views they will receive. The content remains the same each time the elective is administered, so there is no additional time commitment required during additional terms. The course provided a unique opportunity for bilingual course directors to combine their interests in medical education and Spanish for the benefit of learners and the health information-seeking community. Monolingual instructors can consider implementing the English equivalent of the elective.

Registration has remained fairly low due to several factors. The medical school curriculum is dense and has many required elements, whereas electives are optional, so students may choose to take other electives that are offered, or none at all. In addition, the school has Academic Distinction Programs in specialized areas that students can pursue, which require additional work hours, decreasing the time available for electives. Finally, some students may underestimate their Spanish language ability and do not enroll.

Future Considerations

WikiProject Medical Translation-Spanish has been well received by students and has resulted in the dissemination of reputable health information worldwide. Going forward, schools might consider offering the course in more of the world's most-spoken languages to take advantage of learners' multilingual abilities and their desire to provide trustworthy health information to a

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broader audience. Although there have been a handful of Wikipedia medical translation courses in languages other than Spanish, they were not in United States-based medical schools and were not recent [39,40].

Some research supports Wikipedia entries and mentions as scholarly activity for faculty, equivalent to peer-reviewed articles and book chapters, with page views being a comparable metric to journal impact factor [41,42]. Schools could accept contributions to this community resource as a publication type for promotion and tenure and include them on their faculty profile pages. Students and faculty can include them in their curriculum vitae and social media pages, such as LinkedIn. Although online encyclopedia entries may be less formal and structured than other traditional publication types, they can impact consumers and patients more directly and thus merit inclusion. In addition to Wikipedia, other social media alternative article-level metrics (alt-metrics), such as mentions and citations that could be counted as academic output, include content on blogs, Facebook, news, and Twitter [16,42,43]. Given the highly online and networked nature of research today, including non-peer-reviewed scholarly content makes sense and would provide a broader and more inclusive representation of publication activity and value compared with the traditional, more restrictive model.

CONCLUSION

Unlike print encyclopedias of the past, Wikipedia is constantly evolving and relies on editors to create and update its content for consumers worldwide. Editors do not have to be well-known or eminent figures in their fields of study. Rather, they need the requisite subject expertise and desire to advance global health. The impact and reach of this reputable content are crucial for bridging the gap between the public and the health information they seek to access. Implementing this elective and highlighting students' ability to provide reputable consumer health information has created a symbiotic relationship between learners and consumers, where the former strengthen their EBM skills by increasing the quality and readability of medical articles, and the latter are beneficiaries of high-quality, vetted medical information.

AUTHOR CONTRIBUTIONS

Juli McCarroll: Conceptualization, Writing-Original Draft, and Writing-Review & Editing.

DATA AVAILABILITY STATEMENT

No data are associated with this project.

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AUTHORS' AFFILIATIONS

Juli McCarroll, juli.mccarroll@wmed.edu, https://orcid.org/0000-0002-5361-6912, Assistant Professor, Department of Medical Library, Western Michigan University Homer Stryker M.D. School of Medicine, Kalamazoo, MI

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Book Club at a medical school in the Sertão Region of Rio Grande do Norte State, Brazil

Amanda Lima Sampaio; Álida Silva; Yasmin Limão; Lehi Bezerra; Janine Braz

See end of article for authors' affiliations.

Background: The integration of literature and the humanities into medical education offers numerous benefits for both students and the broader community. Engaging with literary texts encourages the development of empathy, critical thinking, emotional awareness, and communication skills, all essential for a more humanistic and socially responsive medical practice. Additionally, initiatives that bring together students and local residents through shared cultural experiences help strengthen the university's connection with the surrounding community and promote mutual understanding. The Book club was created at the medical school in Caicó (RN, Brazil), as a space to explore diverse literary works beyond the health sciences.

Case Presentation: The Book Club was approved as an extension event and is promoted in Escola Multicampi de Ciências Médicas do Rio Grande do Norte (EMCM) by the Pro-Rectory of Extension from Universidade Federal do Rio Grande do Norte (UFRN) situated in Caicó city (RN, Brazil). It has a multidisciplinary team of students, teachers and technical staff. Six literary works were selected based on the alignment with the club's educational goals, particularly the potential to stimulate critical reflection on themes such as grief, racism, gender, and social justice. Registration took place through the Integrated Academic Activities Management System, and the monthly meetings were held in the Medical School auditorium. Participants received pedagogical support via social networks, club app, reading planner and newsletter.

Conclusions: With 22 participants, including 8 community members and 14 medical students, the Book Club explored perspectives such as gender, racism, grief, trauma and colonialism. The predominance of medical students highlights academic interest and institutional support in extension projects, while low community adherence points to the need for new engagement strategies. The analysis of followers on Instagram reveals a significant participation of the local population, especially among women, but also highlights a gap in the presence of men and adolescents. This demonstrates the importance of a more inclusive and diverse approach to attracting different audiences. The Book Club at the public Medical School, by stimulating cognitive and human skills through literature, enriches academic training and strengthens the connection between academia and the community.

Keywords: Medical Education; Book Club; Humanistic Medicine; Literature in medicine

BACKGROUND

Medical training has traditionally followed a predominantly scientific curriculum; however, as the concept of health has evolved to include psychological and social dimensions, the scope of medical practice has also needed to expand [1]. These changes in practice have gained strength in Brazil from the changes in the National Curriculum Guidelines (DCN). In 2001, the DCN first proposed the human and social sciences as core elements within medical curriculum, a position which was subsequently strengthened in 2014 [2].

Humanities education for medical students has been found to be have many benefits [3]. This integration helps medical students develop greater sensitivity and a more comprehensive understanding of human experiences in healthcare [4]. It also fosters essential skills beyond technical knowledge, such as empathy, openness to uncertainty, and more nuanced clinical judgement [5]. Beyond improving care, these skills can also support mental health of students, an increasingly important concern, as emotional exhaustion and career-related discouragement are commonly reported throughout medical training. [6]. Humanities can be introduced through extracurricular activities that reflect the diverse interests contributing to medical education [7] and practice. Reading and reflecting on literature and poetry, for instance, can enhance a doctor's professional effectiveness by nurturing cognitive and emotional abilities.

Literary narratives, as both artistic expressions and sources of knowledge, play a role in the educational and professional growth of students. Such works can offer a foundation for discussion and reflection, with meanings that resonate differently based on each reader's

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perspective and lived experience. In a medical context, an individual patient's narrative about their illness process can often reveal more information and truths than solely scientific approaches [8].

To insert narratives in an academic context, reading clubs are a pedagogical strategy [9,10]. These collective spaces for interaction and dialogue about literary works create an environment conducive to the development of skills that enrich the student's experience with the medical curriculum. In addition, reading clubs promote the development of fundamental skills for a humanized professional practice that is sensitive to the health needs of the population [9]. Empathy is developed by allowing readers to put themselves in the shoes of diverse characters, understanding and feeling their emotions. Communication (verbal and written) is improved through discussions [9].

The benefits extend beyond students and physicians to the broader community, promoting critical thinking, reflection, and literacy [11]. Such initiatives also serve as effective tools for outreachand strengthening the university's community engagement. Therefore, the objective of this work is to describe the process of creation and implementation of a Book Club in a Public Medical School.

CASE PRESENTATION

The Escola Multicampi de Ciências Médicas do Rio Grande do Norte (EMCM), Federal University of Rio Grande do Norte (UFRN), was established in 2014 to address the urgent need to expand access to medical education in rural regions [12]. Its mission is to train physicians to work in underserved and rural areas, respecting the health, ethical, and cultural values of local communities. Approximately 280 students are currently enrolled in the medical program, distributed across all years of study.

Within this context, the Book Club was approved and funded by the Pro-Rectory of Extension, a department within the university responsible for managing and promoting community engagement and extension projects. The Book Club took place at the Medical School in a large auditorium with a capacity of about 50 people. Fourteen of the 22 Book Club participants were medical students, representing 63.6% of the total cohort and approximately 5% of the medical student body [13].

This research was classified by the project team as a public opinion study, with no possibility of identifying the participants, since data was collected anonymously and voluntarily. Therefore, in accordance with Article 2, item XIV of Resolution No. 510/2016 of the Brazilian National Health Council, submission to the CEP/Conep System (Research Ethics Committees and the National Research Ethics Commission - Conep) was not required [14].

Formation of the Team

The Book Club team was formed with the primary objective of integrating literary discussions into the medical curriculum and promoting a dialogue between academia and the community. The selection of team members was based on their demonstrated interest in literature and willingness to contribute to the project. The team consisted of six first-year medical students, two professors, and one librarian. This team was responsible for planning and facilitating the activities for the 22 Book Club participants. The predominance of students reflects the Book Club's role as a space for extracurricular engagement and peer-led activities, while the presence of faculty and the librarian ensured academic rigor and intentional community outreach. The selection process was interest-driven rather than an institutional assignment, aiming to create a team passionate about humanistic approaches to health education.

In addition to the interdisciplinary structure of the team, the active involvement of the medical school librarian was crucial to the project success. Acting as deputy coordinator, the librarian contributed to the strategic planning of the Book Club and led efforts to build an accessible and inclusive literary collection, including direct contact with publishers to obtain books at reduced prices. Beyond these responsibilities, the librarian co-facilitated reading discussions and developed partnerships with librarians from other cities, fostering inter-institutional engagement. This role exemplifies how medical librarianship transcends administrative tasks, positioning the librarian as an agent of community outreach and humanistic education.

To ensure the cohesive functioning of the Book Club, tasks related to specific activities were distributed in pods, each with its respective representatives and assignments. The team planning meetings took place in person every fortnight to discuss the activities carried out by each pod, evaluate internal proposals and ongoing actions related to the Book Club's implementation, and coordinate the upcoming meetings. The pods formed were coordination, organizational, communication and scientific dissemination, and products.

1. **Coordination Pod**

This team was responsible for the development and submission of the initial Book Club project proposal to the Pro-Rectory of Extension of the University, for the development of the calendar of activities and the management of the other teams.

2. **Organizational Pod**

This team carried out managing the space for the meeting's reservation and organization, including the chairs arrangement, projection images, and participants' reception.

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3. **Communication and Scientific Dissemination Pod**

The team conducted the necessary research for writing scientific papers and publications, academic materials, abstracts for congresses, and journalistic releases. This pod was created to ensure that the activities and outcomes of the Book Club could contribute to academic discourse and institutional visibility. The dissemination of the project's results was included as a goal in the initial proposal, highlighting its potential as a model for similar educational and community engagement initiatives.

4. **Products Pod**

This pod executed the production of the Book Club outreach materials, including posts and stories for Instagram (Meta). In addition, the team created the Book Club planner, records of the meetings, and maintains the Newsletter and the Book Club app.

Selection of Works

To ensure equitable access to the selected books, the organizing team prioritized titles available in digital formats and negotiated with publishers to obtain complimentary or discounted copies. The university library supported this initiative by incorporating some of the selected works into its collection. No participant was required to purchase a book to participate in the discussions, ensuring that financial limitations would not be a barrier to engagement.

The works selected for the Book Club were chosen through a process of research and consultation with experts in the fields of sociology, anthropology, and education. Initially, fifteen book options were compiled which addressed essential and relevant topics for public and academic debate, including racism, gender, violence, grief, and colonialism. This resulted in the final selection of six works (Table 1). The selection of the final six books was carried out based on criteria such as attractiveness for the Book Club's target audience, critical reception, and text length—favoring those under 300 pages. Special attention was given to the accessibility of the books, including the availability of digital formats and affordable pricing (ideally under R$50 or US$9.16), to facilitate acquisition by the library and to support broader availability for those who wished to purchase their own copy. The list of readings for the 2023 Book Club can be found in Table 1.

Table 1

Selected works for the 2023 Book Club.

Book	Author	Thematic
"The Dark Side of Skin"(15)	Jeferson Tenorio	Racism; police violence
"Happening"(16)	Annie Ernaux	Abortion; law and its imperative on female bodies
"The Year of Magical Thinking"(17)	Joan Didion	Death; grief
"Crooked Plow"(18)	Itamar Vieira Junior	Violence against women; enduring slave practices; poverty; violence; racism
"In the Eye of the Wild"(19)	Nastassja Martin	Complexity of life; construction of empowering narratives
"The Sound of the Jaguar's Roar"(20)	Micheliny Verunschk	Indigenous peoples; civilizational theory

These literary works stand out for the depth with which they address fundamental themes of the human experience, especially regarding racism, gender, grief, trauma and colonialism. By exploring the lives of Black people in Brazil, the books "The Dark Side of Skin" by Jeferson Tenório [15] and "Crooked Plow" by Itamar Vieira Junior [18], encourage a more empathic and critical understanding of the racial issues that permeate Brazilian society. Annie Ernaux's "Happening" [16] and Joan Didion's "The Year of Magical Thinking " [17] offer deeper perspectives on the female body and grief, respectively, stimulating recognition of the importance of dignity, autonomy and individuality in the processes of illness and healing. Nastassja Martin's [19] narrative in "In the Eye of the Wild" underscores the power of personal history and resilience, showing how emotional and psychological context is an integral part of a person's treatment and recovery. Finally, Micheliny Verunschk's "The Sound of the Jaguar's Roar" [20] confronts participants with the history of colonial violence, encouraging reflection on the historical and cultural impacts on the health of Indigenous populations.

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Implementation of the Book Club: start of activities

Once the planning phase was completed, the Book Club began its activities and expanded the diversification of participants with the Book Club's dissemination strategies.

Social media: Instagram (Meta)

The public announcement of the Book Club after the completion of the planning stage was crucial to start activities. For this reason, publicly, the beginning of the Book Club was marked by the creation of a profile on the social network Instagram (Meta), a platform widely used by the general public (Figure 1A). This network was a key tool for sharing content and reaching the target audience. Instagram (Meta) plays a key role in the dissemination of the Book Club, both to the internal community of the college and to the external public[21].

Posts on Instagram (Meta) began a month before each meeting so that participants had time to read the selected work. The first post included detailed information about the meeting: location, date and time, as well as the title of the chosen work (Figure 1B). Then, the opening of the inscriptions was disclosed (Figure 1C). Subsequently, two new publications presented a mini-biography of the author (Figure 1D), and indications of complementary readings to the theme addressed by the book of the month (Figure 2E). In this way, we sought to encourage interest in the universe of works selected from constant and strategic information.

Registration

Book Club registration was conducted through the University's system and remained open for four days following the public announcement. After the end of the registration period, the club staff sent an email to all registrants to confirm the date, time and place of the meeting. In addition, the email provided a link to access the Book Club app and the reading planner of the month, developed exclusively for participants.

Club App and Planner Notebook

The app for the Book Club was developed in the Glide Apps®. The app provides several features, including a brief account of the history of the Book Club, presented by a fictional character named Anna Karenina (Figure 2A). Participants also had access to the list of books of the year, available for consultation in the virtual environment. In addition, the app included an interactive chat, allowing for the exchange of information between participants and Book Club staff. In this space, it was possible to discuss the readings, to ask questions related to the meetings and share recommendations for literary and non-literary content relevant to the topics addressed. In addition, a planner was available to help participants organise their reading schedule, reflect on key themes, and track their progress through the selected books (Figures 2B). This planner contained spaces for listing important themes addressed by the work, recording striking phrases and a space for the reader to take notes freely (Figures 2C).

