Vital Signs: Health Literacy and Library and Information Science Pedagogy in the United States

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Health literacy supports individuals', families', and communities' health-care decisions. As mediators between health information seekers and medical literature, librarians are essential purveyors of health literacy. Users' trust in libraries as sources of reliable and current health information presupposes the appropriate training of librarians; however, LIS programs lack benchmarks for educating generalist students in health information. On-the-job training remains the latter's sole recourse. This research employs content analysis to explore the current state of health literacy training in LIS programs. First, we define and contextualize health literacy. Next, we posit a health literacy framework comprising five attributes based on the American Library Association's (ALA's) core competencies and relevant scholarship. Third, we examine 118 health-related courses offered by 53 LIS programs in the United States and Puerto Rico. Only 38 courses in 25 LIS programs incorporate one or more of the five attributes. Ultimately, we recommend that LIS programs train generalist students in health literacy as part of the core curriculum, thereby preparing them to develop and support users' health literacy.

Keywords: health librarianship, health literacy, LIS pedagogy, NLM databases, MedlinePlus

> If information professionals in any setting, public library or otherwise, do not know of reputable sources for information, consultation, and support in providing health information services, their publics are not being well served.
> (Smith 2011, p. 162)

Health literacy in Library and Information Science (LIS) pedagogy merits investigation for three reasons. First, health literacy enhances life skills that help individuals and their communities weather changing, potentially disruptive, social, political, cultural, and economic conditions (Horrigan, 2015). Low health literacy, by contrast, is associated with more frequent hospitalizations and use of emergency care services, less frequent use of preventive care measures, diminished ability to interpret labels and health-related communications and to self-manage chronic conditions, a decreased tendency to take medication as instructed, and among the elderly, poorer overall health and higher mortality rates (Berkman, Sheridan, Donahue, Halpern, & Crotty, 2011; Mackey, Doody, Werner, & Fullen, 2016; Miller, 2016). The US health-care system, however, effectively leaves individuals to their own devices to locate salient information (Benjamin, 2010; Chew, 2018; Selden, Zorn, Ratzan, & Parker, 2000). Librarians can help address an urgent public health need by improving both their own health literacy and that of their users. LIS programs have substantial but largely untapped potential to prepare students for such work.

Second, the public has long trusted librarians to provide reliable, current health information. Perhaps most notably, public librarians assist users with health information queries

even though the former often lack formal training (Flaherty & Kaplan, 2016; Luo & Park, 2013; Rubenstein, 2016, 2018; Smith, 2011; Westbrook, 2015). Yet a lack of health information-related LIS training circumscribes generalist librarians' opportunities to assist users. It also hinders their efforts to collaborate with health information professionals (HIPs) in research initiatives more broadly. As a result, entire communities lose the opportunity to benefit from librarians' expertise.

Third, the public demand for health information both online and offline is unprecedented. LIS students' acquisition of health literacy skills will therefore improve their employment prospects (Ma, Stahl, & Price, 2020; Smith, 2011).

KEY POINTS:

- Librarians receive training in the dissemination of current and reliable information, but not necessarily health information.
- Users' trust in libraries extends to current and reliable health information.
- To date, LIS programs have lacked a framework for training generalist librarians in health literacy concepts; this article analyzes what these concepts are and how they are taught in LIS and health degree programs as a means to recommend adding health literacy training to LIS programs' core curriculum.

In light of these three points, this study poses the following research question: What pedagogical approaches to health literacy training are found in LIS programs? First, we define and contextualize health literacy. Second, we review the scholarly literature, which indicates a lack of formal training venues for generalist LIS students. Third, we propose a framework for training generalist LIS students to support users' health literacy. Based on ALA's core competencies and the scholarly literature, it comprises five foundational health literacy attributes (Table 1). Fourth, we describe the study's methods, namely content analysis of program and course descriptions. Fifth, we analyze the 38 courses that evince at least one of the health literacy attributes. We then discuss the pedagogical implications of attribute distributions and relationships. Finally, we note limitations, offer recommendations, and suggest directions for future research.

Literature review

Health literacy definition

Health literacy denotes an individual's ability to locate, gather, understand, and act upon health information appropriately (Selden et al., 2000). It is particularly important for persons managing chronic illness (Mackey et al., 2016; Smith, 2006, 2011). Librarians can support and augment users' health literacy, thereby complementing the specialized health information and services that HIPs provide (Millican, 2014; Smith, 2006). But a lack of opportunities for formal training in this area impedes their capacity to do so.

Health information training opportunities

Formal training for HIPs aligns with specialized competencies set by professional medical associations (Ma et al., 2020). The Medical Library Association (MLA), for example,

defines seven professional competency areas (MLA, 2007).[1] By contrast, ALA core competencies for librarianship guide formal LIS training (ALA, 2009). Like the MLA, ALA's core competencies emphasize lifelong learning and continuing education, but they do so more ecumenically.

Without formal LIS training, of their own volition practicing librarians may undertake informal training in specialized health information services. As one option, the National Network of Libraries of Medicine (NNLM) offers continuing education credits and a professional development program.[2] NNLM also contributed to the MLA's certificate program.[3] A third option consists of self-paced online tutorials (Luo & Park, 2013).

Given these scattered options, librarians' health literacy remains uncertain (Smith, 2011). Integrating health literacy training into the LIS curriculum would ameliorate this situation (Smith, 2006). Yet a framework for formal training is wanting.

Justification for and development of health literacy attributes

We employ content analysis methods to promulgate five health literacy attributes (Allen & Reser, 1990; Bernard & Ryan, 2010; Krippendorff, 2010). More specifically, we operationalize our research question along two lines. First, ALA's eight Core Competencies of Librarianship (ALA, 2009) constitute the foundation of a librarian's skill set.[4] We distill them into five categories: searching for information, conveying information ethically and in accord with relevant policies, evaluating information for users, evaluating information for collections, and collaborating with peers. Second, we draw upon salient scholarly literature to refine these categories into health literacy attributes. These five attributes guide our coding of LIS program and course descriptions. We explain and identify relationships among attributes, core competencies, and the supporting literature in sections 1.3.1 through 1.3.5 (Table 1).

