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ORIGINAL INVESTIGATION

CASE REPORT

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Prevalence and impact of remote and hybrid work in academic health sciences libraries

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Objective: This study assesses the prevalence, usage, and impact of remote/hybrid work in academic health science libraries in 2022 and 2023. Due to differences in survey distribution, we focus primarily on the results of the second survey.

Methods: Researchers surveyed administrators at Association of Academic Health Sciences Libraries (AAHSL) member libraries in the United States in March 2022 and library staff at academic health sciences libraries in March 2023.

Results: The first survey received 71 responses that met inclusion criteria. Ninety-five percent of respondents indicated that remote/hybrid work was allowed in their libraries. Majorities indicated that remote/hybrid work had a positive impact on morale (86%), recruitment (53%) and retention (67%). The second survey received 383 responses that met inclusion criteria. 78% of respondents indicated they were allowed to work remotely, and majorities indicated remote/hybrid work positively impacted work/life balance (75%), morale/job satisfaction (69%), likelihood of staying at their current institution (64%), and productivity/overall effectiveness (58%). Respondents were less likely to accept a fully onsite (45% unlikely) or fully remote (20% unlikely) position than a hybrid one (1% unlikely). In a list of 9 factors associated with recruitment, retention, and job satisfaction, only salary and benefits ranked higher than remote/hybrid work.

Conclusions: Remote/hybrid work is common in academic health science libraries and highly valued by employees. While not without challenges, remote/hybrid work appears to be a valuable tool to support recruitment, retention, and job satisfaction of workers in academic health sciences libraries. The findings of this study can inform library decision makers about future use of remote/hybrid work.

Keywords: Remote work; hybrid work; recruitment; retention; job satisfaction

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INTRODUCTION

The COVID-19 pandemic caused major work disruptions and changes in the United States, including the large migration to remote and/or hybrid work during the pandemic. As the pandemic fades, remote/hybrid work is still available to many white-collar employees. In the broad job market, McKinsey's American Opportunity Survey (2022) noted that 58% of Americans can work remotely at least one day per week, and 87% of respondents indicated they would take advantage of that option if permitted [1]. Gallup reported that as of September 2023 the average worker in the United States works remotely 3.8 days per month [2].

Many libraries, including academic health sciences libraries, are currently trying to determine if and how to offer remote or hybrid work to their employees on a long-term basis. To inform those decisions, we conducted a survey in 2022 of academic health sciences library

administrators and a 2023 survey of academic health sciences library staff. These surveys focus on the state of remote and hybrid work in academic health sciences libraries as well as its impact on factors that may influence recruitment and retention of employees, including those from historically underrepresented groups. The survey results may inform best practices for advocating for, implementing, and supporting remote/hybrid work in academic health sciences libraries.

Library literature related to remote work can be divided into two general time periods: before and after the onset of the COVID-19 pandemic in early 2020. While somewhat uncommon in libraries before the COVID-19 pandemic [3-5], remote work and other forms of flexible scheduling were discussed in the library literature as early as 1984. In fact, pre-COVID literature on remote work identifies many of the advantages and challenges discussed today such as increased job satisfaction, accommodations for

employees with disabilities, home workspaces, and potential isolation [6-8]. As technology advanced, libraries began experimenting with telecommuting and even the National Library of Medicine provided a hybrid work program [9]. In 1992, the Association of Research Libraries (ARL) published the results of a survey of ARL member libraries on flexible work arrangements. Of the 89 respondents, 81 reported offering some type of flexible work arrangement but only 14 offered telecommuting/home-based work. The report's authors noted that "[l]ibrary managers have the unique opportunity to gain a competitive advantage by addressing the developing needs of the work force of the 21st century" [5]. We see similar arguments today in favor of flexible and remote/hybrid work.

In the first decade after the new millennium, several articles discussed communication tools and new developments in videoconferencing, online chat, and social networking facilitated by increased implementation of broadband internet that would transform remote work [10-12]. An accelerating shift to electronic collections also made remote work more feasible for librarians [13]. The increased interest in remote work was also reflected by two articles addressing ethnographic research on information maintained by four fully remote library workers and a proposed theoretical framework for remote's work future among librarians [14, 15].

Many articles were published in the library literature during the COVID-19 pandemic, particularly in 2020 and 2021, that described how individual libraries or departments within libraries coped with the shift to remote work brought on by the COVID-19 pandemic; however, we focused on articles reporting research results. Few published studies focus on academic health sciences libraries. Ragon, et al. conducted three surveys of academic health sciences library leaders to capture the status of the libraries and their services "at key points of the pandemic" [16]. Miller and Janke interviewed academic nursing librarians in Canada regarding how the pandemic affected their work, including (though not emphasizing) the impact of remote work [17]. Petersen investigated "two questions: whether remote and/or hybrid work arrangements were advertised in health sciences libraries prior to the COVID-19 pandemic, and whether there had been an increase in job postings that included flexible work arrangements during 2021-2022" [18]. Several studies have been conducted in general academic and public libraries regarding the prevalence, benefits, and drawbacks of remote work with results indicating productivity in the remote environment and benefits for recruitment and retention [3, 19-21].

METHODOLOGY

Numerous terms have been used to describe remote/hybrid work. In this paper, we use the following terms: fully remote work (no in-office requirements), hybrid work (at least one day per week can be outside the office), and fully onsite (remote work not permitted or permitted in rare/special circumstances only). Finally, we use the term "flexible work arrangements" to refer to the broader concept of deviation from traditional five-day, forty-hour onsite work schedules. Employers who offer other flexible work arrangements (e.g., flex time, compressed work weeks, job sharing) may—but do not always—permit remote/hybrid work.

We designed two surveys to investigate the use of remote and hybrid work in academic health science libraries. The surveys featured questions to obtain data on the usage and prevalence of remote/hybrid work along with demographic questions that allowed us to explore respondents' answers by geographic region, longevity at institution, and by position category. We used Qualtrics to survey administrators of academic health sciences libraries in the United States in March 2022 and academic health science library employees at all levels in March 2023. Both surveys were approved by each of the authors' respective Institutional Review Boards (University of Arizona Institutional Review Board, # STUDY00000747, 2022-2023. The Rockefeller University Institutional Review Board, # 363385; University of Tennessee Graduate School of Medicine in Knoxville. RB number # 4893, 2022-2023). The 2022 survey contained eighteen multiple choice, ranking, and free response questions that asked about the status of remote and hybrid work before and during the pandemic and whether respondents believed remote/hybrid work would continue beyond the pandemic. This survey was distributed to the AAHSL-all email list, which includes directors and other senior administrators at AAHSL member libraries and remained open for three weeks. Respondents had to be a current director or senior administrator at an AAHSL library in the United States to be included in the data.

In 2023, we wanted to learn the extent to which remote/hybrid work persisted in academic health sciences libraries and to expand the survey population beyond administrators to include full-time employees of academic health sciences libraries in the United States. We designed a 25-question survey in Qualtrics using a mix of multiple choice, ranking, and free response questions and distributed it to several email lists including AAHSL-all, MEDLIB-L, MLA caucus and chapter email lists. It remained open for three weeks. The inclusion criteria were that the respondent was a current employee at an academic health sciences library.

At the conclusion of the surveys, results were stored and analyzed in Qualtrics. We ended the survey by asking respondents, "Is there anything else you would like to tell us about remote work policies and practices in your library?" The free text responses were coded by one researcher and verified by another. Responses were coded into the following categories: availability of remote work,

effect on moral/productivity, effect on library operations, and effect on patron engagement. Once all responses were categorized, we analyzed them to identify themes and found the following themes were commonly expressed: positive and negative comments about remote/hybrid options, criticism about the implementation and execution of remote/hybrid work at their institutions, recruitment and retention, and equity concerns.

RESULTS

In the 2022 AAHSL administrators survey, we received 81 total responses, of which 71 met inclusion criteria. Of respondents selecting a region (n = 65), a plurality of responses was received from the Northeast (n = 21, 32%) followed by the Midwest (n = 15, 23%), Southeast (n = 14, 22%), West (n = 11, 17%), and Southwest (n = 6, 9%). This approximately mirrors the geographic distribution of AAHSL institutions (n = 163), of which 27% are in the Northeast, followed by the Midwest (23%), Southeast (23%), West (16%), and Southwest (12%). Most (n = 46/67, 69%) had worked at their current institution for at least 8 years. Respondents were asked about current remote/hybrid work policies at their library as well as the expected continuation of such policies. The majority of respondents (n = 59/62, 95%) indicated the existence of hybrid work of at least 1-2 days offsite while 29% (n = 18/62) indicated that fully remote work was an option. Respondents were optimistic that remote/hybrid work would continue, with 55% (n = 35/64) viewing its continuation as extremely likely and 28% (n =18/64) as somewhat likely. The survey asked respondents to indicate the impact, either positive, neutral, or negative, of their library's remote/hybrid work policy on several items. Responses indicated that remote/hybrid work at their institution had a positive impact (86%, n = 55/64) on employee morale, retaining existing librarians (68%, n = 43/63) and recruiting new librarians (53%, n = 33/62); however, the majority of respondents had a neutral view of remote/hybrid work's impact on employee scholarship (57%, n = 36/63).

For the 2023 survey of all academic health sciences library staff, we received 410 responses, of which 383 met inclusion criteria. When asked what best represented their role, 37% (n = 132/357) selected administrative options (directors, deputy directors, unit heads), 50% (n = 179/357) selected librarian, and 11% (n = 41/357) selected library staff. Forty-six percent of respondents (n = 164/357) indicated that they supervised someone. A plurality (n = 156/358, 44%) indicated that reference/instruction best represented their work area; a full breakdown of respondents by work area is shown in Figure 1. A plurality of responses (n = 111/358, 31%) came from the Northeast, followed by the Southeast (n = 97/358, 27%), Midwest (n = 66/358, 18%), West (n = 56/358, 16%) and Southwest (n = 28/358, 8%). Both public (n = 194/357, 54%) and private (n = 163/357, 46%)

institutions were represented. Respondents also had a wide range of longevity at their current institution; one-third (n = 120/358) had spent fewer than 3 years while 31% (n = 111/358) had stayed longer than 12 years.

When we asked respondents to indicate their race, we received 346 responses, of which 284 (82%) identified as White, 14 (4%) identified as Black or African-American, 12 (3%) identified as Hispanic or Latino/a/x, 5 (1%) identified as Multiracial, 2 (0.6%) identified as Native American or Alaska Native, and 19 (5%) declined to answer. Because of the small number of respondents identifying as other than White (33, 10%), it was not possible to perform a meaningful analysis of survey results by race.

Respondents were asked several questions pertaining to remote/hybrid work. As expected, the frequency of remote work appeared to increase dramatically with the onset of the COVID-19 pandemic. Thirteen percent (n = 46/353) indicated they were allowed to work remotely on a regular basis prior to the pandemic, while 23% (n = 81/353) did so occasionally. Nearly all respondents indicated they worked remotely during the pandemic. Circulation/interlibrary loan respondents were the only group in which greater than one percent of respondents indicated they could not work remotely during the pandemic.

When asked if they were currently allowed to work remotely (fully or hybrid), 78% (n = 275/353) indicated that they did so on a regular basis, while 13% (n = 47/353) said they did but only for exceptional circumstances. Nine percent (n = 31/353) reported they did not have a remote/hybrid option. Eighty-one percent (n = 285/350) believed remote/hybrid work was somewhat likely or extremely likely to continue at their institution beyond the COVID-19 pandemic era.

Figure 1 Current availability of remote/hybrid work by work area
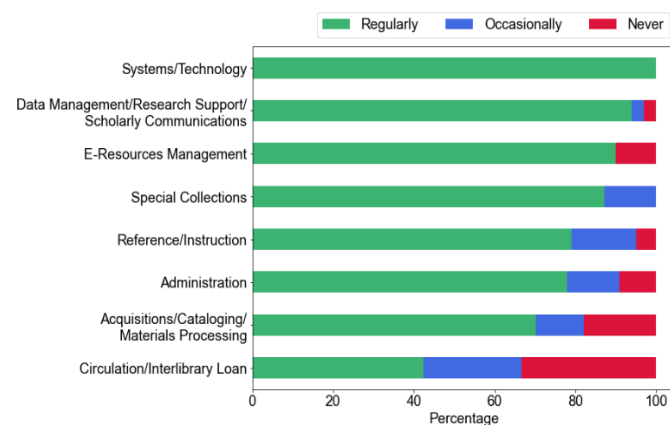
We asked respondents to indicate to what extent they could perform their duties remotely (if allowed). Thirty-seven percent (n =130/353) indicated they could perform all duties remotely, while 50% (n =176/353) indicated that they could perform more than half of their duties remotely. Twelve percent (n = 44/353) said they could perform less than 50% of their position duties remotely while 0.8% (n = 3/353) said they could not perform any of their duties offsite. These results were further broken down by library work area (see Figure 2). Special collections (50%, n = 4/8) and circulation/interlibrary loan (39%, n = 13/33) had a higher percentage that believed less than half their work could be completed remotely.

Figure 2 Library staff by work area: how much of your duties could you perform remotely?
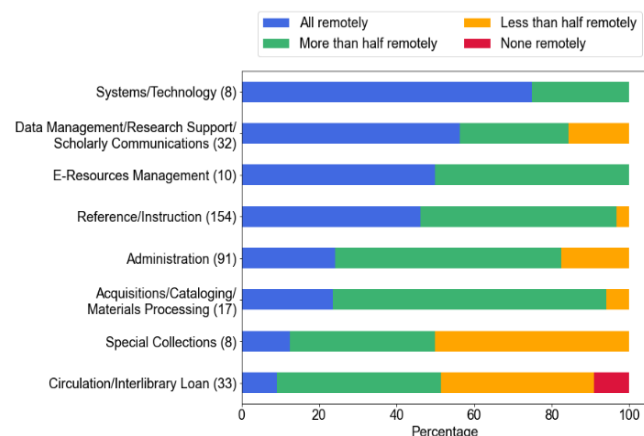
We also wanted to examine the impact of remote/hybrid work policies on several important workplace issues. The majority of respondents (n = 260/345, 75%) said that their library's remote/hybrid work policy positively impacted their ability to balance work with family or other non-work responsibilities. Majorities of respondents also indicated that these policies had a positive impact on morale and job satisfaction (n = 239/345, 69%), likelihood of staying at current institution (n = 220/345, 64%), and work productivity and overall effectiveness (n = 201/345, 58%). Responses were mixed about the impact of remote/hybrid work on a respondent's scholarship; 38% (n =132/344) indicated a positive impact, while 56% (n = 193/344) were neutral. This positive impact from remote/hybrid work opportunities, however, did not extend to relationships and ability to collaborate with colleagues; 30% (n = 104/345) reported a positive impact, while 49% (n = 170/345) expressed a neutral opinion and 21% (n = 71/345) reported a negative impact. Respondents who had been employed at their institutions longer than 12 years more frequently indicated a negative impact on their relationships and collaboration with colleagues (n =37/106, 35%) than those employed at their institutions

for 0-3 years (n =14/117, 12%). Additional study is needed to determine how remote/hybrid work policies impact workplace relationships and collaboration in academic health sciences libraries.

We asked respondents to rank nine factors frequently considered to be beneficial to recruitment, retention, and satisfaction, as shown in Figure 3. The data suggest that respondents ranked remote and/or hybrid work only behind salary and benefits.

Figure 3 Job factors ranked by importance
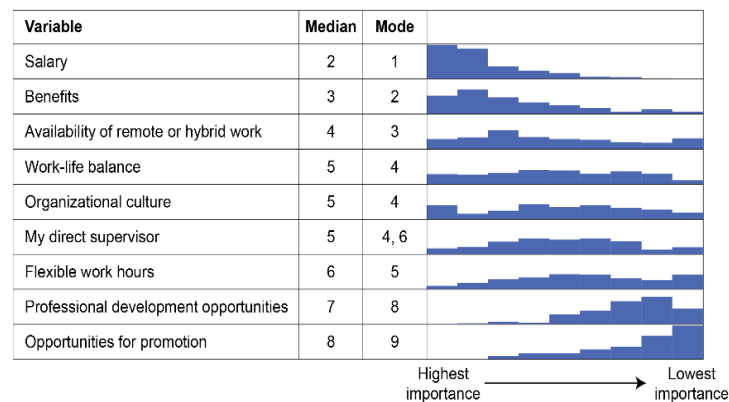
Given this high ranking, it was not surprising to find that respondents valued this option when assessing employment opportunities. 17% (n = 57/336) of respondents indicated they were very likely to accept a fully onsite position, while 45% (n = 151/336) indicated that they were not likely to do so. While almost all respondents (n = 339/344, 99%) were likely or somewhat likely to take a hybrid position, 20% (n = 66/338) were not likely to accept a position that was fully remote. These results varied somewhat by region. 12% (n = 13/107) of respondents in the Northeast indicated they would be very likely to take a fully in-person position compared to 26% (n = 7/27) in the Southwest. A majority of respondents in the West (n = 31/54, 57%), Southeast (n = 52/94, 55%), and Northeast (n = 54/107, 50%) indicated that they were very likely to take a fully remote position as compared to the Southwest (n =11/27, 41%) and Midwest (n = 29/64, 45%).

Responses to this question also varied by gender, as shown in Figure 4. Of the 346 respondents who selected a gender option, 78% (n = 269) were female, 16% (n = 54) were male, 4% (n = 13) selected another gender identity, and 3% (n=10) selected "prefer not answer." We offered several options for indicating gender identity, but due to the small number of respondents who chose an option other than "male" or "female," we collapsed those options into a single category. This was done, in part, to protect respondents' privacy. For respondents identifying as female, 46% (n =124/269) said they were not likely to take

a fully on-site position, compared to 35% (n = 19/54) of male respondents and 23% (n = 3/13) of those who indicated another gender identity. Over three-fourths of respondents who indicated a gender identity other than "male" or "female" indicated they were very likely to take a fully remote position (n = 9/13, 69%), higher than female (n = 136/269, 51%) or male (n = 25/54, 46%) respondents. One should exercise caution when interpreting the results given the uneven groups and potential for confounders.

We also investigated the usage and popularity of remote/hybrid work options among people with disabilities. In response to a survey question, approximately 17% of respondents (n = 58/345) indicated that they identified as a person with a disability or other chronic condition. When asked to rank nine factors frequently considered to be beneficial to recruitment, retention, and satisfaction, respondents with disabilities identified salary, benefits, and remote/hybrid work options as their top three items, the same as all respondents. While we were not able to establish statistical significance, the results suggest that respondents

with disabilities may be more inclined to accept a fully remote position (66%, n =38/58) compared to all respondents (48%, n = 131/271) and may be less inclined to accept a fully onsite position (55% (n=32/58) vs. 42% (n= 114/271) of those not identifying as having a disability). The low number of respondents identifying as a person with disabilities indicates that caution should be exercised when interpreting these results.

We ended the survey by asking respondents, "Is there anything else you would like to tell us about remote work policies and practices in your library?" We received 141 responses to this question. Several comments mentioned themes that were noted in articles referenced in the literature review. While the pandemic created an unprecedented opportunity for remote/hybrid work, many of the concerns, criticisms, and positive evaluations closely resemble those from articles written prior to the pandemic.

Unsurprisingly, there were many positive comments about remote/hybrid work. Several comments mention increased productivity and flexibility along with a few noting that they wish these options had been available when they had children or caregiving responsibilities. Others commented that remote/hybrid options had been "life-altering" with one commenter indicating they "would be forced to retire" if a remote option did not exist. Interestingly, some respondents indicated that remote/hybrid work enables them to better serve their patrons; one commented that "…few people want to meet

Figure 4 How likely are you to take a position with the following options? "Other" includes the following options from the survey: agender, genderqueer or genderfluid, nonbinary, questioning, other gender identity not listed.
Fully In-Person: Men (n = 54), Women (n = 260), Other (n = 13); Hybrid: Men (n = 54), Women (n = 268), Other (n = 12); Fully Remote: Men (n = 54), Women (n = 263), Other (n = 12)
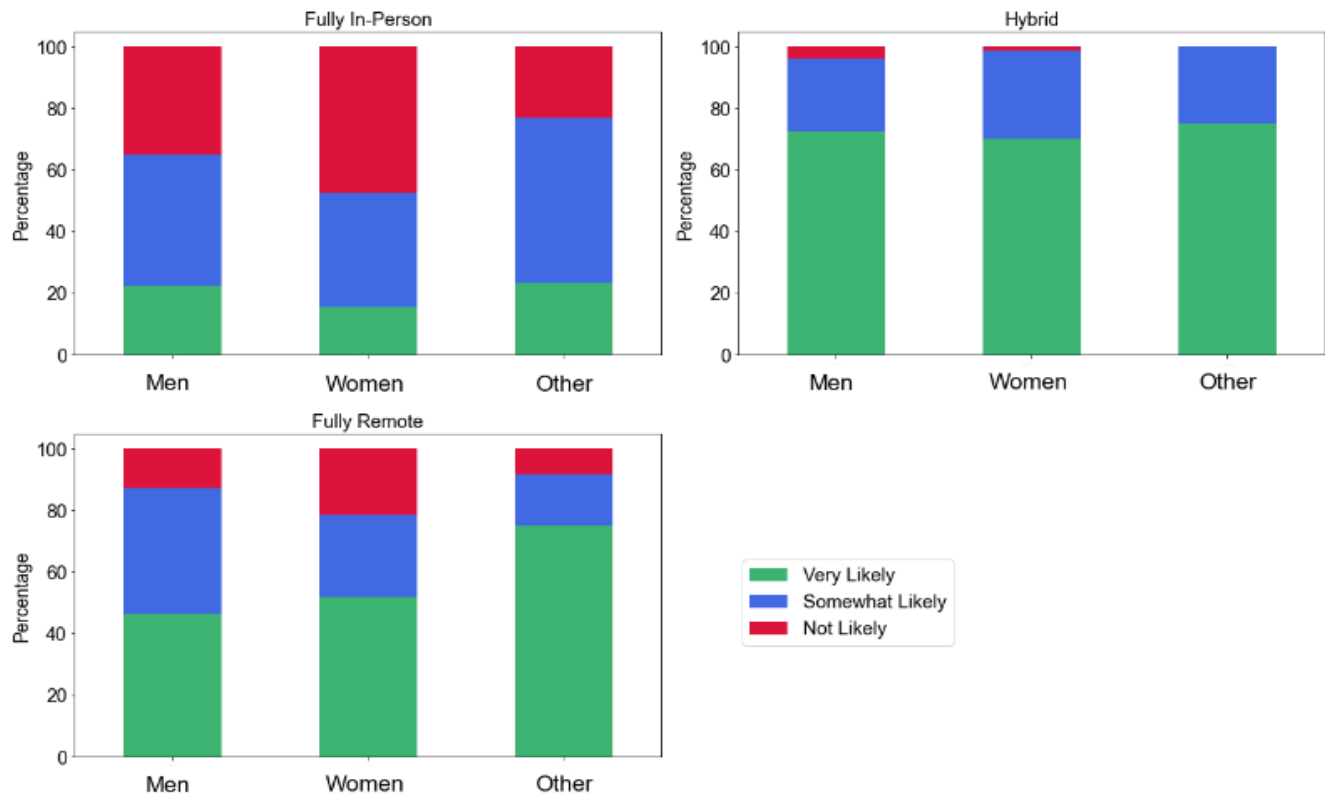
in person. Faculty and students want to meet virtually." Another positive facet of remote/hybrid work for some respondents was their mental health. One comment mentioned, "[remote/hybrid work] had a positive impact on both my work and interpersonal relationships as well as my mental health." Another said, "[s]ince working from home during COVID, my anxiety has almost resolved itself."

Several comments focused on recruitment and retention. Respondents said, "I will not take a job that requires fully in-person/onsite work again" and "[t]he reason that I left my previous job is because they wanted us to be in person full time…I refuse to go back to full time in person work." Others noted that "[t]he flexibility that hybrid work provides is the only thing keeping some of our library personnel from seeking opportunities elsewhere," "[p]eople in my library see remote work as a benefit now," and "several job candidates declined job offer[s] due to no remote/hybrid policy." One respondent took a more nuanced approach: "[t]here is suspicion that remote work policies are being used as a substitute for other career needs of employees, almost as if a hybrid schedule is supposed to make up for lack of organizational commitment in other areas."

Respondents were not uniformly positive about remote/hybrid work. Negative comments indicated that some people "prefer to work on campus for interaction with colleagues," "feel isolated and disconnected" while working remotely and view remote/hybrid work as "crippl[ing] employee relationships." Others wanted to keep "work and home life separate" and noted that they "work more reasonable hours when not working from home." Another respondent commented that with a hybrid work environment, the office "feels empty" and they "miss in-person interactions." One comment mentioned that hybrid work has not generally helped that institution's staff and observes "extremely high levels of burnout, not enough personnel, and a lack of promotion or financial incentives for the work being done."

Perhaps the largest topic covered in the comments concerned equity issues. While many respondents indicated general approval of remote/hybrid work, several had serious concerns about how it was being implemented at their institutions. Respondents noted that "remote work is not applied equitably" and that "remote work provides the greatest monetary advantage to professional staff who are highest earners." Another said, "[a]llowing some staff to work remotely is negatively affecting the morale of those of us who have to work on-site… It's unfair and creates a divide between departments." Recognizing the division between library faculty/professional staff and library staff, one respondent noted, "I don't like the feeling of requiring the lowest paid employees to be here more than other employees just due to the nature of their job." Going further, another commenter said, "[m]y university's policy has been

inequitable and inconsistent. We are no longer allowed remote work except until [sic] special circumstances that must be documented. At the same time, we no longer have weather closures and are told to work from home on the days that the campus is closed. This is terrible for employee morale and frankly is responsible for a definite increase in quiet quitting in our organization."

Several comments focused on positive actions to correct inequities related to remote/hybrid work. Figure 1 illustrates that circulation/interlibrary loan staff were the least likely to have remote/hybrid work options. One respondent noted, "Our Access Services team is not working remotely anymore; but we were able to offer them a shorter work week (35 hours over 4 days [versus] 35 hours over 5 days) when we phased out remote work for them." Another commenter in Access Services said that a remote/hybrid work "option reduces tensions between faculty and staff and makes me feel valued (not just a body at a desk)." These comments indicate that employers can help workers feel valued by offering flexibility and ensuring that all employees benefit from remote/hybrid work.

Discussion

The COVID-19 pandemic greatly increased the possibility of remote/hybrid work for many employees in academic health sciences libraries as survey results indicated that more than three-fourths of respondents are able to regularly work a remote/hybrid schedule.