Figure 1 Communications of the meetings for all communities. A) Book Club page on Instagram (META). B) Post with the data (date, time and place). C) Publication of the opening of registrations. D) Post a mini-biography about the author of the book. E) Post with an indication of complementary readings to the theme of the month.

Clube de Leitura EMCM/UFRN

Espaço organizado e mantido por professores e alunos da EMCM/UFRN entusiastas da literatura.
Sejam muito bem-vindos 📚💚... mais
Ver tradução

linktr.ee/clubedeleituradaemcm

Seguido(a) por leniledalima, buenogis e outras 117 pessoas

O ANO DO PENSAMENTO MÁGICO
Autor: Joan Didion
Dia: 06/06/2023
Horário: 18h30
Local: sala 181 EMCM
CLUBEDELEITURAEMCM

FOI UMA JORNALISTA, ROMANCISTA, MEMORIALISTA, ENSAÍSTA E ROTEIRISTA QUE ESCREVEU ALGUMAS DAS ANÁLISES MAIS NÍTIDAS E EVOCATIVAS DE CULTURA, POLÍTICA, LITERATURA, FAMÍLIA E PERDA. ELA GANHOU O NATIONAL BOOK AWARD EM 2005 POR O ANO DO PENSAMENTO MÁGICO

"Eu escrevo inteiramente para descobrir o que estou pensando, o que estou olhando, o que vejo e o que isso significa."

"Altos voos e quedas livres"

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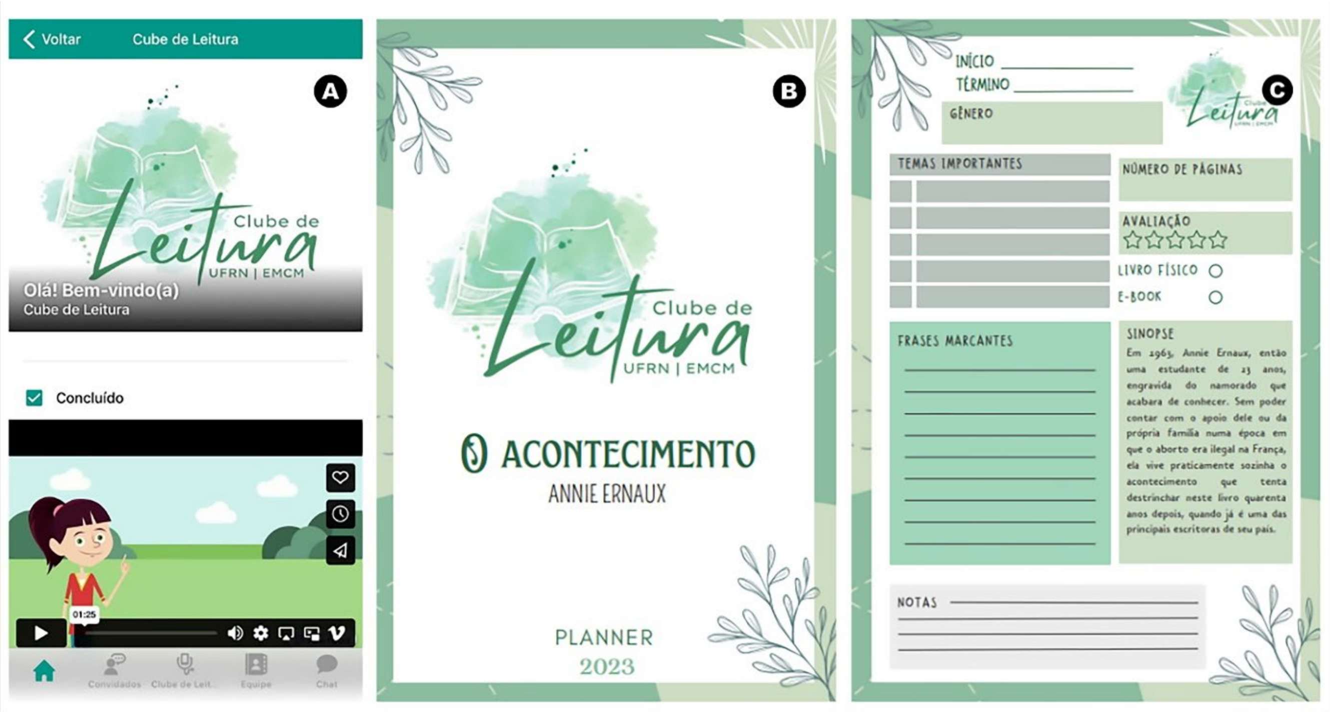
Figure 2 Mobile application. A) Home page of the Book Club App, in which the project is presented by the fictional character Ana Karenina. B) Planner cover. C) Contents of the club planner for reading the book "Happening"(1991).



Em 1963, Annie Ernaux, então uma estudante de 23 anos, engravida do namorado que acabara de conhecer. Sem poder contar com o apoio dele ou da própria família numa época em que o aborto era ilegal na França, ela vive praticamente sozinha o acontecimento que tenta destrinchar neste livro quarenta anos depois, quando já é uma das principais escritoras de seu país.

Book Club Meetings

The Book Club meetings were held monthly, resulting in 6 meetings, in which each month a literary work selected by the team would be discussed. The average duration of the meetings was 90 minutes and each concluded with a brief period of informal socialization among participants. During the meetings, a slide was projected, featuring thematic elements such as color palettes, quotes, and highlights designed to evoke the atmosphere and core themes of the book under discussion. Besides, discussion circles promote open communication, where all participants feel equally valued and encouraged to share their perspectives [22]. The arrangement of the chairs in a circle during the meetings was chosen as a pedagogical strategy, since it contributed to the University and community working together, in contrast to the ineffective tradition of the first acting on the second unilaterally and imposing their beliefs and opinions [23].

The meetings followed a structured sequence of activities. Initially, an introduction to the work was presented, which included a summary, the political and social context at the time of publication, and a brief biography of the author. This stage had an average duration of 10 minutes. Then, the discussion was opened to the participants, who shared their opinions, ideas and personal experiences, enriching the group with multiple perspectives on the same work. The discussion lasted approximately 1 hour. Finally, the last 20 minutes were dedicated to a brief period of informal socialization among participants, often accompanied by a small snack.

DISCUSSION

Reading clubs are a pedagogical initiative to integrate not only the humanities into the health curriculum, but also to create closer dialogue between the University and community. As in other regions of Brazil, the region of Sertão, needs this kind of dialogue between future doctors and the local community to foster mutual understanding, promote empathy, and encourage more effective communication. This exchange helps medical students to better understand the cultural, social, and economic realities of the populations they will serve, while also empowering community members to actively participate in health-related discussions. In this work, we aim to describe the process of creating and implementing a reading club in a medical school in the Brazilian Sertão.

In 2023, the book club received 46 applications, with 22 participants, of whom 64% were medical students and 36% were members of the community. The participation of medical students reflects their interest in extracurricular activities that complement academic training. For students, this highlights the value of initiatives that go beyond clinical training to support interpersonal skills and personal growth, contributing to a more well-rounded and humanistic medical education [9].

For the community, the meetings at the college itself were a plan of rapprochement between academia and the local population, making the institution feel more accessible and welcoming [24]. By eliminating perceptions of hierarchy, the environment becomes inclusive, facilitating an open and constructive dialogue among participants [25]. However, given the low community participation, it is necessary to implement new strategies, such as increasing financial resources for Federal University extension initiatives and including the community in the decision-making process of the projects in which they are involved. Although no formal target was established, the team had anticipated greater interest from the local population, aiming for more balanced participation between academic members and the broader community. This challenge is consistent with previous observations in the literature, which highlight the barriers that socially excluded communities often face in engaging with higher education initiatives. [26].

Before the face-to-face meeting, the participants had access to the chat, the reading planner and the social networks of the Book Club. In the interactive chat on the app, the participants shared recommendations for literary and non-literary content relevant to the topics covered. Something similar happened on the Book Club's social media; however, in this case, the content was publicly accessible to both participants and non-participants. The use of digital resources promotes the integration and engagement of members, facilitating access to a variety of materials and enriching discussions with diverse perspectives [27]. These resources allow for more agile and dynamic communication, potentially expanding the reach and influence of the Book Club. The reading planner, on the other hand, assisted participants in managing their time and monitoring their progress in reading, providing a more structured and engaging experience [28].

The network of readers created through the Book Club's Instagram (Meta) profile showed significant interest from the local population. Metrics from the page revealed that out of 282 followers, the majority were residents of the surrounding region, indicating strong community engagement. This suggests that the club's themes resonate locally and that the initiative may serve as an effective educational strategy to promote reading in a region where only 48% of the population reports having read at least one book in the past three months — a historical challenge in the Northeast of Brazil. [29].

In addition, throughout the implementation of the Book Club, it was observed that most participants belonged to the 25–34 age group. This contrasts with findings from the 2019 Pro-Book Institute (IPL)[29] survey, which identified children and adolescents (11–17 years old) as the most active readers in the country. This discrepancy may stem from several factors, such as the thematic choices and language used in the Book Club, which might not yet fully attract a younger audience.

In our Book Club we had more adults present than adolescents; however, their engagement was still limited by competing responsibilities and time constraints, which are common among individuals aged 18 to 60 [30]. Therefore, it is important to continue diversifying the selected works and formats to ensure accessibility and appeal across different age groups within the community.

Besides, while the Book Club's primary audience was university students and adult community members, there had been hope that some younger readers might also join. The absence of adolescents may be related to the complexity of the selected books, which addressed mature themes such as grief, racial violence, and colonial trauma. In addition, the Book Club did not implement marketing strategies specifically aimed at youth, nor does the medical school currently have an outreach program targeting adolescents. Future iterations may consider including youth-friendly genres, such as fantasy or young adult literature, and forming partnerships with local schools to encourage broader participation.

In relation to gender, it was noted that women showed greater interest and engagement in the Book Club activities. This trend aligns with the findings of the IPL survey [29], which highlights a stronger participation of women in reading practices. Historically, this pattern can be linked to the limited access women had to public life and the labor market, which made reading one of the most accessible cultural and leisure activities [31]. Despite social advances, women continue to be more engaged in literary initiatives. The selection of books by the club, which often addressed themes related to female experiences and perspectives, may have contributed to this strong female participation. At the same time, these themes encouraged meaningful contributions from male participants, who engaged in the discussions from different viewpoints, thereby enriching the dialogue with diverse gender perspectives.

Although no formal survey was conducted in the first iteration of the Book Club, anecdotal feedback from participants highlighted the importance of the meetings as safe spaces for expression and reflection. Some participants described the discussions as "therapeutic" and "essential for seeing the world beyond the hospital walls." These informal accounts reinforced the role of the Book Club as a supportive environment for developing humanistic skills.

The Book Club project proved to be a powerful strategy for integrating the academic and external community, strengthening bonds and fostering critical discussions through literature. The experience of in-person meetings revealed the transformative potential of open dialogue

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between students and community members, highlighting reading as a tool for empathy, active listening, and civic development. Since its implementation, the Book Club has evolved and expanded beyond its initially intended audience. The Book Club continued beyond its initial cycle in 2023, expanding to new audiences, such as elderly community members and children in public schools. While data from subsequent cycles is still being collected and compiled for future analysis, preliminary observations suggest a broader demographic reach and growing engagement. A comparative study is planned to assess the evolution of participation and thematic focus over time.

What makes this Book Club project unique is its implementation within a public medical school located in a rural region of Brazil, designed not only to humanize medical education but also to create a sustained bridge between academia and the surrounding community through literature. The specific goals of the project were to promote critical reflection, encourage empathy and communication among medical students, and strengthen the university's social engagement. These goals were achieved, as evidenced by the active participation of students and the university extension project to broader audiences, including the elderly and children in later editions.

For those interested in developing similar initiatives, we recommend building a multidisciplinary team with diverse skills and fostering strong institutional support from university departments and libraries. It is important to consider local context, accessibility of materials, and inclusive outreach strategies. The contribution of each participant was vital: students brought enthusiasm and creativity; professors provided academic rigor and mentoring; and the librarian offered expertise in content curation, logistics, and inter-institutional partnerships, ensuring equitable access to books and acting as a cultural mediator. This synergy demonstrated how interdisciplinary collaboration can transform reading into an educational experience that also fosters social engagement and emotional connection.

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AUTHOR CONTRIBUTIONS

Amanda Sampaio: Conceptualization; Data Curation; Methodology; Project Administration; Supervision; Writing – Original Draft; Writing – Review & Editing. Álida Silva: Data Curation; Methodology; Resources; Visualization; Writing – Original Draft; Writing. Yasmin Limão: Writing – Original Draft; Writing – Review & Editing. Lehi Bezerra: Conceptualization; data curation; formal analysis; writing - original draft; writing - review & editing. Janine Braz: Project Administration; Formal Analysis; Supervision; Writing – Original Draft; Writing – Review & Editing

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There is no data associated with this article.

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AUTHORS' AFFILIATIONS

Amanda Sampaio, amanda.sampaio.096@ufrn.edu.br, https://orcid.org/0009-0001-9905-1080, Escola Multicampi de Ciências Médicas do RN and Undergraduate Student, Universidade Federal do Rio Grande do Norte, Brazil

Álida Silva, alidaandrielly13@gmail.com, https://orcid.org/0009-0004-4964-9705, Escola Multicampi de Ciências Médicas do RN and Undergraduate Student, Universidade Federal do Rio Grande do Norte, Brazil

Yasmin Limão, ymaria050@gmail.com, https://orcid.org/0009-0000-2745-2961, Escola Multicampi de Ciências Médicas do RN and Undergraduate Student, Universidade Federal do Rio Grande do Norte, Brazil

Lehi Bezerra, lehi.aguiar@ufrn.br, https://orcid.org/0000-0002-9087-8743, Escola Multicampi de Ciências Médicas do RN and Librarian, Universidade Federal do Rio Grande do Norte, Brazil

Janine Braz, janine.braz@ufrn.br, https://orcid.org/0000-0002-9570-6465, Escola Multicampi de Ciências Médicas do RN and Adjunct Professor, Universidade Federal do Rio Grande do Norte, Brazil

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ORIGINAL INVESTIGATION

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Guide to sound teeth: a syllabus-informed instructional session to provide targeted insights into the history of dentistry

Jessica R. Hollister; Keith Mages; Thomas Murphy; Meelin Dian Chin Kit-Wells

See end of article for authors' affiliations.

Background: This case report details an exploratory instructional session for dental students led by librarian-instructors at the University at Buffalo. Using historical source materials from the Robert L. Brown History of Medicine Collection, an hour-long session was developed to introduce year-one dental students to the history of their profession and its ongoing collaboration with important clinical populations.