Attribute 1: Competence in searching NLM databases

The federal government makes reliable and current health information available gratis through resources such as NLM's MedlinePlus.[5] Training in the use of NLM resources prepares LIS students to take advantage of these resources and to teach others to do the same. The first health literacy attribute (A1) therefore centers on developing facility with MedlinePlus. Moreover, work with NLM databases acquaints generalists with clinical and biomedical health information that HIPs utilize, promoting a robust, holistic understanding of health literacy.

A1 pulls together six ALA core competencies: Foundations of the Profession, Information Resources, Organization of Recorded Knowledge and Information, Technological Knowledge and Skills, Reference and User Services, and Continuing Education and Lifelong Learning. These competencies suggest that database searching skills represent a foundational component of health literacy (Barr-Walker, 2016; Chew, 2018; NLM Board of Regents, 2018; Wood et al., 2000).

NLM database skills complement A2, knowledge of policies and ethical conduct.

Table 1: Health literacy attributes, corresponding ALA competencies, and supporting LIS literature

Health literacy attribute code	ALA core competency	Supporting LIS literature
A1: Competence in searching NLM databases.	Competence in searching for reliable, current information ALA parts 1, 2, 3, 4, 5, 7	(Barr-Walker, 2016; Chew, 2018; NLM Board of Regents, 2018; Selden et al., 2000; Smith, 2011; Wood et al., 2000)
A2: Competence in ethically conveying policies related to health information dissemination.	Competence in knowledge of policies, regulations, ethics ALA parts 1, 4, 5, 7	(Berkman et al., 2011; Chew, 2018; Millican, 2014; Selden et al., 2000; Smith, 2006; Somers & Mahadevan, 2010)
A3: Competence in evaluating health materials for individuals and families.	Competence in evaluating information for users of all ages ALA parts 1, 2, 3, 4, 5, 6, 7, 8	(Banks, Cogdill, Selden, & Cahn, 2005; Centers for Disease Control and Prevention & University of Washington's Center for Public Health Informatics., 2009; Chew, 2018; Detlefsen & Galvin, 1986; Selden et al., 2000; Westbrook, 2015; Yi, 2015)
A4: Competence in evaluating print and non-print health materials for collections.	Competence in evaluating information in multiple formats for collections. ALA parts 1, 2, 3, 4, 5, 6, 7, 8	(Barr-Walker, 2016; Chew, 2018; Chobot, 2010; Flaherty & Kaplan, 2016; Huber, Shapiro, & Gillaspy, 2012; Selden et al., 2000; Somers & Mahadevan, 2010)
A5: Competence in collaborating with health partners to foster a proactive health environment.	Competence in collaborating and in forming partnerships. ALA parts 7, 8	(Barr-Walker, 2016; Dalrymple & Roderer, 2011; Detlefsen & Galvin, 1986; Huber et al., 2012; NLM Board of Regents, 2018; Selden et al., 2000; Smith, 2011; Somers & Mahadevan, 2010)

Attribute 2: Competence in ethically conveying policies related to health information dissemination

In developing health literacy, individuals face challenges ranging from the personal and the social to the bureaucratic (Berkman et al., 2011; Millican, 2014; Somers & Mahadevan, 2010).[6] Librarians can mitigate such challenges through ethical, policy-grounded health information dissemination.

A2 combines knowledge of national and international cultural policies, intellectual freedom, technical and soft skills, professional ethics, and lifelong learning. Concentrating on the policies, regulations, and ethical conduct that underpin information interactions, A2 embraces four ALA competency areas: Foundations of the Profession, Technological Knowledge and Skills, Reference and User Services, and Continuing Education and Lifelong Learning.

Such competencies enable librarians to help users, especially those from vulnerable populations, develop health literacy (Berkman et al., 2011; Chew, 2018; Millican, 2014; Selden et al., 2000; Smith, 2006; Somers & Mahadevan, 2010). In the process, librarians gain insight into and ideally experience with policy making and implementation (Barr-Walker, 2016). Attribute 3, evaluating health materials for users, is integral to this process.

Attribute 3: Competence in evaluating health materials for individuals and families

Librarians evaluate materials via user interactions, often in circumstances where social services and health information provision overlap (Detlefsen & Galvin, 1986; Smith, 2011; Westbrook, 2015). Since even users who claim to be health information literate report difficulty accessing health resources and services, librarians can help users develop lifelong learning skills not only in locating but also in vetting appropriate resources (Chew, 2018; Yi, 2015).

A3 therefore entails evaluating health information. It incorporates all eight ALA competencies, adding the sixth (Research) due to the research skills necessary for evaluation and the eighth (Administration and Management) due to the administrative skills needed to evaluate library resources and services.[7] Evaluating health information for collections (A4) is a closely related competency.

Attribute 4: Competence in evaluating print and non-print health materials

Health information seekers may well prefer non-print resource formats. Varying levels of internet access, linguistic preferences, data literacy, or lack of affordable personal technologies all may play a role (Barr-Walker, 2016; Chew, 2018; Chobot, 2010; Flaherty & Kaplan, 2016; Huber et al., 2012; NLM Board of Regents, 2018; Selden et al., 2000; Somers & Mahadevan, 2010).[8] Librarians must further cultivate skills to meet these user needs (Smith, 2011).

A4 centers on competency in evaluating health materials in print, non-print, and audio-visual formats as part of collection building and management (Barr-Walker, 2016; Chobot, 2010; Flaherty & Kaplan, 2016). Like A3, A4 combines all eight ALA competencies but emphasizes the second and fourth areas (Information Resources and Technological Knowledge and Skills) because they concern assistive technologies and ethics as well as collection management skills. Appropriate evaluation of new medical information facilitates integration of clinical and population health information as well as public access to it (Centers for Disease Control and Prevention & University of Washington's Center for Public Health Informatics., 2009; Selden et al., 2000). The fifth attribute (A5) builds on the previous four to encompass the user's perspective within the health information environment.