It is also worth noting that though remote/hybrid work was often treated as a novelty during the pandemic, many of the benefits and drawbacks were identified in the library literature decades ago, as indicated in the introduction [5-6]. Some respondents indicated similar feelings to the pre-pandemic library literature on remote/hybrid work noting that the disconnect and isolation could be difficult while also appreciating the flexibility that the arrangements provided. The COVID-19 pandemic merely forced most libraries into a remote and/or hybrid work environment in an abrupt manner. One challenge will be the revision, implementation, and sustainability of remote and/or hybrid work policies. Despite this, libraries have an opportunity to integrate remote and/or hybrid work to benefit staff and the library through flexible work schedules and newly imagined position responsibilities.

Our results suggest that health sciences library workers value remote/hybrid work highly, and that respondents feel the availability of remote/hybrid work positively affects recruitment, retention, work-life balance, morale/job satisfaction, and productivity. However, respondents' assessments were mixed about the impact of remote/hybrid work on other areas, including relationships and collaboration with colleagues. Longer serving colleagues expressed dissatisfaction three times more frequently with remote/hybrid work than their

more newly hired colleagues. It remains to be seen how remote/hybrid options will impact collaboration and relationships over the longer term. This result invites further research into how library staff form and maintain relationships, collaborate effectively, and maintain a cohesive team atmosphere in a remote/hybrid environment.

The data suggest some interesting possibilities that invite reflection and further research. First, substantial percentages of respondents were not inclined to take either a fully in-person position or a fully remote position. These responses varied by gender. Female respondents more frequently indicated that they were unlikely to accept a fully in-person work option compared to male respondents; however, respondents with a gender identity other than male or female more frequently indicated a desire for a fully remote position. Results were mixed as to whether underrepresented groups prioritized remote/hybrid work to a greater degree than the overall sample. This data suggests that health sciences library workers desire flexibility, but many are unwilling to completely isolate themselves from in-person work. Of course, during the height of the pandemic, many worked in a fully remote capacity. However, as the pandemic recedes, and a new normal develops, people may be uncertain what constitutes their ideal work environment.

Second, recruitment and retention will remain major factors influencing—and being influenced by—the availability of remote/hybrid work. The survey data strongly suggests that a hybrid schedule is valued and very few respondents indicated a negative response to such an offering. Indeed, a 2023 survey of US workers found that 67% would be willing to take a pay cut if they could retain a hybrid schedule [22]. However, several comments suggested that an inequitable implementation of remote/hybrid work can lead to resentment, division, and disengagement. Our results suggest that institutions offering remote/hybrid work may attract additional applicants when conducting job searches, while institutions requiring fully onsite work may have difficulty recruiting and retaining employees.

This study has several limitations. The sample was self-selected and represents only two moments during the aftermath of the pandemic lockdown during 2020-2021. Researchers did not have data on how many health sciences library staff work in the United States. Thus, they were unable to very if respondents adequately represented all regions within the United States. The survey's respondents were 78% female, 16% male, and 4% nonbinary; this roughly approximated Pionke's 2020 study of the Medical Library Association that found 79% of respondents identified as female while 13% identified as male [23]. A 2023 Bureau of Labor Statistics report found that 82.5% of librarians and media collections specialists identified as female [24]. Additionally, our survey data varied from a recent survey of the Medical

Library Association regarding race or ethnicity with our survey having higher participation from White respondents.

Remote/hybrid work is a complex issue; its impact and success can be highly dependent on institutional setting, mix of employees, and/or specifics of implementation. Indeed, the term "hybrid work" can be ambiguous. People working remotely four days per week may have different opinions than those that work remotely one day per week. Unfortunately, the data did not allow researchers to make statistically supported assertions about the preference and experience of library staff from marginalized backgrounds. While data indicated that most academic health sciences libraries offer some form of hybrid work, we did not determine whether this still held true in a hospital or special library environment. Many facets of remote/hybrid work in health science libraries need further exploration including examining librarians from marginalized backgrounds and their experiences with remote/hybrid work, preference for remote/hybrid work based on the age of library staff, and the impact of remote/hybrid work on feelings of community in the workplace.

CONCLUSION

Data from this study indicate that the pandemic initiated a large shift in academic health sciences libraries offering remote/hybrid work arrangements and that work-from-home options show a positive impact on a person's desire to apply for or stay at a position. Remote/hybrid work options are important to employees, outranked only by salary and benefits. While many respondents value a remote/hybrid work option, it must be clearly and equitably implemented to avoid resentment, low morale, and disengagement.

Advocating for remote/hybrid work options is critical and involves many groups including library leadership, librarians, library staff, unions, and professional associations. Survey responses indicate that careful emphasis should be placed on the equitable and transparent implementation of remote/hybrid work. In addition to facilitating in-person work, library leaders will need to be intentional about creating a virtual environment that fosters collaboration, innovation, and trust. Survey results suggest that remote/hybrid work may continue to be a feature of the health sciences library workplace for the foreseeable future.

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DATA AVAILABILITY STATEMENT

Data associated with this article are available in the Open Science Framework at: https://osf.io/d6g2r/.

AUTHOR CONTRIBUTIONS STATEMENT

David Petersen: conceptualization, investigation, methodology, data curation, project administration, resources, writing – original draft, writing – review and editing; Matthew Covey: conceptualization, data curation, formal analysis, investigation, methodology, validation, visualization, writing – review and editing; Janet Crum: conceptualization, data curation, investigation, methodology, resources, writing – original draft, writing – review and editing.

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SUPPLEMENTAL FILES

- **Appendix A**: 2022 Survey Instrument
- **Appendix B**: 2023 Survey Instrument

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MLA Research Training Institute (RTI) 2018 and 2019: participant research confidence and program effectiveness

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Objective: The article reports on an assessment of the effectiveness of the MLA Research Training Institute (RTI) for the years 2018 and 2019. The RTI is a year-long continuing education research methods training and support program for health sciences librarians. The study focuses on assessing RTI participants' research confidence after program completion and compares these results with their perceptions of workshop/program performance and learning outcomes. In addition, the authors discuss how the findings were applied to inform and improve the program.

Methods: The study used a 26-item questionnaire, RTI Research Confidence Questionnaire, to gather information on participants' self-reported research confidence before the workshop, immediately after the workshop, and one year after the workshop to determine statistically significant differences. Differences in research confidence were identified by using three nonparametric statistical tests. Additional workshop and program surveys were used to corroborate the research confidence findings.

Results: Post-workshop and one-year-after-workshop research confidence ratings were significantly higher than pre-workshop levels for years 1 and 2. A comparison of median ratings between years 1 and 2 showed significant increases in research confidence for nine items in year 2. Participants' positive perceptions of workshop/program effectiveness and learning outcomes corroborated these findings.

Conclusion: Overall assessment findings indicated that RTI training helped participants understand, use, and apply research skills to conduct research. Findings also revealed that participants' heightened research confidence persisted at least 12 months postintervention. The RTI Research Confidence Questionnaire proved effective for rigorously assessing and improving the RTI program. This study enhances the currently limited evidence on evidence-based approaches for assessing and improving research instruction for librarians.

Keywords: Research confidence; research process; health sciences librarians; research training; librarian education; librarian research; evidence-based library and information practice (EBLIP)

EC See end of article for supplemental content.

INTRODUCTION

Despite an increasing recognition of the importance of research by health sciences librarians, there have been few national initiatives to educate and support practicing health sciences librarians in conducting research. Moreover, there have been limited opportunities to address the wide range of issues facing health sciences librarians who are motivated to conduct research but are unfamiliar with and hesitant about the research process. As a way to redress these gaps, provide a comprehensive learning and support solution, and build the research capability of health sciences librarians on a national scale, the Medical Library Association (MLA) Research Training

Institute for Health Sciences Librarians (RTI) was developed to help health sciences librarians build research skills, confidence, and experience to increase the quality, quantity, and dissemination of their research outputs.

The RTI builds on a distinctive and prescient vision from 30 years ago [1], which recognizes the importance of research in health information practice. This remains a foundational principle that continues to guide, challenge, and inspire contemporary health sciences librarians [2]. This influential MLA research policy statement [1], along with the second edition [3-4], that links research to health information practice, helped spark the rise of evidence-based library and information practice (EBLIP) [5], a

conceptual framework that has continued to evolve and change with proponents of EBLIP introducing new EBLIP concepts, models, and dissemination platforms over time [2, 5-9]. Inspired by this heightened focus on advancing research in the profession and the subsequent discourse surrounding EBLIP, the research engagement and productivity of health sciences librarians increased over the span of several decades [5, 10-13].

Health sciences librarians benefit from using, creating, and applying research-based evidence in supporting quality health care and library practice. Health sciences librarians have played a key role in initiating, nurturing, and spreading evidence-based practice (EBP) in the health professions [5] and in fostering the growth of the EBLIP movement [5, 9, 14]. Librarian-led research has highlighted the positive contributions of health information provided by health sciences librarians and libraries on clinical decision-making and patient care [15-21], health professions' teaching and learning [17-18, 20-22], and systematic reviews [23-27]. Additionally, health sciences librarians have undertaken research to enhance library services and programs [13, 21, 28-29].

Despite these benefits, many librarians have struggled with conducting and publishing research studies. Journal editors and scholars have noted that the evidence base of health sciences librarianship needs strengthening in several areas, including an uneven quantity and quality of research across subject areas [4,10, 30-33]; an over-emphasis on quantitative and descriptive methods [30, 34-37]; and lower non-publication rates of conference abstracts [37-40]. Other studies have shown that health sciences librarians face various barriers and challenges to conducting and disseminating research, including a lack of research skills, training, and mentorship [4,13,41-43] and a lack of research confidence [43-45], among other hindrances. More recently researchers have focused on research success factors to identify interventions for improving librarian research engagement. Several studies have found that research methods training [46-47], research confidence [48-49], and mentorship [50-54] have contributed positively to the research engagement and productivity of librarians.

Research-related education for health sciences librarians has long been identified as a necessary step for librarians to apply and engage in research. Early MLA research and education policies [1, 55] emphasized the critical analysis and appraisal of published research findings to support healthcare users in clinical and academic settings. MLA's subsequent research policy [3] and professional competencies [56-57] shifted focus toward LIS research methods and cultivating a rich LIS research base. The promulgation of this influential research policy and MLA's professional competencies in research, coupled with the well-documented benefits of integrating research into practice, have led to an increased demand among health sciences librarian practitioners for continuing

education options for research methods training with experienced researchers [13, 58].

Several models of research training institutes for practicing librarians emerged in response to a demand for more in-depth research training. In 2012, the Canadian Association of Research Libraries began offering the Librarians' Research Institute (LRI) to practicing academic librarians in Canada [59]. In the U.S., two continuing education programs were established with grant funding from the Institute of Museum and Library Services (IMLS). The Institute of Research Design in Librarianship (IRDL), established in 2014, provides academic and research librarians with research methods training and support [60]. The Research Institute for Public Libraries (RIPL), launched in 2014, focuses on data and evaluation for public librarians [61].

The MLA Research Imperative Task Force (RITF), with the assistance of a planning group of research experts, developed a proposal to create the Research Training Institute for Health Sciences Librarians (RTI), which was approved by the MLA Board of Directors in 2016 [62]. Subsequently, MLA received federal funding from the Institute of Museum and Library Services (IMLS) Laura Bush 21st Century Librarian Program to establish the MLA Research Training Institute for Health Sciences Librarians (RTI). The RTI is tailored to health sciences librarians' unique educational needs and focuses on advancing the creation, integration, and communication of health information research. In addition, it leverages MLA's educational, conference, and communication tools to maximize the participants' research learning environment, networking, and engagement.

This article examines the effectiveness of the RTI program during its initial two years, Year 1 (2018-2019) and Year 2 (2019-2020), with particular emphasis on changes in participants' research confidence and their perceptions of workshop/program performance and learning. Specifically, the article describes the results of assessing the effectiveness of the RTI summer workshop and continuing support in increasing and sustaining participants' research confidence after workshop completion and one year later. It compares and contrasts these results with survey data, evaluating participants' perceptions of workshop effectiveness and learning outcomes. The article also discusses how the findings were applied to inform and improve the RTI program. Additionally, it presents a brief literature review and description of the RTI program to provide context and rationale for the study.

Description of the RTI Program

For the first two years, the RTI program focused on an in-person summer research methods workshop each July at the University of Illinois Chicago (UIC), followed by a year of formal mentoring and support as participants

designed, conducted, and disseminated a research project. The weeklong workshop consisted of 12 learning modules with separate learning objectives, lectures, learning activities, small and large group discussions, and individual mentoring sessions. The RTI used MLA's MELIB-ED, an online education environment, to deliver content for all learning modules, including pre-recorded lectures, lecture slides, reading lists, schedules, syllabi, assignments, and worksheets.

The curriculum content for the workshop covered all the stages of the research process, including research planning and design, theoretical frameworks, method selection, data collection and analysis, dissemination of research, and reporting findings. Participants received expert instruction from five faculty instructors. All instructors were experienced librarian-researchers selected for their expertise and complementary research skills, as well as their experience teaching research to librarians and information studies students. The five faculty developed the initial curriculum content and delivered the online and in-person teaching activities.

Following the workshop and for the remainder of the institute year, participants participated in a mentoring program and two experiential learning activities (development of a research project and capstone presentation). Each participant was assigned to an experienced faculty/mentor who facilitated small group and individual mentoring sessions throughout the year. Each participant also actively participated in the RTI community of practice for their continued learning and collaboration, which provided online access to shared files, mentor forums, and forums for current and past cohort members. Participants completed a capstone experience at the end of each institute year by developing and presenting a poster on their research project at a special RTI session at the MLA annual meeting. Additionally, participants completed quarterly reports to monitor and support project completion.

The RTI's target audience was practicing librarians with novice and intermediate research skill levels who work in a wide variety of medical and non-medical work settings. RTI participants were selected for the program by a competitive process involving an independent double-blind review of applications by an MLA RTI jury appointed by the MLA Board of Directors, ensuring a fair and rigorous selection of applicants. Applicants were selected based on a publicly available rubric that evaluated the applicant's research learning goals, research proposal, professional achievements, and support letter from a supervisor. Seventy-three health sciences librarians from across the United States submitted applications for Years 1 and 2, and 20 RTI participants were selected to attend each of the two RTIs.

Approaches To Assessing the RTI Program

Rigorous assessments took place throughout the program in both years: pre-workshop, during the workshop, post-workshop, and at quarterly intervals thereafter, including the end of the program. Areas assessed included participants' prior research engagement, research confidence, workshop/program performance, learning outcomes, program impacts, and research output. See Appendix A for an overview of all RTI areas assessed, methods used, and data collection time periods.

The RTI director and faculty used the assessment findings to evaluate the program and learning effectiveness, set goals for improvement for subsequent institutes, and help identify best practices in research learning and teaching. RTI data collection instruments and annual assessment findings are freely accessible online from the RTI website to promote transparency, allow for the verification and reuse of data, and ensure accountability to funding agencies and sponsors [63].

The focus of the present study assessed the program's effectiveness with special emphasis on changes in participants' research confidence and participant perceptions of workshop/program performance and learning. Specific questions that guided this study were:

1. Was the RTI effective in increasing the research confidence of participants post-workshop and one-year post-workshop?

2. Did the pre- and post-workshop research confidence of RTI participants increase in year 2 compared to year 1?

3. What were the perceptions of the RTI participants concerning key program performance and learning outcomes? Did these perceptions confirm or diverge from the research confidence findings?

METHODS

This study used a quantitative approach to explore the effectiveness of the MLA RTI for years 1 and 2. Questionnaires were used to gather information on participants' self-reported research confidence. In addition, two quality improvement questionnaires were administered to gather information on the perceived performance of the RTI workshop/program, participants' perceptions of their learning, and to confirm results inferred from the research confidence data. The areas assessed in this study, including instruments used and timetable for each of these data collection points, are provided in Table 1.

Table 1 Areas Assessed, RTI Instruments Used, and Annual Timetable in Present Study

Areas Assessed	RTI Instrument Used	Annual Timetable
Research confidence (time 1)	RTI Research Confidence Questionnaire	Month before workshop (May)
Research confidence (time 2)	RTI Research Confidence Questionnaire	One month after workshop (August)
Workshop effectiveness	RTI Workshop Evaluation Survey	One month after workshop (August)
Research confidence (time 3)	RTI Research Confidence Questionnaire	One year after workshop (August following year)
Learning outcomes	RTI End-of-Program Evaluation Survey	One year after workshop (August following year)

RTI participants, who consisted of the study's population, were 40 health sciences librarians: 20 in year 1 and 20 in year 2. RTI participants came from 21 states across the United States and from a heterogeneous mix of libraries, including hospitals, academic health sciences, community colleges, health associations, and federal libraries. Participants were employed for an average of 10 years since completing their LIS master's degree and held a wide range of professional positions. 82% were female and 18% were male. All 40 RTI participants were invited to complete all assessments.

Assessing Research Confidence

This assessment uses RTI participants' research confidence as an indicator of the effectiveness of the RTI research training and a predictor of their research success and productivity. Perceived research confidence, or research self-efficacy (RSE), is strongly associated with research training and mentoring in other fields [64]. Our research confidence assessment was informed by the work of Brancolini and Kennedy [65], who used Bandura's theory of self-efficacy [66] to develop, validate, and use a domain-specific research confidence instrument. The RTI Research Confidence Questionnaire (Appendix B) was adapted from their scale, the IRDL Librarian Research Confidence Scale (LRCS-38). The RTI Research Confidence Questionnaire includes a total of 26 items on research methods competencies, organized under the top-level phases of the research process.

The RTI Research Confidence Questionnaire was administered by an MLA staff member serving on the RTI

Leadership Team via an online survey, Survey Monkey, a commercial online survey service. Blinded data was then sent to two authors for analysis. Differences in research confidence levels were identified by using three nonparametric statistical tests in SPSS statistical software (Version 28). The Wilcoxon Signed Ranks Test was used to determine if there were statistically significant differences in the self-reported research confidence of all participants before the workshop (time 1) and immediately after the workshop (time 2). The Friedman test assessed differences in the confidence levels of all participants across 3-time points: before the workshop (time 1), immediately after the workshop (time 2), and at the end of the one-year program (time 3) to assess the RTI's longer-term effectiveness and identify effective strategies that promote longer-term learning and retention. The Mann-Whitney U test was used to compare differences in research confidence between the RTI participants enrolled in year 1 to those in year 2 to determine if program adjustments made in year 2 based on multiple assessments improved the research confidence of participants. The statistical threshold was set at 0.05, $p \le 0.05$, for all tests.

Assessing Workshop Effectiveness and Learning Outcomes

The RTI Workshop Evaluation Survey (Appendix C) consisted of 23, five-point Likert-scale items (1 - poor, 2 - below average, 3 - average, 4 - good, 5 - excellent) that asked participants to rate the effectiveness of specific aspects of the workshop. The RTI End-of-Program Evaluation Survey (Appendix D) consisted of 34 items and used a five-point Likert scale (1 - strongly disagree, 2 - disagree, 3 neither agree nor disagree, 4 - agree, 5 strongly agree) to measure participant perceptions of specific program elements and learning performance. This study uses four overall workshop effectiveness statements from the RTI Workshop Evaluation Survey (Q1, Q4, Q6-7) administered after the completion of the workshop and four learning performance statements from the RTI End-of-Program Survey (Q31-34) distributed at the end of the yearlong program. The four learning performance statements corresponded to four learning performance statements for funded IMLS Learning Award projects. Quality indicators for both surveys were a concurrence percentage of 80% or higher and a mean score of 4.0 or higher for all survey items. By using additional data sources from these two surveys, we compared and contrasted the workshop and learning results with the research confidence data to increase the reliability and robustness of our findings.

As data were collected with the limited intent of evaluating and improving the MLA RTI program, this study meets the definition of quality improvement and did not require approval by an institutional review board.

RESULTS

Research Confidence: Pre- and Post-Workshop (Wilcoxon Signed Ranks Test)

Analysis using the Wilcoxon Signed Ranks Test indicated that there were statistically significant differences in the research confidence ratings pre- and post-workshop for years 1 (N=20) and 2 (N =20), except for two items in year 2: Q7, "Assessing and synthesizing literature that is relevant to my research question;" and Q21, "Knowing how to manage the data." See Table 2: Pre- and post-workshop research confidence for years 1 and 2 (Wilcoxon Signed Ranks Test).

Post-workshop research confidence ratings were **significantly higher** than pre-workshop research confidence for every item assessed for year 1. This result was the same for year 2, except for Q7 and Q21. The median ratings increased from 1.0 to 3.0 points, with the exception of Q7 and Q21 in year 2.

Pre-workshop median ratings for both years were relatively low for four items but were significantly higher post-workshop. Pre-workshop median ratings for both years were high for two items and remained high post-workshop. See Table 3: Pre-workshop research skills with low and high confidence ratings, years 1 and 2.

Post-workshop median ratings for both years were very high (medians of 5) for two items. Post-workshop increases of medians for both years were high (medians that rose 2+) for six items. See Appendix E: Table Post-workshop research skills with high medians and median increases, years 1 and 2.

Research Confidence: Pre-, Post,- and One-Year-After-Workshop (Friedman Test)

Analysis using the Friedman Test indicated that there were statistically significant differences in the research confidence ratings pre-, post-, and one-year-after-workshop for years 1 and 2, with the exception of Q21 for year 2: Q21 *(Mdn 4)*, "Knowing how to manage the data." See Table 4: Pre-, Post-, One-year-after-workshop research confidence for years 1 and 2 (Friedman Test).

One-year-after workshop research confidence ratings for year 1 (N=19) showed **significant gains** for every item over pre-workshop levels. This result was the same for year 2 (N=18), except Q21. Median ratings for both years increased by 0.5-3.0 points for every item one year after the workshop.

One-year-after-workshop median ratings for both years were high (medians with 5) for three items. One-year-after-workshop median increases for both years were high (medians that rose 2+) for ten items. See Table 5: One-year-after workshop research skills with high confidence ratings and median increases, years 1 and 2.

Research Confidence: Year 1 Compared to Year 2 (Mann-Whitney U Test)

A comparison of median ratings between years 1 and 2 showed significant differences for nine items. Seven items showed statistically significant differences in year 2 at time 2 (post-workshop), and four items showed statistically significant differences in year 2 at time 3 (one year after the workshop). See Table 6: Research confidence comparison between years 1 and 2 (Mann-Whitney U).

Participants in year 2 rated more items with high confidence (median scores of 4-5) post-workshop and one-year-after-workshop than those in year 1 (44 vs. 35). Additionally, participants in year 2 rated fewer items with low median ratings (median scores of 3-3.5) at these time points than participants in year 1 (6 vs. 17 items). See Appendix F: Table Median ratings comparison for years 1 and 2.

Workshop Effectiveness and Learning Outcomes

Additional program outcome measures were examined related to participant perceptions of workshop effectiveness and learning outcomes. Participants in both year 1 (N=20) and year 2 (N=20) regarded four main areas of RTI workshop performance highly, encompassing their overall perceptions of the workshop, evaluation of RTI services and staff, assessment of the curriculum quality, and appraisal of the instructors' effectiveness. The ratings ranged from 95% to 100%, indicating that they perceived these aspects as excellent or good. See Appendix G Table Workshop effectiveness and learning outcome results for years 1 and 2.

Large majorities of participants in year 1 (N=19) and year 2 (N=18) strongly agreed or agreed with the four positive learning outcomes statements. Participants in both years strongly agreed or agreed that their interest in and understanding of research increased (ranging from 89%-100%) and that they were confident in applying what they learned and their ability to do research because of the RTI program (ranging from 82% to 95%). The four learning outcomes in both years had median scores of 5 (strongly agree), except one median rating of 4 in year 1. Quality indicators of workshop effectiveness and learning outcomes for both years exceeded our assessment targets of ≥80% and a median rating of ≥4. See Appendix G: Table Workshop effectiveness and learning outcome results for years 1 and 2.

Table 2 Pre- and post-workshop research confidence for years 1 and 2 (Wilcoxon Signed Ranks Test)

	Year 1				Year 2			
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	Z score	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	Z score	*p* value
1. Turning your topic into a question.	3	4	-3.087	.002*	3	4	-3.491	.000*
2. Designing a project to answer your question.	2.5	4	-3.630	.000*	3	4	-3.815	.000*
3. Selecting methods and procedures for your question.	2	3	-3.352	.001*	2	4	-3.971	.000*
4. Developing plan and timeline for your study.	2	4	-3.534	.000*	3	4	-1.973	.049*
5. Identifying appropriate information sources in which to conduct your literature search.	4	5	-2.221	.026*	2.5	5	-3.769	.000*
6. Using relevant keywords and search strategies to discover literature about the research topic.	4	5	-2.804	.005*	4	5	-2.299	.022*
7. Assessing and synthesizing literature that is relevant to your research question.	3	4	-2.984	.003*	4	4	-0.758	.448
8. Using a theoretical framework to inform the research design of your study.	1	3	-3.022	.003*	1.5	3	-2.702	.007*
9. Identifying sources of research funding and funding agency requirements.	2	3	-3.570	.000*				
10. Choosing an appropriate data gathering procedure.	2	3.5	-4.011	.000*	2	4	-3.787	.000*
11. Determining which members of a population to include in your study.	2	4	-3.672	.000*	2	4	-3.676	.000*
12. Knowing how to design a focus group.	2	3	-3.804	.000*	2	3.5	-3.903	.000*
13. Knowing how to run a focus group.	2	3	-3.682	.000*	2	3	-3.677	.000*
14. Knowing how to design an interview.	2	4	-3.685	.000*	2	4	-3.794	.000*
15. Knowing how to conduct an interview.	2	4	-3.499	.000*	2	4	-3.903	.000*
16. Knowing how to design a survey.	2	4	-3.839	.000*				
17. Knowing how to administer a survey.	2.5	4	-3.250	.001*	2.5	4	-3.703	.000*
18. Knowing institutional processes and standards to ensure that your study is conducted ethically.	3	4	-3.274	.001*	3	4	-3.469	.001*
19. Knowing what method of data analysis to use for your study.	1	3	-3.668	.000*	1.5	4	-3.872	.000*
20. Knowing what type of assistance you might need to undertake data analysis.	2	4	-3.809	.000*	1	4	-3.864	.000*
21. Knowing how to manage the data you have gathered.	2	3.5	-3.668	.000*	4	4	-.924	.356
22. Knowing how to code qualitative data to identify themes and subthemes.	1	3	-3.660	.000*	2	4	-3.560	.000*
23. Reporting results in written format.	2	3	-3.486	.000*	3	4	-3.787	.000*

	Year 1				Year 2			
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	Z score	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	Z score	*p* value
24. Reporting results verbally.	2	3	-3.463	.001*	2.5	4.5	-3.677	.000*
25. Identifying appropriate places to disseminate results.	3	4	-3.640	.000*	3	4	-3.405	.001*
26. Tracking the dissemination and impact of your research.	3	4	-3.458	.001*	2.5	4	-3.072	.002*
*p value significant (p<0.05) by Wilcoxon Signed Ranks test.								