Case Presentation: At the request of course faculty, the University at Buffalo's Dental Liaison Librarian, History of Medicine Curator, and History of Medicine Archivist were invited to develop and lead a session on the history of dentistry for a first-year course, Profession, Practice, and Community Dentistry (PDO 801). A core feature of this course is the introduction of students to eight underserved dental patient populations—referred to as "communities of focus." To supplement student learning, library staff utilized the holdings of the Robert L. Brown History of Medicine Collection to bring together stories, artifacts, and printed materials that spoke not only to the history of the profession, but also to the history of the communities of focus. Thought prompts were developed to guide students during a textual analysis activity that analyzed representative materials.

Conclusions: Overall, this interdisciplinary collaboration provided the opportunity to develop and implement a syllabus-informed historical instructional session that offered targeted insights into dentistry's past. Through guided discussions, hands-on exploration, and textual analysis of historic materials, instructors worked to inspire and educate participating dental students as they progress further along their path as providers of patient-forward care.

Keywords: Dental history; Medical humanities; Interdisciplinary collaboration; Dental students

BACKGROUND

Subject librarians to health sciences schools at academic institutions are uniquely positioned to form relationships with health sciences faculty and incorporate medical humanities pedagogies into health sciences curriculums [1, 2]. As repositories of historic primary source materials, special collections are also well suited to enable impactful, perhaps unexpected, discussions among health sciences students [3]. Together, academic libraries and special collections can support interdisciplinary approaches to medical humanities by providing physical and intellectual neutral spaces to facilitate more meaningful conversations beyond the influences of traditional departmental contexts [4]. The University Libraries system at the University at Buffalo consists of a liaison structure wherein librarians provide subject-specific services to departments and schools at the university, including a Dental Liaison Librarian to the School of Dental Medicine. Beyond that, the University Libraries is home to multiple special collections, such as the Robert L. Brown History of Medicine Collection. Building off the existing literature, the University at Buffalo's Dental Liaison Librarian [JH] and the Curator [KM] and Archivist [TM] from the Robert L. Brown History of Medicine (HoM) Collection collaborated with a Clinical Assistant Professor of Pediatric and Community Dentistry in the School of Dental Medicine [CKW] to design a syllabus-informed session introducing first-year dental students to selected facets of dentistry's professional history.

Initial conversations began at an informational booth operated at the 2024 Buffalo Niagara Dental Meeting. Staffed by JH, KM and TM, the booth featured a sampling of historical dental artifacts from HoM, including hand-painted lantern slides from the New York State Department of Education, a "Compound Magneto-Electric Machine" (purportedly able to painlessly extract teeth), thumb-operated dental drill, and a dental pelican and tooth key (historic extraction tools). These artifacts facilitated an engaging discussion with CKW, a meeting attendee, and culminated with an invitation for JH, KM, and TM, to infuse historical conversations into CKW's

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Profession, Practice, and Community Dentistry (PDO 801) course.

CASE PRESENTATION

Overview of Course and Session

A key feature of *Profession, Practice, and Community Dentistry* (PDO 801) is early student exposure to clinical sites and patient care. Through this course, students are introduced to eight dental patient communities of focus (see *Table 1*). As part of their learning, students visit area clinical sites related to each of these communities. It was decided that the HoM would be included among these visited clinical sites. After gaining familiarity with the course syllabus, and the communities of focus, JH, KM, and TM designed a session that would feature historical dental materials aligned with stated course objectives and communities of focus.

Table 1

Communities of Focus

Community Name	Community Description and Key Oral Health Topics
Pre- and post-natal community	Concerns both parents and babies before and after childbirth and into early childhood. Sometimes includes extended caregivers. E.g., pregnancy gingivitis; maternal oral health; infant teething; non-nutritive sucking behaviors; Early Childhood Caries (ECC); person-centered, compassionate care.
Adolescent community	The period of accelerated biological growth, changes, and social role transitions between childhood and adulthood. E.g., dental caries; poor oral hygiene; dental anxiety; desire for esthetics; oral piercings; substance use; sexual health considerations; eating disorders; person-centered, compassionate care.
Intellectual and Developmental Disabilities community	Intellectual and Developmental Disabilities (IDD) are conditions that begin early in life and affect learning, communication, daily living skills, or physical development. E.g., oral hygiene capacity; dental caries; xerostomia; sensory, behavioral, communication, and mobility considerations; dietary habits; caregiver education; person-centered, compassionate care.
HPV medically compromised community	Individuals whose immune systems or overall health make them less able to fight infections, including the human papillomavirus (HPV). E.g., risk of HPV; preventative care; vaccination education; caregiver education; sore monitoring; person-centered, compassionate care.
Elderly and aging community	Adults, typically 65 years or older, whose health, mobility, or daily living abilities may change as they age. E.g., xerostomia; dental caries; gum disease and inflammation; oral cancer; medication interactions; cognitive decline; accessibility needs; person-centered compassionate care.
Native American community	Diverse groups of Indigenous peoples of the United States. E.g., ECC; barriers to access; water fluoridation; diabetes; periodontal disease; tobacco use; oral cancer; person-centered, compassionate care.
Refugee community	Individuals and families who have been forced to flee their home country due to war, violence, persecution, or threats to human rights and who cannot safely return. E.g., dental caries; barriers to access; trauma and stress; communication, cultural, financial, and language considerations; oral health literacy; dental anxiety; person-centered, compassionate care.
Homeless/ unhoused community	Individuals and families who lack stable, safe, and consistent housing. E.g., barriers to access; untreated oral diseases and infections; pain management; xerostomia; substance use; oral cancer; person-centered, compassionate care.

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Ultimately, an hour-long session with the following objective was developed:

> Students will be introduced to the history of dental practice, with a particular focus on community outreach. Using historic books, artifacts, and archival collections, participants will be exposed to a variety of materials from the HoM collection and will work with facilitators to better understand how historical practices continue to impact contemporary dentistry.

To accommodate the course structure and total number of students, four identical sessions were held, with individual students attending on specific dates within their assigned group. Using this model, each student was able to visit the HoM once during the 2025 Spring Semester. Every session, students separated into groups for two stand-alone learning components, run simultaneously. Half of participants began their experience in the HoM's reading room for a tour and general overview of dental history [KM]. The second group of students began with a hands-on analysis of historical texts related to the course's communities of focus [JH, TM]. After 30-minutes, students switched locations, ensuring that everyone experienced both the museum tour and the textual analysis.

Resources Selected

Building upon discussions with course faculty and the session objective, the HoM staff [KM, TM] worked to identify topical historic materials held within the collection. As the session consisted of two stand-alone components, two distinct sets of historic materials were selected. The first series of items were artifacts, archival, and printed materials meant to broadly illustrate the history of dentistry. Among those included were antique tooth-extraction instruments, such as dental pelicans and tooth keys, classic images and texts in the history of dentistry, such as Jan H. Steen's 17th c. etchings *The Charlatan* and *The Dentist* [5, 6]. Also featured was a stereoscope accompanied by stereographs from Cryer, Cunninham, and Waterston's *Dental Stereoscopic Dissections of the Head and Neck* which represented a novel, early-modern mode of dental education [7]. See *Table 2.1* for an overview of items selected to illustrate the general history of the profession [5-26].

The second series of selected items were historic source materials to be specifically analyzed by participants. Towards this end, representative items reflecting each of the course's eight communities of focus were investigated. Unfortunately, the special collections team was unable to identify holdings specifically related to the provision of dental care to the unhoused or refugee populations.

Historic sources related to all other populations of focus were identified and made available for textual analysis. Among items selected for analysis were Dr. Henry A. Cotton's (1921) *The defective, delinquent, and insane; the relation of focal infections to their causation, treatment, and prevention*, Klein & Palmer's (1938) report for the U.S. Office of Indian Affairs, *Dental Caries in American Indian Children*, and the inaugural issue of the *Bulletin of Academy of Dentistry for the Handicapped* (1963-4), published by the eponymous professional organization [18, 22, 25]. See *Table 2.2* for an overview of materials consulted by students.

Structure of Sessions and Pedagogy

Upon arrival, students were separated into two sections. Groups that began with the HoM component were first provided with a general overview of the collection. This included discussions on the founding of the University at Buffalo (1846) and the School of Dental Medicine (1892). Historic illustrations and photographs depicting the exterior and interior spaces of the university during these early eras were shown. Following this, a tour of the closed stacks was provided.

Next, students were brought into an adjacent instructional space to learn more about the history of dentistry as a profession, centered around the objects presented in *Table 2.1*. The spectacle and methods of pre-modern tooth extraction were illustrated with study of 17th century etchings and contemporary extraction instruments such as dental forceps and pelicans. The evolution of dental education and outreach was touched upon with discussions regarding early licensing examinations, the dental dissection stereographs, and hand-colored glass plate slides from the New York State Department of Education depicting school children demonstrating proper brushing techniques. Several of these items were the same as those highlighted at the Buffalo Niagara Dental Meeting, described above, as they were well received at that event. Afterwards, students explored the collection on their own, as the instructor [KM] alerted the concurrent session instructors [JH, TM] that they were ready to switch groups.

During the textual analysis component, students were led to the HoM conference room space, which included an exhibit of an early 20th century dental clinic. Here, students were invited to choose a seat at the conference table aside 1 of 9 pre-selected historical source materials (see *Table 2.2*) pertaining to the communities of focus outlined in the syllabus (see *Table 1*). Inspired by Mages and Lohr's medical humanities seminar, students were then oriented to the historic textual analysis activity structure: 12 to 15 minutes to analyze the source in front of them either individually or in small groups (left to student choice), followed by a 12 to 15-minute, moderated, full group discussion wherein students introduced their source and offered any insights or observations [3].

During this component, students were reminded that they would not be able to thoroughly review an entire source in the given time, however they were invited to consult a

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Table 2

Overview of Historic Materials Selected for Session

2.1: Materials Selected to Illustrate the History of Dentistry as a Profession	
Goepp, R. M. (1922). *Dental state board questions and answers*. Philadelphia, PA: W. B. Saunders Company.	Dental State Board questions and answers collected over the years from various dental journals, which are representative of questions asked by the State Board of Examiners in the United States.
Cryer, M. H., Cunningham, D. J., Waterston, D. (c.1900). *Dental stereoscopic dissections of the head and neck*. Meadville, PA: Keystone View Co.	A volume of stereoscopic cards that each showcase a different pair of images and descriptions that are designed to be placed into a stereoscope.
Stereoscope (early 20th c.). For viewing above.	An optical device designed to create the illusion of depth by presenting 2 slightly different images, so the brain combines them into a single 3-D image.
James, B., Callender, C., Buckingham, J. T. (1814). *A treatise on the management of the teeth*. Boston, MA: Charles Callender.	The first full-length book on dentistry published in the United States, and the first with a dental illustration.
Hunter, J., & Johnson, J. (1778). *A practical treatise on the diseases of the teeth : intended as a supplement to the natural history of those parts*. London, J. Johnson.	Early dentistry text concerning human teeth.
Tooth Extraction Instruments: Forceps (18th c.), Pelican (late 18th c.), Tooth Key (19th c.).	Forceps: A grasping instrument used to pull teeth. Pelican: A tool that was an improvement over the forceps with two claws and a two-sided hammer that acted as a lever to pull teeth. Tooth Key: A further advancement, this tool, which resembles a door key, provides greater leverage for faster extraction.
Visual depictions of historic tooth extractions; mounted, reprinted images included: Jan H. Steen. (c.1650). *The Charlatan*. Rijksmuseum, Amsterdam, Netherlands. Jan H. Steen. (1651). *The Dentist*. Royal Picture Gallery, The Hague, Netherlands. Gerard Dou. (1672). *Der Zahnarzt*. Gemäldegalerie Alte Meister, Dresden, Germany. David Teniers. (c.1660). *Der Zahnarzt*. Royal College of Surgeons of Edinburgh, Edinburgh, UK.	Prints of paintings depicting dentists extracting teeth, used to show both the perception of dentists and the brutality of extraction.
Dental Lantern Slides from New York Department of Education (early 20th c.; hand-colored, highlighting children demonstrating proper brushing technique).	Transparent photographic images mounted on glass plates for image projection.
2.2: Historic Sources Analyzed by Students	
Klein, H., Palmer, C. E. (1938). *Dental caries in American Indian children*. Washington, D.C.: U.S. Government Printing Office.	A report on dental caries in different Native American populations.
Keyes, F. A. (1919). Institutional dentistry (insane) report No. 4. *The Boston medical and surgical journal*, *180*(4), 89-93.	A report from Medfield State Hospital on how dentistry was practiced at the institution.
Spooner, S. (1838). *Guide to sound teeth, or A popular treatise on the teeth : illustrating the whole judicious management of these organs from infancy to old age* (2nd ed.). Collins, Keese, & Co.	A text that covers dental care from infancy to advanced age populations. Used as an example to show what about dentistry is the same or similar to modern dentistry.
Hogeboom, F. E. (1927). *Practical pedodontia, or juvenile operative dentistry and public health dentistry; an introductory text for students and practitioners of dentistry* (2d ed.). The C.V. Mosby Company.	A text that covers adolescent, perinatal/prenatal populations, and public health dentistry.
Cotton, H. A. (1921). *The defective, delinquent, and insane; the relation of focal infections to their causation, treatment, and prevention*. Princeton, N.J.: Princeton University Press.	A text that covers the Intellectual and Developmental Disabilities community. Draws a relationship between diseases/conditions and dental health.

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Newmayer, S. W. (1924). *Medical and sanitary inspection of schools; for the health officer, the physician, the nurse and the teacher* (2nd ed.). Lea & Febiger.	A text that covers the Adolescent community and how dental practice is discussed in schools.
Gies, W. J. (1926). *Dental education in the United States and Canada; a report to the Carnegie Foundation for the advancement of teaching*. The Carnegie Foundation for the Advancement of Teaching.	A text demonstrating deficiencies in the dental care of Black and African American populations and statistics on early twentieth century dental schools in the U.S. and Canada.
Academy of Dentistry for the, H. (1963). Bulletin of Academy of Dentistry for the Handicapped. *Bulletin of Academy of Dentistry for the Handicapped.*	A text that covers the Intellectual and Developmental Disabilities community. Discusses the unique needs of patients with disabilities.
Brauer, J. C. (1939). *Dentistry for children*. P. Blakiston's Son & Co., Inc.	A text that covers dentistry in the Adolescent community and was used to demonstrate the techniques pediatric dentists use to engage children in the office.