Attribute 5: Competence in collaborating with health partners to foster a proactive health environment

The volume and complexity of health information have burgeoned since the Medicare and Medicaid legislation of the 1960s. Integrating health literacy concepts from multiple perspectives enables librarians to foster collaborations with HIPs and other health partners such as user-centered community programs (Barr-Walker, 2016; Dalrymple & Roderer,

2011; Detlefsen & Galvin, 1986; Huber et al., 2012; NLM Board of Regents, 2018; Selden et al, 2000; Smith, 2011; Somers & Mahadevan, 2010). For example, the Public Library Association (PLA) and NLM began coordinating health sciences librarianship and public library outreach campaigns in 2018.[9] Further, NNLM designs its own training programs, and the PLA provides "Health Community Tools for Public Libraries."[10] Finally, NLM's strategic plan (2017–2027) recommends developing community health information portals, an initiative for which librarians seem ideally suited.

A5 thus leverages the ALA's seventh competency (Continuing Education and Lifelong Learning) to encourage users' and librarians' lifelong learning and its eighth (Administration and Management) to stimulate collaborations with peers, HIPs, library community stakeholders, and health partners toward a proactive health environment for diverse users.

In sum, the five health literacy attributes comprise the study's analytical construct (Table 1). We inductively and iteratively develop a framework centering on these attributes.

Methods

To determine health literacy training opportunities in LIS programs, we rely on content analysis of the program and course descriptions of 53 ALA-accredited LIS programs in the United States and Puerto Rico (Allen & Reser, 1990; Bernard & Ryan, 2010; Charmaz, 2014; Gorman, Clayton, Shep, & Clayton, 2005; Krippendorff, 2010; Pickard, 2017; Saldaña, 2009).[11] Given the absence of benchmarks, we formulated an analytical framework for LIS health literacy training that encompasses five attributes. Our coding revolves around these attributes (Table 1). The unit of analysis is unstructured text retrieved from LIS programs' online course catalogs.

Between the fall of 2018 and the spring of 2019, we examined the websites and course catalogs of 53 LIS programs. These 53 programs fall into three categories: LIS programs that do not offer health-related courses (NHR), LIS programs that offer health-related courses but designated neither degrees nor specializations in health information (LIS), and LIS programs that offer health specialization certificates or degrees in conjunction with health-related courses (DP) (Table 2).[12]

We coded each of the 53 accredited LIS programs NHR, LIS, or DP (Appendix B). Forty programs offer 118 health-related courses in ALA-accredited LIS programs. Twenty-seven of the 40 programs are LIS; they offer 50 of the 118 courses (42.37%). The remaining 13 programs are DP; they offer 68 of 118 courses (57.63%).[13]

Guided by our five health literacy (HL) attributes, we coded the 118 courses.[14] The courses fell into four categories (Table 3).[15] First, HL courses include one or more of the five HL attributes.[16] Second, INF courses cover both informatics and health informatics topics.[17] Examples include data management, databases, health information technologies (HIT), consumer health informatics or consumer health information (CHI), health informatics, infrastructure, knowledge representation, medical informatics, security, and systems. Third, LIB courses address health sciences librarianship, collection management, knowledge representation, research, resources, and services.[18] Fourth, practicums (PRAC) hinge on extracurricular experiential learning.[19] Our analysis centers on the 38 HL courses offered by 25 programs.

Table 2: Preliminary corpus of 53 ALA-accredited LIS programs in the United States

Institutional program types	Program type codes	No. of programs	No. of courses
Institutions with no health courses	NHR	13 of 53 (24.53%)	0
LIS programs that offer health-related courses but no health degrees or specializations	LIS	27 of 53 (50.94%)	50 of 118 (42.37%)
LIS programs that offer health degrees, certificates, dual degrees, or other types of specialization in health areas	DP	13 of 53 (24.53%)	68 of 118 (57.63%)

Table 3: The 118 health-related courses offered by 40 programs

Health literacy (HL)	Informatics (INF)	Librarianship (LIB)	Practicum (PRAC)
38 courses	36 courses	32 courses	12 courses
(32.2%) in 25 programs (62.5%)	(30.51%) in 18 programs (45%)	(27.12%) in 23 programs (57.5%)	(10.17%) in 7 programs (17.5%)

Findings

Course attributes

Table 4 shows attributes per course for each of the 38 HL courses.

Five-attribute courses

Most important, not a single course includes all five health literacy attributes. This is especially noteworthy given the availability of NLM's MedlinePlus (A1), the imperative of complying with ethical and legal policies in providing health information to users (A2), the need to evaluate health materials for users and collections (A3, A4), and the benefits of a proactive, user-centered health environment (A5). Just as the eight ALA competencies constitute the foundation of professional librarianship, so does health literacy effectively turn on these five attributes.

Four-attribute courses

Although no DP courses feature four attributes, one LIS course (43-LIS-95) does (A2, A3, A4, A5). It suggests an almost fully realized user-centered, holistic strategy for health literacy training. That said, its neglect of A1 (searching NLM databases) is striking given the pertinence of MedlinePlus.

Three-attribute courses

No LIS courses feature three attributes, but three DP (07-DP-13/A3-A4-A5, 08-DP-17/A2-A3-A5, 18-DP-30/A2-A3-A4) courses do. Not one, however, includes A1 (searching NLM databases); rather, A3 appears three times, and A2, A4, and A5 twice each.[20]

In these three cases, attribute triples suggest relationships among multiple areas of concentration. First, 07-DP-13 prioritizes collection management in medical and hospital library programs and touches on user services and education. Course content combines evaluation of materials for users and families (A3), evaluation of print and non-print health materials for collections (A4), and proactive collaboration with health partners (A5). Second, 08-DP-17 explores how stakeholders in government and medical associations frame the provision and use of medical and consumer health information in these settings. Course content addresses ethically conveying policies (A2), evaluating health materials for users and families (A3), and proactive collaboration with health partners (A5). Third, 18-DP-30 focuses