Table 3 Pre-workshop research skills with low & high confidence ratings, years 1 & 2

Q#	Skills with **low** confidence*	Q#	Skills with **high** confidence †
8	Using a theoretical framework	6	Using relevant keywords and search strategies to discover literature about the research topic
19	Knowing what method of data analysis to use for your study	7	Assessing and synthesizing literature that is relevant to your research question
20	Knowing what type of assistance, you might need to undertake data analysis		
22	Knowing how to code qualitative data to identify themes and subthemes		
* Research skills with pre-workshop ratings of ≤2 and post-workshop ratings of ≥ 3.		*† Research skills with pre-workshop ratings of ≥ 3 and post-workshop ratings of ≥4.*	

Table 4 Pre-, post-, and one-year-after-workshop research confidence for years 1 and 2 (Friedman Test)

	Year 1					Year 2				
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=19)	χ^2	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=18)	χ^2	*p* value
1. Turning your topic into a question.	3	4	4	14.392	.001*	3	4	4	15.125	.001*
2. Designing a project to answer your question.	2.5	4	4	28.836	.000*	3	4	4	26.793	.000*
3. Selecting methods and procedures for your question.	2	3	4	20.985	.000*	2	4	4	28.557	.000*
4. Developing plan and timeline for your study.	2	4	4	18.000	.000*	3	4	4	24.295	.000*

	Year 1					Year 2				
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=19)	χ^2	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=18	χ^2	*p* value
5. Identifying appropriate information sources in which to conduct your literature search.	4	5	5	7.190	.027*	2.5	5	5	14.659	.001*
6. Using relevant keywords and search strategies to discover literature about the research topic.	4	5	5	12.884	.002*	4	5	5	11.302	.004*
7. Assessing and synthesizing literature that is relevant to your research question.	3	4	5	14.982	.001*	4	4	4.5	12.667	.002*
8. Using a theoretical framework to inform the research design of your study.	1	3	3	25.581	.000*	1.5	3	3	14.880	.001*
9. Identifying sources of research funding and funding agency requirements.	2	3	3	19.500	.000*					
10. Choosing an appropriate data gathering procedure.	2	3.5	4	32.794	.000*	2	4	4	30.145	.000*
11. Determining which members of a population to include in your study.	2	4	4	22.164	.000*	2	4	4	20.698	.000*
12. Knowing how to design a focus group.	2	3	4	30.207	.000*	2	3.5	4	23.639	.000*
13. Knowing how to run a focus group.	2	3	4	30.145	.000*	2	3	4	20.109	.000*

	Year 1					Year 2				
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=19)	χ^2	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=18	χ^2	*p* value
14. Knowing how to design an interview.	2	4	4	28.444	.000*	2	4	4	26.655	.000*
15. Knowing how to conduct an interview.	2	4	4	25.240	.000*	2	4	4	27.898	.000*
16. Knowing how to design a survey.	2	4	4	27.263	.000*					
17. Knowing how to administer a survey.	2.5	4	4	19.478	.000*	2.5	4	4	26.308	.000*
18. Knowing institutional processes and standards to ensure that your study is conducted ethically.	3	4	5	20.491	.000*	3	4	5	22.291	.000*
19. Knowing what method of data analysis you would use for your study.	1	3	3	26.517	.000*	1.5	4	3	27.594	.000*
20. Knowing what type of assistance you might need to undertake data analysis.	2	4	3	25.200	.000*	1	4	4	25.733	.000*
21. Knowing how to manage the data you have gathered.	2	3.5	3	22.800	.000*	4	4	4	5.434	.066
22. Knowing how to code qualitative data to identify themes and subthemes.	1	3	3	26.281	.000*	2	4	4	26.333	.000*
23. Reporting results in written format.	2	3	4	20.481	.000*	3	4	4.5	23.705	.000*
24. Reporting results verbally.	2	3	4	21.893	.000*	2.5	4.5	4.5	23.186	.000*
25. Identifying appropriate places to	3	4	4	27.345	.000*	3	4	4.5	17.273	.000*

	Year 1					Year 2				
Questions about specific skills and knowledge needed for a research project.	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=19)	χ²	*p* value	*Mdn* (Pre, N=20)	*Mdn* (Post, N=20)	*Mdn* (1 Yr, N=18	χ²	*p* value
disseminate results.										
26. Tracking the dissemination and impact of your research.	3	4	4	19.538	.001*	2.5	4	4	19.283	.000*
* *p value significant (p<0.05) by Friedman test.*										

Table 5 One-year-after-workshop research skills with high confidence ratings and median increases, years 1 and 2

Q#	Research Skills
3	Selecting methods and procedures for your question*
5	Identifying appropriate information sources in which to conduct your literature search†
6	Using relevant keywords and search strategies to discover literature about the research topic†
10	Choosing an appropriate data gathering procedure*
11	Determining which members of a population to include in your study*
12	Knowing how to design a focus group*
13	Knowing how to run a focus group*
14	Knowing how to design an interview*
15	Knowing how to conduct an interview*
18	Knowing institutional processes and standards to ensure that your study is conducted ethically*†
22	Knowing how to code qualitative data to identify themes and sub-themes*
24	Reporting results verbally*
*Research skills with one-year-after-workshop median increases of ≥ 2. †Research skills with one-year-after-workshop ratings of 5.	

Table 6 Research confidence comparison between years 1 and 2 (Mann-Whitney U Test)

Questions about specific skills and knowledge needed for a research project.	*U* (Pre) Time 1	*p* value	*U* (Post) Time 2	*p* value	*U* (1 Yr) Time 3	*p* value
1. Turning your topic into a question.	182.00	.596	170.00	.383	168.00	.918
2. Designing a project to answer your question.	192.00	.819	131.50	.062	162.00	.763
3. Selecting methods and procedures for your question.	173.00	.432	87.00	.001*	152.00	.541

Questions about specific skills and knowledge needed for a research project.	U (Pre) Time 1	p value	U (Post) Time 2	p value	U (1 Yr) Time 3	p value
4. Developing plan and timeline for your study.	164.50	.314	63.00	<.001*	159.00	.699
5. Identifying appropriate information sources in which to conduct your literature search.	194.00	.864	160.50	.203	162.00	.743
6. Using relevant keywords and search strategies to discover literature about the research topic.	174.50	.468	159.00	.334	144.00	.272
7. Assessing and synthesizing literature that is relevant to your research question.	188.00	.737	179.50	.549	162.00	.763
8. Using a theoretical framework to inform the research design of your study.	182.50	.603	167.50	.355	168.00	.921
9. Identifying sources of research funding and funding agency requirements.	198.50	.966	111.50	.011*	159.50	.714
10. Choosing an appropriate data gathering procedure.	170.00	.383	129.00	.038*	123.50	.120
11. Determining which members of a population to include in your study.						
12. Knowing how to design a focus group.	199.50	.988	197.00	.931	158.50	.684
13. Knowing how to run a focus group.	188.50	.738	187.00	.710	124.50	.137
14. Knowing how to design an interview.	188.00	.726	180.50	.772	148.00	.457
15. Knowing how to conduct an interview.	174.00	.449	192.50	.828	165.00	.846
16. Knowing how to design a survey.						
17. Knowing how to administer a survey.	186.00	.684	157.00	.177	139.50	.279
18. Knowing institutional processes and standards to ensure that your study is conducted ethically.	187.50	.723	170.00	.367	153.00	.528
19. Knowing what method of data analysis you would use for your study.	150.00	.113	143.00	.103	136.50	.390
20. Knowing what type of assistance you might need to undertake data analysis.	184.00	.638	178.50	.531	143.00	.371
21. Knowing how to manage the data you have gathered.	34.00	<.001*	194.00	.863	107.00	.042†
22. Knowing how to code qualitative data to identify themes and subthemes.	141.00	.074	169.50	.382	109.50	.049†
23. Reporting results in written format.	155.00	.204	94.00	.002*	90.00	.009†
24. Reporting results verbally.	160.50	.257	105.00	.007*	103.00	.028†
25. Identifying appropriate places to disseminate results.	176.50	.495	136.00	.048*	132.50	.205
26. Tracking the dissemination and impact of your research.	175.50	.497	198.00	.952	129.00	.266

p value significant (p<0.05) by Mann-Whitney U test.

*Seven research skills (Q3-4,9-10,23-25) showed statistically significant differences in year 2 at time 2 (post-workshop).

†Four skills (Q21-24) showed statistically significant differences in year 2 at time 3 (one year after workshop).

DISCUSSION

 Post-workshop research confidence increased significantly compared to pre-workshop research confidence for all items assessed for year 1 and all items for year 2, except for two items that had high scores that remained stable. Likewise, research confidence increased significantly one year after the workshop over pre-workshop confidence levels for all 26 items for year 1 and 25 items for year 2, with 1 item in year 2 testing high and remaining stable for all three time points. Moreover, median increases of more than 2 occurred more frequently one year after the workshop (time 3) than immediately after the workshop (time 2), indicating that participants' research confidence was not only sustained but continued to increase in many instances one year later.

Overall assessment findings related to significant improvements in research confidence as a direct result of RTI participation indicated that the RTI training offered helped participants develop confidence in understanding, using, and applying research skills. A secondary outcome of this study was in participants' research confidence retention at least 12 months postintervention, measured using the same questionnaire 12 months after workshop completion. We confirmed the research confidence findings by using other data sources, which indicated that participants perceived aspects of the workshop as effective and were able to acquire knowledge to conduct research as a result of their RTI participation.

RTI post-assessment research confidence results resemble those reported for the IRDL research training program [65]. RTI participants showed significant or sustained increases in post-workshop research confidence compared to pre-workshop levels, including the 19 items that were comparable to IRDL items. A direct comparison of results with IRDL program evaluations was not possible since our study employed nonparametric statistical tests to assess differences in the research confidence of RTI participants across multiple time points and included additional questionnaire items that were specifically relevant to health sciences librarianship. We also diverged from the IRDL study in that we were interested in assessing the impact of training on longer-term research learning/confidence retention of librarian participants, i.e., the inclusion of a one-year-later period (time 3), which has not been studied previously. A search of the literature uncovered no other focused research self-efficacy assessments of librarian research methods and support programs other than the seminal research confidence work developed for the IRDL program [65]. Like the IRDL study, the RTI used results (evidence) from a research self-efficacy instrument developed for librarians, in our case, the RTI Research Confidence Questionnaire, to assess the effectiveness of the RTI research training program and to revise and improve RTI research instruction.

Using the RTI Research Confidence Questionnaire to assess participants' research confidence allowed us to take a detailed approach to evaluating and improving our research instruction. Through iterative questionnaires, we were able to identify areas needing improvement, implement adjustments, evaluate these revisions, and determine whether they improved post-workshop confidence from year 1 to year 2. Changes to the curriculum made between year 1 and year 2 based on multiple assessment measures included reorganization of some classroom content and bolstering learning activities on topics in which participants had lower confidence ratings. The RTI faculty paid particular attention to items that received the highest and lowest levels of confidence pre- and post-workshop (time 1 and time 2). The pre-workshop data for year 1 (time 1) indicated that participants felt highly confident about literature reviews. Based on this data, the faculty changed the lecture-based content on literature reviews to online pre-workshop content in year 2, creating more time during the in-person workshop for topics with lower confidence ratings. Confidence levels for literature reviews post-workshop (time 2) remained high in year 2. Two items with very low median ratings pre-workshop pertained to the topics of theoretical frameworks and data analysis; faculty augmented these lectures with additional learning exercises, small group discussions, and hands-on activities. Post-workshop ratings in year 2 suggest that these curricular additions had a positive effect on participants' confidence ratings in these areas, as they were higher than in year 1. Integrating statistical training into the curriculum proved challenging, and various strategies were used to enhance the curriculum in this area over time. Even though the confidence ratings for data analysis topics were among the lowest, items related to data analysis showed some of the greatest post-workshop increases.

A comparison of the results of the confidence ratings for years 1 and 2 revealed statistically significant increases in numerous areas between these two years. Changing select classroom content to online formats did not appear to lessen the research confidence of year 2 participants while adding select classroom content and learning activities in areas of lower confidence appears to have increased the research confidence of year 2 participants. Median overall ratings for year 2 participants were higher than for year 1 participants. Ratings of 3 (moderately confident) decreased from year 1 to year 2, and ratings of 4 and 5 (confident and very confident) increased from year 1 to year 2.

The significant and sustained gains in research confidence one year after the workshop were particularly noteworthy and encouraging. Several learning strategies were developed and refined over the two years to optimize participant retention of knowledge, skills, and confidence. These post-workshop learning supports included the ongoing availability of course content and lecture

recordings for participants via MEDLIB-ED; increasing mentoring support via individual and small group sessions and listservs; developing a quarterly report form and process for participants to report and reflect on their research learning and progress and receive encouragement; and providing focused guidance and structure for participants completing their capstone project that consolidated and integrated participants' research learning with hands-on research experience at the end of each program year. Weaving these knowledge/confidence retention strategies into the fabric of the program provided participants with a richer engagement and more enduring grasp of research twelve months post-workshop completion.

LIMITATIONS

Several study limitations merit discussion. Firstly, it is worth noting that this study evaluated a relatively small population (40 participants) of practicing health sciences librarians who were self-selected to apply to and were chosen based on selection criteria to participate in the RTI training program. The findings are not meant to be generalized to all health sciences librarians in the US who may be interested in research training. It does suggest, however, that the research confidence and output of motivated librarians can be positively impacted immediately, and after one year by participating in the RTI.

Secondly, due to the nature of self-report questionnaires, there is a possibility of response bias. Participants may not understand questions or misremember but answer anyway or may answer in a socially acceptable manner. The reinforcement of survey confidentially to encourage more accurate responses and the use of the same research confidence scale for generating data over different time periods provided greater confidence that our findings were valid and generalizable. We also used extensive follow-up procedures that limited the attrition bias of the one-year follow-up data for both years. In addition, the use of data triangulation allowed us to cross-validate findings with multiple data sources (research confidence data with workshop effectiveness and learning outcome data) and helped reduce the potential for bias, giving us further confidence in our study conclusions.

Thirdly, two random survey questions (Q9 and Q16) were inadvertently omitted in the post-assessment survey (time 2) for year 2. During the analysis, we did not draw comparisons, inferences, or conclusions based on this unintended missing data with other types of study data.

CONCLUSIONS

The present study enhances the currently limited evidence on effective ways to train practicing health sciences librarians in planning, designing, and executing research.

The authors could not find any studies that have examined research methods training models for health science librarians or the connection between research methods training and research confidence of health sciences librarians, and only two studies that applied research confidence concepts to academic librarian research training [65] and support services [67]. Our study amplifies the evidence-based approach and research confidence assessment work of the Institute for Research Design in Librarianship (IRDL) program. Like that program, the RTI Research Confidence Questionnaire proved effective for rigorously assessing and improving the RTI program. The RTI questionnaire was also useful for assessing the research confidence retention of RTI participants over time. The RTI faculty will continue to use and update the RTI Research Confidence Questionnaire and base programs on the results, thus using an evidence-based approach to evaluate and improve future research training programs for health sciences librarians. The RTI training, support, and assessment model can be informative for those designing, teaching, assessing, and improving research methods training in various disciplines, formats, and across educational levels. The model, which cultivates research education and self-efficacy, has proven to be an effective approach for building the research capacity of health information practitioners and serves as a promising foundation for advancing MLA's generational research vision.

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DATA AVAILABILITY STATEMENT

Data associated with this article are available in the Open Science Framework at
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AUTHOR CONTRIBUTIONS

Lessick S: conceptualization, project administration, funding acquisition, methodology, writing - original draft, writing – review & editing; Philbrick J: conceptualization, methodology, formal analysis, data curation, visualization, writing – review & editing; Kloda L: conceptualization, methodology, writing – review & editing.

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SUPPLEMENTAL FILES

- **Appendix A**: Table Overview of RTI Areas Assessed
- **Appendix B**: RTI Research Confidence Questionnaire
- **Appendix C**: RTI Workshop Evaluation Survey
- **Appendix D**: RTI End-of-Program Evaluation Survey
- **Appendix E**: Table: Post Workshop Research Skills with High Medians Increases
- **Appendix F**: Table: Median Rating Comparison
- **Appendix G**: Table: Workshop Effectiveness Learning Outcomes

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Consulting with an embedded librarian: student perceptions on the value of required research meetings

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See end of article for authors' affiliations.

Objective: This qualitative research project was undertaken to discover how students perceive the embedded librarian in their nursing class. The researchers determined how a required group research meeting was valued by students and whether that value warranted the necessary time and energy by an embedded librarian.

Methods: Researchers conducted focus groups with twenty-three students from two different sections of the same nursing research methods undergraduate course. Students' responses to a series of five questions were recorded within Zoom and supplemented by handwritten notes. Data was coded by hand and patterns that emerged from the five focus groups were analyzed.

Results: Participants reported overall satisfaction with the embedded librarian and students felt they benefitted from the required research meeting with the librarian, which was part of the searching assignment rubric and closely tied to the assignment itself.

Conclusion: Based on the data, a required research meeting with an embedded librarian, who is familiar with the course assignments, reinforces classroom instruction, point-of-need assistance with search strategies, and the opportunity to strengthen the relationship with the librarian for future research needs.

Keywords: Embedded librarian; Qualitative Research; Consultations; Nursing Students; University Library

EC   See end of article for supplemental content.

INTRODUCTION

The benefits of embedded librarianship for university students broadly [1, 2, 3, 4, 5] and in nursing courses specifically [6, 7, 8] are well established in the literature. David Shumaker defines embedded librarianship as relationship-building that takes librarians out of the library and makes them part of a disciplinary team [1]. Others offer specific examples of embedded librarian activities such as point-of-need information instruction [9], physical presence in departments [10], virtual presence in library management systems [6], research consultations [11], and assessment of assignments [12]. Blake et. al. determined that due to embedded librarianship "Nursing students felt more confident in their literature searches, completion of assignments, and research. They also felt that librarian assistance led to an improvement in their grades" [7].

At Illinois State University, the practice of embedded librarianship for nursing students is an integral part of the curriculum. The required junior-level undergraduate nursing research methods class can be challenging for nursing students who have previously only taken hands-on skill-based courses; it is a high-impact course which uses embedded librarianship to improve student research skills. The research class has been a key course in the undergraduate nursing curriculum for many years. Prior to fall 2015, students were supported by one-shot library sessions. This ended when an embedded librarianship pedagogical model was integrated into the class.

The course's culmination is a collaborative research poster, and each assignment throughout the semester is designed as a component of this final project. The embedded nursing librarian attends classes regularly, provides three different information literacy sessions on finding, evaluating, and citing evidence, and plays a critical role in course content development, assignment development, instruction, and grading. Typically, the course is held in-person, however in spring 2021 the class met synchronously online. Paramount to the information

fluency goals of the course was a required online, synchronous research meeting with the librarian to reinforce the material covered within the library instruction sessions.

Research consultations have been a staple of academic library services for years. Consultations can occur at a reference desk, in a consultation space, and within a virtual environment. Studies have shown that students feel more comfortable meeting with librarians in private spaces for consultations rather than in public spaces [13], and they prefer online sign-up for consultations as opposed to reaching out directly to a librarian [14, 15]. The embedded librarian used these best practice techniques when scheduling research meetings with the nursing students to make them more comfortable and to give them autonomy to find meeting times that work best in their schedules.

Student groups had to meet with the librarian in the first half of the semester to begin research for their collaborative poster. The research meeting has been a required component of the course since spring 2016 because voluntary research workshops offered by the librarian in fall 2015 had very low attendance and proved ineffectual in reinforcing library content presented in class. Four to five students met with the librarian for half an hour. The embedded nursing librarian held mandatory research meetings to assist students with the group search strategy assignment. As the creator of this assignment, the librarian was well-versed in the required components. Students also discussed initial articles they found with the librarian as well as sharing their PICOT questions for a discussion of possible search terms. The librarian graded the final submissions of the group search strategy assignment with the rubric she created (Appendix A).

Research consultations are often part of embedded librarianship within learning management systems and face-to-face courses. Librarians embedded in course sites and classrooms are often familiar with the curriculum and required research projects. Kamada et. al. remarks that being embedded in a course "enables the librarian to provide customized support for users' complex information seeking activities" and gives librarians an advantage in assisting students with their literature searches and assessment of search results [10]. Research consultations empower students to apply what they learned in library instruction class sessions by providing a structured opportunity to organize information and make notes on search strategies and advice from the librarian [16]. Rogers & Carrier found students from various subject backgrounds value consultations to receive individualized attention from an expert [13]. Students who meet in consultation with a librarian report higher confidence in their research abilities because of increased knowledge of the research process and a stronger relationship with the librarian [17].

Within nursing and health sciences-related embedded librarianship literature, consultations are often mentioned in passing as one of many interventions [18, 19]. There is evidence in the literature that voluntary one-on-one consultations held by librarians are beneficial to students [11]. However, grade-dependent group consultations as a component of a research assignment are not described in the research literature. A required consultation with the nursing librarian aligns with the Kamada et al. assertion that ultimately, "...the embedded librarian model... aims to assist [pharmacy students] in proactive ways rather than waiting for users to seek assistance" [10]. There is evidence in the literature that required consultations can be more powerful and impactful as an extension of a library instruction session [20].

The effort and labor involved in coordinating and meeting with every student group is considerable; this led the embedded librarian to investigate the following questions: what were student attitudes towards the required intervention, how do undergraduate students perceive the value of a research meeting with an embedded librarian, and how does this value assist an embedded librarian to justify the time and effort required to build in research meetings in a course?

METHODOLOGY

Applied thematic analysis was used to determine undergraduate nursing students' perceptions of a required research meeting with the embedded librarian. Previous research at Illinois State University found from initial analysis of collected information fluency outcomes based on pre- and post-test data that "interactions with the embedded librarian had a positive impact on students' skills" [12]. Due to the quantitative nature of the previous findings, a qualitative study was necessary to better understand the student perspective on the impact of recognized outcomes. Focus groups allowed for a rich qualitative analysis of the students' experiences. Current students of the nursing research methods course were recruited as participants by their course instructor. A $50 gift card as an incentive for participation was made possible through a university research grant which helped to recruit participants. Approval for the study was obtained from Illinois State University's Institutional Review Board (IRB-2020-587).

There were 95 students in various sections of the nursing research methods course. In total, 23 of those students participated in a series of 4 focus groups with two researchers: a facilitator and a note-taker. Three of the focus groups had 6 student participants and one had 5. One additional student met with researchers and was interviewed individually due to limited scheduling flexibility. More than 24% of the sample frame were participants in the study. Focus group meetings occurred over video conference and were allotted 60 minutes,

although sessions ended earlier if appropriate. To ensure open sharing, the embedded librarian was not part of the focus groups.

Focus groups consisted of an explanation, completion of unfinished consent forms, discussion of the questions, and concluding business with the incentives (Appendix B). Participants were encouraged to answer every question and add their thoughts to other participants' answers. Some focus groups received follow-up questions and others did not. Follow-up questions were also responsive to participant answers and were not the same across focus groups when utilized. After the six planned questions were asked, the note-taker verbally summarized the responses to each question during the focus group. Participants were given the opportunity to say whether it was an accurate summary and to add additional comments/changes before the focus group concluded. Focus group notes also captured non-verbal communication such as nodding which would not be represented in a video conference transcript. These steps helped validate participants' focus group responses.

In addition to the notes, the sessions were also recorded and the closed caption feature in the video conference software was used to capture exact quotes from participants. The video conference transcript was cleaned and anonymized before analysis. The focus group transcripts and notes were reviewed by authors 2-4 (Caitlin Stewart, Mallory Jallas, and Joshua Newport) to analyze comments and to identify common themes using applied thematic analysis. Using Excel, authors 2-4 individually annotated the transcript for themes and developed a codebook based on their reading. Then, the themes and codebooks were compared, a shared codebook was created, and the transcripts were re-coded again using the same code book. It was then determined that the themes, which had been created to be relevant across all six questions, lacked specificity and failed to sufficiently capture the nuance within answers to specific questions, so a second analysis was undertaken to identify themes specific to each focus group question. To do this, authors 2-4 divided up the questions and their responses and created more granular themes which better reflected trends and anomalies in participant responses to the same question before collaboratively validating the findings. Finally, the main themes identified in this process were considered holistically and card sorted without classifying specific focus groups or question prompts to identify trends. The embedded librarian was only involved in the card sorting portion of the thematic analysis to mitigate possible bias. Quotations from participants were edited minimally for clarity and brevity.

RESULTS

The themes that emerged during the focus groups indicated three main trends: a need for supplements to library instruction sessions, the research meeting serving as an important intervention point, and challenges faced with the research meeting.

Need for More Than a Class Demonstration

This research methods course was not the first time most students worked with the embedded librarian. She also previously facilitated instruction with participants in their program orientation and skills courses. Some focus group participants remembered these past interactions with the nursing librarian, but the specifics of the library instruction were unclear. One individual recalled, "…I do remember now in [a previous course] her coming in and talking to us about the databases, but I didn't feel I retained that…" Other students did not remember that the embedded librarian had done instruction in other courses and commented that it would have been helpful to know her sooner: "I feel, though, it would have been helpful if I got to know her last semester, so that when I had to use the databases, I knew who specifically to contact because that was something I wasn't really sure how to do…" Despite attending previous courses, many of the students failed to retain the visit and the skills targeted from a class demonstration alone. This suggests that higher-impact strategies may be necessary for student learning.

Participants often needed individual or group repetition to be successful, beyond the class demonstration. As one participant shared, "…the meetings with [the embedded librarian] I think were extremely vital to make sure we were on the right path… just correcting anything that could have been misunderstood." The research meeting as a required check-in with the embedded librarian served as a point of contact for participants who had questions about expectations, skills, procedures, or more. Having multiple opportunities to learn or reinforce learning outcomes was important to many participants. Some participants expressed anxiety or shame over requiring repetition, but the nature of the research meeting normalized the asking for additional support and help. One participant shared with agreement from others that they still did not know how to search the database after it was covered in class, but the embedded librarian at the research meeting asked participants if they wanted to be shown again without the participant having to ask. One participant revealed, "[The embedded librarian] was always down to just go ahead and reteach us this stuff, no matter how many times we're like 'can you do that again' she's fine with it." It is important to note that some participants felt the class demonstrations were sufficient but appreciated the embedded librarian being widely available, as one participant put it, "…once we were introduced to the online databases [during class] we didn't really have a hard time navigating them, but I would say the benefits definitely were her being there all the time in case we would need something…" While some

participants needed additional support, others mentioned feeling confident searching after the class demonstrations.