Table 3

Thought Prompts Provided during Student Review of Materials

3.1: General Guiding Thought Prompts	**3.2: Source-Specific Thought Prompts Provided during Student Review of Materials**
Does anything surprise you?	According to the source, what is relationship between geography/environmental factors and dental caries? (*Dental Caries in American Indian Children*, 1938) [18]
Do you think this was forward-thinking at the time?	How is the dentist considering the unique needs of the patient? How are they not? (*Bulletin of Academy of Dentistry for the Handicapped*, 1963) [25]
Would you consider this patient-forward?	Are there relationships being drawn between diseases or conditions of the tooth/mouth and those with IDDs? (*The defective, delinquent, and insane*, 1921) [22]
Who is the author, editor, or organization responsible for creating the source?	What is the relationship being drawn between pulling teeth and mental health? (*The defective, delinquent, and insane*, 1921) [22]
Why was the resource created or published?	What is the significance of dental clinics being located in schools? (*Medical and sanitary inspection of schools*, 1924) [23]
What is the population of focus?	How are the techniques of pediatric dentists of the past similar or dissimilar to those of today? (*Dentistry for children*, 1939) [26]
What assumptions are being made about the population-in-question?	Does the sentiment of 'public health dentistry' in the text resonate today? In what ways? (*Practical pedodontia*, 1927) [21]
How does the setting, (i.e., time, place), inform the source?	How has practice changed? How has it remained the same? (*Guide to sound teeth*, 1838) [20]
Are there throughlines to dental education today?	What is the significance of the authors identifying Black and African American populations as a population in particular need? (*Dental education in the United States and Canada*, 1926) [24]
	Looking at the author's 12 remedial suggestions for the Medfield State Hospital, how has dental practice changed? How has it remained the same? (*The Boston medical and surgical journal*, 1919) [19]

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"thought prompt" handout (see *Table 3.1*) to guide their analyses. Designed to facilitate critical thinking and reveal throughlines between dental topics of the past and today, each thought prompt handout included a set of general questions (see *Table 3.1*) as well as a 1-2 source-specific questions (see *Table 3.2*). Handouts were placed with their respective source during set up. Thought prompts were developed using teaching with primary source pedagogies, such as those framed by the University of Maryland Baltimore County Special Collections at the Albin O. Kuhn Library and Gallery, asking students to meet the document, observe its parts, make sense of it, and use it as historical evidence [27].

To further guide analysis, pre-set bookmarks were placed within each source to draw students' attention to topics of potential interest. After the individual analysis, instructors [JH, TM] moderated full group discussions by going around the table and inviting each student or small group to introduce their source and anything within that caught their interest.

DISCUSSION

Student Reception to HoM Tour Component

Reflecting upon the HoM tour component of the sessions, it was noted that participants tended to be quieter at the beginning than at the end of this 30-minute portion. It is unknown if this relative lack of interaction with the instructor [KM] was due to the somewhat early hour (9:00AM), lack of interest in the more general portion of the tour, their presence in an unfamiliar site, or some combination of these factors. By the end of this portion, conversations and questions typically increased. This may be due to the introduction of artifacts more directly connected to dental history. When thinking specifically about these objects, discussions and demonstration of the tooth extraction instruments generated much interest. Students readily interacted with these pieces and often recoiled upon learning how they were used. Similarly, interactions with the stereoscope and the dissection stereographs were colorful, with exclamations often expressed when 3D images 'snapped' into focus for the viewing student. Such expressions align closely with earlier experiences of the instructors when introducing these specific materials to dental professionals.

One participant brought their own historic dental artifact to their session, in hopes of learning more about the piece, an early 20th century circular brass cusp die-plate. Manufactured by L.D. Caulk Dental Depot, die-plates such as this were used in the molding of dental crowns. While the HoM holds other cusp die plates, this particular example was not among the collection's holdings. Researching contemporary printed sources housed within the HoM, special collections staff were able to locate the same die-plate within a medical supply catalog from Lee S. Smith & Son (1905), as well as the methods and materials necessary to produce such crowns, reported within Henry A. Collett's (1922) *Gold Shell Crowns and How to Make Them* [28, 29].

Student Reception to Textual Analysis Component

Due to the interactive activity, reflections upon the textual analysis component of the session revealed more about student impact than the HoM tour component. On this front, the instructors [JH, KM, TM] have worked to discern which aspects were most successful, and which require refinement.

Similar to Rajagopalan et al., instructors [JH, TM] found that students were cautiously intrigued by the novelty of the sessions and may have considered working with historical primary sources a "break" from traditional didactic coursework [30]. The instructors worked to dispel any student uncertainty by clearly explaining the activity, how it relates to their course content, and acknowledging that the session may be different than their other dental school classes. To meet students at their respective learning and comfort levels, handouts of the thought prompts were provided to guide textual analysis, or as a "jumping off point" for those eager to unpack the content with their own observations. These served to foster engagement and dialogue amongst students, in preference of producing "correct" responses.

During the individual analysis portion of the session, many students preferred to view the guiding thought prompts as a structured assignment. They worked diligently to answer the proposed questions, rather than use them as a springboard for their own discovery. Thus, once these students answered the thought prompts on their handouts, they were content to sit and wait for the group discussion without further exploring their source. Whether this was due to the pressure of limited time, wanting to "complete" the assignment, lack of comfort with unstructured analysis, or some combination of the three, is unknown. Additionally, instructors noted a few disinterested participants chose to disengage once they saw there was no set assignment. Those few put little effort into their analyses or relied upon their fellow students to provide analyses on their behalf.

Differing learning styles were also reflected in the full group discussions, revealing unique insights and discoveries from the sources. When speaking to the group, most students preferred to introduce their source by answering the thought prompt questions exactly as they were indicated and not expanding beyond that. Other students answered portions of the thought prompts and instead used the group discussion to emphasize aspects of source material that piqued their interests. To further engage, instructors [JH, TM] responded to the students' assessments with additional follow-up questions, where appropriate: "Did anything in this source surprise you?;"

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"What sparkled to you?;" "How is this similar or dissimilar to dentistry today?". Such questions fostered open dialogue and encouraged students to draw their own comparisons between dentistry of the past and today. In one instance, a student excitedly shared a figure of a throat with diphtheria in Newmayer's (1924) *Medical and sanitary inspection of schools*, proclaiming that this was "the same figure" they were studying in preparation for an upcoming exam in a different class [23]. This enthusiasm reflects the sentiment expressed by students of Mages and Lohr in their medical humanities seminar, with one of their students stating the session was "Very interesting and relevant to our studies" [3].

Further, students would use the group discussions to highlight terms or practices from the historic sources they recognized, or phrases that resonated with them. For instance, from *Practical pedodontia*, a couple students emphasized the quote, "No one man has a monopoly on the best methods to care for children," before describing how this outlook remains relevant in modern practice [21]. For both the *Medical and Sanitary Inspection of Schools* (1924) and *The Boston Medical and Surgical Journal* (1919), students contrasted the past presence of in-house dentists for preventative care in schools versus curative care in prisons and mental health facilities and posited how these past practices may continue to impact practice with these populations today [19, 23]. These student-led discoveries informed pedagogy, allowing the instructors [JH, TM] to expand their own knowledge and understanding of the sources, and to better put the sources in conversation with the dental student curriculum in subsequent sessions. Such discoveries also created avenues for conversation and feedback between instructors and students, allowing each group to learn from one another.

For future sessions, the instructors [JH, KM, TM] intend to work with the dental faculty to employ a flipped classroom approach using their university's learning management system (LMS). As exemplified by Mages and Lohr's 2017 study, students will be asked to browse digital excerpts of pre-selected, topical texts from the HoM collection via the LMS on their own time and ahead of the in-person session [3]. Upon their subsequent visit to the HoM collection, students will be able interact with the full, original source. The instructors anticipate that early exposure and interaction with historic materials may increase student interest and "buy-in" during the in-person session. Beyond that, students will have the opportunity to reconcile the digital snippet of the text with the full context of physical source, revealing new insights into the history of dentistry.

Although instructors did provide paper handouts of the thought prompts during the textual analysis activity, students were not required to complete these. The instructors also did not survey students after the session. Similar to Mages and Lohr, who viewed their medical humanities seminar as an outreach opportunity as much as a learning one, instructor priority was building positive and lasting rapport with the dental school and its constituents, while increasing the visibility of the HoM collection [3]. During future sessions, and with approval from the university's institutional review board (IRB), the instructors plan to collect written student responses and post-class evaluations to better gauge impact and continue to improve class experience. Furthermore, as the instructors were unable to provide access to historical materials relating to refugee and unhoused communities during these sessions, a gap in HoM holdings has been identified. With this knowledge, HoM staff can target these areas for collection development initiatives.

Overall, this interdisciplinary collaboration provided the opportunity for the dental liaison librarian, HoM staff, and dental school faculty to develop and implement a syllabus-informed historical instructional session that provided targeted insights into dentistry's past. Through the activities documented above, the instructors worked to inspire and educate dental students to better provide quality and historically informed patient care.

AUTHOR CONTRIBUTIONS STATEMENT

Jessica R. Hollister: Conceptualization; methodology; project administration; supervision; writing—original draft; writing—reviewing and editing. Thomas Murphy: Project administration; resources; writing—original draft; writing—review and editing. Keith Mages: Conceptualization; methodology; project administration; resources; supervision; visualization; writing—original draft, writing—review and editing. Meelin Dian Chin Kit-Wells: Conceptualization; supervision; writing—review and editing.

DATA AVAILABILITY STATEMENT

There are no data associated with this article.

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AUTHORS' AFFILIATIONS

Jessica Hollister, jrhollis@buffalo.edu, Dental Liaison Librarian, University at Buffalo Libraries, Buffalo, NY

Keith Mages, kcmages@buffalo.edu, Curator, Robert L. Brown History of Medicine Collection, University at Buffalo Libraries, Buffalo, NY

Thomas Murphy, tpm23@buffalo.edu, Archivist, Robert L. Brown History of Medicine Collection, University at Buffalo Libraries, Buffalo, NY

Meelin Dian Chin Kit-Wells, mc30@buffalo.edu, Clinical Associate Professor Emeritus, Department of Pediatric and Community Dentistry, University at Buffalo School of Dental Medicine, Buffalo, NY

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CASE REPORT

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PubMed: an untapped source for open educational resource images

Ellie Svoboda; Teresa Connolly

See end of article for authors' affiliations.

Background: Open Educational Resources (OER) are free learning materials that benefit students in higher education, including in the health sciences. As more health sciences OER materials are created, there is a need for openly licensed health sciences images. Traditional OER repositories lack specialized health sciences imagery while PubMed is a biomedical database that has potential to fill this gap.

Case Presentation: A nursing faculty partnered with a health sciences librarian to search PubMed for openly licensed images for a pathophysiology OER textbook. The librarian used existing filters in PubMed to identify articles that have Creative Commons licenses as well as images. The nursing faculty assessed these images and added relevant ones to the pathophysiology textbook.

Conclusions: PubMed is a free resource that health sciences librarians use on a regular basis. Utilizing the database to find openly licensed materials allows librarians to use a familiar tool for a new and exciting purpose.

Keywords: PubMed; open educational resources; OER; images; repositories

BACKGROUND

Open educational resources (OER) are defined as "learning, teaching and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license, that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others" [1]. Textbooks are one type of OER that are created and implemented within higher education. The process of eliminating a textbook from a course and replacing it with an OER has positive benefits in higher education such as maintaining final course grades and preventing course withdrawals [2]. Furthermore, when an OER textbook is instituted within a course there is a reduced financial textbook burden for students and this can disproportionately affect students of diverse backgrounds by reducing their anxiety [2-4].

Despite these known benefits of OER, adoption within health sciences educational programs such as nursing remains challenging [5]. Luo [6] completed a systematic literature review of barriers to the integration of OER and found that discoverability of OER was a consistent problem. Besides difficulty finding materials, reviewing potential OER is time consuming and with fragmented repositories faculty could miss key resources. OER repositories have a variety of materials beyond textbooks, such as videos, course modules, and virtual learning environments which only complicates the discoverability of resources.

Within health sciences education, the implementation of anatomical illustrations as a visual learning tool is widely utilized. Over the years, hundreds of textbooks on medical illustrations have been created and evolved from simple hand drawings to digital photography [7]. Creating images in OER is difficult because many faculty lack funding to pay medical illustrators and most do not have illustration skills themselves. This leads faculty to search for images which can be extremely time consuming and results frequently disappoint. Anecdotally, when the authors were working with health care educators on creating OER one of the most common questions by faculty is "where do I find medical OER images." Google Images is a common source for openly licensed images, but using it for medical images can be frustrating. For example, when one searches "heart diagram" in Google Images, hundreds of results are returned including basic renderings of the heart as well as complex labeled images. However, when the search is restricted images that have a Creative Commons license there are far fewer images many of which are more simplistic or even cartoon illustrations.

Other sources for health sciences OER images include image repositories such as the Public Health Image Library (PHIL) from the CDC, the Cell Image Library from the Center for Research in Biological Systems, and Openi from the NLM [8-10]. These resources include many relevant images; however, they are fractured into

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subdisciplines and require the same search to be run in multiple repositories which can be time consuming.

The following case report describes the process that a nursing faculty and health sciences librarian used to identify quality openly licensed images for an OER textbook. We will describe how we utilized PubMed, an unorthodox source for OER but a common database for medical research, to locate openly licensed health sciences illustrations. The process is easy to follow and could be replicated by other health sciences librarians.

CASE PRESENTATION

The University of Colorado Anschutz Medical Campus is an R1 research university with six professional schools that serve 4,500 students. The University of Colorado Anschutz College of Nursing has both undergraduate and graduate programs with more than 1,100 students. The undergraduate program has roughly 500 students and College of Nursing faculty are working to lower the cost of textbooks for undergraduate nursing students. This involves adopting existing nursing OER textbooks as well as creating new OER textbooks and learning materials. One of the creation projects in this effort is authoring a textbook on undergraduate pathophysiology that will be licensed CC-BY-NC. Pathophysiology is a core nursing curriculum class and there is not yet an OER textbook that can replace the current commercial textbook used by the College. Creating an OER pathophysiology text will significantly reduce the cost burden of textbooks for CU Anschutz nursing students as well as students in nursing and health sciences programs at other institutions.

Creating a textbook is a significant undertaking that involves not only writing the content that students need to learn but also generating activities and quizzes to help students reinforce and check their own knowledge. Visual aids and images are an important component of reinforcing concepts and providing contextual information. These aid in the learning of most subjects but are especially important in pathophysiology due to the variety of disease processes, which are most effectively communicated visually.

The faculty authoring the pathophysiology text do not have graphic design or illustration skills and the medical illustrator at the university does not offer services to individual faculty. Hiring a freelance medical illustrator or graphic designer was also prohibitively expensive. Instead, the authors looked for existing, openly licensed (specifically CC-BY) images that can be incorporated into an OER text. Unfortunately, finding openly licensed images on niche healthcare topics in the usual OER repositories was proving to be challenging.

The College of Nursing has a strong relationship with the Strauss Health Sciences Library and the lead author reached out to the nursing liaison librarian for assistance. Librarians have expertise in copyright and database searching which makes them natural partners to assist health sciences faculty with locating openly licensed materials. The nursing liaison librarian has a special interest in copyright and had previously discovered that PubMed has a filter for identifying open access (OA) articles [11]. This functionality made PubMed an exciting and untapped resource for openly licensed health sciences images.

In addition to a general filter that finds articles with any open license, PubMed also has filters that allow users to specify particular Creative Commons licenses. Below is a table of the Creative Commons licenses and their corresponding filters in PubMed [12].