Table 4: Attribute sets coded in 38 courses across 25 programs

Attribute sets	Number of courses with zero to 5 attributes	Program course codes	Attributes per course				
			A1	A2	A3	A4	A5
5 attributes	0 courses	NA	0	0	0	0	0
4 attributes	1 course	43-LIS-95		A2	A3	A4	A5
	LIS						
3 attributes	3 courses	07-DP-13			A3	A4	A5
	3 DP	08-DP-17		A2	A3		A5
		18-DP-30		A2	A3	A4	
2 attributes	12 courses	02-DP-02			A3		A5
	7 LIS	08-DP-16			A3		A5
	5 DP	08-DP-18		A2			A5
		14-DP-22		A2			A5
		16-LIS-27	A1				A5
		22-DP-43			A3		A5
		28-LIS-50		A2		A4	
		40-LIS-83	A1	A2			
		41-LIS-87			A3		A5
		47-LIS-104				A4	A5
		51-LIS-115		A2	A3		
		52-LIS-116		A2			A5

(*Continued*)

Attribute sets	Number of courses with zero to 5 attributes	Program course codes	Attributes per course				
			A1	A2	A3	A4	A5
1 attribute	22 courses	03-LIS-09		A2			
	10 LIS	07-DP-12	A1				
	12 DP	08-DP-15					A5
		15-LIS-26	A1				
		18-DP-32					A5
		19-LIS-33				A4	
		21-LIS-36					A5
		21-LIS-37					A5
		22-DP-38					A5
		30-DP-58				A4	
		31-LIS-60				A4	
		39-DP-64				A4	
		39-DP-66		A2			
		39-DP-74					A5
		39-DP-75		A2			
		41-LIS-88					A5
		43-LIS-94				A4	
		46-LIS-102				A4	
		46-DP-103			A3		
		48-DP-106					A5
		49-LIS-110				A4	
		50-DP-114			A3		
Totals	38 courses	59 attributes in 38 courses	4	12	11	12	20
# programs with attribute			4	10	10	10	14

exclusively on consumer health information, namely on services to aging US populations. Course content includes ethically conveying policies (A2), evaluating materials for users and families (A3), and evaluating print and non-print health materials for collections (A4).

In summary, no LIS program offers a five-attribute course. If we compare four-and three-attribute courses, one LIS course (43-LIS-95) and one DP (18-DP-30) course do foreground the user-centered perspective essential to health literacy. Four-and three-attribute

courses are lamentably scarce (4 of 38 or 10.53%); none of these courses, moreover, includes A1 (searching NLM databases). Further, the high-attribute courses suggest that EBP requirements apply to health literacy training for HIPs, and that HIPs' training may (or may not) entail the holistic approach best suited to the user's perspective. This underscores the rationale for developing generalist core curricula focused on the health literacy of all users. Collaborations among HIPs, generalist librarians, and stakeholders may promote information environments supportive of health literacy for patients as well as for users more generally.

Two-attribute courses

Among the 12 two-attribute courses, the A3-A5 pair (A3 evaluating health materials for individuals and families-A5 collaborating with health partners to foster a proactive health environment) occurs most frequently (four times: 02-DP-02, 08-DP-16, 22-DP-43, 41-LIS-87).

Three DP courses (02-DP-02, 08-DP-16, 22-DP-43) surface EBP-based evaluative skills for HIPs to foster proactive collaboration (A5). Conversely, the LIS course (41-LIS-87) emphasizes consumers' skills in managing their personal health information needs in the face of mass media resources (A5).

The A2-A5 pair (A2 ethically conveying policies related to health information dissemination-A5 collaborating with health partners to foster a proactive health environment) occurs in two DP courses and one LIS course (08-DP-18, 14-DP-22, 52-LIS-116). These courses train students to empower users so the latter can proactively manage health information (A5); they also acquaint students with health information-related policies and ethical frameworks (A2).

The broad applicability of A2, A3, and A5 helps explain the frequency of A3-A5 and A2-A5 combinations among DP and LIS courses. Notably, attributes may focus not only on the individual user (41-LIS-87) but also on community health initiatives (02-DP-02). Conversely, the absence of A4 (evaluating print and non-print health materials for collections) in the most common attribute pairs suggests that this topic either receives less attention overall or that it merits only narrow focus in single courses.

The five remaining two-attribute courses (A1-A2, A1-A5, A2-A3, A2-A4, A4-A5) occur once each. All are offered by LIS programs. First, two courses feature A1 (searching NLM databases) in combination with either A2 (competence in knowledge of policies and ethics) or A5 (collaborating with health partners to foster a proactive health environment).

The A1-A2 course (40-LIS-83) specializes in searching biomedical databases, including one NLM database (A1), and delves into policies related to the various databases (A2). Given these foci, a generalist LIS student is not likely to enroll in this course. The A1-A5 course (16-LIS-27) offers comprehensive perspectives on librarianship and health literacy issues in the context of US health care (A5). It also includes skills in searching two NLM databases (A1), therefore making explicit its relevance to generalist LIS training. Overall, then, these two LIS courses tailor skills in A1 (searching NLM databases) to quite different ends (one specialist, one generalist); this illustrates both the curricular flexibility of LIS programs and the broad range of information science skills germane to health literacy.

Second, three courses with A2 (ethically conveying policies related to health information dissemination) in common include one combination with A1 (40-LIS-83, discussed above), one with A3 (evaluating health materials for individuals and families), and one with A4 (evaluating print and non-print health materials for collections).

The A2-A3 course (51-LIS-115) considers the evaluation of resources (A3) in tandem with policy issues (A2) at health sciences libraries *and* in public library settings. This course shows how EBP and generalist evaluation skills may complement one another in the context of the health information lifecycle. In a different approach, the A2-A4 course (28-LIS-50) highlights social and cultural perspectives concerning collection management and information sources. Finally, as the A1-A2 course (40-LIS-83) covers policies (A2) and specialized biomedical database searching (A1), A2 and co-attribute courses in these examples span both specialized medical applications and library-centered health information interactions. As with A1's co-attribute courses (40-LIS-83, 16-LIS-27), the flexibility of LIS programs benefits students, yet at the same time may diffuse focus on basic health information training competencies.