Research Meeting as Intervention Point

Participants named the research meeting as a key intervention to redirect their methods and yield a positive result. They generally found the meeting helpful – with some crediting it with their success on the assignment. This meeting is key for early identification of research challenges and timely intervention. It was especially helpful as a requirement for those who may have been unaware that they could improve their PICOT question and methodology. One participant shared, "I think going into it, we thought that all our stuff was really perfect and like we didn't really need to change anything. And then walking through it [with the embedded librarian] we realized... that maybe we didn't do this quite right." This research meeting allowed an intervention point for students who would likely not have elected to confer with a librarian if it was not a requirement, and who would have otherwise not had the chance to course correct. For this to be successful, students must trust that the librarian is knowledgeable about the course requirements and practiced at the skills necessary.

Participants also identified that the meeting was a great opportunity to discuss approaches to research without feeling like a failure. As one participant stated with agreement from others, "It was just constructive criticism, and it didn't make us feel bad in any way. Usually, I'd be like, 'Oh my gosh! Why did we do that?' or like, 'We're so dumb!' or something, but... she made it a really nice environment..." Another participant shared, "When we met with her, she definitely commented on a lot of the things that we did, but it was... constructive criticism that helped us search a lot better and use our resources a lot better because we were a little confused on even how to use some of the databases and stuff." They appreciated the embedded librarian's constructive feedback during project group meetings and felt it alleviated confusion.

Participants also reported that the meeting made their searching more efficient. Many students were searching and finding results but using strategies which meant they had to review a lot of results or peripherally relevant information. For example, a participant suggested, "the meeting definitely was helpful because I was just not searching in an efficient way, and I was sifting through all these articles that just weren't useful..." Another shared, "...when we went into the meeting, we kind of had no idea what we were doing with the whole project... [our approach] was very basic." Participants commented on the shift from using simple search strategies to doing something much more nuanced and targeted. Additionally, participants felt the embedded librarian was easily able to recognize where searches were going wrong and show them how to fix them. Participants described going to the embedded librarian with one idea for their

project, and she would be able to tell students what was causing their problems and how to adapt, "because she just has familiarity with what we're looking up already." This participant recognized that librarians who are accustomed to research often have an idea of what to expect, so if the search results are different from their expectation they know how to adjust and even that they need to adjust.

Participants appreciated the embedded librarian making suggestions to improve even when not encountering a problem. As one participant expressed, "Even if you didn't run into any problems, I feel like she would always give suggestions like 'Oh, maybe try this if you want to further investigate' or 'Replace this with this,' even if you were already coming up with terms." Other participants agreed that the embedded librarian doing this was helpful. Participants were often happy with their search strategy if it was yielding results, allowing them to finish the assignment. The embedded librarian's suggestions to improve student searching pushed participants to think more critically about the process of research and acquiring deep skills that will be clinically effective. This showed the research process as one which is not entirely results-oriented.

Ultimately, participants identified many key skills in their research process as being strengthened or honed during the research meeting. These include explanations of database use; database limiters; Boolean logic; subject headings; critical evaluation; and PICOT questions. These various skills represent impact throughout stages of the research process. Example quotations for these skills are represented in Table 1.

Table 1 Participants' perceptions of required research meetings on the research process

Research Skill	Participant Quote
PICOT Question	"So, our PICOT question, we had to basically make it more specific when we met with her. And I think if we didn't have that one-on-one meeting, we would have been going the wrong direction."
Database Use	"I would say probably learning how to use the different sources was the most helpful thing that I got from having the librarian in the class. [It] just, like, made me so much more comfortable and... just broadened what I was able to do when I was able to use more than one source, more than one database..."
Database Limiters	"I think I knew that there were all these limiters, but I didn't know either A) how to use them or B) what they meant... I could get to the list

	where a huge box of limiters [were] and I just didn't. I got overwhelmed and just kind of closed out of it before she walked us through it."
Boolean Logic	"She also walked us through how to use the AND, NOT, or OR... and I thought that was extremely helpful. She made it really clear like how useful those are and exactly how to use them."
Subject Headings	"Subject headings was something I didn't realize that databases had their own specific use, like specific words that are most useful in each individual database, so that was one of the new things that I learned. I had used limiters in the past, but that was something that I found useful."
Critical Evaluation	"I feel like I did just always trust… like, 'oh, if it's in a database, that means it's a good article', but just even knowing to question the quality of it, I feel like was such an important part. Even if we can't totally tell the quality of an article now, at least I know that's a question that I should be asking myself."

Challenges with Research Meetings

Despite the overall effectiveness of the research meetings described by participants, some challenges were also disclosed. The scheduling and timing of the research meetings was chief among these. One participant explained that their project group had very limited shared availability outside of class, so the use of class time for the research meetings would have been ideal. They acknowledged that the embedded librarian was flexible regarding timing and coming up with a solution, but options were slim especially when project group members had childcare responsibilities and jobs. Several participants in the focus group also said that they wished the research meetings were longer as they ran out of time. Because the meetings were running over and scheduled back-to-back, participants recommend building in a transition time between group meetings. A project group which met with the embedded librarian earlier in the blocks of possible meeting times noted that it was challenging to have the meeting first because they did not have as much time to prepare or send materials to the embedded librarian ahead of time. As one participant summarized, "Once we were in the group, I do think she was very helpful and answered all of our questions and really… helped us narrow things down and figure out what we're doing, but definitely, the scheduling issue was probably the biggest challenge..." Given the benefits and challenges students brought to light, the required research meeting appears worthwhile.

DISCUSSION

In the context of this nursing research class, students identified the project group meeting with the embedded librarian as critical to their research process (See Table 1). This meeting served as an intervention point that allowed students to ask questions, identify their assignment progress, address any discrepancies in their understanding, and get direct feedback from the embedded librarian. This meeting served as an extension and, in most cases, an expansion of the course instruction for students. Participants remarked that this meeting was a place to go more in-depth and engage critically with the skills they learned during their class time. In this research meeting, the embedded librarian models the research process by doing searches with the students and supports the project group's individual needs. Most critically, several participants noted this meeting as the turning point for their project where they were able to address fundamental issues with their work. Across all the focus groups, students consistently cited this intervention as important to their overall success in the course.

In addition to bolstering the student learning experience, the research meeting created individualized attention absent from the large online synchronous classroom. Incorporating this required meeting for student groups to facilitate their project in consultation with a librarian served as a vital connection point for the students. Noting an investment of time upfront in the assignment and building on the students' perceptions of the embedded librarian as accessible aided in the process. The feedback from students in this course and the library literature confirm that opportunities for embedded librarians to meet the individual needs of students or their project groups are extremely impactful [10].

Group consultations are underrepresented in the literature which largely focuses on voluntary, individual consultations both when connected and unconnected from other embedded librarianship interventions [11, 13, 16, 17]. Interestingly, students noted in the focus group conversations that they were unaware that other students were struggling in similar ways and thought their project groups were the only ones with issues. The project group dynamics add a layer of complexity to this analysis by impacting student perceptions of their own research identity. In individual projects, students are isolated in their research skills and lack context for others. Through a group project, while that individual view of research competency remains, nuance is added by confronting the research skills of the group at large. The dynamic was not enough to normalize the research process for participants, instead, their perception shifted to assign their experiences and difficulties as being unique to their project group rather than common to all their class peers.

Research-based imposter syndrome emerged in certain participant responses. Specifically, transfer students in the

focus groups shared that their perception was that their peers had already learned about research and the library, and they were disadvantaged or remedial in their approach. Among traditional students, there were comments about generally "trusting" database results too much and lacking the evaluative skills to select appropriate sources. There were also discrepancies in who felt equipped to successfully research based on the class demonstration alone and who needed repetition. This is made more complex due to some participants declaring that they felt prepared to research after the class demonstration alone but later identified the research meeting as helpful in completing the assignment. The initial confidence or anxiety of some participants after the class demonstration may have led to complicated project group dynamics.

The research meeting can help level the playing field and establish growth for all participants. These student perceptions highlight an opportunity for the embedded librarian to integrate and share context for where students are in their research process and facilitate conversation in the consultations that allow for the surfacing of some of these feelings. While participants did not mention it directly, the nature of the group project meant that students often divided work so that group members completed areas that played to their research strengths rather than developing all skills uniformly. This could potentially lead to future gaps in students' research skills. The question emerged: how do we simultaneously yield individual research growth and successful project group outcomes? Also, what is an embedded librarian's responsibility to proactively build student researchers' self-efficacy and push back against imposter syndrome in the research classroom? These questions were raised from discussions with participants but currently lack clear answers.

The value of required research meetings is contextualized by the high-time commitment of embedded librarianship and the scalability of new components. It is important to critically evaluate and reflect on the embedded librarianship methodology so that the student perception of interventions and logistical realities are balanced [6, 7, 11]. This equilibrium is important to maintain so that content and interventions are not added to the detriment of student learning outcomes or librarian well-being. Considering these variables, a required research meeting aligned with a class assignment as part of a larger embedded librarian program has true value from the student perspective. However, the ability to implement such an intervention requires sufficient staffing and resources to be meaningfully implemented.

A future direction for this research could integrate perspectives from teaching faculty collaborating with an embedded librarian to explore the impact of required group research meetings. In addition to this expansion, quantitative and qualitative assessments on required

group research consultations in other instructional settings could help bridge gaps in the literature about this practice within academic librarianship.

LIMITATIONS

There are some limitations to this study which are important to note. First and foremost, there was a time delay between the research meetings and the focus groups. Unfortunately, this meant that participants sometimes vocalized difficulty remembering the specifics of interventions and details of the research meeting.

Because students were all recruited from two course sections and a shared degree program, students had pre-existing relationships with other focus group participants. Some revealed that they were group members on the collaborative research poster. This could impact how students represented their experience, including confidence when researching and self-perception of skills and growth. Additionally, because of the small sample size and focused environment, results only demonstrate that these students in this context perceived value from the required research meeting.

Finally, the initial research question was focused on the student perception of embedded librarian practices more generally. However, the focus of the research project evolved to highlight the required research consultation due to its prevalence in participant responses. Data on other elements of the embedded librarian practices was collected but is not represented in the scope of this article. On occasion, participant comments did not clearly connect to a specific embedded librarian intervention but made more general statements. In those cases, conversational context was used to ascribe meaning.

While the questions were designed to allow participants to guide the conversation, in some cases that flexibility led to students incompletely responding to questions. Recommendations for future research would suggest critically evaluating the scope of questions. For example, in most groups focus group participants initially responded to the first question, "What benefits and/or challenges did you experience interacting with the librarian?" only with benefits. The facilitator began following up on this question specifically asking about challenges. This was important given the need to critically evaluate student perceptions, both positive and negative.

CONCLUSION

The research meeting reinforces research skills from class demonstrations, provides point-of-need research support for the assignment, and nurtures relationships between librarian and student for the future. Given the need to balance high-impact embedded librarianship with scalability, reflecting on current practices with the lens of student perceptions is vital. This model of required group

research consultation merits further exploration in the embedded librarianship literature from varied library settings. This assessment can inform local practice and leverage existing instructional relationships to constantly improve student learning outcomes in ways that are more nuanced than simply adding work or new strategies. Adding new instructional elements without assessing the impact of existing approaches can lead to burnout and can miss vital connections to student learning outcomes. The authors found that participants assigned a high value to the required group research meetings. However, for successful implementation, it also requires a librarian or librarians who highly value the principles of embedded librarianship and yield meaningful interactions with students.

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DATA AVAILABILITY STATEMENT

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

AUTHOR CONTRIBUTIONS

Susan R. Franzen: conceptualization; funding acquisition; resources; methodology; project administration; supervision; writing – original draft; writing – review & editing. Caitlin Stewart: conceptualization; methodology; investigation; validation; data curation; formal analysis; writing – original draft; writing – review & editing. Mallory Jallas: conceptualization; methodology; investigation; data curation; formal analysis; validation; writing – original draft; writing – review & editing. Joshua Newport: methodology; data curation; visualization; formal analysis; validation; writing – original draft; writing – review & editing.

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SUPPLEMENTAL FILES

- **Appendix A**: Rubric
- **Appendix B**: Focus Group Questions

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Understanding the performance of geographic limits on Web of Science Core Collection databases, using the United Kingdom as an example

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Objective: To consider the approaches within Web of Science Core Collection (WoSCC) databases for limiting geographically. To compare the limits to an adaptation of NICE's UK MEDLINE filter for use on WoSCC databases.

Methods: We tested and appraised the inbuilt functions and search field options that support identification by countries/regions and affiliations. We compared these with an adapted filter to identify healthcare research on or about the UK. We calculated the recall of the inbuilt limits and filter using 177 studies and investigated why records were missed. We also calculated the percentage reduction of the overall number-needed-to-screen (ONNS).

Results: Inbuilt limits within WoSCC enable identification of research from specific countries/regions or affiliations if there is data in the address field. Refining by affiliations allows retrieval of research where affiliations are in the 200 or 500 most frequent for a set of results. An adaptation of the UK MEDLINE filter achieved an average of 97% recall. ONNS was significantly reduced using the filter. However, studies where the countries or regions are only mentioned within the full text or other non-searchable fields will be missed.

Conclusion: Information specialists should consider how inbuilt geographic limits operate on WoSCC and whether these are suitable for their research. The adapted filter can sensitively limit to the UK and could be useful for systematic reviews due to its high recall and ability to significantly reduce ONNS. Geographic filters can be feasible to adapt for use on WoSCC databases (where similar search fields are used between platforms).

Keywords: Geographic search filters; information retrieval; literature searching; web of science; core collection

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EC   See end of article for supplemental content.

INTRODUCTION

Geographic limits or search filters aim to retrieve research with a common geographic location and are useful tools to focus the results of database searches [1]. Although many databases contain inbuilt limits, our experience is that there is often limited detail at the point-of-use on how these have been designed. Information specialists may not have time to investigate whether these are appropriate to use or could exclude relevant material. In contrast, user-developed search filters are more transparent, and often supported by data on information retrieval performance.

Searchers may have various reasons for wanting to restrict geographically: ranging from identifying research with a particular geographic focus or about specific populations, or to identify research undertaken by authors from certain regions. The searcher therefore needs to be aware of whether inbuilt limits or search filters have been designed to find research *on* or *from* a country (or both). Ayiku and colleagues suggest that the risk of excluding relevant material through untested methods may discourage the application of geographic restrictions and therefore increase the screening burden [2].

Data referencing geographic locations can be contained across a variety of search fields. For example, a United Kingdom (UK) filter for finding studies on or about the UK within MEDLINE (via Ovid), searches across the following fields: subject headings; title; abstract; journal word; institution; and country of publication [3]. However, geographic details may not be included in titles, abstracts, or subject headings (or not applied reliably), which affects the ability to find research on or about a given population [4]. Geographic-specific data might only be available at full text level, which is often non-searchable on database platforms [5]. Most geographic search filters are designed for use on MEDLINE or

Embase [6, 7]. Only one geographic search filter, designed to retrieve research published by nursing scientists affiliated to German-speaking countries within specific nursing journals, has been published for the Web of Science Core Collection databases [8].

The Web of Science (WoS) platform is a valuable source of research papers and citations across a range of subjects [9, 10]. It facilitates bibliometric analyses (due to its origins as a citation index) and is also useful for systematic searches in health and social care [11]. The WoS platform should not be referred to as a single database, as it consists of several databases and database collections, depending on the subscription [12]. Users can search the databases of the Web of Science Core Collection (WoSCC) either individually or together. Given the large volume of content within this database collection, limiting by geographical location could be useful to focus search results. There are two inbuilt functions that refine the search results geographically (Countries/Regions or Affiliations). It would be useful to understand how they have been designed; what they are suitable for; and how reliable they are to use. It also prompts consideration of how these inbuilt limits compare with a geographic search filter adapted for use on WoSCC databases.

OBJECTIVE

This paper aims to inform users about the performance of limiting geographically when searching for healthcare information on WoSCC databases. It describes a study exploring how the inbuilt limits (Countries/Regions and Affiliations) have been designed. It also tests and compares the performance of the inbuilt limits versus a translated search filter for retrieval of records on the UK.

METHODS

Four processes were undertaken as follows:

1. Communication with WoS on the design of the inbuilt limits (Countries/Regions and Affiliations).

2. Adaptation of the UK MEDLINE filter to the WoSCC databases.

3. Testing the recall of the inbuilt limits and adapted search filter using four datasets on/about the UK.

4. Determining the reduction in overall number-needed-to-screen (ONNS) offered by the inbuilt limits versus the adapted search filter.

1. Understanding the Design of the Inbuilt Limits in WoSCC Databases (Countries/Regions and Affiliations)

Throughout 2022 and 2023, e-mail enquiries were made with the Web of Science Group (WoSG) support team on refining by Countries/Regions or by Affiliations on WoSCC databases. The enquiries asked which fields the WoSCC databases use to find data on Countries/Regions or Affiliations; whether affiliation data is combined with country (to differentiate between institutions with the same or similar names in different countries); and whether the names of countries, regions and affiliations is consistent or variable. WoSG were also asked whether the limits restrict to a certain number of results (and whether this could be increased), and if data is taken from all authors or only the lead author. The database help guides on refining results and viewing 'Affiliation-Enhanced' data also informed how the limits would perform and helped assess the strengths and limitations of each approach [13, 14].

2. Adapting the UK MEDLINE Filter to the WoSCC Databases

Ayiku et al.'s UK MEDLINE filter is a validated geographic search filter designed to retrieve research *on* or *about* the United Kingdom on Ovid MEDLINE with high recall and precision but will also retrieve research *from* the UK [15]. As Ovid MEDLINE and WoSCC databases have different search fields and there are no controlled subject headings on WoSCC, the adapted filter aimed to match the search syntax and search terms of the MEDLINE filter closely and make use of the available search fields in WoS. The search fields used in the adapted filter for WoSCC were:

- TS= terms in either title, abstract, author keywords, and keywords plus fields;

- TI= terms in title field;

- AB= abstract field;

- AD= address field (which will find institution and place names);

- CU= country/region in the address field;

- SO= publication titles field;

- OO= organization field; and

- OG= affiliation field (previously called organization-enhanced).

The process of adapting the MEDLINE filter involved checking the results retrieved from individual search lines to understand the search operations on WoS and then refining the filter accordingly. See the supplementary material for the filter and its line-by-line comparison to NICE's UK MEDLINE filter.

3. Testing the Recall of the Inbuilt Limits and Search Filter on Datasets on/about the UK

Four datasets were used to test the recall of the inbuilt limits and the adapted search filter. Datasets 1-3 consisted of 81 records on UK-based populations taken from three systematic reviews conducted by the EPPI Centre at University College London [16, 17, 18]. The full texts of these papers had been manually assessed and coded as being on a UK population, and they had not been limited to the UK in the searching or title and abstract screening stages of the review. Only records found on WoSCC databases were included in this dataset. Their presence in WoSCC was checked by selecting the database(s) used originally and searching the title field with suitable phrases.

Dataset 4 consisted of digital object identifiers (DOIs) that the National Institute for Health and Care Excellence (NICE) used as one of their gold-standard sets (GS3) for external validation of their UK MEDLINE filter. This contained references to research on or about UK populations that had been identified from the geographic setting of each paper. These are noted within the evidence description sections which summarize the included papers supporting NICE guidelines [19]. The DOIs were searched across the following six WoSCC databases and identified 96 records in this database collection:

- Science Citation Index Expanded (SCI-Expanded) 1900-present;

- Social Sciences Citation Index (SSCI) 1956-present;

- Arts & Humanities Citation Index (AHCI) 1975-present;

- Conference Proceedings Citation Index – Science (CPCI-S) 1990-present;

- Conference Proceedings Citation Index – Social Science & Humanities (CPCI-SSH) 1990-present; and

- Emerging Sources Citation Index (ESCI) 2015-present.

Once the 81 records for datasets 1-3 and the 96 records for dataset 4 were retrieved, the inbuilt geographic limits and translated filter were applied to investigate how many records were retained and why records were missed. For both inbuilt limits, the default option was used to refine the results, which lists the top 200 countries/regions or affiliations (i.e., the most frequent) within a set of results. The datasets are described in Table 1.

Table 1 Datasets Used

	81 records consisting of:
Datasets 1-3	6 records on SSCI taken from a review of children's views about obesity, body size, shape and weight (dataset 1).
	14 records on SSCI, taken from a review on transition of young people from children's to adults' health and social care services (dataset 2).
	61 records on SSCI, CPCI-SSH and ESCI, taken from a review of public health service provision by community pharmacies (dataset 3).
Dataset 4	96 records on SCI-Expanded; SSCI; AHCI; CPCI-S; CPCI-SSH; and ESCI.

The overall process of testing the recall of the inbuilt limits and search filter is summarized in Figure 1. Full strategies are available in the supplementary material.

Figure 1 Testing the Recall of the Inbuilt Limits and Search Filter on Datasets on/about the UK
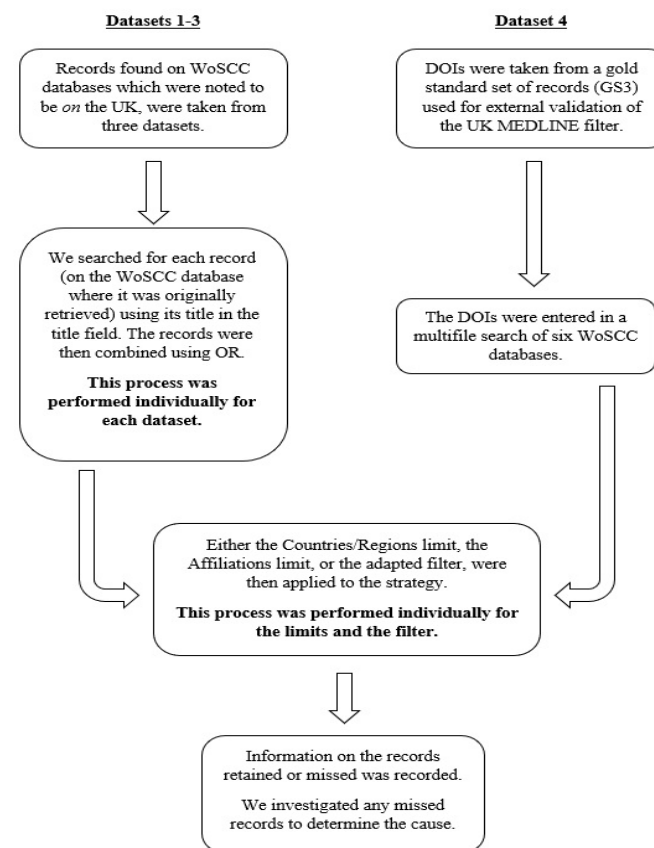
4. Determining the Reduction in ONNS offered by the Inbuilt Limits Versus the Adapted Search Filter:

ONNS is a term that refers to the overall number of records that need to be screened on title and abstract and is different from the typical number-needed-to-screen metric (which indicates the number of records needed to screen on title and abstract to find one included reference) [20]. Determining the reduction in ONNS therefore measures the reduced overall number of records that need to be screened. It is valuable to explore how ONNS is reduced when applying the inbuilt limits and filter as this shows the reduced screening burden.

The original search strategies from datasets 1 and 3 were replicated as closely as possible and then the inbuilt limits or translated UK filter were applied. Application of the Countries/Regions and Affiliations limit refined the results using the list of the top 200 countries/regions or affiliations within a set of results. It was expected that the reproduction searches would not retrieve the same number of results as the original searches, due to various factors such as updates to the search functionality of the database collection over time. For dataset 1, the original search retrieved 1,915 records, whereas 2,416 were retrieved by the reproduced search. For dataset 3, the original search retrieved 5,284 records, whereas 5,377 were retrieved by the reproduced search.

Reduction in ONNS was calculated by comparing the percentage change in the number of records retrieved when applying the inbuilt limits and filter to the reproductions of the original search strategies used for datasets 1 and 3. Datasets 2 and 4 could not be used, either due to changes to the search functionality of WoSCC databases affecting reproducibility (dataset 2), or due to no search strategy to reproduce (dataset 4).

RESULTS

1. Using the Inbuilt Limits in WoSCC Databases (Countries/Regions and Affiliations)

The inbuilt limit for Countries/Regions is one of the options under 'refine results' and is designed to find or exclude research *from* a country rather than *on* a country. The limit uses the CU field (Countries/Regions), which is determined by the countries and regions listed for every author in the address field. When using this limit, the following UK choices may be listed: England, North Ireland, Scotland, Wales, UK and United Kingdom [21]. The country names are consistent, but their availability will vary depending on whether results contain author addresses from that country or region. It is not possible to select anything narrower such as individual towns or cities using this inbuilt limit.

The inbuilt Affiliations limit is designed to find or exclude research *from* an affiliation and uses the OG (Affiliation) field to search for all author affiliations. There are several points to note. Firstly, the OG field retrieves records containing an affiliation's preferred name or its name variants and is the only field that can find 'Affiliation-Enhanced' data [22, 23]. As an example, the University of Leeds is also referred to by the name variants 'White Rose University Consortium' and 'N8 Research Partnership' in the Affiliation-Enhanced data. Secondly, it is not always obvious which affiliation a name variant belongs to without further examination of the record's metadata (e.g., 'Hospital for Sick Children SickKids'). Thirdly, for institutions that have campuses based in other countries the affiliation is listed as the main campus, and the country/region is listed as the actual location. For example, records by Oxford University Clinical Research Unit in Vietnam will show in results for Oxford University using the Affiliations limit (as well as its name variants) and in Vietnam and for the Countries/Regions limit. Fourthly, the OG field is still referred to by its previous name 'Organization-Enhanced' in WoS guides that have not been updated [24].

Expanding the Countries/Regions or Affiliations sections displays the top 200 countries/regions or affiliations (i.e., the most frequent) that are directly applicable to the user's results. The search bar allows the option to find countries/regions or affiliations applicable to the results, regardless of whether they are in the top 200 record count. Users can refine by up to a maximum of the 500 most frequent countries/regions or affiliations by selecting 'Analyze Results' and clicking on the 'Web of Science Categories' drop-down box to select either 'Countries/Regions' or 'Affiliations' [25]. This page shows the number of times each of the countries/regions or affiliations appears in a set of results (and how many records do not contain data in the address field). The minimum record count can be adjusted on this page to specify how many times countries/regions or affiliations must occur in the results, but the user must press enter to apply this before refining their results. There is also an option to obtain data on up to 100,000 frequent countries/regions or affiliations relevant to a set of results [26, 27]. However, there is no option to include records that do not have any data for the authors' countries/regions or affiliations [28, 29].