Table 1

License	PubMed filter	Function
CC-BY	"pmc cc by license"[filter]	Allows for unlimited reuse as long as attribution is provided.
CC-BY-SA	"pmc cc by-sa license"[filter]	Allows for unlimited reuse as long as attribution is provided and derivative works apply the same license.
CC-BY-NC	"pmc cc by-nc license"[filter]	Allows for reuse but prohibits any commercial applications of the work. Requires attribution.
CC-BY-NC-SA	"pmc cc by-nc-sa license"[filter]	Allows for reuse but prohibits any commercial applications of the work. Requires attribution and that derivative works apply the same license.
CC-BY-ND	"pmc cc by-nd license"[filter]	Allows for unlimited sharing but prohibits any derivative works. Requires attribution. Is not compatible with OER.
CC-BY-NC-ND	No PubMed search filter for this license	Allows for sharing but prohibits any commercial use and derivative works. Requires attribution.

	Is not compatible with OER.

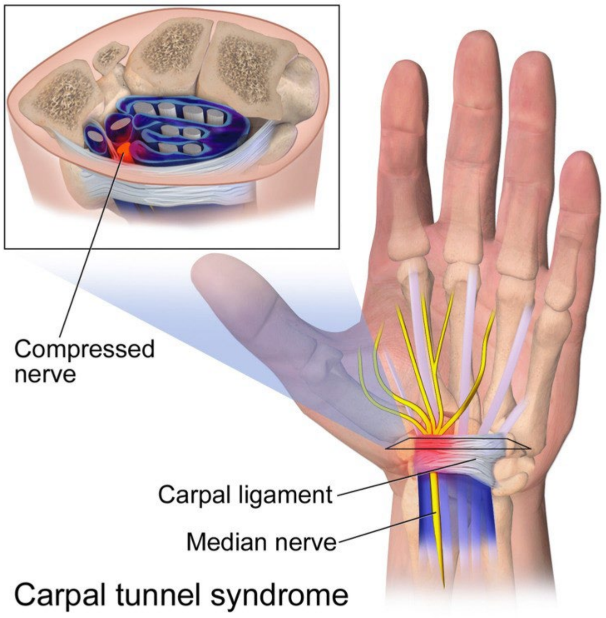
The librarian decided to use the filter for CC-BY articles ("pmc cc by license"[Filter]) because works under that license can be used in any OER context and would be compatible with the pathophysiology textbook. The librarian chose not to use the general OA filter because it retrieves articles with all of the Creative Commons licenses including the non-derivative licenses that are incompatible with OER. The librarian also used the filter for articles that are not copyrighted and in the public domain ("pmc cc0 license"[Filter]) because those articles would also be eligible to be incorporated into an OER textbook.

To find images for the pathophysiology textbook, the lead author created a list of more than fifty diseases that would be featured in the book. The librarian used this list to search in PubMed for articles on that topic. To maximize her time and to keep the result sets highly focused, the librarian searched basic search terms for the diseases along with either the field tag for titles and abstracts [tiab] or for titles [ti]. Depending on the scope of the research, these terms were combined with the word pathophysiology with the title and abstract field tag [tiab]. These results were then limited with the Creative Commons filters. From the resulting pool of articles, the librarian manually went through the first ten to thirty results and identified which articles had figures. These articles were then downloaded into an EndNote library with groups for each disease state. The EndNote library was then compressed and sent to the nursing faculty for review. The goal was to identify images that presented the classic form of a disease with clarity and the key components labeled.

When reviewing these images, the nursing faculty often found hyper-specific x-rays or photographs of unique case presentations which were mostly unsuitable for an undergraduate textbook. However, occasionally, there are simple and straightforward illustrations of the pathophysiology of a disease state. Below is an example of an ideal illustration for undergraduate nursing students that visually conveys the pathological process of carpal tunnel syndrome [13]. This image was downloaded from PubMed as a figure in a guideline on carpal tunnel syndrome [14]. The original source of the image is a site called WikiJournal of Medicine that includes many Creative Commons licensed diagrams and illustrations on health sciences topics.

The nursing faculty uploaded this image into Pressbooks, the online platform that the OER textbook is hosted within, in the chapter that covers carpal tunnel syndrome. When students are reading about the pathophysiology of carpal tunnel syndrome, this image will provide a visual experience that meets more learning styles and student needs.

Figure 1 Carpal Tunnel Syndrome by BruceBlaus is licensed under a CC-BY-3.0 license.



This image is available under the Creative Commons Attributions license and permits use, distribution, and reproduction in any medium as long as attribution is provided. To provide an adequate attribution, users must include the title of the work, the author of the work, the source of the work, and the license of the original work [15].

The OER undergraduate pathophysiology textbook is still being written but so far, the faculty author has been able to add six illustrations that were identified in PubMed using the methodology above. As more chapters are authored, this number will likely increase. There are still some diseases that need images that the authors haven't been able to locate in either PubMed or other OER image repositories.

DISCUSSION

This methodology can be reproduced by health sciences librarians at any institution including academic campuses that are engaging in the creation of Open Educational Resources projects such as textbooks, case studies, videos, or simulations, as well as hospitals at which physicians are lecturing at society conferences and would like to include copyright-safe images in their slides. Most health sciences

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librarians use PubMed on a frequent basis and will be familiar with the recommended field tags.

Another benefit of finding images in this way is that librarians can discover repositories and collections of openly licensed images of which they might not otherwise have been aware. That was the case with the WikiJournal of Medicine, which the authors found when searching for carpal tunnel syndrome images. This resource has now been used and searched directly for other images for the textbook.

While this method can create many opportunities, there are also some limitations. First, an article with an open license does not guarantee that the figures included within are also openly licensed. Librarians need to provide some education to patrons who are evaluating the figures regarding the complexity of article and image licensing. This will help prevent a well-intentioned patron from using a copyrighted image by accident. If librarians would like to learn more about copyright and how Creative Commons licenses work, the content of the Creative Commons Certification Course is freely available online [16].

It is also important to clearly delineate the role of the librarian. The nursing liaison librarian did not assess the figures because she does not have that expertise. The onus for determining the appropriateness and veracity of images must lie with the faculty.

Another limitation is that most of the figures are in formats that are difficult to edit. With many Creative Commons images, authors are legally allowed to make modifications, such as moving the location of a caption or adding additional captions. This is more difficult when the image is in a format such as a PDF, which may require additional software and expertise which may not be accessible to everyone.

Finally, many of the figures are highly specific to the content of the article. There are often case reports highlighting an unusual presentation of a disease state. Generally, for a textbook, it is better to present undergraduate students with the typical or expected version of a disease or condition. However, if the audience is clinicians or residents, these specific images might be very helpful. This means that authors may have more sifting to do to find the images that fit the needs of their audience.

If health sciences librarians keep these limitations in mind, this method of searching PubMed is an easy way to help patrons find openly licensed images for their projects without having to learn the quirks of a variety of OER repositories. It has been an asset to the authors at the University of Colorado Anschutz Medical Campus and has been replicated for other sections of the pathophysiology textbook.

As creation and implementation of OER grows in health sciences education, more faculty will need to find openly licensed materials. Current mainstream methods and sources of openly licensed medical images are inadequate and alternative methods are needed. Searching PubMed with an OA filter is a creative approach to finding open-sourced images that capitalizes on health sciences librarians existing skills and knowledge.

AUTHOR CONTRIBUTIONS

Ellie Svoboda: Conceptualization; methodology; investigation; resources; writing - original draft; writing - review and editing. Teresa Connolly: Conceptualization; methodology; investigation; resources; writing - original draft; writing - review and editing.

DATA AVAILABILITY STATEMENT

There are no data associated with this article.

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AUTHORS' AFFILIATIONS

Ellie Svoboda, MLIS, ellie.svoboda@cuanschutz.edu, Strauss Health Sciences Library, University of Colorado Anschutz, Aurora, CO

Teresa Connolly, PhD, RN, ACNS-BC, teresa.connolly@cuanschutz.edu, College of Nursing, University of Colorado Anschutz, Aurora, CO

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CASE REPORT
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Enhancing patient care: the power of librarian-mediated literature reviews

Heather J. Martin, AHIP; Carrie Grinstead, AHIP; Danielle Linden, AHIP

See end of article for authors' affiliations.

Background: Our health system library fields thousands of requests for literature searches each year in support of research, policy, evidence-based practice projects, and care for individual patients. With fewer library staff than comparable institutions and an engaged, multidisciplinary clinical workforce, we face ongoing pressures to do more with less and to demonstrate our value.

Case Presentation: A 2021 article in the *Journal of Hospital Librarianship* offered an existing survey and basic project design that we used to assess our impacts. We adapted, with permission, the survey and methods of "Analysis of a Hospital Librarian Mediated Literature Search Service at a Regional Health Service in Australia," a quality improvement project authored by Siemensma et al. (2021) [1]. Throughout 2023 we sent the adapted survey to all employees and affiliated clinicians who requested literature searches. The survey included five multiple choice questions as well as a free text box for comments. Respondents were asked to provide simple demographic information and consider the impact and quality of results they received from the librarian.

Conclusions: Our survey-based evaluation of our literature search service underscores the importance of librarian-mediated literature searches for clinical practice, policy development, and patient care. Demonstrating hospital library impacts is increasingly important and increasingly challenging for understaffed teams. Assessments using previously published surveys are feasible for non-academic libraries and serve as compelling cases for the continued and expanded integration of library resources into clinical practice and decision-making.

Keywords: Hospital libraries; Surveys & Questionnaires; Information Services; Expert Searching; Clinical Support; Program Evaluation

See end of article for supplemental content.

INTRODUCTION

Providence is a not-for-profit Catholic health system serving 51 hospitals, 1000 clinics and a comprehensive range of health and social services across 7 US states. With over 122,000 employees including 34,000 physicians, Providence is the 6th largest not-for-profit health system in the United States [2]. The clinical information needs of the organization are supported by the Providence Library. With 9 FTE librarians and 2 FTE library staff, the Providence Library operates at less than 50% of the MLA recommended staffing for Bronze-level service [3,4].

As most of the primary clientele of Providence Library are in clinical positions (e.g., physician, nurse, or pharmacist), mediated literature searching to support patient care is one of our most heavily used services. As a small library team serving a large health system, we need to carefully evaluate the effects of our work, share our successes, and gather information to help us improve. However, for librarians working alone or on understaffed hospital teams, the task of developing and validating new survey tools for evaluating services can be intimidating and time-consuming. Our team identified the survey published by Siemensma et al. (2021) as meeting our needs and integrating well into our team's existing workflows and tools [1]. We hoped that by adapting and implementing an existing survey instrument, collecting program evaluation data would require only minimal additional staff time and would not affect our day-to-day literature search, article retrieval, collection management, website maintenance, and education and outreach services.

CASE PRESENTATION

Methods

We adapted, with permission, the survey and methods of "Analysis of a Hospital Librarian Mediated Literature Search Service at a Regional Health Service in Australia" [1]. We built the survey using REDCap, as it was readily

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available to the team and we had experience using the tool to collect service statistics [12,13]. We retained Siemensma et al.'s[1] survey questions regarding impacts of and satisfaction with literature search results but adjusted demographic questions for our setting. In late 2022, we submitted our project to our institution's Institutional Review Board (IRB), who determined that it was not human subjects research and did not require IRB review. Data collection began in January 2023 and ended in January 2024. We sent the adapted survey to all employees and affiliated clinicians who requested literature searches. See Appendix A for the survey. When a librarian completed a search and sent results to the requestor by email, they noted the requestor's email address in a REDCap form. Each Friday we ran a report of all email addresses that had received literature searches two weeks prior. This time frame was chosen to remain true to the study being reproduced, and in the hope that it would give the requestor enough time to review results and determine quality and impact, while not waiting so long that they may forget specifics.

Like the Australian study, we used a generic email address to send the survey request to our users, as associating the request with an individual member of our staff could result in perceived pressure to respond [1]. We did not want our patrons to feel that their decision to respond or not, or anything they might say in the survey, could affect their future use of our services or their relationships with the library team. Email addresses were noted separately from the survey, used only to distribute the survey link, and not retained. The same link was sent to all participants with no ability to connect a response to an individual, and the survey questions included no identifying information. Participation was voluntary and we did not compensate respondents in any way.

Because the purpose and results of each search were different and may have had different impacts on clinical care or practice, requestors received an email with the survey link each time they requested a new search. However, if one patron requested multiple searches in one week, they would receive only a single survey for that week. We had some concern that frequent requestors would be bothered by receiving many surveys over the course of the year, but we did not receive any negative feedback.

The survey email included introductory language about the project with instructions and a link. The survey included five multiple choice questions as well as a free text box for comments. Respondents were asked to provide demographic information and consider their specific literature search question and the impact and quality of results they received.

We used Excel to compile summary statistics, documenting survey response rate, respondents' primary job roles, impact on practice, perceived quality of the literature review, and time saved.

Results

Data collection closed in January 2024 after twelve full months.

We sent 1,048 surveys and received 237 responses, for a response rate of 22.61%. Since we did not collect personally identifying data in the survey, we do not know if each response came from a different patron, if some frequent users of our service responded to the survey more than once throughout the course of the year, or if responses from frequent users were different from those who responded only once.

Respondents were asked to self-identify with the role they felt best described their primary responsibilities within the health system (see Table 1). The most frequently selected roles were nursing staff (65 responses; 27.4%), medical staff (43 responses; 18.1%), administration (36 responses; 15.2%) and educator (35 responses; 14.8%). Respondents were allowed to select more than one role, such as nurse and educator. The survey's categories were intentionally broad to encompass the range of roles in our complex organization.

Table 1

Self-identified roles from survey respondents. Proportions sum to >100% since some respondents selected more than one role.

Role	Number of responses	Proportion of responses
nursing staff	65	27.4%
other	54	22.8%
medical staff	43	18.1%
administration	36	15.2%
educator	35	14.8%
allied health	27	11.4%
researcher	17	7.2%
resident/fellow	4	3.4%
pharmacy	2	0.84%
student	1	0.42%

As with role, respondents were able to select as many impacts as applied for each service interaction (see Figure 1). Respondents selected a median of two impacts, and 29 respondents did not select any. All respondents confirmed

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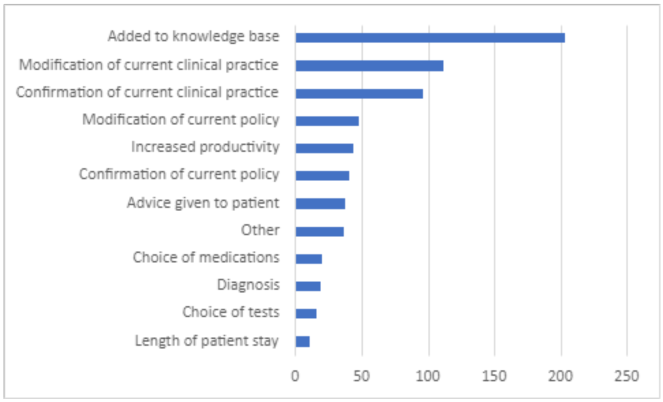
that utilizing the librarian-mediated search service saved them time. Thirty-five percent (83) of respondents said our search saved them one to three hours, 29% (68) said four to six hours and 31% (72) said we saved them more than seven hours of their own time. Over 98% (229) of survey respondents rated their search results as either high or very high quality. Eighty-five percent (198) perceived their results as being of very high quality, with 13% (31) rating the results they received as high quality. No respondents rated the search results they received as low quality and only 1.7% (4) rated their results as neither high nor low quality.