Third, two courses contain A4 (evaluating print and non-print health materials for collections). As discussed above, A2-A4 (28-LIS-50) draws out the socio-cultural dimensions of policies (A2) in connection with collection management (A4). By contrast, the A4-A5 course (47-LIS-104) emphasizes collection management (A4), inclusive of consumer health literacy and advances in biomedical science (A5). Geared for those who are not necessarily HIPs, course content foregrounds library administration. Thus 47-LIS-104 combines collection management in the A4 attribute (evaluating print and non-print health materials for collections) and collaboration on a proactive health information environment (A5).

In sum, the 12 courses with paired attributes include seven LIS and five DP courses. Pairs of attributes on their face focus narrowly but ideally complement one another. Adapted to specialized medical librarianship, health sciences libraries, or generalist libraries, course content may foreground basic user-centered health information seeking skills. But holistic health literacy training remains wanting.

One-attribute courses

Single-attribute HL courses constitute the largest category (22 of 38 or 57.89%) (Table 4). Ten are LIS; 12 are DP. In this group, A1 (searching NLM databases) and A3 (evaluating health materials for individuals and families) each occurs twice. A2 (ethically conveying policies related to health information dissemination) occurs three times, A4 (evaluating print and non-print health materials for collections) occurs seven times, and A5 (Competence in collaborating on a proactive, participatory health information environment) occurs eight times.

Cross-analysis of course-attribute distributions (Table 4) and program-wide attributes (Table 5) sheds further light on this phenomenon.

Program attributes

We calculated HL ratios based on the number of attributes that occur in a given program (Table 5).[21] Attributes, it should be noted, frequently appear more than once across a given

Table 5: LIS and DP programs ranked by HL program attribute ratio (highest to lowest)

Ratio 5:0	**No programs**	
Ratio 4:1	**3 programs**	**Attributes**
07-DP	7. DC Catholic University of America, The	A1, A3, A4, A5
18-DP	18. KY Kentucky, University of	A2, A3, A4, A5
43-LIS	43. PA Pittsburgh, University of	A2, A3, A4, A5
Ratio 3:2	**2 programs**	**Attributes**
08-DP	8. FL Florida State University	A2, A3, A5
39-DP	39. OH Kent State University	A2, A4, A5
Ratio 2:3	**11 programs**	**Attributes**
02-DP	2. AZ Arizona, University of	A3, A5
14-DP	14. IL Illinois at Urbana-Champaign, University of	A2, A5
16-LIS	16. IN Indiana University - Purdue University, Indianapolis	A1, A5
22-DP	22. MI Michigan, University of	A3, A5
28-LIS	28. NC North Carolina at Chapel Hill, University of	A2, A4
40-LIS	40. OK Oklahoma, University of	A1, A2
41-LIS	41. PA Clarion University of Pennsylvania	A3, A5
46-DP	46. SC South Carolina, University of	A3, A4
47-LIS	47. TN Tennessee, University of	A4, A5
51-LIS	51. WA Washington, University of	A2, A3
52-LIS	52. WI Wisconsin-Madison, University of	A2, A5
Ratio 1:4	**9 programs**	**Attributes**
03-LIS	3. CA California, Los Angeles, University of	A2
15-LIS	15. IN Indiana University - Bloomington	A1
19-LIS	19. LA Louisiana State University	A4
21-LIS	21. MD Maryland, University of	A5
30-DP	30. NC North Carolina Central University	A4
31-LIS	31. NJ Rutgers, The State University of New Jersey	A4
48-DP	48. TX North Texas, University of	A5
49-LIS	49. TX Texas at Austin, University of	A4
50-DP	50. TX Texas Woman's University	A3

program's curriculum.[22] For instance, a 4:1 program attribute ratio indicates the presence of four of five attributes, irrespective of the number of courses or of repeating attributes.

First and most important, no program includes all five attributes (i.e., a 5:0 ratio). In fact, program-attribute ratios indicate that both LIS and DP programs cover health literacy concepts partially and inconsistently. To secure training in all five health literacy attributes, a student would need to take at least two courses. As no program offers all five attributes, moreover, a student would be obliged to attend multiple iSchools and LIS programs to do so. For example, the LIS program at University of Pittsburgh (43-LIS)[23] and the DP program at the University of Kentucky (18-DP) each cover attributes A2, A3, A4, and A5; achieving competency in A1 would entail an additional course at another institution such as Indiana University (15-LIS). Alternatively, the Catholic University of America (07-DP) offers one course with A1, A3, A4, and A5; for competence in A2, however, an additional course at an institution such as the University of California, Los Angeles (03-LIS) would be needed.

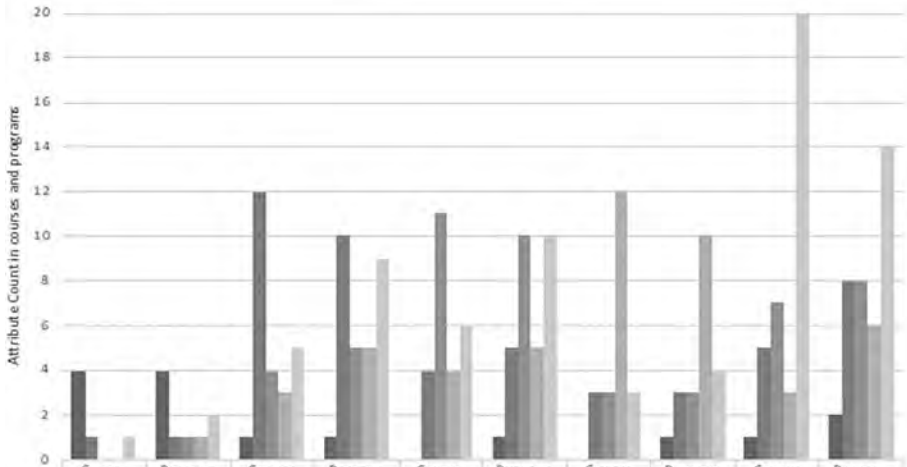
Although holistic training remains elusive, partial coverage of health literacy competencies is evident. Three key points emerge from Table 5. First, only five of 25 programs (20%) have high ratios (4:1 or 3:2). Of these, four are DP (07-DP, 08-DP, 18-DP, 39-DP) and one is LIS (43-LIS). As noted in section 3.1, however, neither DP nor LIS courses guarantee the prioritization of the user's perspective.