Clarivate's further information about the Countries/Regions and Affiliations limits are contained in a section on advanced search field tags (for fields CU and OG, respectively) [30]. Additional information on the Affiliations limit can also be found on Clarivate's viewing affiliation-enhanced name(s) page [31].

2. Adapting the UK MEDLINE Filter to the WoSCC Databases

In adapting the UK MEDLINE filter, checking the results retrieved from individual search lines on WoSCC databases led to the following findings which influenced

the adaptation of the filter. Firstly, Northern Ireland is abbreviated as North Ireland on WoSCC databases. Therefore, it was necessary to include the terms "North Ireland*" and "North Irish*". Secondly, search terms for the National Health Service (NHS) retrieved results from non-UK National Health Services (e.g., Italy) with no UK authors. To reduce this noise, these terms were combined with UK country terms in the AD (address) field using the Boolean operator AND. Thirdly, the UK MEDLINE filter's use of the Boolean operator NOT for certain UK place names that might pick up irrelevant results (e.g., York NOT New York) could exclude records where researchers based in these locations have collaborated unless these records are found with other lines in the search filter. For this reason, in the adapted filter, certain UK place names were combined with relevant UK place names using the Boolean operator AND wherever these were searched for in the AD field.

It should be noted for these second and third points, where relevant UK place names were combined with certain search terms using the Boolean operator AND, many of these place names had been searched for elsewhere in the filter using different field tags. In comparison, the AD field searches for affiliation names as well as place names. See the supplementary material for further details on the adaptation of each line of the UK MEDLINE filter for use on WoSCC databases.

3. Testing the Recall of the Inbuilt Limits and Search Filter on Datasets on/about the UK

Recall is shown to vary in the datasets from the EPPI Centre (sets 1-3) and NICE (set 4). Tables 2 and 3 show how many of the records from datasets 1-3 and 4 were retained with each of the geographic limits applied and why records were missed.

Table 2 Recall for Datasets 1-3

Geographic Limit	Recall of Records (N=81)	Number of Missed Records	Missed Record Reason
UK Filter	81 (100%)	0 (0%)	N/A
Countries/ Regions Limit	78 (96%)	3 (4%)	Non-UK author address (1) No data in address (2)
Affiliations Limit	77 (95%)	4 (5%)	Non-UK affiliation (1) No data in address (2) Ambiguous affiliation (1)

Table 3 Recall for Dataset 4

Geographic Limit	Recall of Records (N=96)	Number of Missed Records	Missed Record Reason
UK Filter	91 (95%)	5 (5%)	UK data in full text only (5)
Countries/Regions Limit	88 (92%)	8 (8%)	Non-UK author address (8)
Affiliations Limit	81 (84%)	15 (16%)	Ambiguous affiliation (1) Non-UK affiliation (9) Not in top 200 Affiliations (5)

4. Determining the Reduction in ONNS offered by the Inbuilt Limits versus the Adapted Search Filter

The original search strategies for datasets 1 and 3 were replicated as closely as possible. The replicated strategy for dataset 1 found 2,416 results, whereas the strategy for dataset 3 found 5,377 results. Table 4 shows how these figures were reduced with each geographic restriction applied.

Table 4 Reducing ONNS

Geographic Limit	Dataset 1		Dataset 3	
	2,416 records reduced to:	Reduction Amount	5,377 records reduced to:	Reduction Amount
UK Filter	631	1,785 (74%)	1,560	3,817 (71%)
Countries/ Regions Limit	261	2,155 (89%)	698	4,679 (87%)
Affiliations Limit	168	2,248 (93%)	505	4,872 (91%)

DISCUSSION

Understanding and Using the Inbuilt Limits in WoSCC Databases (Countries/Regions and Affiliations)

For users to understand how WoSCC's inbuilt limits operate and how to use them effectively, information could be clearer at the point-of-use. For instance, the Countries/Regions limit could specify 'Countries/Regions (of authors)'. The limits could also include a description

that only the top 200 countries/regions or affiliations are displayed (as the default option) and that the search box can be used to find specific countries/regions or affiliations of interest [32].

Knowledge on how WoSCC's inbuilt limits have been designed (i.e., to search in the address field) helps users to understand what they might need to do to include results without data in the address field and enhance recall. For instance, an option to obtain records without data on countries/regions could be useful. This can be achieved by applying the limit to exclude all countries and regions from the results, repeating this step to include the countries and regions that *are* of interest, and then using the Advanced Search Query Builder to combine these two sets together using OR. Simply excluding *only* the irrelevant countries and regions would not achieve the same result. This is because authors from different countries or regions can work together, so their exclusion could inadvertently remove results of interest. Using a similar method with the Affiliations limit to obtain records without affiliation data is possible. However, as the method involves excluding all affiliations from the results this could require repeated iterations of search lines that exclude all affiliations, since there are so many affiliations and only a maximum of 500 can be excluded on a single search line.

For users looking to use their own search terms rather than relying on the inbuilt limits, searching using the OG (Affiliation) field tag could be a useful option to find affiliation names as well as name variants for affiliations, whereas the field tag OO (Organization) could be used where particular affiliation names are wanted [33]. Alternatively, it is possible to search the AD (Address) field which will search for affiliations or place names within a record's address field [34]. However, users should be aware that only the OG field will pick up Affiliation-Enhanced data.

Comparing the Recall of the Inbuilt Limits and Search Filter on Datasets on/about the UK

The recall of the inbuilt limits and adapted search filter was consistently high because research on the UK was typically produced by UK authors. The recall of the UK filter was 100% for datasets 1-3 and 95% for dataset 4 (averaging 97%). In comparison, recall was slightly reduced using either of the inbuilt geographic limits for datasets 1-3 and 4. For Countries/Regions, recall was 96% and 92% respectively (averaging 94%) and for Affiliations 95% and 84% respectively (averaging 89%).

The high recall of the Countries/Regions limit supports its application as a precise way of geographically limiting to the UK or other countries when conducting literature searches, though this is not its intended purpose. However, in the context of other geographic locations, it is unclear whether studies on the country of investigation

are typically conducted by researchers from that country, or whether this could prejudice the results toward certain research fields.

The recall of the Countries/Regions limit could be enhanced if there was an option to include records without data in the address field. However, this could increase noise (and records containing relevant geographic data outside of the address field would still be missed). For datasets 1-3, two of the three records missed by the Countries/Regions limit had no data in the address field. The same records were also missed by the Affiliations limit for this reason.

The Affiliations limit missed records for a variety of reasons, including records without an affiliation in the top 200 record count, ambiguous data, and non-UK affiliations. Overall, the main reason the Affiliations limit missed records was due to non-UK affiliations. For dataset 4, six of nine missed records mentioned the UK in the full text only; one mentioned the UK in the abstract; and the remaining two had errors in the metadata meaning UK affiliations were not listed. This highlights the importance of searching the abstract field to find records on a particular geographic location. It also demonstrates that records can be missed due to incorrect metadata in WoSCC databases.

An issue with the application of the Affiliations limit is its ambiguous data. For instance, the affiliation 'New Croft CTR' (representing the New Croft Centre in Newcastle, UK) isn't easily identifiable as a UK affiliation without further investigation and was the cause of one of the fifteen missed records for datasets 1-3.

The high recall of the adapted UK filter was due to its application of a broader range of search fields in comparison to the inbuilt limits. It can be important to search publication titles to retrieve research on or about a specific population. Notably, the filter's application of the SO (publication) field tag allowed it to find a record in the *British Journal of Clinical Psychology* by Australian authors which was missed by both inbuilt limits.

In total, only five records were missed by the filter. These were all multi-country studies, where UK data was only accessible in the full text. This is one of the main limitations of the UK filter (which also applies to the NICE UK MEDLINE filter). However, these multi-country studies were also missed by the inbuilt limits.

Determining the Reduction in ONNS offered by the Inbuilt Limits Versus the Adapted Search Filter

The overall number of records retrieved was substantially reduced using either of the inbuilt limits or the adapted filter compared to the use of no geographic restrictions. However, this could be at the expense of retrieving relevant records, especially for sensitive searches designed to find records *on* rather than *from* a geographic location.

The adapted filter offered a large percentage reduction in ONNS (an average of 72% fewer records) even though this was the lowest reduction overall due to its more sensitive performance versus the inbuilt limits.

The tests performed to show the reductions in ONNS aimed to show an *approximate* reduction. Records can change database within WoSCC over time. Clarivate note that records are indexed at journal-level and, depending on the journal performance, could move from ESCI to a flagship database such as SCI-Expanded, SSCI, or AHCI [35].

Applying the Findings to Other Contexts

As most of the UK terms in the adapted filter are generic, it could be applied to UK searches conducted outside of a healthcare context if terms for the NHS were removed. Sutton and Campbell's study on adapting a lower middle-income country filter makes the point that '[p]erformance of filters can be varied and may need adapting to the needs of research topics' [36]. The adapted filter could be modified to incorporate geographic terms that reflect the context the filter is being used for, such as words for relevant regions, counties, towns, villages, or affiliations. A further consideration is that inbuilt language limits could help to limit geographically. Although language limits may not always be applied precisely (for example, English is used to disseminate work to an international readership), using other language limits on WoSCC could prove useful if trying to find records from populations where research is written in specific languages. For example, it may be useful to restrict to records written in Swedish, if retrieval of records about Sweden is a goal.

Geographic filters can be feasible to adapt for use with WoSCC databases (where similar search fields are used between platforms), and other filters could be developed in the same way. Although the focus of this paper has been on the UK, similar approaches could be used for other countries. For example, to identify research *on* or *about* low and middle-income (LMIC) countries, it would be important to use topic searches for the country in addition to the Countries/Regions limit to improve identification of relevant research. Using additional terms for LMICs would improve sensitivity of such a filter (e.g., see https://epoc.cochrane.org/lmic-filters).

The 'Analyze Results' feature available to use with WoSCC databases could be beneficial in the adaptation or creation of new geographic search filters to test and refine search filters as they are being developed. For each line of the search entered onto the database(s), relevant Web of Science Categories (e.g., Publication Titles, Languages, Countries/Regions etc) could be selected in the drop-down box for 'Analyze Results' which has downloadable data for up to 100,000 results.

LIMITATIONS

This is an exploratory study based on data that were readily available to the authors and was conceived with literature searching in mind. It therefore may not fully reflect applications of the WoSCC inbuilt limits for conducting bibliometric studies that focus on where the research is produced. The inbuilt limits were not designed for locating studies that are *about* a geographical population, and inevitably they had lower performance than a filter that was designed to do so. The original searches for datasets 1 and 3 were conducted during 2008 and 2017 respectively and the volume of results would likely be considerably higher if updated to the current date. So far, the adapted filter has only been tested using four datasets on healthcare literature, comprising 177 records, which is 12% of the size tested for the NICE UK MEDLINE filter [37].

CONCLUSION

It is beneficial to understand how or whether to use the WoSCC inbuilt geographic limits for different use cases. Many database platforms that have designed inbuilt limits lack information on how these operate or how to use them effectively, which could give a false sense of security to less experienced searchers or cause expert searchers to be wary of using them altogether. This study therefore increases the awareness of searchers and information specialists in their application of geographic limits on WoSCC databases. For healthcare systematic reviews, the adapted UK filter appears to be an effective method to retrieve data both *on* and *from* the UK, as geographic data can be represented across a range of search fields. The filter will pick up everything retrieved by the Countries/Regions limit and can significantly reduce ONNS, though there is scope for further enhancements. Although the focus is on the UK, the findings are informative for identifying research from or about other geographical areas, and for using geographic limits and search fields on WoSCC databases.

AUTHOR CONTRIBUTIONS

HF conceptualized the project; sourced dataset 4; adapted the UK MEDLINE filter; corresponded with WoS; tested the inbuilt limits against the filter; methodology; analysis, writing - original draft, editing & revision. CS conceptualized the project; sourced datasets 1-3; methodology; analysis; writing - editing & revision.

DATA AVAILABILITY STATEMENT

Data associated with this article are available in the supplementary material.

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SUPPLEMENTAL FILES

- **Appendix A**: Supplementary Material

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A community engagement program to improve awareness for credible online health information

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Background: The volume of online health information available makes it difficult to navigate and check its validity and reliability. A community-based MedlinePlus training program was developed to improve participants' ability to access credible online health information.

Case Presentation: The program was a public-private partnership between a managed care organization and four local public libraries. A total of eight programs were held between October and November 2017. Each program had a 30-minute cooking demonstration followed by a 30-minute training on access to and navigation of the MedlinePlus website. Program participants were Medicaid beneficiaries, dually eligible for Medicare and Medicaid beneficiaries, and community members from a Pennsylvania county (n=39). A pre-and post-training questionnaire was administered to assess participants' knowledge and practice, and their ability to access health information on the MedlinePlus website. We conducted a retrospective analysis of the data collected during the MedlinePlus trainings. Results from the Wilcoxon Signed Rank test indicated no statistically significant change in participants' ability to access information (Z= -1.41, p=0.16) after attending the program.

Conclusion: Although the median pre- to post-program responses improved from 'incorrect' to 'correct,' the number of programs held, and low attendance might be the reason for non-significant results. Participants reported that the program was informative, the website was comprehensive and user-friendly, and they were impressed by the healthy and inexpensive meal preparation from discount store-bought food. Holding MedlinePlus training programs in conjunction with a cooking program and collaborating with local public libraries might be a promising format that needs additional research.

Keywords: Health literacy; managed care organization; public-private sector partnership; Medicaid; dually eligible for Medicare and Medicaid; public libraries; program development; MedlinePlus; nutrition program

EC See end of article for supplemental content.

BACKGROUND

The internet as a source of information for health has grown. However, the sheer volume of online information available makes it difficult to navigate and verify the reliability and timeliness of information found [1]. The potential harm from inaccurate information could be significant such as disease and medication mismanagement, higher likelihood of adverse health outcomes, and emergency department visits [1]. According to a 2013 Pew survey, about 59% (approx. 185 million) of US adults were online to get insights into their health conditions. In addition, 35% used the internet to diagnose their medical condition or someone else's of which only 53% followed up with a visit to their medical provider [2].

Americans who receive Medicaid or are dually eligible for Medicare and Medicaid beneficiaries have lower income

and education, a greater number of chronic conditions, and are more likely to have social needs such as housing, food, and transportation than those who have private health insurance [3, 4]. In accordance with the general population, a 2018 Deloitte survey of US Health Consumers found that 89% of adult Medicaid beneficiaries owned smartphones [5] and nearly 71% of dually eligible beneficiaries residing in communities owned a smartphone or tablet [6], so it is likely that their health information seeking behavior from online resources is also similar to the larger population. Studies have shown that women, younger adults, White individuals, and those with some college degree or advanced degree are more likely to seek online health information [2, 7]. Apart from information on health conditions, individuals also obtain information on drugs, nutrition, and fitness from online resources [2, 7]. Moreover, the seekers of health information are less likely to check the reliability and

timeliness of online information. Thus, with the rapid growth in internet use for information on health conditions, it is crucial that vulnerable populations are aware of credible health information sources. Although more research is required to examine the association between exposure to non-credible health information and health behaviors and outcomes [8], acting upon non-credible health information with no follow-up with a health care provider may lead to adverse health outcomes resulting in higher health care utilization and cost.

To improve individuals' access to credible online health information, we developed a program about the MedlinePlus website to train community members from a southwestern Pennsylvania county. The MedlinePlus website is produced by the National Library of Medicine, the world's largest biomedical library that delivers consumer health information on health, wellness, disorders, tests, drugs and supplements, and genetics in language that health consumers can understand. MedlinePlus offers reliable, up-to-date health information online for free [9]. Previous studies have documented MedlinePlus trainings in a Hispanic community [10], among patients and clinical staff in a community health center [11], and along with a cooking program for community members and other providers in a low-resource setting [12]. However, information on MedlinePlus trainings developed with a public-private partnership that targeted specifically Medicaid and dually eligible beneficiaries in the community is limited. Our objective was to examine program participants' ability to access online health information after attending a MedlinePlus training program. We hypothesized that there would be an improvement in participants' ability to access information on the MedlinePlus website after participation in the program.

CASE PRESENTATION

The program development and implementation were a public-private partnership between a managed care organization (MCO) and four public libraries in a Pennsylvania county. MCOs are health care delivery systems organized to manage cost, utilization, and quality [13]. The MCO manages health care for Medicaid and for the dually eligible for Medicare and Medicaid beneficiaries in Pennsylvania. The reason for selecting the specific county was that the MCO had high beneficiary density, an English-speaking population, and beneficiaries with poor health literacy scores at the census tract level; additionally, beneficiaries had a higher numbers of health conditions, emergency department utilization, and hospitalizations relative to other counties. The MCO partnered with four local public libraries in the county to develop an interactive MedlinePlus training program. The program was developed and implemented during April 2017-July 2018. The target population was adults (22 years or older), Medicaid and dually eligible beneficiaries, and

community members. A total of eight programs were scheduled, two programs in each of the four selected libraries. The total number of program participants was 42, of which 39 participants returned the completed questionnaire.

Participant Recruitment

Recruitment of MCO beneficiaries included approaching those residing within a five-mile radius of each of the four libraries identified using Maptitude mapping software (Caliper Corp.). A separate member list for each library was created with member names and addresses. Three project staff made telephone calls to beneficiaries and informed them about the program. Beneficiaries were offered the MCO's transportation program to and from the venue. Recruitment of community members was through handing out flyers at local grocery stores, exhibition of posters in all four public libraries, library staff handing out fliers to its patrons, and through the social media platform, Facebook.

The Program

A one-hour program was developed collaboratively by the MCO and local public library directors.

The MedlinePlus training was provided along with an interactive cooking program. The cooking program was a strategy to attract participants to the MedlinePlus training. A local chef demonstrated how to prepare nutritious non-stovetop recipes from local discount stores (Dollar Tree, Dollar General, Family Dollar) purchases (Appendix A). The duration of the cooking program was 30 minutes. Once the cooking demonstration was over, two MCO staff trained the participants on the MedlinePlus website (i.e., how to access the website and search information on health and healthcare issues). The mode of presentation of the MedlinePlus website training was audio-visual. Participants were requested to browse the website using their smart phones. All program participants had their personal smartphones. The MCO staff guided program participants to the MedlinePlus website through the Google search engine. Once landing on the website, the MCO staff walked them through how to search for health topics such as diabetes and hypertension, to access information on drugs and supplements, and to watch videos on health conditions and surgeries. The duration of the MedlinePlus training was 30 minutes including 10-15 minutes of presentation and another 15 minutes for questions and answers and to obtain completed questionnaires. The training was limited to an hour to keep participants' interest.

Questionnaire

A questionnaire including both quantitative and qualitative questions was administered to participants that examined their knowledge, practice, and attitudes on

online health information seeking and impact of the program (Appendix B). The two-page questionnaire had pre-program questions on one side and post-program questions on the other. The pre-program questions were completed by program participants prior to the beginning of the program and post-program questions after the completion of the program. Responses were measured on a Likert scale. The literacy level of the questionnaire was kept at Flesch-Kincaid grade level of 2.4 to ensure understanding from a health literacy perspective. The questionnaire did not collect protected health information such as name, address, age, gender, and type of health insurance from the participants. The questionnaire was administered between October and November 2017.

Assessments

Participants' knowledge was assessed based on whether they had heard about MedlinePlus, which websites they felt gave good facts about health, and how difficult they felt it was to find reliable health information. Participants' online practices before they accessed medical care was assessed based on three things they would do online before going to medical appointments and how likely they would do these after the training. In addition, participants reported what they learned from the program and were asked to rate it.

The program participants were assessed pre- and post-program on their capability of browsing the MedlinePlus website. The participants were asked to browse MedlinePlus and answer the question of "What is the most prevalent arthritis type in the US?" The answers were measured on a Likert scale as incorrect (scored as 1), partially correct (scored as 2), and correct (scored as 3). Participants who were able to access the website and answer the question correctly were categorized as those with 'correct' responses. Participants who were able to access the website, however, got the answer to the question wrong were categorized as those with 'partially correct' responses. Participants who got the answer totally wrong were categorized as those with 'incorrect' responses. We combined the partially correct and incorrect participant responses into one category as 'incorrect' responses. The response categories used for analysis were 'correct' and 'incorrect'. We analyzed the pre- and post-responses using the Wilcoxon Signed Rank test that is widely used to examine pre- and post-measures from related samples [14,15]. In addition, we examined participants' qualitative responses about the program using content analysis. Quantitative analysis was conducted using STATA version 15 (StataCorp, College Station, TX) and qualitative analysis was conducted with Excel. The Allegheny Singer Research Institute-West Penn Allegheny Health System (ASRI-WPAHS) Institutional Review Board approved the study.

RESULTS

Of the 39 responses received, 72% (n=28) were from community members and 28%(n=11) were from MCO beneficiaries. Before attending the program, about 15.4% of the participants used the MedlinePlus website for browsing health information, 10.3% had heard about the MedlinePlus but did not use it, and 66.7% had not heard about it. Participants stated that WebMD (59%), MedlinePlus (36%) and NIHSenior Health (26%) provided credible online health information. Other websites used for health information included Dr.Oz, University of Pittsburgh Medical Center, and Mayo Clinic (Table 1).

Only 18% of participants always searched for health conditions before a doctor's visit and 46% did so sometimes. About 41% sometimes asked for help from family and friends to search health information online. About 62% always received advice on health conditions from family and friends and 21% sometimes received advice on health conditions from family and friends. Nearly 46% of participants reported difficulty in finding credible online health information.

After attending the program, about 72% of the participants were very likely or somewhat likely to use MedlinePlus, 74% were very likely or somewhat likely to tell others about the website and 72% reported that they would help others use the website. About 82% reported that the program helped them to search credible online health information. Nearly 77% of program participants responded that the program helped them to access the website to research health conditions. About 64% of participants reported that they would use the website to get ready for a medical appointment, and 21% were not sure about it (Table 1).

Participants' pre-program responses were compared with their post-program responses. On average, the program participants' responses improved from pre-program to post-program. However, a Wilcoxon signed rank test indicated that this improvement was not statistically significant (Z= -1.41, p=0.16) (Table 2).

Of the 39 program participants, 90% (n=35) rated the program. About 62%, 26% and 2.6% rated the program as excellent, good, or poor, respectively. Participants' perceptions about the program were categorized into five themes: very informative, comprehensive, and up-to-date information, user friendly, trustworthy website, and healthy and inexpensive meals. About 62.9% (n=22) of participants provided no response to the open-ended questions. Among the 37.1% (n=13) who responded, 38.4% reported that the program was very informative, 23% thought the MedlinePlus was comprehensive and had up-to-date information, 15.4% reported the website was user friendly, 23% thought the website was trustworthy, and 62% thought the cooking program showed how to prepare healthy and inexpensive meals from discount store food.

Table 1 Participants' knowledge, practices, and attitudes around online health information (n=39)

Items	Responses	Percentage
Heard about MedlinePlus	Yes, I have used it.	15.4
	Yes, but not used it	10.3
	No, I do not know about it	66.7
	No response	7.6
Websites that give good facts about health*	Medline plus	35.9
	NIHSenior	25.6
	WebMD	59.0
	Wikipedia	20.5
	Everydayhealth	17.9
	All the above	17.9
	None	15.4
	Others	7.7
Participant practices around online health information		
Research your health or symptoms online	I never do this	30.8
	I sometimes do this	46.2
	I almost always do this	17.9
	Does not apply to me	5.1
Ask family or friends to help you find health information online	I never do this	51.3
	I sometimes do this	41.0
	I almost always do this	2.6
	Does not apply to me	5.1
Listen to advice from family or friends about how to treat a health problem	I never do this	2.6
	I sometimes do this	20.5
	I almost always do this	61.5
	Does not apply to me	12.8
	No response	2.6
Hard to find health information online that one trusts	Very hard	5.1
	A little hard	41.0
	Pretty easy	23.1
	Very easy	5.1
	I do not look online for health information	20.5
	No response	5.2
After attending the program, participants were likely:		
Use MedlinePlus to research health questions	Very Unlikely	5.1
	Somewhat Unlikely	7.7
	Not Sure	10.3
	Somewhat Likely	33.3
	Very Likely	38.5
	No response	5.1

Use NIHSeniorHealth to research health questions	Very Unlikely	10.3
	Somewhat Unlikely	7.7
	Not Sure	17.9
	Somewhat Likely	30.8
	Very Likely	25.6
	No response	7.7
Tell others about MedlinePlus	Very Unlikely	5.1
	Somewhat Unlikely	10.3
	Not Sure	5.1
	Somewhat Likely	28.2
	Very Likely	46.2
	No response	5.1
Help others use MedlinePlus	Very Unlikely	5.1
	Somewhat Unlikely	7.7
	Not Sure	10.3
	Somewhat Likely	25.6
	Very Likely	46.2
	No response	5.1
Program enabled participants to:		
Find credible online health information you trust	Yes	82.1
	No	2.6
	I am not sure	5.1
	Does not apply to me	5.1
	No response	5.1
Use MedlinePlus to research health condition or treatment	Yes	76.9
	No	2.6
	I am not sure	10.3
	Does not apply to me	5.1
	No response	5.1
Get ready for a health visit	Yes	64.1
	No	2.6
	I am not sure	20.5
	Does not apply to me	5.1
	No response	7.7
Read about a health condition	Yes	76.9
	No	2.6
	I am not sure	10.3
	Does not apply to me	5.1
	No response	5.1

Participant rating of the program	Excellent	61.5
	Good	25.6
	Not sure	0
	Not good	0
	Poor	2.6
	No response	10.3

*The total does not add up to 100 as the item was a multiple response.

Table 2 Results from Wilcoxon Signed-Rank test examining the change in participants behavior pre- and post- program attendance (n=39)

	Sample Size	Percentile			Wilcoxen Signed-Rank test		
		25th	50th (Median)	75th	Z	p-value	Effect Size
Pre-Program	39	1	1	2	-1.414	0.16	-0.23
Post-program	39	1	2	2			

Some of the responses to the open-ended question "Write down one or two things you liked learning today that you will use" were as follows.

"Great resource found in one place. It is user friendly. Very informative."

"Website is lot easier to navigate."

"I never thought a healthy meal could be made from products purchased from Dollar store." (Appendix C).