Figure 1 Literature search impacts identified by survey respondents. Respondents were able to select as many impacts as applied to each service interaction.



We also received 170 comments in the free-text space provided at the end of the survey. Though formal qualitative analysis was not conducted on the free-text comments, we identified some common sentiments within participant responses. Respondents frequently expressed gratitude (60 comments) and positive experiences with a library team member (73 comments). Many also commented on the fast response and the time saved by the service (15 comments). Others described their search results as accurate, thorough, or relevant (39 comments). A sample of representative respondent comments are presented below:

> The Providence Librarian has been a huge help to me in the past few years. This year I finally started doing research and although I am the Principal Investigator for this project, I still feel lost at times with how much information is out there. The Librarian is magic and helps me SO much. I sometimes feel like I am over-using them but I truly am so grateful for this service.

> [The librarian] was beyond amazing. She produced the perfect literature review in an incredibly short time. I never would have been able to replicate that on my own. What she provided allowed us make a clinical decision that is currently different from our policy. Thank you!

> I cannot express how much benefit to clinic productivity, and up to date EBR pt care this program has for our cancer clinics. I do not have the time nor expertise to search the same methods the librarians provide to me. The depth of academic research is top notch and dependable. What a huge mistake to patient care if this resource were to be lost.

> The medical librarian services are high quality and the quickest and most comprehensive I have worked with in my career so far. The response time is incredible as is receiving the information needed is exactly what I look for.

> Wonderful resource. The search was helpful for prepping of a rare/complex patient and periprocedural/perioperative management. There was a scarcity of literature detailing some specific requests but the thorough search and summary of peer-reviewed and other sources was very much appreciated.

DISCUSSION

The adoption of an existing tool made this project manageable under time and staffing constraints and allowed us to more easily leverage results for external dissemination and for advocacy within our organization. The approach also builds on an existing body of survey-based assessments from similar settings [1,5-11]. Previous studies document the importance of impacts of information provided by libraries on patient care decisions [1,5]. Like the Australian project that inspired our work, all studies reviewed used surveys, and a few included follow-up interviews [5-10,14-16].

Marshall et al's landmark 1992 study evaluated hospital library services based on clinical impacts, not simply user satisfaction [5]. In the decades since, Marshall and colleagues have developed larger-scale studies [6,7], and hospital libraries have assessed impacts on patient care decisions, clinicians' professional development, and return on investment of library services [8,14-16]. Similarly, our survey showed that literature searches added to users' knowledge base; affected diagnosis, therapy, or the advice given to a patient; modified or confirmed clinical practice; and improved productivity.

A 2014 Marshall study referenced the challenges in accessing patient records and the complexity of clinical decision-making; studies in this area cannot directly attribute clinical outcomes to library resources or services and instead rely on self-report from library users [7]. In 2022, a study based on interviews with medical librarians highlighted a need for new measurements of library impacts [17]. We could not measure effects on patient outcomes, but our results add to the body of literature indicating that evidence compiled by professional librarians affects care decisions.

Impacts may be indirect, since search services add to users' knowledge base; however, studies also indicate that libraries contribute to a broader culture of inquiry. Brian et al. found that clinicians asked more questions when a

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librarian was present on rounds, and 45% (154) of respondents to a survey by Brettle at all "reported using the information [provided by the librarian] to deliver training and education to other staff" [10,16]. Our free-text comments suggest that our users also share literature search results with larger teams.

Existing literature consistently demonstrates that search services save time for clinicians [7-9]. Over 50% (140) of our respondents stated that our searches saved them over four hours. A 2022 UK study demonstrated a positive return on investment from a hospital library [8]. While our findings suggest that our services could save organizations money or provide additional value, further evidence is needed to support this claim.

Over 98% (229) of respondents rated the results they received as high or very high quality, similar to the 98.21% satisfaction rate achieved by our Australian colleagues [1]. This highlights our librarians' professionalism and the trust we've earned in our organization.

Finally, our survey results helped to build an overall health system library value case, demonstrating the essential role of library professionals in supporting clinical decision-making and improving patient care. These findings underscored the importance of library staffing even amid budget reduction targets and were recently used to advocate for sustained investment in library personnel. Through a one-sheet flyer and a summary in our widely shared Providence Library Annual Report [19], results reached leadership, frontline clinicians, and key library stakeholders and champions, such as nursing research councils. We presented this work externally at the Medical Library Association 2024 Annual Meeting in Portland, Oregon [20], as well as in internal conferences [21].

Further research may seek improved methods of assessing patient care impacts and explore questions related to library services and clinician well-being and job satisfaction. However, straightforward survey assessments are feasible for small, non-academic library teams and serve as compelling cases for the continued and expanded integration of library resources into clinical practice and decision-making.

Limitations include the possibility of voluntary response bias, as individuals who feel strongly positive or negative may be more likely to fill out the survey. Additionally, no formal qualitative analysis was done and future studies may want to build that into the work plan. Finally, while this study made clear the positive impact that librarian-mediated literature searches had on our clinicians, it is not generalizable beyond our institution. However, we encourage other hospital libraries carry out similar projects.

AUTHORS CONTRIBUTION STATEMENT

Heather J. Martin, MISt, AHIP: Conceptualization, Writing - Original Draft. Carrie Grinstead, MLIS, AHIP: Software, Data Curation, Writing - Review & Editing. Danielle Linden, MLIS, AHIP: Writing - Review & Editing.

DATA AVAILABILITY STATEMENT

Data associated with this article is available from the authors upon request.

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SUPPLEMENTAL FILES

Appendix A: Survey Email

AUTHORS' AFFILIATIONS

Heather J. Martin, MISt, AHIP, heather.martin@providence.org, https://orcid.org/0000-0002-2633-096X, Providence

Carrie Grinstead, MLIS, AHIP, carrie.grinstead@providence.org, https://orcid.org/0000-0003-0400-7667, Providence

Danielle Linden, MLIS, AHIP, danielle.linden@stjoe.org, https://orcid.org/0009-0008-5508-3663, Providence

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Blogs as data: using XQuery for content evaluation

Eli Wachter; Elizabeth A. Mullen

See end of article for authors' affiliations.

Circulating Now, the history of medicine blog for the National Library of Medicine (NLM), highlights blog posts written by community contributors. To evaluate the community represented within the blog, the project team explored how XQuery, a language for querying XML data, could be utilized in developing a dataset on institutions represented in the blog. The team used ChatGPT to develop the XQuery script and processed the queries through BaseX. The resulting data was transferred to Excel where additional data elements, such as geographic location and institutional type, were manually added. From this dataset, the team created visualizations in Tableau to show the over 400 unique institutions across the world represented. These visualizations supplemented an internal report for the *Circulating Now* Editorial Board, illustrating the current engagement reach of the blog and areas for future possible collaboration.

Keywords: History of Medicine; Data Visualization; Data Analysis; National Library of Medicine

Virtual Projects are published on an annual basis in the *Journal of the Medical Library Association* (*JMLA*) following an annual call for virtual projects in *MLAConnect* and announcements to encourage submissions from all types of libraries. An advisory committee of recognized technology experts selects project entries based on their currency, innovation, and contribution to health sciences librarianship.

The history of medicine blog for the National Library of Medicine (NLM), *Circulating Now*, emphasizes the role of community contributions to the shared knowledge and understanding of medical history. The blog published more than one thousand posts between 2013 and 2024, including many by guest authors, connecting the NLM collection to research at institutions around the world. To evaluate the community represented within this blog, Eli Wachter, former NLM Associate Fellow, partnered with Elizabeth Mullen, Managing Editor for *Circulating Now*, to develop a strategy to pull the names of institutions from the blog's content, connect these institutions to their geographic location and institutional type, and create visualizations to showcase the engagement reach of *Circulating Now* for the blog's Editorial Board.

Since *Circulating Now* is hosted on WordPress with easy access to Extensible Markup Language (XML) exports, the project team explored XQuery, a language for querying XML data, as a potential data collection strategy. BaseX, an open-source data processing engine, allowed the team to query the XML files through its robust XQuery processor. The team used ChatGPT iteratively to develop the XQuery script, providing the GenAI tool with a blank template of the XML structure, the desired keywords, and the end export goal. The final version of the XQuery script identified keywords associated with institutions (such as "university," "library," and "center") and pulled five words before and after each keyword to isolate the institution's name.

Once the XQuery script was executed, the resulting data was transferred to Excel. Unnecessary words were removed manually, leaving only the institution names. Geographic information, such as city, state, and country, were added manually to the spreadsheet. For institutions that had multiple locations, and the exact location was not mentioned in the blog, the team defaulted to the main headquarters location for the institution. Institutional type (e.g., academic, library, museum, or professional organization) was assigned by keywords within the institution's name and manually reviewed.

Importing the cleaned data into Tableau, the team created visualizations that effectively represented the institutions NLM connected with through the blog. The data included over 400 unique institutions, with high representation on the U.S. East Coast and large cities like Washington D.C., New York, and Chicago. Areas for growth included U.S. Mountain states (Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming) and countries outside of North America and Western Europe. Two-thirds of represented institutions were academic, suggesting opportunities for increased direct collaboration with libraries and museums, ensuring their names are included in the post. These visualizations supplemented an internal report for the *Circulating Now* Editorial Board. As conveyed in a July 24, 2025, *Circulating Now* post authored by Wachter and entitled "Circulating Now as Data: Community Representation," the project as a whole demonstrates the potential of using XML as a dataset, offering insights to

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inform future blog content, outreach, and editorial decisions.

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AUTHORS' AFFILIATIONS

Eli Wachter, MLIS, wachter7@msu.edu, Data Visualization Librarian, Michigan State University Libraries, Michigan State University, 366 West Circle Drive (DB 24), East Lansing, MI

Elizabeth A. Mullen, MA, elizabeth.mullen@nih.gov, Managing Editor of Circulating Now, National Library of Medicine, National Institutes of Health, 8600 Rockville Pike, Bethesda, MD

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Evaluating automated or artificial intelligence search tools for evidence synthesis

Robin Featherstone

See end of article for authors' affiliations.

To advance information retrieval science for producing evidence syntheses at Canada's Drug Agency, the Research Information Services team developed a replicable process to evaluate automated or artificial intelligence (AI) search tools. The team inventoried 51 tools in the fall of 2023 and built a flexible evaluation instrument to inform adoption decisions and enable comparison between tools. Building on this foundational evaluation work, the team further conducted a comparative analysis on three top-ranked tools in the fall of 2024. The investigation confirmed that these automated or AI tools have inconsistent and variable performance for the range of information retrieval tasks performed by Information Specialists at Canada's Drug Agency. Implementation recommendations from this study informed a "fit for purpose" approach where Information Specialists leverage automated or AI search tools for specific tasks or project types.

Keywords: Information Sciences; Information Storage and Retrieval; Review Literature as Topic; Artificial Intelligence; Generative Artificial Intelligence; Large Language Models; Automation

Virtual Projects are published on an annual basis in the *Journal of the Medical Library Association* (*JMLA*) following an annual call for virtual projects in *MLAConnect* and announcements to encourage submissions from all types of libraries. An advisory committee of recognized technology experts selects project entries based on their currency, innovation, and contribution to health sciences librarianship.

Context, aims, and significance of the virtual project: Canada's Drug Agency is a pan-Canadian health organization that provides independent evidence and advice so health system leaders can make informed drug, health technology, and health system decisions. The Research Information Services (RIS) team at Canada's Drug Agency consists of masters in library and information science (MLIS)-credentialled Information Specialists (ISs) who conduct systematic and abbreviated literature searches for evidence reports produced by the agency.

Given the volume of untested and rapidly evolving automated or Artificial Intelligence (AI) tools for information retrieval, RIS initiated a project to identify, evaluate, and recommend tools to incorporate into IS workflows. Canada's Drug Agency funded this work, and the RIS project team consisted of one manager, six ISs, a statistician, and an IS methodologist.

Through this work, the RIS team developed a sustainable evaluation process to stay abreast of emerging search technologies and a customizable instrument to be used by other evidence synthesis producers. This evaluation work was foundational to the subsequent conduct of a comparative analysis of automated or AI search tools and the development of implementation recommendations for Canada's Drug Agency and all evidence synthesis producers.

Brief description of the virtual project: For the primary project phase, RIS compiled an inventory of 51 search tools, assessed and ranked these tools, and built a flexible evaluation instrument to prioritize tools for further testing. RIS also conducted a comparative analysis of three top-rated tools from the team's evaluations and published recommendations that showed the variable performance of AI search tools and identified cases where their use was warranted for information retrieval tasks.

Technology used: RIS' inventory relied on curated collections of search tools: the Systematic Review Toolbox, and York Health Economics Consortium's list of citation analysis tools. RIS supplemented the inventory with tools identified through a weekly research feed generated from a Semantic Scholar research library.

RIS built our inventory and our evaluation instrument using Microsoft Excel. The comparative analysis for this project tested Lens.org, a metadata aggregator of scholarly and patent literature; SpiderCite, a citation searching tool now available through the TERA suite of automation tools for systematic reviews; and Microsoft Copilot, a generative AI chatbot built upon OpenAI's GPT-4 LLM5.

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Advantages, limitations, and impact: An advantage to the evaluation instrument is that it allowed RIS to compare tools as they become available and to prioritize tools that the team determined to be the most likely to benefit their work. A limitation of this work is that the evaluation criteria did not account for potential sources of bias in the tools (e.g., language bias). The project team acknowledges the need for ISs to interrogate sources of biases and for tool developers to report these transparently. Despite this limitation, the flexible evaluation instrument may be modified to account for additional criteria by users – including potential sources of bias. With the development of evaluation approaches and implementation recommendations from testing, RIS' work enables judicious use of innovative AI and automated technologies to enhance information retrieval for Canada's Drug Agency and other evidence synthesis producers.

Contact information: requests@cda-amc.ca.

LINKS

- Systematic Review Toolbox: https://www.systematicreviewtools.com/
- York Health Economics Consortium's list of citation analysis tools: https://sites.google.com/york.ac.uk/yhectrainingpages/home/sept-2022-citation-analysis
- Semantic Scholar: https://www.semanticscholar.org/
- Artificial intelligence search tool evaluation instrument. Ottawa: Canada's Drug Agency; 2024. https://www.cda-amc.ca/sites/default/files/AI-Search-Tool-Evaluation-Instrument_v1.1.xlsx Accessed 2025-08-28.
- Lens.org ("The Lens"): https://www.lens.org/
- SpiderCite: https://tera-tools.com/spidercite
- Microsoft Copilot: https://www.microsoft.com/en-ca/microsoft-copilot

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AUTHORS' AFFILIATIONS

Robin Featherstone, robin.featherstone@cda-amc.ca, https://orcid.org/0000-0003-2517-2258, Acting Director, Research Information Services, Canada's Drug Agency, Ottawa, Ontario

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Building an interactive dashboard to visualize institutional open access publishing trends

Emily F. Gorman; Nicole Shelawala; Amy Yarnell

See end of article for authors' affiliations.