Second, fully 20 programs (80%) have low ratios (2:3 or 1:4). The 2:3 ratio includes eleven of 25 programs (44%) (seven LIS and four DP). The 1:4 ratio includes nine of 25 programs (36%) (six LIS and three DP). This desultory coverage is quite striking because 13 of these 20 (65%) programs are LIS. While DP programs mandate EBP competencies for HIPs, no comparable mandate exists for training LIS generalists to support health literacy in the general population.

Third, 13 of 53 (24.53%) LIS programs in the United States do not offer any health-related information courses (Table 2). Among the 27 of 53 (50.94%) programs that do, only 14 include courses with health literacy attributes, and all but one of those fall in the low ratio category (Table 5). Specialized training available in LIS programs that offers certificates and degrees in health information applies to HIPs, but it does not amount to holistic training in basic health information literacy geared for users in the general population.

In Figure 1, we juxtapose findings for courses and programs.[24] Attribute groups vary in number of attributes and in complexity. A1 has few co-attributes; it occurs in only four courses and four programs. This sparsity may reflect narrow focus on the use of NLM databases for health literacy training or the minimization, even omission, of the topic in LIS curricula.

In contrast to A1's infrequent appearance, A2 occurs in 12 courses and 10 programs, A3 in 11 courses and 10 programs, A4 in 12 courses and 10 programs. This clustering pattern may reflect the influence of traditional library science training, including knowledge of policies (A2) and evaluating health information for users (A3) and collections (A4). Both program types provide this training, and EBP requirements specifically pertain to HIPs' interactions with clinicians, patients, and health-care consumers. Co-attribute patterns vary



	Courses	Programs	Courses	Programs	Courses	Programs	Courses	Programs	Courses	Programs
	A1 Group		A2 Group		A3 Group		A4 Group		A5 Group	
A1	4	4	1	1	0	1	0	1	1	2
A2	1	1	12	10	4	5	3	3	5	8
A3	0	1	4	5	11	10	3	3	7	8
A4	0	1	3	5	4	5	12	10	3	6
A5	1	2	5	9	6	10	3	4	20	14

Figure 1: Visualization of health literacy attributes in 25 LIS programs and 38 courses.

widely among these three, implying LIS program flexibility or the blurring of distinctions between program types if attributes are considered in the aggregate.

Last, A5 occurs most frequently of any other single attribute (20 courses and 14 programs). A5 encompasses the user's perspective on the health information environment; the frequency and variety of co-attribute relationships in this group encourage a holistic outlook to enrich users' ongoing health literacy networks.

In sum, LIS programs must reconsider their strategy for health literacy training—or lack thereof. Such a reconsideration should commence with current pedagogy. Our findings suggest that the combination of one single- and one multiple-attribute course transcends program type as well as high versus low ratios, comprising all three of the 4:1 ratio programs (07-DP, 18-DP, 43-LIS) and two of the 2:3 ratio programs (22-DP and 41-LIS).

The implications for health literacy training are as follows. Single-attribute courses imply a narrow focus, while multiple-attribute courses imply the study of interrelated concepts of health literacy. For instance, three single-attribute courses (07-DP-12, 08-DP-15, 43-LIS-94) are part of multiple course programs that cover four out of five attributes overall (07-DP, 08-DP, 43-DP). In this approach, a holistic emphasis prevails, albeit through the aggregation of single and multiple attribute courses. By contrast, 15-LIS-26, a health sciences librarianship course that concentrates on A1 (NLM database searching) stands alone in a program (15-LIS) that offers no other health-related courses. This program, like eight others

that offer one course with one attribute (36.00%) (Table 5), constrains a holistic pedagogical approach to health literacy training.

Discussion

This study suggests that LIS programs have considerable room for improvement in health literacy training. If a new five-attribute course is not feasible, programs might embed attributes across existing courses, as suggested in the two-course approach found in study data (section 3.2). Alternatively, and more fundamentally, integrating health literacy attributes (skills) into core LIS curriculum offers four benefits for generalist LIS students. First, it lays the groundwork for information professionals to parlay basic health literacy skills into manifold career paths. Second, it enhances LIS graduates' potential to partner with HIPs on individual or institutional bases. Third, health literacy skills enrich information professionals' capacity to serve diverse constituencies.

Five recommendations follow. First, training generalist LIS students in NLM database skills prepares them to disseminate authoritative, reliable, and current health information to users. Only four of 25 programs, however, incorporate this competency. Readily available and designed for public use, MedlinePlus in particular supports health literacy training for LIS students who in turn support the development of users' health literacy skills.

Second, LIS students must appreciate policies and ethics in all information areas, health information perhaps foremost among them. Specialized health courses must adhere to EBP competencies in the 10 programs that feature this attribute. It is unclear, however, whether policies and ethical issues pertinent to generalist librarian training are covered.

Third, LIS programs should train students in evaluating health information for users, families, and communities. Merely 10 of 25 programs (40%) cover this topic. Equipped with this competency, students will be prepared to enhance users' ability to evaluate resources independently. Such evaluation skills benefit users directly; they can also encourage feedback to improve collection development and service provision.

Fourth, competence in evaluating print and non-print health materials is crucial, not only in light of users' personal preferences but also because adults with low health literacy gravitate toward non-print formats such as broadcast and internet media (Somers & Mahadevan, 2010). Yet just 10 of 25 programs (40%) offer training in this area. As new formats debut and universal access technologies evolve, competence in this skill will serve LIS students well.[25]

Fifth, a proactive health information environment encourages collaboration among librarians, users, health sciences libraries, and other community institutions and service providers. Fourteen of 25 programs (56%) foreground these skills.