DISCUSSION

Although our study did not find a statistically significant improvement in participants' ability to access online health information after attending the program, the public-private partnership, the MedlinePlus training, and the cooking demonstration program from discount store-bought food have implications for future community development programs on improving e-health literacy in under-resourced populations.

Achieving population health objectives all alone is difficult in a rapidly changing and complex world [16]. Partnerships with community-based organizations such as local public libraries to achieve population health objectives is critical as these organizations are trusted entities in the community, have the goodwill of community members, and have wide access to them. Moreover, libraries have evolved from their traditional role of storing, preserving, and issuing tangible books, journals, and CDs to being digital hubs of information exchange and management. In addition, their role now entails empowering communities through knowledge exchange, working with community leaders, local for-

profit and non-profit organizations, and patrons to develop programs on early learning initiatives, parent and caregiver education, employment information, health, and social services among others. This new role makes public libraries ideal community partners to collaborate on public health initiatives. Our partnership with libraries relied on clearly specified and shared goals, agreed roles and responsibilities, transparency and accountability, equality of participation, benefits to both parties, and meeting agreed obligations [16, 17].

Furthermore, people seek and share health information from multiple sources such as health care providers, family and friends, health plans, traditional media, social media, pharmaceuticals, and the internet. Studies on online health information seeking behavior show an increasing number of people explored social media platforms for health information [1, 18]. Quality of health information on these platforms is questionable, and social media disseminates both misinformation (conflicts with best scientific evidence) and disinformation (coordinated or deliberate effort to spread misinformation to gain money, power, or reputation) more rapidly and broadly [1, 18]. MedlinePlus is a free, online, comprehensive, health information website for patients, their families and friends [9], access to which they obtain evidence-based information on health and health care. Prior to attending the program, seven in ten had not heard about MedlinePlus or heard about it but did not use it. An equal number of participants after attending the program reported that they intended to use the website for researching health conditions, tell others about the website, and help others use it. Another six in ten reported that they will use the website prior to a medical appointment. The program participants found the website

to be informative, comprehensive, up-to-date, user friendly, and trustworthy. Similar positive feedback was documented in previous studies [10-12]. A MedlinePlus training provided along with a cooking program for health care providers and low-income, uninsured, or underinsured women found the website to be valuable and easy-to-use [12]. In another program, librarians and high school peer-tutors conducted MedlinePlus training for their peers, teachers, school administrators, families, and community members in a Hispanic community. The students and teachers reported that the website was very or somewhat useful for their personal and school use [10]. Another program conducted group trainings for clinical staff and one-on-one training for patients in a community health center. Patients suggested they would use MedlinePlus instead of general Google searches or commercially supported online health education sites and after the training a significant proportion of clinical staff recommended the website to their patients [11].

Many of the MCO's Medicaid and dually eligible beneficiaries reside in food deserts or lack financial resources to be on a diet of fresh produce. In addition, discount stores have rapidly grown in low-income neighborhoods, rural areas, and communities of color, and these areas often do not have access to fresh produce [19]. These stores carry non-perishable and processed food. A diet of ultra-processed food leads to greater calorie intake and weight gain than a diet of fresh fruits, vegetables, and other minimally processed foods [19, 20]. Obesity, hypertension, diabetes, and cardiovascular diseases are more prevalent in low-income populations compared with the general US population [21]. Our program introduced a strategy to reduce the prevalence of chronic health conditions in this population through demonstration of cooking healthy recipes from discount store-bought food. The majority of the program participants were impressed by the cooking demonstration.

The study had several limitations. First, the non-significant results may be due to the small number of participants in the study. Although the program was advertised through social media, in-person and in public places, the one-month period of advertisement may not have been enough. Second, the local public libraries were conducting the program for the first time, and it may take time to attract participants; word-of-mouth publicity is considered the best marketing strategy, and it takes time. Third, the program timing (3:30-4:30 p.m., US eastern time) and months (October 19 to November 21, 2017) in which they were conducted may not have been suitable for participation. Fourth, if the program were held a greater number of times in each library, it may have encouraged more participation. Fifth, all program participants had smartphones, however this may not be the case always if the program were to be scaled up. Sixth, the program was held in four public libraries from a single county in southwestern Pennsylvania, hence results are not generalizable.

The objective of the community-based MedlinePlus training was to improve participants' ability to access credible online health information. With a public-private partnership, we developed and implemented the MedlinePlus trainings along with a cooking program in community settings. The program participants found MedlinePlus to be informative, user friendly, and with the most current and trusted information on health topics. The cooking demonstration was deemed useful as none of the participants knew nutritious meals could be prepared from discount store purchases. Although the program was well received by the participants, statistically favorable results were not achieved, which could be due to fewer people in attendance. Community events have previously shown low participation rates [12, 14] and identifying strategies to improve community participation is key to the success of future similar programs. If the program were to be scaled-up, advertisements about the program would be preferable at least two to three months prior to the scheduled program. Specific community health needs and interests should be identified prior to the development of future programs. Nevertheless, the program provided a unique opportunity to address health-related social needs, specifically health literacy and nutrition among low-income populations. We believe our program can serve as a model for future public-private partnerships on public health initiatives. Partnerships with public libraries are crucial to community health as they are used by a broad segment of the population [22]. Nearly 97% of the US population lives within a public library service area [23] and the libraries have provided a safe place and support for health programs on addiction, nutrition, homelessness, and language services for immigrants, among others [24,25]. The public trust in librarians due to their ability to curate and share reliable information [22,24], their reach [23], and support for health programs [22,24], make them an important ally to collaborate on community health programs. Public libraries in this study played an active role in designing and hosting the program. The library directors were trained on MedlinePlus website so that they can host similar programs in the future and participated in marketing the program to the library patrons through fliers and word of mouth. Also, as part of the program, each of the library received a laptop, projector, and screen to hold the program and for future use. Future program implementation should target strategies on increased participation, and mid-session assessments for facilitators to fix participants navigation issues to increase successful MedlinePlus website use.

FUNDING DECLARATION

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Open Science Framework (OSF) at https://osf.io/w9af8.

AUTHOR CONTRIBUTIONS

Shamly Austin: conceptualization, methodology, data management and analysis, writing – original draft, reviewing, and editing; Emily Hughes: project management and data collection; Haiyan Qu: methodology, critical review, and editing.

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SUPPLEMENTAL FILES

- **Appendix A**: Recipes
- **Appendix B**: Questionnaire
- **Appendix C**: Qualitative Responses

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Standing up for representation in undergraduate medical education curricula through medical student, librarian, and faculty collaboration: a case report

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Background: A shortage of images of pathology on diverse skin tones has been recognized for decades in health professions education. Identifying skin manifestations of disease depends on pattern recognition, which is difficult without visual examples. Lack of familiarity with visual diagnosis on skin of color can lead to delayed or missed diagnoses with increased morbidity and mortality. As the United States continues to increase in ethnic and racial diversity, addressing the disparity in health outcomes with education is vital.

Case Presentation: At the Hackensack Meridian School of Medicine, students, librarians, and faculty came together to address this problem and develop a database of dermatological conditions in people with darker skin tones. A student group initiated a series of meetings with faculty to determine the best approach to address and enhance the representation of diversity in disease images within the curriculum. With the guidance of faculty and librarians, students performed a literature search and created a database of images of skin pathologies in people with darker skin tones. The database was disseminated to course directors and lecturers, and the noted disparities were corrected for the next cohort of students. The database provides an easily accessible resource for creating lecture slides.

Conclusion: This project brought awareness of the need for inclusivity and generated a broad review of the curriculum to be more representative of all patient populations. Most importantly, our experience provides a roadmap for institutional change through student, librarian and faculty collaboration and cultivation of a culture of optimism and acceptance.

Keywords: Medical Education; diverse skin images; Diversity, equity, and inclusion; clinical diagnostic reasoning; reducing healthcare disparities

BACKGROUND

Efforts within medical education to address the health inequities laid bare in *Unequal Treatment* have focused on specific interventions such as improving instruction of the social determinants of health, implicit bias, and upstander training [1,2]. An area sometimes overlooked during curriculum revisions are the curricular materials themselves, which present a critical opportunity to mitigate implicit bias in US physician graduates [3]. Presenting pathology on diverse skin tones and properly contextualizing racial associations of disease is essential early in medical school curricula to engender the knowledge, skills, and attitudes necessary for the equitable practice of medicine.

Improvements in the images available for educational use are urgently needed, as diversity in medical images throughout the medical literature is an ongoing issue. Lester et al. (2019) described a need for a commitment to documenting, photographing, and publishing manifestations of disease in a wide variety of skin tones [4]. This disparity was also evident during the height of the COVID-19 pandemic, with a lack of published images of COVID-19 cutaneous manifestations in patients of color, which may have contributed to poorer outcomes [5]. Clearly, the ability to identify novel etiologies of disease and evolving threats depends on inclusive literature and timely dissemination of knowledge of presentations in patients with darker skin tones.

This lack of diverse imagery, especially in dermatology textbooks, is significant because differences in skin tones can affect how diseases manifest [6]. In dermatologic textbooks, certain presentations are described as "classic," such as redness [4,5,7]. These presentations can be missed in patients of color, as more pigment in the skin can mask redness, obscuring the "classic" signs. For example, Raynaud's disease is frequently described as "red, white, and blue" discoloration of the digits, a description that necessitates a background of fair skin to enable detection. Approximately 3-5% of the general population suffer from Raynaud's disease [8]. It is important to identify it in

patients with darker skin tones because it can be a sign of an underlying connective tissue disorder, and these conditions impact Black patient populations more severely. For example, the prevalence of systemic lupus erythematosus is four times higher in people who are Black than White [9]. In addition, Black and Native Americans with systemic sclerosis tend to have more severe disease phenotypes than White Americans [10].

Equally worrisome is the consequence of missing the diagnosis of skin cancer in patients with darker skin. Unfamiliarity with the presentation of skin cancers such as basal cell carcinoma, squamous cell carcinoma, and melanoma in people with darker skin can lead to diagnosis of the cancer at later stages, delay the time to treatment, and result in poorer outcomes [11]. For example, in a study of trends in melanoma mortality, White patients had the highest incidence of the disease, yet patients who were non-White suffered the highest mortality [12]. A recent scoping review found evidence suggesting that "socioeconomic factors, lack of access to healthcare, the presence of bias, and deficient skin cancer education among non-White populations as well as lack of physician training may contribute to the disparity in mortality rates related to melanoma in this group" [13]. These findings highlight the need to expand the teaching of health disparities to encompass the social determinants of health as well as to identify additional factors underlying such disparities in order to develop effective solutions.

CASE PRESENTATION

The pre-clerkship phase at Hackensack Meridian School of Medicine (HMSOM) is a clinically framed and deeply integrated curriculum spanning 16 months [14]. Relevant pathologies are presented throughout seven courses: Molecular and Cellular Principles, Structural Principles, Infection Immunity and Cancer, The Developing Human, Homeostasis and Allostasis, Nutrition Metabolism and Digestion, and Neurosciences and Behavior. Based on adult learning theory, evidence-based active pedagogical approaches tied to session learning objectives are utilized within every course to promote the achievement of session content and course learning objectives. Large-group sessions utilize slides to present basic biomedical science foundations and clinical presentations of disease. Throughout the session, students meet in pairs and/or small groups to evaluate case vignettes, discuss related questions, and then report their findings back to the entire class.

In July 2018, the inaugural cohort began the Phase 1 pre-clerkship curriculum. As part of the HMSOM's continuous quality assurance process, student and faculty feedback led to improvements in the initial curricular offerings. Our 2020 cohort entered the HMSOM at the same time as the US was reckoning with the racially motivated murders of

Ahmaud Arbery, Breonna Taylor, and George Floyd amid revelations of pervasive violence against people of color by law enforcement and its institutions. This prompted urgent discussions about race across academic institutions; at our medical school, discussions around structural racism and its impact on health outcomes were held in a variety of forums and included evaluating the curriculum to address this ongoing public health crisis [15].

While curriculum leaders were planning this work, a student of color found that his skin tone was not represented in the images of skin pathologies presented during dermatology sessions. A group of like-minded students came together after realizing this was a recurring gap in the curriculum. They hoped to bring about positive change to improve subsequent versions of the course and enhance integration across all segments of the Phase 1 curriculum. The students sought guidance from faculty and staff at the HMSOM, leading to the creation of a student-led task force that included the expertise of course directors, medical librarians, and the director of the Office of Diversity, Equity and Inclusion.

The joint student and faculty task force had multiple discussions which mobilized around several priorities: 1) creation of an online library resource and diverse skin tone images database for faculty teaching in Phase 1, 2) communication of concerns to student representatives on curricular committees, and 3) researching the possibility of a network-wide image repository program.

The first and most urgent priority was the creation of a library resource and diverse skin tone images database. This resource would be made immediately available to course directors and teaching faculty in need of images to create comprehensive teaching materials and course content that fully represented the diversity of clinical presentations of dermatological diseases across the human population. Medical librarians located several dermatology textbooks, and finding gaps in our collection, purchased additional textbooks for this mission. Medical librarians then created an online Toolkit, using LibGuides by Springshare, called "Representation in Medicine," which listed these texts and other resources [16]. With a broad understanding of representation, we also used this opportunity to include texts on cultural competence, LGBTQIA+ health, and medical racism.

Students then generated a list of diseases they wanted to see more diversely represented in session materials, focusing on infectious and inflammatory conditions. Conditions of high frequency (e.g., eczema) and high impact (e.g., toxic epidermal necrolysis) were prioritized. Non-dermatologic manifestations of disease (for example: jaundice, hyperpigmentation, and petechiae) will be added over time.

Beginning in April 2021 and with the guidance of medical librarians, students searched the textbook literature and PubMed for images using keywords for specific

pathologies. This search resulted in 28 source publications for 88 images of 57 conditions. The images, in JPEG format, were organized alphabetically by condition and hosted on a new LibGuide (Springshare), which we titled "Diverse Skin Images Database." The complete citations for each image were also provided, with a direct link to the source material so the image could be viewed in context. Since many of the images were collected from proprietary textbooks, copyright rules dictated that we password-protect the Database. The password was then broadly shared with students, staff, and faculty at the HMSOM. At the same time, the librarians and faculty vetted a trial of Visual Dx™, a subscription-based image library featuring clinical images of disease in diverse skin tones, and this resource was eventually acquired [17].

Faculty and librarians then curated a collection of related open access databases and resources for posting within the Toolkit alongside the database. This Toolkit includes several reviews, articles, opinion pieces, books, and other resources that have been published to address the misrepresentation of race and gaps in diverse imagery. One such resource comes from medical student Malone Mukwende, co-author of *Mind the Gap* [18,19]. The purpose of this clinical handbook is to serve and help healthcare professionals learn how diseases can manifest in patients with darker skin. The Toolkit currently contains *Mind the Gap* along with textbooks specializing in images of disease on skin of color and databases of high-quality open access images of medical conditions in a range of skin tones (Table 1).

The student-led task force and database represents a just-in-time intervention for on-the-ground deployment for rapid utilization. We found that course directors and faculty were immediately amenable to using a database to create course and session materials. The newly created and evolving curriculum presented a relatively malleable substrate for this intervention. For faculty accustomed to teaching with specific slides, the Database and Toolkit are easily searchable resources for replacement and/or addition of images.

The Database and Toolkit have been available on the library homepage since February 2021 and are maintained and updated as additional images and resources become available [16]. Before every Phase 1 course, faculty and course directors are advised of this resource and encouraged to use it for their course and session revisions. Since its launch, most course directors have accessed the database for course materials. Since their creation in 2021, the Toolkit has been viewed 1,954 times and the Database has been viewed 542 times [20].

Table 1 Resources within the Representation in Medicine Toolkit at Hackensack Meridian School of Medicine

Textbooks specializing in images of disease on skin of color[a]	Online resources containing high-quality open-access images of medical conditions on a range of skin tones
Alexis AF, Barbosa VH. *Skin of Color: A Practical Guide to Dermatologic Diagnosis and Treatment*. Springer; 2013.	Black & brown skin https://www.blackandbrownskin.co.uk/
Donkor CMYA, Aryee-Boi J, Osazuwa IR, Afflu FK, Alexis AF. *Atlas of Dermatological Conditions in Populations of African Ancestry*. Springer; 2021.	University of New Mexico's Inclusive Dermatology: Creating a Diverse Visual Atlas of Skin Conditions https://hsc.unm.edu/medicine/departments/dermatology/inclusive-dermatology/
Jackson-Richards D, Pandya AG. *Dermatology Atlas for Skin of Color*. Springer; 2014.	Skin Deep: A DFTB Project https://dftbskindeep.com/
Love PB, Kundu RV, eds. *Clinical Cases in Skin of Color: Medical, Oncological and Hair Disorders, and Cosmetic Dermatology*. Springer; 2016.	American Academy of Dermatology Association Skin of Color Curriculum https://www.aad.org/member/publications/impact/2022-issue-3/new-skin-of-color-curriculum-is-here
Moiin A, ed. *Atlas of Black Skin*. Springer; 2020.	Cutis - The Latest in Skin of Color https://www.mdedge.com/dermatology/skin-color
Taylor SC, Kelly AP, Lim HW, Anido Serrano AM, eds. *Taylor and Kelly's Dermatology for Skin of Color*. Second edition. McGraw-Hill Education; 2016.	

[a] Additional textbooks dating back to 1981 can be found at: https://skinofcolorsociety.org/search-results/uncategorised/skin-of-color-dermatology-textbooks

Students have noted how much they appreciate when faculty include images of diseases in patients with darker skin tones. "Students have shared that the resources have been invaluable in enhancing their understanding and diagnosis of dermatologic diseases in people of color," says HMSOM medical student, Alexander C. Ekwueme (email communication, May 23, 2024). "This progress underscores the crucial need for inclusive medical education, providing future healthcare professionals with the knowledge and tools to deliver equitable care. The positive feedback highlights the Toolkit's role in filling a vital gap in medical training and its potential to improve clinical outcomes for diverse populations."

DISCUSSION

Given the array of diseases that manifest in skin, healthcare professionals across all specialties will encounter patients with signs and/or symptoms related to the skin. Educational initiatives to increase awareness, knowledge, and diagnostic skills to enable accurate disease detection is imperative to ensuring that every patient receives the highest quality of care, regardless of skin tone. Recognizing the unique opportunity and privilege of serving patients in one of the most diverse states in the country, we aim to utilize the broad reach of our parent health network to establish procedures for the submission of diverse presentations of pathology seen in clinics and hospitals throughout the network. Licensing and copyright restrictions prevent us from publicly sharing all the images currently in the Database, but over time, we hope to utilize many more open-source images to make this database a public resource with the potential of accepting submissions to benefit all healthcare students and professionals worldwide.

These joint efforts to enhance and increase the teaching of skin diseases in people of color were endorsed and embraced by the Dean of HMSOM, Jeffrey R. Boscamp. As the teacher of a session entitled "Dermatologic Manifestations of Infectious Skin Diseases," he incorporated photographs from the Representation in Medicine Toolkit into his slides and described different skin disease presentations in patients with a broad spectrum of skin colors. His example set a high bar for faculty at the HMSOM as well as across academic institutions to follow.

Our students, librarians, and faculty continue to screen the literature for additional open access resources and plans to expand the Database are underway. The work of this group led to recognition by the HMSOM Medical Education Committee (MEC), which in July 2022 established the Cultural Humility Curriculum Subcommittee. This group is charged with providing the MEC with guidance on the development and review of an integrated cultural humility curriculum that builds students' abilities to care effectively for all patients and

populations, with the goal of achieving equitable health outcomes. Since its inception, this subcommittee has audited the Phase I curriculum using the Association of American Medical Colleges Tool for Assessing Cultural Competence Training [21]. Most recently, a recognized thought leader Hetty Cunningham, MD (Columbia University Vagelos College of Physicians and Surgeons) was invited to the HMSOM to support and consult on developing inclusive and anti-bias materials for medical educators [22].

Many influential medical professional organizations, such as the Association of American Medical Colleges (AAMC) and the International Skin of Color Society (SOCS), are working to reverse the effects of structural inequities in the healthcare system. For example, the Arnold P. Gold Foundation seeks to advance humanism in healthcare through compassion, respect and inclusivity of the cultural and ethnic backgrounds of others [23]. The observation of a gap in diverse images, initial discussions around this problem, and the design of the Database were featured at the Gold Foundation Humanism and Honor Society's Structural Racism Initiative in May of 2021. Student and faculty members of our team were invited to share a talk followed by a "Question & Answer" discussion session. Since this presentation, our medical students have continued to add images to the Database and advocate for this initiative throughout our institution as a solution to address healthcare disparities.

Since our initiative to increase the diversity of diagnostic images in dermatology began at our medical school, we discovered that several academic institutions in the US were moving in similar directions to expand their curriculum to include presentations of dermatologic diseases on people of color. Although the depth and breadth of images and resource links vary between schools, these efforts have provided a more inclusive perspective on how dermatologic disease varies among people with different skin colors worldwide. To accomplish this goal, we searched the US for school of medicine websites and listed these databases in Tables 2A and 2B. The sites in Table 2A house collections of photographs of different dermatologic diseases on people with skin of color. The sites in Table 2B provide substantial resource lists for those wishing to expand their curriculums. These resources include books, videos, and resources housed by private, commercial, and government organizations. We hope that the resources provided in Tables 2A and 2B will collectively lead to the inclusion of these images and resources in didactic curriculums and expand the knowledge base of trainees across the healthcare professions.

Table 2A Individual SOM Diversity Image Databases

Academic Institution	Name of Database	URL
University of Iowa Health Care	Dermatology Skin of Color Image Atlas	https://www.healthcare.uiowa.edu/skinofcolor/atlas/
University of New Mexico School of Medicine	Photo Gallery of Skin Conditions	https://hsc.unm.edu/medicine/departments/dermatology/inclusive-dermatology/gallery.html
University of North Carolina at Chapel Hill School of Medicine	Dermatology Image Library	https://webapps.med.unc.edu/dil/
Wayne State University School of Medicine	Dermatology Image Atlas	https://medtech.med.wayne.edu/dermatology/

Table 2B University Websites with Collections of Multiple Resources

Academic Institution	Name of Database	URL
Hackensack Meridian School of Medicine	Representation in Medicine	https://library.hmsom.edu/representation
Loyola University Chicago	Loyola University Dermatology Medical Education Website	https://www.meddean.luc.edu/lumen/meded/medicine/dermatology/melton/title.htm
The State University of New York at Buffalo	Skin of Color Resources	https://research.lib.buffalo.edu/skin-of-color-resources
University of South Carolina School of Medicine Columbia	Skin of Color Resources	https://uscmed.sc.libguides.com/medicalimages
Washington University School of Medicine in St. Louis	Brown Skin Matters	https://becker.wustl.edu/news/brown-skin-matters/

Our project focuses on clinical images of disease, however the issue of lack of diversity in representation of disease in medical education extends to illustrations used to provide visual depictions of anatomy, physiology, and pathology. A 2018 study found that only 4.5% of images in commonly required anatomy and physical diagnosis textbooks depicted illustrations including dark skin [24]. Medical Illustrator and Medical Student Chidiebere Ibe brought a spotlight to this issue specifically with his depictions of a range of human conditions, most famously a pregnant black woman with her unborn fetus [25]. This work has led to further initiatives championed by the Association of Medical Illustrators to create equity in medical illustrations for print and digital teaching materials.

We urge educators across the health professions to critically evaluate the images used to depict disease in teaching materials to ensure they are representative of all the patient populations. Furthermore, health science educators should encourage collaborators, authors, and publishers to continue to expand the diversity within the available images of manifestations of disease. By establishing a committee such as the Cultural Humility Curriculum Subcommittee, academic institutions can ensure continuous and sustainable change that encourages partnership of students, faculty, and staff. The benefit of this approach will extend not only to patients, but also to students in the health professions themselves as trainees who feel their race is under-represented or presented in a biased way can experience isolation and burnout.[4] Strategies to reduce healthcare disparities with respect to race, ethnicity and gender in the medical student body are critical initiatives that will become fortified when we broaden our lens of representation to the curricular materials themselves.

DATA AVAILABILITY STATEMENT

There is no data associated with this article.

AUTHOR CONTRIBUTIONS

EMH wrote the initial draft of the manuscript; RA, MED, ACE, CS searched the literature and collected resources and images for the database; TA provided guidance and support on the approach to this initiative; CPD and AEP created the structure of the database and built the website to house the Toolkit; MM, LDS, and JFZ provided guidance and direction at all phases of the project; and LDS, JFZ, and AEP edited and updated the manuscript for submission.

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Designing a framework for curriculum building in systematic review competencies for librarians: a case report

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Background: Librarians play an important role on systematic review teams because of their expertise in information organization, database searching, and records management. Many systematic review training opportunities exist, but not all are tailored to the needs of librarians. The Medical Library Association, along with a workgroup of experts on systematic reviews and review services, developed a Systematic Review Services Specialization (SRSS) that was launched in 2022. One of the required courses in the specialization was developed by the authors, who set out to build a value-added curriculum that would provide essential searching skills for librarians working in evidence synthesis domains.

Case Presentation: The authors present a case report on creating a framework for developing a new course in the Medical Library Association's Systematic Review Services Specialization. The objectives of the course were intended to align with six systematic review competencies for librarians developed and published by a group of health science librarians from the University of Michigan in 2017, which include 1) conducting a reference interview, 2) performing preliminary searches, 3) selecting appropriate resources to search, 4) building an extensive, comprehensive, and documented search strategy, 5) peer reviewing search strategies, and 6) reporting search methods. With these objectives in mind, the instructors created four separate modules and an activity.

Conclusion: Systematic review skills for librarians are essential to many health science library jobs since librarians are considered important collaborators within systematic review teams. Through eleven cohorts of the course held over 2022-2024, the authors constructed and delivered a comprehensive curriculum.

Keywords: Teaching; curriculum; systematic reviews; expert searching

EC See end of article for supplemental content.

BACKGROUND

Health science librarians are becoming essential members of systematic review teams. Research has shown that librarian co-authors were positively correlated with higher-quality reported search strategies [1-5]. Other investigations have demonstrated that a librarian plays a central role on a systematic review team beyond searching for literature [6-9]. Most methodological guidance, including the *Cochrane Handbook for Systematic Reviews of Interventions, JBI Manual for Evidence Synthesis*, *Campbell Collaboration*, and the *National Academies for Science, Engineering, and Medicine,* states that an information retrieval expert should be consulted for the literature search [10-13]. The *Cochrane Handbook* notes that "review authors should work closely, from the start of the protocol, with an experienced medical/healthcare librarian or information specialist" [14].