As part of an effort to seek sustainable support models for Open Access (OA) publishing, the University of Maryland, Baltimore (UMB), Health Sciences and Human Services Library's (HSHSL's) Scholarly Communications Committee developed an interactive dashboard to visualize university-wide OA publishing trends. Using publication data exported from Scopus and visualized in Microsoft Power BI, the dashboard displays five years of publishing trends by OA model, publisher, journal, school, and citation count. The dashboard is fully interactive, allowing users to filter results based on school, OA model, and year.

The design of the dashboard was iterative, with planning discussions taking place in Summer 2024, data model development and initial data collection in Fall 2024, refining of the visualization and data model in early Spring 2025, and the publication of the final dashboard to our website in April 2025. The dashboard continues to be refined and improved based on feedback from stakeholders, and the project team plans to incorporate data on publishing costs in Spring 2026.

The project was designed for sustainability and adaptability, with a documented workflow that will be easy for future committees to implement. This innovative, replicable approach supports informed decision-making around OA publishing and provides a model that can be adopted by other academic health sciences libraries.

Keywords: Open Access Publishing; Scholarly Communications; Data Visualization; Interactive Dashboards

Virtual Projects are published on an annual basis in the *Journal of the Medical Library Association* (*JMLA*) following an annual call for virtual projects in *MLAConnect* and announcements to encourage submissions from all types of libraries. An advisory committee of recognized technology experts selects project entries based on their currency, innovation, and contribution to health sciences librarianship.

BACKGROUND

Researchers at the University of Maryland, Baltimore (UMB) often express concerns about meeting Open Access (OA) publishing requirements from funders given the high costs of Article Processing Charges (APCs). As part of a broader effort to investigate effective and sustainable avenues of support for APCs, the library's Scholarly Communications Committee created a novel, interactive dashboard (https://www2.hshsl.umaryland.edu/hshsl/about/openaccess.cfm) to track the university's OA publications and gain a better understanding of OA trends and barriers. The dashboard was embedded into the library website, making it accessible to the entire university community. The goal of the dashboard project was to create an accessible, sustainable product that could be shared with and customized for multiple campus stakeholders.

DESCRIPTION

To achieve the project goals, publication data were exported from Scopus and imported to Microsoft's Power BI to build the dashboard, where facets including OA model, publisher, journal, year, and school can be used to create different visualizations. To keep the dataset manageable, the project team focused on publications from the last five years.

The dashboard was designed iteratively and collaboratively, from planning starting in Summer 2024, to collecting and modeling the data in Fall 2024, and finally refining and publishing the visualization in Spring 2025. Since the Scholarly Communications committee membership changes annually, the 2024 committee prioritized automating the process of updating the dashboard with new data where possible so that future committees can continue to refine the dashboard based on feedback from stakeholders.

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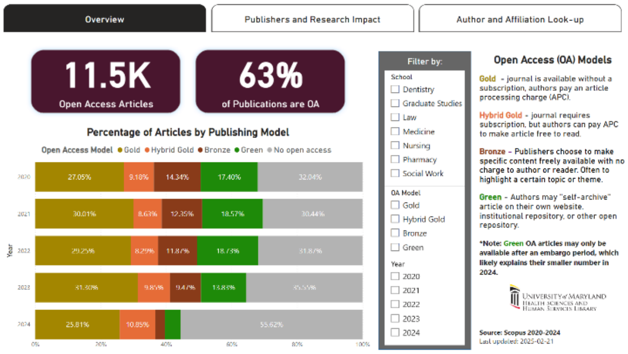
Figure 1 Overview



Open Access (OA) Models

Gold – journal is available without a subscription, authors pay an article processing charge (APC).

Hybrid Gold – journal requires subscription, but authors can pay APC to make article free to read.

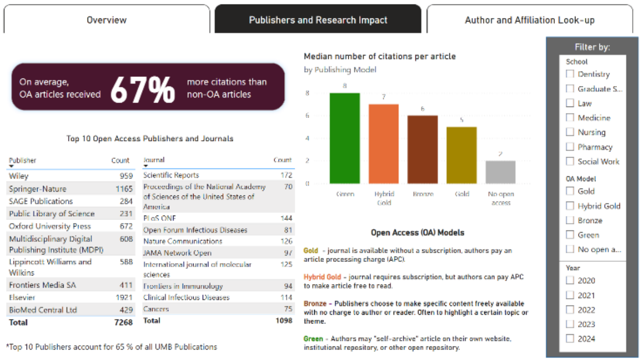
Bronze – Publishers choose to make specific content freely available with no charge to author or reader. Often to highlight a certain topic or theme.

Green – Authors may "self-archive" article on their own website, institutional repository, or other open repository.

*Note: Green OA articles may only be available after an embargo period, which likely explains their smaller number in 2024.

Source: Scopus 2020-2024
Last updated: 2025-02-21

Figure 2 Publishers and Research Impact



Publisher	Count
Wiley	959
Springer-Nature	1165
SAGE Publications	284
Public Library of Science	231
Oxford University Press	672
Multidisciplinary Digital Publishing Institute (MDPI)	608
Lippincott Williams and Wilkins	588
Frontiers Media SA	411
Elsevier	1921
BioMed Central Ltd	429
Total	**7268**

Journal	Count
Scientific Reports	172
Proceedings of the National Academy of Sciences of the United States of America	70
PLoS ONE	144
Open Forum Infectious Diseases	81
Nature Communications	126
JAMA Network Open	97
International journal of molecular sciences	125
Frontiers in Immunology	94
Clinical Infectious Diseases	114
Cancers	75
Total	**1098**

*Top 10 Publishers account for 65 % of all UMB Publications

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Green – Authors may "self-archive" article on their own website, institutional repository, or other open repository.

Figure 3 Publishers Filtered

Publisher	Count
American Medical Association	97
Total	**97**

Journal	Count
Scientific Reports	172
Proceedings of the National Academy of Sciences of the United States of America	70
PLoS ONE	144
Open Forum Infectious Diseases	81
Nature Communications	126
JAMA Network Open	97
International journal of molecular sciences	125
Frontiers in Immunology	94
Clinical Infectious Diseases	114
Cancers	75
Total	**1098**

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Green – Authors may "self-archive" article on their own website, institutional repository, or other open repository.

Figure 4 Author Lookup

Author	Title	Year	Journal	Publisher	OA Model	Citations	Affiliations
Kaiser A.	Immunotherapy and radiation therapy for gastrointestinal malignancies: Hope or hype?	2020			Gold	3	University of Maryland Medical Cente
Munir K.M.	Recurrent Painful Hashimoto Thyroiditis Successfully Treated by Thyroidectomy	2020	AACE Clinical Case Reports	Elsevier	Gold	1	Department of Medicine, Division of I
Papadimitriou J.C.	Recurrent Painful Hashimoto Thyroiditis Successfully Treated by Thyroidectomy	2020	AACE Clinical Case Reports	Elsevier	Gold	1	Department of Pathology, Medical Sc
Peng C.C.-H.	Recurrent Painful Hashimoto Thyroiditis Successfully Treated by Thyroidectomy	2020	AACE Clinical Case Reports	Elsevier	Gold	1	Department of Internal Medicine, Uni
Ferrari M.A.	Recurrent Painful Hashimoto Thyroiditis Successfully Treated by Thyroidectomy	2020	AACE Clinical Case Reports	Elsevier	Gold	1	Division of Endocrinology, Diabetes a
Song L.	Recurrent Painful Hashimoto Thyroiditis Successfully Treated by Thyroidectomy	2020	AACE Clinical Case Reports	Elsevier	Gold	1	Department of Pathology, University
Payne G.F.	Polyelectrolyte in Electric Field: Disparate Conformational Behavior along an Aminopolysaccharide Chain	2020	ACS Omega	American Chemical Society	Gold	14	Institute for Bioscience and Biotechno

TECHNOLOGY

The dashboard was built in Power BI (Version 2.141.1253.0), a Microsoft data visualization and business intelligence platform. Power BI allows data to be imported in multiple formats. This data can be modeled and cleaned within the platform using the embedded Power Query technology. The dashboard was designed in Power BI Desktop and then published to the cloud-based Power BI service. From there, it was embedded into the library website. By using Power BI, the project team was able to take advantage of an institutional Microsoft account and connect the dashboard to the data stored in an Excel file on a shared Microsoft Teams site.

CONCLUSIONS

The dashboard provides valuable insights: nearly two-thirds of UMB's publications from the past five years (that are indexed in Scopus) are OA, and those OA publications received more citations on average than non-OA publications (a median of 8 citations for Green OA versus 2 citations for non-OA). The dashboard approach has the advantage of allowing stakeholders to customize the visualizations based on their interests. The project team created a documented workflow (https://osf.io/qcw2p/), ensuring that future library committees will easily be able to update data and implement future changes. However, limitations remain: the data are constrained to publications indexed in Scopus, a database selected because it provides both affiliation and open-access information. Additional integration with surveys, APC data, and other sources is also needed to present a fuller picture of publishing practices, which is something the project team hopes to incorporate into the dashboard in the future. The project team also plans to investigate ways to further automate the process of updating the dashboard's data using the Scopus API.

The dashboard has received positive feedback in presentations to library leadership and campus organizations such as the Institute for Clinical and Translational Research. While current usage data is low, 142 page views since April 2025, the library communications team is seeking additional opportunities to promote the dashboard to a wider campus audience. By offering a replicable, well-documented process for visualizing OA publishing trends, the project supports informed decision-making within the institution while also serving as a model for other health sciences libraries seeking to advance their own OA initiatives.

Contact Information: publishing@hshsl.umaryland.edu

DOCUMENTATION

https://osf.io/qcw2p/

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AUTHOR CONTRIBUTIONS

Emily Gorman: conceptualization; writing—original draft; writing—review & editing. Nicole Shelawala: conceptualization; data curation; writing—original draft; writing—review & editing. Amy Yarnell: conceptualization; data curation; writing—original draft; writing—review & editing.

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The authors would like to thank Thom Pinho for his help in designing the appearance of the dashboard, and Brad Gerhart for his help with exploring options for how to best embed the dashboard in our library's website.

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1. Dashboard site: **https://www2.hshsl.umaryland.edu/hshsl/about/openaccess.cfm**

AUTHORS' AFFILIATIONS

Emily F. Gorman, MLIS, efgorman@hshsl.umaryland.edu, https://orcid.org/0000-0002-1210-1082, Research and Education Librarian, Health Sciences and Human Services Library, University of Maryland, Baltimore, MD

Nicole Shelawala, MLIS, nshelawala@hshsl.umaryland.edu, https://orcid.org/0009-0004-4461-3623, Research and Education Librarian, Health Sciences and Human Services Library, University of Maryland, Baltimore, MD

Amy Yarnell, MLS, ayarnell@hshsl.umaryland.edu, https://orcid.org/0000-0003-4650-1188, Head of Data and Bioinformation Services, Health Sciences and Human Services Library, University of Maryland, Baltimore, MD

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A generalist institutional data repository offering both open and restricted access to support NIH data sharing compliance

Seonyoung Kim; Xing Jian; Marcy L. Vana

See end of article for authors' affiliations.

In response to the 2023 NIH Data Management and Sharing (DMS) Policy, Washington University School of Medicine in St. Louis launched Digital Commons Data@Becker, a generalist institutional data repository supporting both open and restricted access to research data. Managed by Bernard Becker Medical Library's DMS Team, the repository offers a fully mediated curation workflow that guides researchers through consultation, metadata capture, documentation, and quality control. Draft Digital Object Identifiers (DOIs) can be issued once access type is determined, with final DOI publication following curation and QC. Restricted datasets require Human Research Protection Office (HRPO) review and Data Transfer and Use Agreements (DTUAs), while open access datasets are freely downloadable.

The repository leverages persistent identifiers such as Open Researcher and Contributor ID (ORCID iDs), Research Organization Registry (ROR) IDs, and DOIs, along with the DataCite metadata schema and custom metadata fields. Since its launch in 2023, Digital Commons Data@Becker has published 30 datasets spanning biomedical imaging, sequencing, quantitative assays, flow cytometry, and qualitative survey data. Across all datasets, there have been 4,409 views and 4,120 files downloaded, with restricted datasets generating 13 access requests, three of which were granted through DTUAs. Researchers emphasize the value of free institutional curation, flexible access models, and rapid DOI assignment.

Digital Commons Data@Becker demonstrates how a generalist institutional data repository can balance accessibility and security to support NIH compliance, while advancing FAIR (Findable, Accessible, Interoperable, Reusable) data sharing and long-term stewardship.

Keywords: Data Repository; Data Sharing; Data Curation; NIH Data Management and Sharing Policy; Institutional Repositories; FAIR data principles; Restricted Access; Open Access

Virtual Projects are published on an annual basis in the *Journal of the Medical Library Association* (*JMLA*) following an annual call for virtual projects in *MLAConnect* and announcements to encourage submissions from all types of libraries. An advisory committee of recognized technology experts selects project entries based on their currency, innovation, and contribution to health sciences librarianship.

In response to the 2023 NIH Data Management and Sharing (DMS) Policy, Washington University School of Medicine in St. Louis (WashU Medicine) launched Digital Commons Data@Becker, a generalist institutional data repository that supports both open and restricted access to research data. Managed by Bernard Becker Medical Library's DMS Team, the repository provides WashU Medicine researchers with a curated and FAIR (Findable, Accessible, Interoperable, and Reusable) data-sharing solution tailored to National Institutes of Health (NIH) and publisher requirements.

PROJECT IMPLEMENTATION

The repository was deployed in early 2023, and is an instance of Digital Commons Data, the institutional version of Mendeley Data. Deposits are mediated entirely by the Becker DMS Team to improve metadata quality, ensure compliance with human participant data requirements, and streamline workflows for researchers. Submissions begin with an online consultation request, followed by individualized consultations. The curation workflow includes identifying data types, collecting required metadata and supporting documents, converting files into open formats, and determining access type (open or restricted). A draft DOI can be issued once access type is determined, typically within a day for open access datasets and within a week for restricted access datasets. After curation and quality control, the final dataset with DOI is usually published in coordination with manuscript acceptance or publication, ensuring timely and reliable data availability.

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Datasets resulting from research with human participants undergo review with the WashU Human Research Protection Office before access type is finalized. Access requests to published datasets with restricted access are handled through a Data Transfer and Use Agreement (DTUA) process requiring institutional signature and involving WashU's Joint Research Office for Contracts. In contrast, datasets published with open access can be freely accessed and downloaded.

STAFF INVOLVEMENT

The project is led by the Becker DMS Team (two data curators: Seonyoung Kim, PhD, Xing Jian, PhD; and repository manager Marcy Vana, PhD, who performs the final QC). The Becker DMS Team curates deposited datasets, develops policies, creates FAQs, documentation, and training resources, and provides ongoing feedback to the Digital Commons Data support team to enhance functionality.

TECHNOLOGIES USED

Digital Commons Data@Becker leverages persistent unique identifiers such as Open Researcher and Contributor ID (ORCID iDs), Research Organization Registry (ROR) IDs, and Digital Object Identifiers (DOIs), and uses the DataCite metadata schema. A built-in version comparison tool highlights changes across revisions using color code, while custom metadata fields such as keywords, other contributing organizations (without ROR IDs), and a revision history field, enhance dataset description. Built-in metrics track views and downloads for open access datasets but only track views for restricted access datasets. Download metrics of restricted access datasets are tracked manually based on the DTUA process records. The repository is registered with FAIRsharing and re3data, increasing visibility and trust.