Ultimately, formal training in health literacy prepares LIS students to cultivate their own health literacy and that of their users. Moreover, health literacy training enables generalists to collaborate with peers, HIPs, and stakeholders to foster proactive health communities through the evaluation and use of reliable health information. Supportive networks for reliable health information, in turn, participate in local and global conversations on the role of public and personal health in diversity, equality, inclusion, and environmental sustainability.

Future research

We suggest three areas for future research. First, librarians might gather health literacy-related data from user studies and collection management statistics. Such data would be useful to scholarly and clinical research collaborations, to public health officials, and to LIS and specialized HIP curriculum designers. Second, analysis of LIS and HIP syllabi may provide data to complement this study. Third, examination of program and course descriptions and syllabi of non–ALA-accredited programs and non–US-based programs may prove fruitful.

Limitations

Three limitations merit mention. First, our findings address only ALA-accredited programs located in the United States. Second, the study assumes that LIS course titles and descriptions reflect departmental or programmatic priorities. Third, instructors' syllabi may cover topics not mentioned in course titles and descriptions. This study represents an early contribution to what we trust will be a robust conversation on health literacy in LIS pedagogy and practice.

Conclusion

This research suggests that generalist LIS degree programs should teach students basic health literacy skills. We have developed a framework comprising five health literacy attributes. Grounded in ALA core competencies and the literature of both LIS and health sciences librarianship, these attributes include competence in searching NLM databases, in ethically conveying policies related to health information dissemination, in evaluating health materials for individuals, families, and communities, in evaluating both print and non-print health materials, and in collaborating with health partners to foster a proactive health environment.

Health literacy training ultimately enables generalist librarians to help users cultivate their own health literacy skills. The ever-increasing demand for health information, and the ever-changing ecology of health information and its dissemination, calls for agility not only in the health information sciences but also in information training for generalist LIS professionals. In short, health literacy training merits a place in LIS pedagogy, complementing EBP-based health literacy expertise of HIPs in fostering the health and wellness of individuals, families, and communities.

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Notes

1. Description from the website: "Following are the seven professional competency areas defined in *MLA's Competencies for Lifelong Learning and Professional Success,* needed by health sciences librarians throughout their careers."
2. See "Discover NNLM Training Opportunities": https://nnlm.gov/training.
3. See https://www.mlanet.org/page/chis.
4. We thank the reviewers for calling our attention to documentation that places ALA competencies circa 2009 in the fuller context of formal training for LIS information professionals. Formal training is guided by "Standards for Accreditation of Master's Programs in Library and Information Studies," consisting of five standards: (1) Systematic planning, (2) Curriculum, (3) Faculty, (4) Students, and (5) Administration, Finances, and Resources (Committee on Accreditation of the American Library Association, 2015).
5. See https://medlineplus.gov/.
6. The *Affordable Care Act* (ACA), for example, recognizes the many personal and social benefits of health insurance yet neglects to ground the statutory definition of health literacy in regulatory support mechanisms (Somers & Mahadevan, 2010).
7. The pedagogical goal of training LIS generalists to evaluate health information for users is distinct from but complements specialized training for HIPs to evaluate evidence-based healthcare (EBH) research for use by physicians and physicians (Guyatt & Evidence-Based Medicine Working Group, 1992).
8. Outdated print resources, too, may exacerbate low health literacy (Flaherty & Kaplan, 2016).
9. See http://www.ala.org/pla/initiatives/healthliteracy
10. See https://publiclibrary.health
11. LIS programs feature 23 areas of concentration, one of which is Health Sciences Librarianship/ Health Informatics, plus options for combining degrees within a program or with other departments (Appendix A, Tables A1–A2). It should be noted that programs may of their own accord designate specializations as appropriate.
12. The study distinguishes between LIS and DP programs because a health sciences librarianship concentration foregrounds the needs of health sciences practitioners (LIS), while a health-related LIS degree is oriented toward the needs of clinical and medical professionals (DP). Bodies such as AHIMA accredit informatics programs, for example, while medical librarians and IMIA have set forth core competencies in LIS health-related degree programs.
13. DP programs include formal health degrees such as a Master of Science in Health Informatics as well as certificates or other forms of specialization in health information competencies. In these cases, only LIS courses are included in our corpus.

14. The authors base their interpretations on close reading of course descriptions and titles. Our approach was influenced by Subramaniam & Jaeger (2011).
15. The course code categories are high level; in particular, the term "health informatics," as Dalrymple and Roderer (2011) note, straddles uses in information science programs and those in health sciences programs.
16. This is the case whether course content is INF or LIB.
17. The authors thank a reviewer for pointing out that "informatics" is defined by the American Medical Informatics Association (AMIA), for example.
18. Because INF and LIB overlap in hybrid courses, courses that prioritize informatics are coded INF while courses that emphasize traditional librarianship are coded LIB.
19. Lack of controlled vocabulary for terms used in course titles and course descriptions presents challenges. Running queries on the corpus for "health literacy," for example, we found only two course descriptions with this phrase, and two with the variation "health information literacy." Additionally, we manually perused course titles and descriptions to discern the presence of "health literacy" attributes in course content as we coded.
20. Common ground on A3 (evaluating health materials for individuals and families) in these DP courses may correspond to evidence-based practice (EBP) skills required for professional certifications.
21. Table 5 condenses Appendix C.
22. Appendix C tabulates attributes present as well as attributes missing per program.
23. Since the time of data collection, the LIS program at University of Pittsburgh ceased to offer specialization in health sciences librarianship or health information. Even so, this program remains useful to our study of how health literacy concepts may be taught.
24. Figure 1 brings together data from Appendices B and C.
25. See ALA's fourth competency, "Technological Knowledge and Skills."