Comprehensive searches "aim to be as extensive as possible in order to ensure that relevant studies as possible are included in the review" [14]. Formal literature searches are often complex, containing multiple concepts that require knowledge of individual database syntax and Boolean operators. Systematic searches aim to avoid selection or information bias that could occur with the use of inappropriate search terms, the omission of related terms, or the failure to apply an objective and reproducible search to a "range of sources"[15]. Further, the literature searches must be exhaustively documented to ensure transparency and reproducibility.

Many health science librarians work in settings where the provision of systematic review support is growing. In addition to building and documenting comprehensive literature searches, librarians can often find themselves

providing advice on methods, resources, records management, screening, citations, and more [6]. In 2017, Townsend et al. developed a competency framework for librarians involved on systematic reviews [16]. This framework, adapted from Miller's Pyramid for Clinical Assessment, outlines six competency areas with smaller associated skills and indicators [17]. The Medical Library Association's (MLA) Systematic Review Services Specialization (SRSS) Systematic Review (SR) Workgroup, composed of systematic review experts and later, Systematic Review Caucus members, used the Townsend et al. competencies to define twenty-six fundamental skills on two Learning Pathways (Level I and Level II), which are satisfied through various courses, both elective and required, within the SRSS [16, 18, 19]. For a list of the twenty-six fundamental skills, see Appendix A in the Supplementary Material list.

While other systematic review training opportunities exist, some 1) are not tailored to the needs of librarians or do not include librarians on the instructor team, 2) have been discontinued, or 3) have access barriers. Librarians teaching librarians, as described in this case report, is pivotal for providing opportunities of peer knowledge sharing, discussing best practices in searching, empowering librarians as researchers and collaborators, and developing systematic review services to meet user needs. The MLA's SRSS courses, and the course described in this case report, can be a robust complement to a librarian's systematic review training.

CASE PRESENTATION

In this case report, the authors describe their approach to establishing a thorough and engaging curriculum for the required SRSS Level I core course, *Essential Searching Skills for Librarians on Systematic Review Teams,* with the goals of meeting the objectives established by the SR Workgroup of the MLA and to build confidence in participants embarking on systematic review support [18]. Individuals who wish to earn the Systematic Review Services Specialization must take eight required core courses and four electives selected from a course list. The pilot class was held in person at the MLA Annual Meeting in New Orleans in May 2022. Subsequently, the course was offered online in October 2022; February, March, April, May, August, October, and December 2023; March 2024, and once again in person in May 2024 at the Annual Meeting in Portland, Oregon. Each class had approximately thirty registered participants who were added to a Slack channel for the purposes of course information dissemination and communication. The instructors established an open course site on Open Science Framework (OSF), with links to required and supplemental readings, digital handouts for various topics, slides, and instructions for the course activity.

Course Planning and Structure

Through a series of virtual meetings and emails spread out over several months leading up to the pilot course, the instructors discussed the course objectives and how best to deliver and achieve them. Four modules were established that would meet the course objectives: Module 1, consultation and pre-searching, Module 2, searching, Module 3, search strategy peer review, and Module 4, search reporting. Table 1 outlines the learning objectives provided to the instructors by the MLA SR Workgroup, the curriculum module in which those objectives are met and their corresponding SRSS skills.

Table 1 Learning Objectives for Essential Searching Skills for Librarians on Systematic Review Teams

Learning Objective	Covered In	Maps To SRSS Skill
Determine the need for a systematic review.	Module 1	8
Conduct preliminary searches.	Module 1	8, 9
Select appropriate databases.	Module 2	9
Build a comprehensive search strategy.	Module 2	10, 13
Review search strategies.	Module 3	11
Report search methods.	Module 4	12, 14

Because the course is a requirement in the SRSS Level I Learning Pathway, the content is intentionally designed for searchers of all levels, since both new and experienced searchers earning the specialization enroll. PubMed is the primary platform used for the class, although participants are encouraged to begin their searches with the database and platform they feel most comfortable using when doing their own searches. PubMed is chosen because it is fully accessible without restriction to anyone with internet

access and incorporates the MeSH database of controlled vocabulary, which is relied on heavily for terminology harvesting and knowledge-building.

The pilot in-person offering was allotted a total of four hours, while the online offerings have been divided into two 2.5-hour sessions. The following elements of the case presentation focus on the virtual offerings, since they have been in the majority, and are not meant to present the detailed and proprietary content of the class, but rather to provide a useful framework to others who may wish to establish or investigate building a curriculum for the purposes of enhancing systematic review searching.

The Course

Introduction to the Material

During the introduction to the course, participants are asked to take a five-question pre-test. The instructors introduce themselves and provide logistics for the course. Prior to beginning Module 1, the instructors also discuss persistently perplexing terminology within the field, such as distinguishing between databases and platforms, describing natural language search terms, and identifying the myriad ways in which database providers name their thesauri and controlled vocabulary. The instructors then describe the schedule for what will be covered and in what order. Transitions are accommodated with a pause for questions and discussion before moving on. Use of chat, live discussion, and other modalities of interaction are strongly encouraged to support participant engagement.

Module 1: Consultation and Pre-Searching

The first module focuses on doing a cursory search of the literature and conducting the reference interview. The instructor emphasizes the importance of librarians understanding the impact of systematic review collaborations on their time and workloads, as projects like these can often take more work than initially expected.

The module starts with a discussion about doing a preliminary search on the research topic, including searching for systematic reviews already published, and how to find systematic reviews that are in-progress. Finding non-systematic review articles is also covered to illustrate ways to identify relevant keywords and spelling variations in order to begin compiling a list of terms that can be used in the search strategy. In addition to keywords, systematic reviews and other articles identified are also used to start gathering a list of possible controlled vocabulary terms.

The second part of Module 1 focuses on the specialized reference interview, asking questions, and setting expectations. For the initial reference interview, the benefits of asking open-ended questions and conducting in-person or virtual meetings rather than relying only on e-mail exchanges are stressed. The reference interview should be used to ask more in-depth questions about the research topic, inquire if anyone on the research team previously worked on a systematic review, discuss key aspects of the methodology and finally, ask about restrictions to the search. A variety of restrictions, such as age group, language, and geographic location, initiate instructor and participant debates about how and whether restrictions can be applied without introducing bias. The topics of database selection, clinical trials, grey literature, hand-searching, preprints, and a brief introduction to drug and chemical searching are also covered during this section.

Module 2: The Search

Module 2 contains the most content. Instructors present their individual methods for search documentation and introduce five question development frameworks, such as the well-known PICO (population, intervention, comparison, outcome) and several others, for use as an aid in identifying distinct search concepts. This is followed by an overview of concept nesting, which entails building smaller search concepts to be combined into a larger search.

The next section includes a review of database controlled vocabulary, which are used to locate subject headings and identify information in the record to determine the heading's relevance to the topic. Examples from the MeSH and Emtree thesauri are used to demonstrate these topics. Although MeSH terms are openly available through PubMed, Emtree terms are available only through licensed resources, so not everyone will have access. Emtree terms are demonstrated, however, since the Emtree thesaurus provides important information for searchers and should be used if access is available. The next section delves into advanced searching techniques, syntax, and database documentation. Differences among various databases and platforms are highlighted, and a discussion of filters and hedges completes the lesson.

A live demonstration of building a thorough and well-documented search in PubMed using the techniques discussed in class, such as term-harvesting and controlled vocabulary, is followed by an introduction to the course activity. The course activity involves constructing a search string for one of three concepts that are part of a larger research question. Participants are given time to discuss their approaches in smaller groups. This abbreviated activity is chosen over a full systematic review search to accommodate the participants in skill-building. The time constraints and the participants' various levels of database searching skills are factors in choosing this modality. Building a full systematic review search can take several weeks, requires input from an actual research team, and is not feasible in the context of this course. Participants are dismissed from the first virtual session at this point, returning in the second virtual session where they

assemble once again in their smaller groups to discuss, finalize, and submit their search concepts. After the breakout groups, the instructors live-test the full three-concept search strategy in PubMed, identify potential key articles, and share tools that could help expedite translating the search to other databases. There is time for discussion regarding what questions would have been asked of a real, not theoretical, research team. Some additional searching skills, like testing for errors, proofreading, ensuring the inclusion of key articles, and translating equivalently across platforms and databases are covered.

Finally, the instructors examine both open and subscription drug information resources in more depth. One drug is used as an example to demonstrate differences in generic, brand, alternative, and chemical names, all of which may be used in systematic searching.

Module 3: Peer Reviewing a Search with Peer Review of Electronic Search Strategies (PRESS)

The third module presents a comprehensive review of the Peer Review of Electronic Search Strategies (PRESS) 2015 Guideline Statement [20], which provides an evidence-based guideline for peer review. The instructor discusses the rationale for search peer review. Several tools are demonstrated to assist librarians with the process such as the PRESSforum website, which is a repository for tutorials, files, and videos that illustrate the entire process and a place where librarians can request and offer peer review of their search strategies [21]. The PRESSforum website also provides a link to the latest version of the PRESS Search Submission and Peer Review Assessment form, which is available via the CADTH website as a Word file and interactive PDF [22]. The module concludes with a demonstration and brief discussion of various suggestions that can be implemented to evaluate each element of a search strategy, including question translation; Boolean and proximity operators; subject headings; text word searching; spelling, syntax, and line numbers; and finally, limits and filters.

Module 4: Reporting the Search with PRISMA-Search

Module 4 covers the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Search (PRISMA-S) extension and gives an overview of best practices in search reporting [23, 24]. Sixteen items are described, with examples of reporting for each, which are categorized into four parts according to the publication: 1) information sources and methods, 2) search strategies, 3) peer review, and 4) managing records. The participants then have the opportunity to provide feedback on several selected published search methods using the categorized items from PRISMA-S.

Conclusion of the Course

Having covered the reference interview and pre-searching, search documentation, syntax, term harvesting, search peer review, and search reporting, the instructors discuss their own anecdotal experiences as librarians on systematic review teams and provide time for an open-ended discussion. Finally, participants are asked to complete a post-test, identical to the pre-test, provided by the instructors, and a course feedback form provided by MLA.

Course Feedback and Performance

Comments from the course feedback forms were consistently positive. Recurring themes were centered around 1) the instructors' abilities to curate content for both new and experienced searchers, 2) enthusiasm for the breakout rooms and the course activity, and 3) the ability to incorporate something new from the class into their professional work. Constructive critiques ranged from 1) not enough time to too much time, 2) a desire for individual feedback on an individual search, and 3) frustration with the number of communication tools used during the course (see Appendix B in Supplementary Material: Selected Feedback). For each iteration of the course, the instructors consider previous cohorts' feedback and make small adjustments as necessary. For example, an early cohort disclosed that they did not understand the idea of concept nesting, so concept nesting instruction was provided in greater detail. Other cohorts reported that they enjoyed the time spent in smaller groups and found it valuable, so the instructors lengthened the amount of time that participants spent in small groups to support time for individual discussion. An emerging theme on feedback from all cohorts was the realization that there are no absolute answers in systematic searching. The instructors have not received feedback that necessitated larger changes.

As noted, the course pre-test and the post-test were identical. The five questions cover both confidence level in searching and knowledge items covered specifically within the course. The participant pre-test/post-test scores demonstrate an increase in knowledge for skills important to systematic review searching which are outlined in the list of SRSS skills (Table 2).

Table 2 Pre-Test/Post-Test Analysis

Test Question	Unit	Pre-test	Post-test	Difference	SRSS Skill
How confident are you at building a comprehensive literature search? (1=least, 5=most)	Mean	3.32	3.96	+0.64	8-14
The Cochrane Handbook Recommends searching which three resources?	Percent Correct	74	84	+10	9
Select appropriate drug resources (participants were asked to select all appropriate resources from a list).	Percent Correct	92	96	+4	9
PRESS Statement contains (participants were asked to select the elements of the PRESS publication)	Percent Correct	62	70	+8	11
PRISMA-Search contains (participants were asked to select the major categories of the PRISMA-S)	Percent Correct	62	78	+16	14

DISCUSSION

For the instructors, the question of "*Does this add value?*" has been a guiding principle when deciding how to structure the course and when to implement changes. The instructors usually learn something new from the participants, as many of them have been willing to share unique tips and new knowledge about platform vendors and database updates with the group. The bulk of the course content (Modules 1 and 2) focuses on search development techniques such as using both keywords and controlled vocabulary, searching multiple resources, not relying on database filters, implementing field tags, and searching each resource in an equivalent manner, which are important best practices for systematic searching. The instructors continue to believe that one of the most valuable takeaways of the course is that the searcher has a great deal of autonomy in deciding how to develop, build, and document the search regarding the order and structure of the terms and the platforms used for documentation. What matters the most is that the documented searches are sensitive in nature and easily reproducible.

Librarians who support systematic reviews and other evidence syntheses can benefit from the opportunity to engage in the course *Essential Searching Skills for Librarians on Systematic Review Teams*. Participants have a chance to meet and chat with other librarians supporting similar services and doing comparable work, observe searching processes other than their own, identify existing guidance documentation, gain practice in building a comprehensive concept, and determine best practices for establishing future systematic review collaborations and instruction. Librarians looking to develop systematic review instruction may find this case report beneficial in instituting their own instructional materials and/or curriculum. For these librarians, it may also be a worthwhile task to review the systematic review competencies devised by Townsend et al., as well as the roles for librarians on systematic review teams described by Spencer and Eldredge, as the instructors of this course did when initially planning and developing the curriculum [6, 16].

As evidence synthesis methodologies continue to evolve, author teams cannot overlook the profound impact of librarians and their search expertise in supporting evidence synthesis methodologies. The development of proficient searching skills and searching instruction techniques among librarians is essential for mitigating bias, ensuring credibility, and upholding the integrity of published evidence syntheses. This case report demonstrates how the instructors, through diligent planning and subject matter expertise, built a robust course curriculum, thereby playing a crucial role in supporting the professional development of librarians supporting systematic review services and earning their Systematic Review Services Specialization.

SUPPLEMENTAL FILES

- **Appendix A**: Systematic Review Services Specialization: SRSS Competencies
- **Appendix B**: Selected Participant Feedback

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Shifting temporal patterns in physical usage of a health sciences library following the extension of operational hours

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See end of article for authors' affiliations.

Background: Students regularly state a strong preference for increased library operational hours to accommodate learning needs. While many academic libraries provide extended hours, academic health sciences libraries appear to adopt such models less frequently. This is not due to lower levels of student demand for extended hours.

Case Presentation: In response to student preferences for increased hours, our institution shifted its budget to provide an additional 10 weekend hours (Friday-Sunday). This study is a post-hoc assessment of temporal changes in physical library use over weekend days pre- and post-implementation of extended hours. This study used (non-exam) weekend physical library usage data one year before and after implementing extended hours (January 2018-January 2020). We ran descriptive statistics to assess the hourly use pattern changes in physical library usage.

Conclusion: For the regular academic year, students arrived earlier and stayed later, with less severe hourly peaks in opening and closing times physical use patterns seen in the pre-implementation period. Overall, we saw increases in all three areas of physical usage data studied. The data provides evidence of the true need for extended hours among users, along with hourly patterns reflecting a better match of hours with patron study patterns.

Keywords: Physical Library Usage; Extended Hours; Weekend Library Hours; Health Sciences Library Hours

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BACKGROUND

Anecdotal evidence, along with published literature, makes clear the near-universal nature of student preferences for extended operational hours to accommodate learning needs, with library directors noting that providing study space is their top priority [1-8]. Students usually request unlimited, 24-hour access [9] and academic library administrators have listened. Since the mid-1990s, the number of Association of Research Libraries (ARL) libraries reporting use of one of the various 24-hour operating models increased from 5.15% [10] to 91% [1]. Concomitantly, the number of publications on the practice and effect of extending operating hours in academic libraries has risen [1-5,10-15].

The same is not true of medical and health sciences libraries (HSLs), which are not exempt from student demand for extended hours [11,16-17]. The last broad study of HSLs' operational hours was published in 2003, reporting that the number of service hours among Association of Academic Health Sciences Libraries (AAHSL) member libraries increased by only 5% or 4

hours per week between 1978-2002 [18]. More recent AAHSL member operational hours data are not freely available. Beyond the outdated, available AAHSL data and a smattering of articles, published evidence about HSLs' operating hours is largely presented through posters at regional library conferences [19,20]. While HSLs may be included in broader surveys of libraries, they face unique challenges with budgets and user populations that differ from their Academic Library counterparts [21,22]. HSLs should be considered separately to better understand their operation and usage.

The reasons for the relative paucity of literature on this topic from HSLs are unknown. One publication on extending hours in a HSL indicates that budgetary reasons drove decisions about extended hours, noting that user demands for extended weekend hours could only be met by cutting weeknight hours [12]. Budgetary considerations for extended hours are more frequently discussed in academic library publications, which describe budgetary issues such as extra staffing, security, and other library services [1,4,5,10,13,23]. For HSLs, which may have

smaller budgets than their Academic Library counterparts [24], these considerations might weigh more heavily in operational hours decisions, which must be balanced against increasing, competing demands [22,25].

When library budgets can accommodate changes to operational hours, the costs must be weighed against expected levels of library use during extended hours. Projecting levels of use of extended hours may involve examination of entry and exit gate counts around then-current opening and closing times, service statistics, interviews, or survey data on the typical times of day that students study [23]. These pre-implementation data points are critical and may lead libraries to reduce their hours of operation rather than extending them [26].

Following the extension of operational hours, post-hoc assessments are equally important, providing evidence for (or against) continuation of a model. Post-hoc assessments may involve operational data, observational data (such as head counts), time use studies, or interview data elucidating students' reasons for using the library during extended hours. Published, post-hoc studies reveal that the primary reason students use the library during extended hours is as a study space [14,27-29], with reference and operational services going largely unused during extended hours [1,14,15]. Many libraries subsequently reduce or eliminate such services. Libraries that do offer extended hours services typically focus on circulation [4,15,27]. As previously noted, most of these statistics come from academic libraries, but the findings are mirrored in two HSL-based studies, which found that most survey respondents neither borrowed materials, requested articles, nor requested skilled assistance from staff during extended hours [30,31].

Both survey data from users about the adequacy of library hours and post-hoc data on library usage are critically important, allowing libraries to make informed decisions in the face of competing budgetary pressures and user demands. This study describes the process of implementing and analyzing the impact of extended library hours in an academic HSL through the lens of physical usage of the library's spaces and resources. This was accomplished by examining the library's gate count, circulation, and study room reservations both pre- and post-extended hours.

CASE PRESENTATION

The Laupus Health Sciences Library is a large, academic medical library situated on East Carolina University (ECU) Health Sciences Campus in a small metropolitan area. Laupus Library serves [>4,500] students enrolled in four colleges and schools on that campus (including the School of Medicine, the School of Dental Medicine, the College of Allied Health Sciences, and the College of Nursing), along with the university's teaching hospital, ECU Health Medical Center. Laupus Library also

indirectly supports the health-adjacent disciplines and classes on the academic campus. Most of the health sciences programs are weekday, in-person programs, with few select distance education programs.

Prior to 2019, Laupus Library was open 95.5 hours per week (7:30am–12:00am Monday through Thursday, 7:30am–5:00pm Friday, 9:00am-5:00pm on Saturday, and 12:00pm–12:00am on Sunday). The library contains 28 study rooms that students could reserve for 3 hour blocks up to two times per day. Over the weekend, Saturday service included both a reference librarian and a full-time paraprofessional staffing the sole point of service, between 9:00am-5:00pm. Sundays were exclusively staffed by paraprofessionals and students. This model was used for at least a decade of library operations, during which time students regularly requested extended hours via direct emails and satisfaction surveys.

In 2018, the leadership of the departments primarily responsible for providing circulation, reference, technical, and operational support changed. The two new leaders oversaw the User Services (US) department, consisting of reference and instruction librarians and a User Engagement paraprofessional, as well its subdepartment, Access Services (AS), managed by a librarian and including paraprofessionals responsible for staffing the service desk. After reviewing a decade's worth of reference statistics and student requests for extended hours, the new leaders reassessed service desk models, including service desk staffing and extended operational hours.

Changes in operational hours required a reconsideration of staffing to accommodate the extension of hours. In lieu of moving existing paraprofessional and librarian schedules, US and AS leadership proposed a new part-time (.5 FTE) AS position to cover the extended hours. The position was viewed as critical to ensuring that the part-time paraprofessional would be available on Saturdays to assist librarians with any unusual operational questions. Simultaneously, the number of full-time personnel needed to staff the service desk on Saturdays was reassessed. The proposed staffing model included either a librarian or a full-time paraprofessional staffing the service desk, as well as the part-time position, rather than two full-time employees. These combined changes were meant to accommodate student learning needs and better utilize the time of those providing weekend user-facing services.

In considering weekend extended hours, six schedule options were originally offered to library administration. The final expanded operational model chosen by administration was a mix of several of the models, increasing operations by 10 hours over the weekend. The model was chosen due to its benefits for the personnel working weekends (including student workers) and for the library's budget. Planned absences were covered by full-time staff shifting their hours and unplanned absences

were managed by student workers and voluntary support from other employees. Three hours each were added on Friday and Saturday (5:00pm-8:00pm) and four hours were added on Sunday (8:00am-12:00pm), increasing the library's operating hours to 105.5. The .5 FTE staff position was approved to cover extended hours between Friday and Sunday, funded through the personnel budget. Library administration reported shifting its budget to accommodate the changes rather than requiring new funds for the .5 FTE position, notably through an attrition-driven reduction in the number of student workers. The new position, along with the change to desk staffing, reduced the number of Saturdays that other members of US had to work from monthly for paraprofessionals and bimonthly for librarians to twice per semester for each respective employee type.

Although the library opened a virtual reality lab during this time, it was not open during the extended hours. No other programmatic or advertising changes were made beyond announcing the extended operational hours via physical signage, the health campus listserv, and liaison outreach to their colleges/schools. This announcement was sent just prior to the change and upon its initial implementation.

METHODS

This study retrospectively assessed the effect of extended weekend hours on physical use of the library using gate counts, circulation statistics, and room reservations between January 14, 2018, and January 12, 2020. The institution's University and Medical Center IRB confirmed that because this study used standard operational data to assess how aggregate weekend academic library use changed after operational changes at an institution, involving no hypothesis and not collecting information about the library's individual users in response to the change, it did not meet the federal definition of Research and no Human Subjects Research considerations or regulations were triggered by the reported assessment. Additionally, gate count and circulation data contained no identifiable information. Only the raw room reservation data included identifiable information and all user identifiers were anonymized and removed.

The dates chosen represent one year each prior to and following the implementation of extended hours. Although extended hours continued until the onset of the pandemic, this choice of time periods allows for a matched sample, pre- and post-implementation, aligning with the starts of spring semesters.

The three metrics chosen — gate counts, circulation, and room reservations — provide a rich picture of the physical use of the library during operating hours, covering building occupancy levels throughout the day, use of materials in the library's physical collections, and use of dedicated study spaces. The library gate count data were taken from Sensource hardware and software used in the library to capture entries and exits, along with their time stamps [32]. Circulation data were harvested from the Integrated Library System (ILS), SirsiDynix Symphony. Room reservations were captured through an internally built room reservation system.

All data from these systems were exported as either .xlsx or .csv files and subsequently cleaned and prepared for use by adding additional data points such as whether the date and time for a given case occurred during the regular academic semester, during extended hours, or during an exam period. Gate entries occurring during time periods when the library was closed to all students, such as state and federal holidays, were removed from the dataset. The cases that occurred during exam periods were removed from analysis files because exam periods vastly alter student library use and study behaviors and because, even prior to the implementation of extended hours, exam periods already included short-term extended operating hours.

Descriptive statistics were used to assess hourly use of physical spaces and resources, pre- and post-extended hours for the following data points: total number of users per weekend day by hour (assessed by gate counts), total checkouts per weekend day by item type and by hour, and total number of room reservations and room reservation hours by weekend day. Hourly usage trends were generated as multiple line graphs, paneled by weekend day and semester. Data analysis was performed in SPSS. Cleaned and de-identified data sets are provided in Open Science Framework.

RESULTS

Laupus Library's statistics showed altered hourly physical use patterns across all three of the data sets that we collected, though there was variation by weekend day and by semester for hourly patterns in gate counts, room reservations, and circulation.

Gate Count

Gate counts of entries were higher post-implementation, across all three weekend days. Gate count totals were consistently highest on Fridays, lowest on Saturdays, and rising again on Sundays, both pre- and post-implementation. Hourly gate entry patterns reveal changing use: while gate entries were similar on Fridays and Saturdays, Sunday gate count entries show an altered pattern, with a gentle slope at the start of the day, as opposed to the large spike in entries at opening, pre-implementation. This changed pattern held true across semesters. Exit counts by weekend day across semesters also show that extended hours led to a significantly reduced spike at closing time on Fridays and Saturdays. Sunday exit data is mirrored across pre- and post-implementation. Gate count entry data also indicate that

the proportion of entries during the extended hours as a proportion of the total entries for a given weekend day varied by weekend day (Friday: 8%; Saturday: 11%; Sunday: 21%). The data are available in Supplementary Table 1. Figures 1 and 2 show the gate count entries and exits, respectively, by time of day for each weekend day, pre- and post- implementation of extended hours.