OUTCOMES AND ASSESSMENT

Since launch, the repository has supported deposits spanning biomedical imaging, sequencing, quantitative assay results, flow cytometry, and qualitative survey data. As of September 2025, 30 datasets have been published (19 open access, 11 restricted). Collectively, these datasets have received 4,409 views and 4,120 files have been downloaded. For restricted datasets, 13 requests were submitted and three granted after DTUA execution. Researchers have emphasized the value of free expert curation, flexible access options, and rapid DOI assignment. The flexible open and restricted access options reduce reliance on costly external repositories and allow WashU Medicine investigators to retain stewardship of sensitive data while meeting funder expectations. It also enables linked deposits of mixed datasets, such as openly available survey instruments paired with de-identified survey results under restricted access (e.g., https://doi.org/10.17632/6z94cbyt2r.1 and https://doi.org/10.17632/n8r43gf2dm.1), lowering barriers for discovery while protecting sensitive information.

CONCLUSION

Digital Commons Data@Becker demonstrates how a generalist institutional data repository can balance accessibility and security to support NIH DMS policy compliance. By offering both open and restricted access, coupled with a fully mediated expert curation workflow, the repository ensures high-quality, FAIR-aligned data sharing that empowers researchers and strengthens institutional support for research transparency.

REPOSITORY ACCESS

https://digitalcommonsdata.wustl.edu/research-data

AUTHOR CONTRIBUTIONS

Seonyoung Kim: Conceptualization, Project Administration, Data Curation, Writing – original draft; Writing – review & editing. Xing Jian: Project Administration, Data Curation, Writing – review & editing. Marcy L. Vana: Conceptualization, Funding Acquisition, Supervision, Project Administration, Writing – review & editing.

AUTHORS' AFFILIATIONS

Seonyoung Kim, PhD, seonyoung.kim@wustl.edu, https://orcid.org/0000-0002-8854-287X, Senior Support Scientist, Data Management and Sharing Services Group, Bernard Becker Medical Library, Washington University in St. Louis, MO

Xing Jian, PhD, jianx@wustl.edu, https://orcid.org/0000-0002-0043-8729, Senior Support Scientist, Data Management and Sharing Services Group, Bernard Becker Medical Library, Washington University School of Medicine in St. Louis, MO

Marcy L. Vana, PhD, vanam@wustl.edu, https://orcid.org/0000-0001-7648-7116, Associate Director, Research Services, Bernard Becker Medical Library, Washington University in St. Louis, MO

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COMMENTARY
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Taking it a step farther: acknowledging librarians' systematic review work in the promotion or tenure process

Rebecca Raszewski, AHIP; Abigail Goben

See end of article for authors' affiliations.

Librarians' contributions to systematic review projects receive inconsistent recognition within promotion or tenure processes. A review of thirty-six academic libraries' norms and procedures revealed only two that mentioned systematic reviews. Recognition and inclusion of systematic reviews and other evidence synthesis is further complicated by variance in recognition of interdisciplinary work. This commentary provides recommendations for academic library leadership to establish standards for documenting and evaluating systematic review work in annual reviews and promotion or tenure, explicitly recognizing the value of participation in interdisciplinary scholarship, inclusion of search strategies as a scholarly output, and providing guidance for the external review process. We close with a call to action for professional organizations to establish centralized guidelines to ensure the full recognition of librarianship and scholarly participation in systematic reviews.

Keywords: Systematic Reviews; Evidence Synthesis; Annual Review; Interdisciplinary; Promotion; Tenure

Librarians have been recognized as important contributors to systematic reviews for over twenty years [1–3]. Over these last two decades, librarians have become regarded as key partners for this research methodology, with their expertise in search strategy development increasingly leading to co-authorship opportunities. This growth is an acknowledgement of the time health information professionals have devoted to building partnerships and collaborating with clinicians, faculty, researchers, and staff in other disciplines. While professional library associations and academic health sciences libraries now offer robust educational programs on the systematic review process and how to develop enterprise-level systematic review services, few libraries properly recognize the individual contributions their librarians make to the systematic review processes within their promotion, tenure, or annual reviews.

In this commentary, we are using the term systematic reviews as being synonymous with the term evidence synthesis, though we recognize that the latter also encompasses other kinds of review methodologies such as integrative, rapid, or scoping reviews. Additionally, while this commentary primarily focuses on the impact for librarians working in health sciences settings, systematic review work is becoming more commonplace for librarians across a variety of other disciplines.

Consulting or teaching about the systematic review process have become important aspects of most academic health sciences libraries. Librarians have developed competency frameworks [4–7], systematic reviews services [8–15], forms or systems for collecting information to develop protocols or documenting their work [16–18], and strategies for negotiating their involvement within systematic review development [19–21]. They have co-developed reporting standards such as PRISMA and validated search hedges [22,23]. Although the role of librarians and the credit they are given have been debated [24–26], librarians will continue to be involved in this process, whether as co-authors or consultants.

Health sciences library organizations such as the Medical Library Association (MLA) have acknowledged expert searching within professional competencies [27,28] and standards [29,30], recognizing this as often being the primary role of a librarian on a systematic review team. To support librarians' development, MLA and other health information and non-profit organizations offer continuing education opportunities for librarians on conducting systematic reviews and gaining professional recognition for their participation [31-34]. Additionally, librarians who seek Academy of Health Information Professional (AHIP) certification can list the citations of published systematic reviews they have co-authored as part of establishing or maintaining their credential [35]. Yet it is unclear whether or how academic libraries value their librarians' work on systematic reviews as part of the promotion process or in annual reviews.

The authors reviewed thirty-six United States academic libraries' promotion or tenure norms where librarians are

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employed as faculty or have faculty status, including the authors' own institution. The included institutions are prolific for their systematic review work or serve as regional libraries within the National Network of Libraries of Medicine. The norms were obtained from searches on libraries' websites, interactions through libraries' chat services, or email or ticket requests to individual librarians or departments. Systematic reviews were only mentioned in two of the thirty-six libraries' promotion guidelines. The Spencer S. Eccles Health Sciences Library at the University of Utah mentions "novel systematic reviews" as an example under the creation of new knowledge category that also includes original research articles, scholarly monographs, presentations, and other kinds of research [36]. A related category, novel synthesis of existing knowledge, would give librarians credit for literature reviews or "review that proposes new conceptualizations of existing evidence." The University of Florida mentions systematic reviews and meta-analyses with peer reviewed articles as "indictors of distinction" for promotion [37]. The lack of acknowledgement within promotion guidelines suggests that academic and health sciences libraries have not recognized librarians' critical role in the systematic review process and how the time-intensive nature of these projects should be viewed within annual reviews and promotion processes.

RECOMMENDATIONS

Systematic review work must be included in annual reviews and promotion and tenure norms so that this labor and intellectual contribution is documented and recognized. Below we outline specific suggestions for what should be tracked to provide appropriate recognition for this work.

Annual Reviews

As a part of the annual review process, librarians who are co-authors must receive scholarly credit for any systematic reviews that are in process, submitted for publication, or have been published. Additionally, librarians must document instances when they completed a search, but a co-authored publication did not result. They should also include the number of consultations conducted as well as the amount of time spent on review-related tasks like translating searches into databases, citation tracing, or writing the methods section. To facilitate and standardize this across librarians at a given institution, an internal tracking system should be created or adopted to support librarians documenting their systematic review work so that they can quickly and consistently pull reports. A robust tracking system will ensure that the librarians' impact is documented for library leadership and for reports out to central campus administration. Additionally, these internal reports should be used to assess workloads and evaluate whether the quantity of systematic review requests is sustainable relative to current staffing levels [38]. It will also allow the identification and disruption of any trends where librarians are being inappropriately excluded from co-authorship when partnering with specific colleges or departments. As systematic reviews often require significant effort by the librarian at the beginning of the project, which may or may not see follow-through by the rest of the team, we recommend a written Memorandum of Understanding [39,40] by the team prior to project initiation, and to review ICMJE [41] rules for co-authorship and document team expectations towards publication.

If there is a disconnect between how librarians value their systematic review work versus their administrators or peers, then library administration or senior librarians need to initiate discussions to resolve this issue and ensure evaluation consistency. This is especially critical at institutions where librarians are expected to produce original scholarship as a criterion for evaluation. Supervisors and mentors will need to establish, support, and reinforce boundaries on their junior colleagues' involvement in systematic review work so they can develop their independent scholarship in addition to their systematic review contributions. This will likely need to continue to be handled on an individualized level, but library supervisors and leadership should recognize this labor and critically appraise the efforts being allocated to this work, especially if follow-through to publication is not consistently achieved.

Promotion or Tenure

As systematic reviews are now a recognized form of scholarly activity across most disciplines, librarians must revise promotion and tenure norms and other promotion standards to specify how their colleagues' will receive credit for their systematic review work for scholarship and/or librarianship requirements. This should be supplemented with clear guidance for departmental, campus, and external reviewers, to reduce confusion and inconsistent evaluation.

Systematic reviews are typically conducted on topics that are outside of the Library and Information Science (LIS) discipline, which at some institutions may not be assigned to the librarians' primary area of scholarship but to interdisciplinary work or counted as part of their librarianship. Even when evaluated as scholarship, one 2016 study did not find consensus as to whether systematic reviews were more or less important than LIS scholarship [26]. In the years since, this has not changed. During our review of libraries' norms, only 11 of the 36 libraries' promotion guidelines included text that valued interdisciplinary work or publications the same as LIS publications. One library's norms mentioned they "may be an indicator of distinction", while another library valued interdisciplinary work less. Where in alignment

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with campus standards, systematic reviews are likely to best fit into an interdisciplinary statement of scholarship.

Librarians in faculty positions may be expected to develop their own independent research agenda in addition to their contributions to systematic reviews. Participating as the librarian member of a systematic review team may not be considered a demonstration of unique scholarship nor an advance in the knowledgebase of librarianship. Norms should identify expectations for librarians required to pursue their own independent research, with appropriate support, with the addition of recognition and credit for participation in interdisciplinary research including systematic reviews. Clear documentation and expectations in this respect will allow librarians to balance their commitment of effort between their own scholarly-led efforts and serving as part of an interdisciplinary team on a systematic review. Systematic reviews where the librarian serves as the lead author or where the topic is directly connected to their scholarship, such as a review on nursing information literacy interventions, would fall under the librarian's own scholarly agenda. Library norms should indicate if a number of articles is required, and what balance will be accepted between a librarian's personal scholarship and their interdisciplinary scholarship.

Search Strategies

Librarians should also consider including the search strategies or search hedges they have developed in their annual reviews or promotion packets as a supplemental form of scholarship If the search strategies are not included within the affiliated reviews, they should create an affiliated record in PROSPERO, place them in their institutional repository or a resource like Open Science Framework (OSF), or plac them on a LibGuide or similar resource to allow peer discovery and reuse. Some Canadian libraries have begun posting their search strategies in their institutional data repository to better highlight and control their usage [42–46]. SearchRxiv, a search strategy archive that allows searches to be shared and re-used, is another opportunity for librarians to highlight their search strategies [47]. Additionally, Haddaway et al's 2022 article includes recommendations for a data structure that can be used to report reproducible search strategies [48]. Librarians could also include the number of times a search strategy or hedge has been viewed or even cited in their promotion packets. They should also ensure that they are giving proper credit to other librarians by citing their publications or search strategies if they have used them or integrated them into their search strategies.

Guidance for External Review

As libraries have a variety of norms and expectations for promotion, it is incumbent that leadership and senior librarians create clear and standardized guidance that assists external reviewers in understanding how the library values systematic review work: if these reviews count towards librarianship or scholarship, and the expected balance between librarian-led work versus collaborative work on interdisciplinary projects. Without this guidance, reviewers from other institutions may be confused as to why systematic review work is not being fully reflected within candidate's statements, CV, or other dossier materials.

One technique to facilitate this would be the creation of an annotated bibliography where the candidate describes their role in each of their scholarly outputs. For systematic reviews this could include protocols, the specific tasks performed (searching, deduplication, title/abstract screening, etc.), and/or the total amount of time spent on each phase of the review. Additionally, we recommend advocating for a separate interdisciplinary statement in addition to the traditional teaching, scholarship, and service statements for all librarians to address their engagement across disciplines.

As part of our dossier for promotion and tenure cases, University of Illinois Chicago (UIC) University Library gives library faculty the option to write and include an interdisciplinary statement. Most of the health sciences library faculty write an interdisciplinary statement to highlight their systematic reviews and other interdisciplinary scholarship, their service work at other colleges such as curriculum or search committees, or their service work at their hospital such as hospital-wide or nursing councils. When the interdisciplinary statement has included scholarship, the candidate has the option of sharing it with external reviewers to more fully document how their systematic review and other interdisciplinary work fits in with their scholarship. UIC Library also encourages faculty to annotate their citations within their CVs and dossiers so external reviewers and the campus-wide Promotion and Tenure Committee can better understand the librarian's role or contributions [49].

CALL TO ACTION FOR PROFESSIONAL ASSOCIATIONS

To reduce the replication efforts of documenting systematic review work across organizations, associations such as MLA or the Association of Academic Health Sciences Libraries (AAHSL) should develop and provide recommendations to their members on how to document their contributions to systematic reviews for annual reviews and promotion. A taxonomy for systematic review work like CRediT could be developed that would define the librarians' contributions to various phases of the systematic review process [50]. The health sciences librarianship literature has a few examples of articles that cover librarians' roles in the systematic review process [51–53]. It could also be used by librarians who work on systematic reviews that are never completed, or whose role as search consultants may only be documented as an

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acknowledgement in published systematic reviews for their work [25,26]. An example of this is present in the Cochrane Collaboration Contribution of the Authors section [54]. However, as many systematic reviews are not completed or published, this will be an incomplete representation of librarians' efforts. Similarly, due to the time frame for publication, some librarians may need documentation prior to submission or publication of their work on the reviews.

Librarians lay the foundation for the systematic review process. The review cannot proceed until the database searches are developed, translated, and finalized; the final citations are downloaded from databases; and duplicate citations are removed. Within our own institutions, we need to better demonstrate our contributions to fully capture our work within the systematic review process. We further need to discuss as a discipline how we are valuing the contribution of our expertise in systematic reviews not only to librarianship but beyond. Otherwise, we and our workplaces are failing ourselves by potentially undervaluing this scholarly labor or presenting an incomplete view of our work.

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AUTHORS' AFFILIATIONS

Rebecca Raszewski, MS, AHIP, raszewr1@uic.edu, https://orcid.org/0000-0003-1210-4272, Associate Professor & Information Services & Liaison Librarian, Library for the Health Sciences, University of Illinois Chicago, Chicago, IL

Abigail Goben, MLS, agoben@uic.edu, https://orcid.org/0000-0002-6520-3648, Professor & Data Management Librarian - University Library, and Data Policy Advisor - Office of the Vice Chancellor for Research, University of Illinois Chicago, Chicago, IL

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