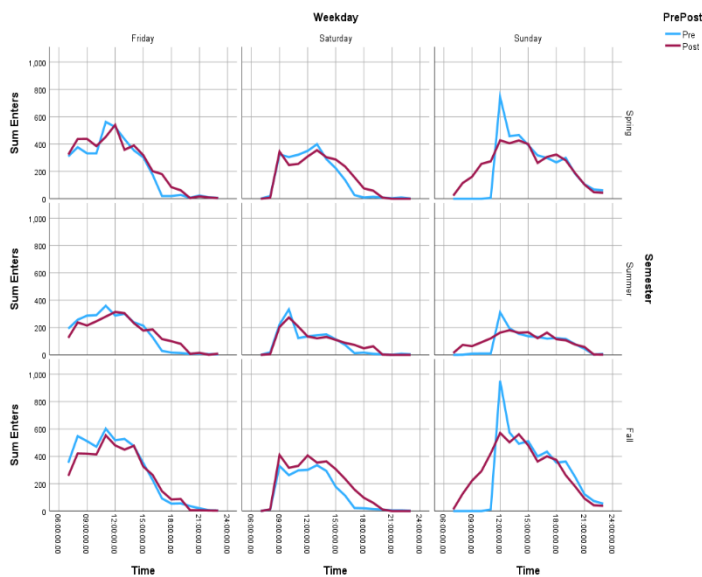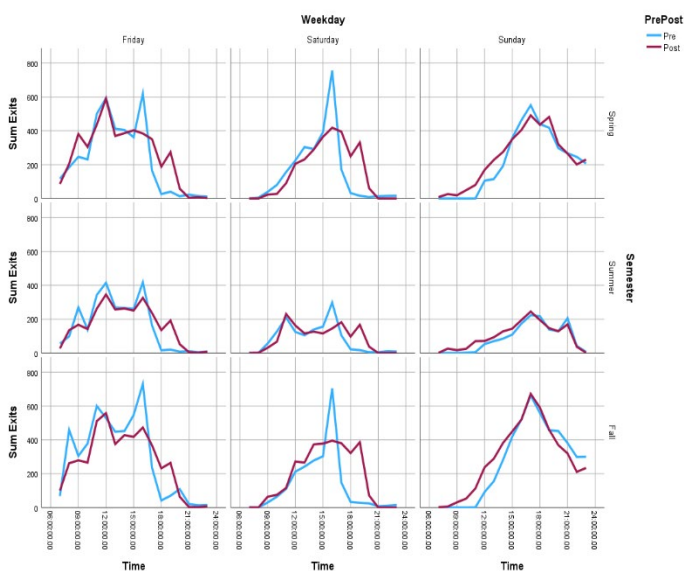**Figure 1** Sum of Entries by Time of Day for Friday, Saturday, and Sunday, by Semester

Figure 2 Sum of Exits by Time of Day for Friday, Saturday, and Sunday, by Semester


Room Reservations

The total hours of room reservations occurring during extended hours in 2019 accounted for 17.73%, 17.34%, and 15.91% of all reservations during the Spring, Fall, and Summer Semesters respectively (Supplementary Table 2). Supplementary figures 1-3 show the changes in hourly patterns of reserved study room use as well as start and end times pre- and post-implementation of extended hours. The authors note that the data indicate that room reservations were higher post-implementation, though not uniformly. Start times on Spring and Fall Semester Sundays, post-implementation, show a gradual increase in room reservation start times throughout the morning, as opposed to the steeper slope of study room reservation hours starting at noon, pre-implementation. Likewise, the room reservations on Fridays and Saturdays show much higher hourly rates of reserved study room use in the late afternoon, in addition to use of study rooms during extended hours. General room reservation patterns follow library data trends more broadly, with Sundays having the highest level of use of reservable study rooms. The authors note an incidental finding of a consistent 3 p.m. dip in reserved study room use.

Circulation

Circulation data increased following implementation of extended hours. Overall, the number of items checked out increased by 40.18% during non-exam periods between the pre- and post-implementation periods of study, though summer circulation decreased. Circulation patterns by time of day changed most notably on Saturdays during the period of study, with higher and shifted peaks during the Saturday afternoons of the Spring and Fall Semesters. Examining circulation by item types, results indicate that the anatomical model collection, which is library-use only, saw a large increase in use during the extended hours, with particularly high usage on Sundays in the Spring and Fall Semesters, even within the hours of pre-implementation operation. Patterns of use by time of day were typically similar, except for Saturdays, when anatomical model use peaked late in the day, indicating high levels of student use during extended evening hours. This increase in usage was also observed in other library-only items like dry-erase marker kits. Items that could be used outside the library (typically books and laptops) saw either declines in checkouts during extended hours or small increases. Data on circulation are presented in Figure 3 and Supplementary Figure 4. The sum of checkouts for these year-long periods as a total are nonetheless low.

Figure 3 Changes in Circulation by Hour, Pre- and Post-Implementation of Extended Hours, by Weekend Day and Semester
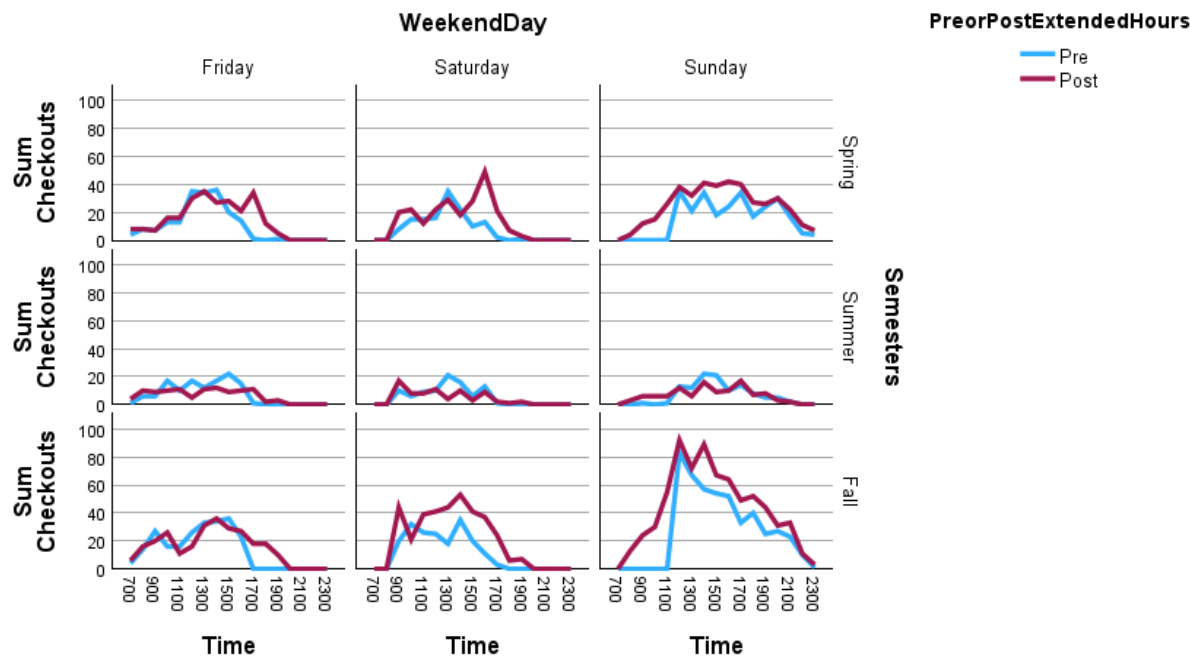
DISCUSSION

The results of the study signal that extending operational hours based upon students' expressed need resulted in altered temporal patterns of physical space and resource usage, with students entering, using dedicated study spaces, and checking out library-only items during those extended hours. Student entries and room reservations had less marked peaks around openings on Sundays and closings on Fridays and Saturdays. The data also show increased use of resources (spaces and collections) overall, with variation by semester. The latter findings are notable in the face of published data from the profession describing dropping gate counts over the last two decades [33-36] as electronic resources make a substantial portion of library collections accessible anywhere.

The observed temporal changes in physical library usage following implementation of extended hours underline the ongoing value of the library as space beyond the hours when classes occur or during typical weekend 'business hours.' This also ties neatly with discussions of libraries as a "third place," with their own unique environment [37-39] possibly offering advantages over other locations for study for the student accessing the library post-extended hours. The increase in library use for the weekend days and times during which operational hours were extended is particularly noteworthy, given that Friday and Saturday evenings and early Sunday mornings cut into the traditional social weekend when students typically engage in social, employment, and religious activities, or weekend morning sleep [40, 41].

The authors note that not all weekends, across all semesters, saw the same, or similar rates in use of the library during extended hours. This may reflect changing student priorities across the Fall, Spring, and Summer Semesters. These disparities are most notable in the Fall Semester, which the authors suggest has stronger attractions altering study behaviors, such as major American holidays, campus events such as homecoming, and campus social and cultural experiences, such as establishing and rekindling friendships after the summer, Greek organization initiations and events, and big-time sporting events [42].

The results of the study allowed Laupus Library to confirm that student demand for extended hours was an expression of true need, rather than a desire for unfettered access to resources, regardless of actual need or use. Extreme peaks around pre-implementation opening and closing times indicate pent-up demand, reflecting the times when many students would have come earlier or stayed later. Moderated temporal patterns in the post-implementation data indicate that operational hours better fit extant academic study patterns among users.

The data additionally provides some sense of the value of extending hours to Laupus Library's users. The authors did not attempt to calculate a monetary value of the extended hours, an exercise which would be difficult, and even problematic in the paradigm of education and

research being the primary 'business' foci of higher education institutions. Indeed, determining a Return On Investment (ROI), as applied in business, can be problematic in any library context, and may not be the most effective means of showing the value of operating hours changes to those assessing the value of library services [43]. Instead, assessing how students, faculty and staff choose to use their time during hours that they might otherwise spend pursuing academic, financial, or psychosocial goals in other locations shows value in compelling ways. As Shepherd, Vardy, & Wilson [44] note, "… time is a limiting factor for everyone, [therefore] how people use their waking hours reflects their values, priorities and personal interests" (p. 450).

Importantly, the change in staffing patterns did not impose a high level of burden on pre-existing positions or the library's budget. Although not formally assessed, library employees expressed satisfaction with the altered weekend schedule. Additionally, no user complaints about reduced weekend access to librarians were submitted to administrators during or after the study period. This, along with the temporal shifts in physical use, was an important confirmation for library administrators. As previously noted, post-hoc assessments such as this one are key to ensuring that limited budgets are best allocated to balance user needs and responsible accounting.

Laupus Library, like most other libraries, closed its doors in March 2020 and did not reopen until August 2020. Upon reopening, it employed reduced hours of operation, gradually increasing over the following three years. It was only in Spring 2022 that hours returned to similar levels to those offered in 2019. By that time, the service model had changed to a study hall model, with no staffed service desk on Sunday-Thursday between 10:00 p.m. and 12:00 a.m. or on Friday and Saturday evenings due to low circulation numbers and low reported staff interactions with users. To date, users have not formally reported dissatisfaction with this study hall model for extended hours. Additionally, the library looked at gate count data by hour and removed two hours on Sunday (8:00 a.m.-10:00 a.m.) due to lower entrances during that time. Specific student demand for study space played a key role in this change. The pandemic impacted physical library use and further analysis on post-pandemic usage trends is warranted, both within Laupus Library and across health sciences libraries, such as an examination of overarching impacts on gate counts between 2020 and the present, use of librarian services during the hours when librarians are present, and the ways that libraries adjusted operational models throughout the pandemic.

CONCLUSION

The change in temporal patterns of library use during extended hours justified the change in operational hours and demonstrated the need for extended hours, without increasing operational costs. Although the COVID-19 pandemic halted the extended hours, the data informed the library's slow readoption of extended hours following the fall of 2021. While many things have changed in the last several years, student demand for physical library access remains strong.

LIMITATIONS

Gate counts have known limitations for understanding how a library is being used, along with the potential for counting inaccuracies [45]. Because this study used post-hoc, pre-existing data, head counts were not available to the authors; this limits the authors' ability to assess which areas of the library were being used and the types of activities in which library users were engaged. Two data points, room reservation data and circulation data, may not accurately reflect rates of library use. For example, anatomical models are frequently checked out by one student for use in group study sessions. The number of students using models may not be accurately reflected in the circulation data. Similarly, room reservations may be inaccurate; many students used unoccupied study rooms without a room reservation and users neither had to verify their arrival on time (or at all) for their reserved study room time, nor could they 'check out' from the room. This study could therefore only assess the hours of intended use determined by room reservations. This may have led to either an undercount or an overcount in both study room sessions and hours.

The authors did not assess reference desk statistics due to known limitations of the data. Notably, there is both an issue with the fidelity to entry at time of service event, both broadly as well as in individual variability in recording the reference interaction at all. Additionally, librarians in Laupus Library note their use of Saturdays to complete backlogged work received during the standard business week, which would falsely inflate statistics about librarian services on Saturdays when they worked.

Most notably, this study evaluated outcomes of operational changes, rather than elucidating the reasons students accessed the library during extended hours or the value they put on the extended hours. These questions merit further study.

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DATA AVAILABILITY

Data associated with this article are available in Open Science Framework at https://osf.io/6utk7/.

AUTHOR CONTRIBUTIONS

G.J. Corey Harmon: conceptualization; data curation; investigation; writing – original draft; writing – review & editing; Kerry Sewell: conceptualization; data curation; formal analysis; methodology; visualization; writing – original draft; writing – review & editing.

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SUPPLEMENTAL FILES

- **Appendix A**: Supplementary Tables

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History in context: teaching the history of dentistry with rare materials

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See end of article for authors' affiliations.

Background: History and health humanities instruction offers a framework for professional students to examine the arc and development of their profession as well as develop cultural competencies. Exploring ideas, themes, and health care practices and approaches through historical instruction can show students how culture influences health care and practice, therefore providing a context for further development of cultural competence skills.

Case Presentation: This case report describes a collaboration among a dentistry course instructor, a liaison librarian, and curators of a rare book collection. Working together, this team offers an active learning class that examines the historical arc of the dental profession. We aim to have students use primary source materials to examine the experiences, research, and narratives of their profession.

Discussion: Using a World Cafe with thematic tables allows students to safely examine rare materials and artifacts and have meaningful conversations about themes that are critical to dentistry's past, present, and future. Students reported that engaging with artifacts and historical materials provided a different way to understand history and enhanced their learning experience. Engaging students in this work builds critical thinking skills that are essential to evidence-based practice.

Keywords: History of Dentistry; Active Learning; Librarians; Curators; Health Humanities

EC   See end of article for supplemental content.

BACKGROUND

Contemporary health sciences curricula seek to train their students in systemic challenges within health care. Educating students about structural inequities is essential for promoting an understanding of how systemic biases in health science research, education, and access to health care can lead to disparate health outcomes. In dentistry and dental education, there is a move away from race-based to race-conscious care by efforts to recognize and reduce biases [1-2]. History holds lessons about how practices and beliefs like racial, sexual, and class-based biases have been embedded in the foundations and frameworks of the health sciences. Medical humanities and explorations of the history of dentistry session can highlight the continuities of those biases into present practice, create conversation about the foundations of dental practice, and raise critical questions of the source of the practices dental students would learn through their education [3].

Dentistry offers a unique opportunity in the context of health disparities and historical education. In the United States, separate systems for medical and oral health care have exacerbated disparities and increased barriers in access to oral health care [4]. Teaching the history of dentistry can provide a unique lens for understanding the professionalization of dentistry, its separation from medicine, and the impact of access to oral health care. Unfortunately, teaching the history of dentistry is not currently prioritized in the curriculum [5].

Historical medical libraries are widely viewed as unique and distinctive collections for facilitating student learning, as their primary resources can guide students through complex and challenging conversations related to the impacts of health care inequity that will remain relevant to them throughout their career as a health professional [6-7]. Institutions have integrated teaching with historical medical collections into medical education curricula to help students gain perspective and context about their scientific and clinical learning, and to understand that, as Barr et al. state, "medical practice is shaped by a multitude of social, cultural, and political forces" [8]. By working with materials that demand analytic engagement, students are presented with opportunities to grow in their critical thinking skills through interpretation and self-reflection [9].

As in other health sciences, integrating the range of knowledge, skills, and abilities required to effectively use historical primary resources (primary source literacy) into dental education activates critical thinking skills. Engaging students in this work can foster the development of practical skills that are essential to evidence-based practice, which prioritizes a rich continuum of experience, research, and narrative that professionals build, revisit, and reflect upon throughout their careers [3, 8, 10-12].

CASE PRESENTATION

The Health Sciences Library (HSL) and Wangensteen Historical Library of Biology and Medicine (WHL) support courses and curriculum in the Academic Health Sciences at the University of Minnesota (UMN). A move to a new building (2021) presented an opportunity for both libraries to revisit their objective of increasing collaboration between the HSL liaisons and WHL curators. To facilitate this the WHL curators hosted subject-specific tours for liaisons showing the breadth of materials (print and artifact) related to their subject. The liaison librarian to the School of Dentistry participated in a tour and left with knowledge of materials relevant to dentistry and an invitation to seek out opportunities to collaboratively support courses and students in the School of Dentistry.

In March 2022, the liaison librarian met with an international cohort of dental students from Germany to tour library spaces and discuss services offered by the HSL. This also included a visit to the WHL where the students explored a curated set of historical dental materials which resulted in a thoughtful conversation around the history of dentistry and intersections with modern dental education and practices. The UMN coordinator of the international program was impressed with the ways students engaged with the materials and asked the liaison librarian and WHL curators to develop a similar session for a history of dentistry class session for year one dental students. The liaison librarian, curator, associate curator, public services supervisor, reference specialist, and course director formed a group (henceforth referred to as the "project team") to develop a course drawing broadly on their pedagogical, subject content, and historical expertise.

The project team developed a two-hour session that is part of Dental Professional Development, a required course for year one Doctor of Dental Surgery (DDS) students (n=105). The project team's objective was for students to contextualize the history of dentistry through rare books and artifacts, as well as to analyze materials with the goal of understanding dentistry's past so they could better understand its future.

The course director shared curricular content from prior classes to provide context. The project team reviewed the materials, electing to build an assignment around Jane A. Weintraub's "What Should Oral Health Professionals Know in 2040: Executive Summary," which projected future trends and developments for dentistry [13]. The project team identified five themes from Weintraub's article that connected dentistry's past, present, and future that would become the framework for the class: (1) the connection between oral and systemic health; (2) diversity, equity, and inclusion; (3) aesthetics; (4) technology; and (5) patient consumerism for oral health care [3]. These themes are significant because they connect to evidence-based practice and current conversations that the students will be engaged in throughout their dental education.

The project team followed the 2021 revisions to Bloom's taxonomy as they developed content for the course [14]. To provide a foundation for the course session, the project team created an ArcGIS StoryMap, "History of Dentistry in Context" [15]. It includes a timeline of major events in the history of dentistry, selected popular culture highlights to situate students in the historical framework being discussed, and deep-dive sections on the five thematic areas to prompt students to think about how culture shapes health, health care, and the experience of practitioners.

The curators used their expertise to select and finalize a group of historical primary sources that reinforced the themes. A learning approach that prioritizes skill development in historical and primary source analysis and critical thinking is foundational to teaching in the WHL library [16]. Artifacts and texts are not presented as oddities or curios, but as materials that should be interrogated and contextualized with other sources to understand both historical and contemporary people, cultures, events, and practices. This active learning approach aims to humanize history where students can think about the context of an item, how it was used, the intent behind a text or idea, and connect it with their present situation. The challenge that this class presented was how to structure it so 105 students could have meaningful interactions with rare materials in an active way.

A World Cafe structure was proposed for the class. Originally seventy items were identified as potentially relevant to the course. The project team reviewed each item, identified and bookmarked excerpts related to the themes, and chose which thematic area each item would go in. Content selected for the course was in English, with a focus on dentistry in the United States, and covered roughly the mid-1800s to early 1900s with most materials from the 1920s (Appendix A). These materials were chosen since the students were primarily English speakers from the United States and we wanted materials they could easily comprehend, and which may seem familiar during their dental education. The project team also chose a small selection of historical dental artifacts for the students to peruse before and after class. We organized

the final selection of sixty items among the five themes with each theme having two tables. The students were divided into groups of ten to twelve people and rotated through the five thematic tables. The project team wrote three to four questions per theme to engage students with the materials, prompt exploration and discussion about the theme, and consider how the history of dentistry is related to the present and future of dentistry (Appendix B). Student groups were invited to respond to these questions on large Post-it Notes at each table and encouraged to build upon one another's comments. Facilitators were also at each table to prompt discussion and inquiry among the students. Each group spent about fifteen minutes at each table before rotating to the next theme.

At the end of the course session there was a debrief with the class where students shared what they found surprising or what they learned as they examined, thought about, reflected on, and discussed the rare materials and questions. Students shared feedback and their reflection of the class via an optional Qualtrics form (Appendix C). The Qualtrics questionnaire was submitted to the UMN Institutional Review Board and granted exempt status (STUDY00019894). The form consisted of seven required Likert scale questions and two open-ended questions which asked:

- What is one way that you think the themes presented today apply to your education and future as a dental practitioner? (required)

- Please share feedback or suggestions for future history of dentistry sessions. (optional)

A copy of the Qualtrics questionnaire can be found in the supplemental materials (Appendix C).

Impact of teaching with historical materials and artifacts

The Qualtrics questionnaire had a response rate of 59.05% (n=62). Students indicated that their interest in the history of dentistry was stimulated by this session. Most respondents indicated that they learned something new, that the StoryMap was useful, and that they were planning to tell someone about the session (Table 1).

An open-ended question at the end of the Qualtrics questionnaire asked: What is one way that you think the themes presented today apply to your education and future as a dental practitioner? A thematic analysis was conducted of the responses to identify how respondents connected class content to their education and future as a dental practitioner. Two main themes emerged: (1) history as a linear trajectory, and (2) growth of the dental profession.

Table 1 Responses to History of Dentistry Questionnaire

	Strongly or Somewhat Agree (%)	Neither (%)	Strongly or Somewhat Disagree (%)
Learned something new	61 (98.39)	1 (1.16)	-
Enjoyed working with artifacts and historical texts	59 (95.16)	2 (3.23)	1 (1.16)
Engaging with historical texts/artifacts provided a different way to learn	60 (96.77)	2 (3.23)	-
Working with artifacts/historical texts enhanced my learning	61 (98.39)	1 (1.61)	-
The StoryMap provided historical context relevant to the history of dentistry	58 (93.55)	3 (4.84)	1 (1.61)
	Yes (%)	**Might (%)**	**No (%)**
I'm planning to tell someone about the things I learned today.	53 (85.48)	7 (11.29)	2 (3.23)

The first theme, history as a linear trajectory, is a progressive view of history where the past is bad, and the future is good. Students commented that "It was good to learn the mistakes of the past, so that we don't repeat them in the future," and "We saw a lot of outdated attitude[s] towards dentistry and even what would now consider as malpractice today in dentistry." This contrasts with a second perspective theme, which appreciates the intersection of the profession's past with its present and recognizes the past as the foundation upon which the present and future are built. Students were able to juxtapose dentistry's past and present, "What we learned today shows how much dentistry has advanced and change[d] throughout time, which makes you realize that it could change in our lifetime as well." Students also

identified themes from the past that continue to be relevant today, "Some concepts from older books that discussed things such as the systemic and oral health connections stay true today though" and recognized that, "Past dentistry built a solid foundation for today['s] dentistry and has been used as inspiration for modern dental practices."

DISCUSSION

Collaboration between a liaison librarian, curators, and course director resulted in a unique, engaging, and impactful class. The active, hands-on session allowed students to engage with major themes and questions that have impacted dentistry's past and future. Students were engaged throughout the two-hour class and students had active conversations about the materials and the themes. Using a World Cafe provided a structure for students to move throughout the classroom and learn about the five thematic areas. Students were more interested in artifacts, such as dental instruments and tools, which was expected. With a one-shot class it can be challenging to engage students with print and physical materials that they are seeing for the first time but identifying specific excerpts and giving students a few minutes to explore materials allows for engaging conversations at the tables. Facilitators also assisted in prompting conversation by asking questions related to the theme and materials. The StoryMap provided valuable content and a grounding in historical thoughts, events, and developments in dentistry and dental care. The combination of brief narrative text, images, and timeline allowed for students to comprehend when themes were emerging in dentistry as well as the societal and cultural events of the time that were influencing dentistry. Several students referred to the content of the StoryMap in their facilitated in-class discussions.

Overall, students connected themes from dentistry's past to dentistry's present and were aware of its influence on today's scientific thought. However, there is nuance in thinking about how history impacts the health sciences. Some students understood history as disconnected from present practices, relying on a historical narrative that emphasizes linear progress, noting that "I think it [history] applies to reflecting on mistakes and how they can be prevented in the future." This can be viewed as a rupture from the past and creates a triumphalist narrative where present practices and thoughts overcame the biased science of the past [3]. Our intention for the class was to move students beyond this perspective so they can see the social dimensions, ideologies, and practices from the past that continue to influence dentistry today [3,11]. There is value in connecting with the "emotional aspects" of practice from today and the past [8]. It can be challenging to break from the view of linear progress, but some of the students started to understand this, indicating that "It is important to know about the past and how it impacts

current dentistry of the day, and how we can make dentistry better in the future." For future classes, the project team will edit questions for the facilitators to center table discussions on the growth of the dental profession, so students can identify and explore how the past continues to affect current dental practice.

While we were able to conduct this class in person with physical materials, it is possible to conduct these sessions virtually or with digital surrogates of historical sources. Online digital collections from archives and libraries offer opportunities for those who may not have access to an archival or rare book collection to engage with these materials for historical instruction [17]. During the COVID-19 pandemic, limitations in access to physical collections resulted in archival and special collections pivoting to use digital surrogates for instruction [18]. Having students engage with materials, either physical or digital, in small groups is needed for fostering meaningful discussions about the context of materials and topics [12]. Utilizing active learning techniques, such as a World Cafe, offers a structure for students to explore digital surrogates and have interactive conversations around specific topics or questions.

Co-creation of course material was essential to ensuring that students could see connections between complex historical material and their education as dental practitioners. While this case focused on historical instruction in dentistry, this kind of class session would be meaningful in other health sciences disciplines. Materials can be selected to cater to specific disciplinary needs. For example, a public health class may utilize materials and artifacts to discuss social determinants of health and community health needs [11], while a pharmacy class may explore changes in drugs and medicine to access to health care and changes to the role of the pharmacist [19].

Historical instruction is vital to professional programs, although it is a topic that is often overlooked and dismissed in favor of other requirements and the competition for space in the curriculum. It is a foundation for one's professional identity. Thinking about perspectives, populations, or patients who are or are not represented in the historical record shows that professional identity and the evidence knowledge base may be on shakier ground than one initially thinks. Examining difficult or uncomfortable questions within a historical context can sometimes be easier for students since it allows them distance from the conversation. Learning about themes that are critical to understanding the past, present, and future provides students with an opportunity to explore wicked problems, such as the siloing of dentistry and impact of social determinants of health on dental care, and to think critically about them in a setting that fosters challenging questions and difficult conversations.

DATA AVAILABILITY STATEMENT

Data associated with this article are available in the Open Science Framework at: http://dx.doi.org/10.17605/OSF.IO/AMVSJ.

AUTHOR CONTRIBUTIONS

Nicole Theis-Mahon: conceptualization, methodology; writing - original draft; writing – review & editing; Anna Opryszko: conceptualization, methodology; writing – review & editing; Ai Miller: conceptualization, methodology; writing – review & editing; Emily Beck: conceptualization, methodology; writing – review & editing; Lois Hendrickson: conceptualization, methodology; writing – review & editing.

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SUPPLEMENTAL FILES

- **Appendix A**: Bibliography of Materials
- **Appendix B**: Table Questions
- **Appendix C**: Qualtrics Questions

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