Appendix A: LIS programs

Source: http://www.ala.org/CFApps/lisdir/index.cfm

Table A1: Areas of concentration/career pathways within LIS programs

C-1	Academic Librarianship
C-2	Archival Studies
3	Book Arts
4	Children's Services
5	Cultural Heritage Information Management
6	Digital Libraries
7	Health Sciences Librarianship/Health Informatics
8	Information Systems Design/Analysis
9	Knowledge Management
10	Law Librarianship/Legal Information Services
11	Management and Administration
12	Music Librarianship
13	Organization of Information
14	Public Librarianship
15	Records Management
16	Reference and User Services

(*Continued*)

17	School Librarianship
18	Science Librarianship
19	Special Collections
20	Special/Corporate Librarianship
21	Thesis Option
22	Young Adult Services
23	Other

Table A2: Options for other degrees within a program

Bachelor's degree
Continuing education (non-degree)
Dual/joint degree programs
Other master's degree
PhD
Post-master's certificates

Appendix B: Corpus data by institution code and program type, state and name, total number of health-related courses per program, and allocation of course classifications

Institution code and program type	State and Institution	#Health-related courses	HL	INF	LIB	PRAC
01-LIS	1. AL Alabama, University of	1			1	
02-DP	2. AZ University of Arizona	4	1	2	1	
03-LIS	3. CA California, Los Angeles, University of	4	1	3		
04-LIS	4. CA San Jose State University	1		1		
05-LIS	5. CA Southern California, University of	1			1	
06-NHR	6. CO Denver, University of	0				
07-DP	7. DC Catholic University of America	3	2			1
08-DP	8. FL Florida State University	4	4			
09-LIS	9. FL South Florida, University of	1			1	
10-NHR	10. GA Valdosta State University	0				

(*Continued*)

Institution code and program type	State and Institution	#Health-related courses	HL	INF	LIB	PRAC
11-NHR	11. HI Hawaii, University of	0				
12-LIS	12. IA Iowa, University of	1		1		
13-LIS	13. IL Dominican University	1		1		
14-DP	14. IL University of Illinois at Urbana-Champaign	4	1	2	1	
15-LIS	15. IN Indiana University - Bloomington	1	1			
16-LIS	16. IN Indiana University - Purdue University, Indianapolis	1	1			
17-LIS	17. KS Emporia State University	1			1	
18-DP	18. KY University of Kentucky	4	2	1	1	
19-LIS	19. LA Louisiana State University	1	1			
20-NHR	20. MA Simmons University	0				
21-LIS	21. MD Maryland, University of	4	2	2		
22-DP	22. MI University of Michigan	9	2	2	3	2
23-DP	23. MI Wayne State University	2		1	1	
24-NHR	24. MN St. Catherine University	0				
25-NHR	25. MO Missouri, University of	0				
26-LIS	26. MS Southern Mississippi, The University of	1		1		
27-NHR	27. NC East Carolina University	0				
28-LIS	28. NC North Carolina at Chapel Hill, University of	7	1	2	3	1
29-NHR	29. NC North Carolina at Greensboro, The University of	0				
30-DP	30. NC North Carolina Central University	3	1	2		
31-LIS	31. NJ Rutgers, The State University of New Jersey	1	1			
32-LIS	32. NY Albany, University at, SUNY	1			1	
33-LIS	33. NY Buffalo, University at, SUNY	1			1	
34-NHR	34. NY Long Island University	0				
35-NHR	35. NY Pratt Institute	0				
36-LIS	36. NY Queens College, CUNY	1			1	
37-NHR	37. NY St. John's University	0				
38-NHR	38. NY Syracuse University	0				

(*Continued*)

Institution code and program type	State and Institution	#Health-related courses	HL	INF	LIB	PRAC
39-DP	39. OH Kent State University	18	4	10		4
40-LIS	40. OK Oklahoma, University of	5	1	1	2	1
41-LIS	41. PA Clarion University of Pennsylvania	2	2			
42-DP	42. PA Drexel University	5		2	1	2
43-LIS	43. PA Pittsburgh, University of	5	2		3	
44-NHR	44. PR Puerto Rico, University of	0				
45-LIS	45. RI Rhode Island, University of	1			1	
46-DP	46. SC University of South Carolina	4	2		2	
47-LIS	47. TN Tennessee, University of	1	1			
48-DP	48. TX University of North Texas	5	1	1	2	1
49-LIS	49. TX Texas at Austin, University of	2	1	1		
50-DP	50. TX Texas Women's University	3	1		2	
51-LIS	51. WA Washington, University of	1	1			
52-LIS	52. WI Wisconsin-Madison, University of	2	1		1	
53-LIS	53. WI Wisconsin-Milwaukee, University of	1			1	
Totals	Courses	118	38	36	32	12
Totals	Programs	40	25	18	23	6

Note. For explanations of abbreviations, see Tables 2 and 3.

Appendix C: Coding for 25 institutions whose LIS programs offer a total of 38 courses that have one or more health literacy attributes

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
1	02-DP	2. AZ Arizona, University of (Continued accreditation						2:3
	02-DP-02 (1 of 38)	LIS 624 Community Health and Medical Informatics			A3		A5	

(*Continued*)

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
2	03-LIS	3. CA California, Los Angeles, University of (Continued accreditation)						1:4
	03-LIS-09 (2 of 38)	457. Health Sciences Librarianship		A2				
3	07-DP	7. DC Catholic University of America, The (Continued accreditation)						4:1
	07-DP-12 (3 of 38)	LSC 870: Health Sciences Information	A1					
	07-DP-13 (4 of 38)	LSC 871: Health Informatics			A3	A4	A5	
4	08-DP	8. FL Florida State University (Continued accreditation)						3:2
	08-DP-15 (5 of 38)	LIS 5418 Introduction to Health Informatics					A5	
	08-DP-16 (6 of 38)	LIS 5419 Consumer Health Informatics			A3		A5	
	08-DP-17 (7 of 38)	LIS 5631 Health Information Sources		A2	A3		A5	
	08-DP-18 (8 of 38)	LIS 5788 Management of Health Information Technology		A2			A5	
5	14-DP	14. IL Illinois at Urbana-Champaign, University of (Continued accreditation)						2:3
	14-DP-22 (9 of 38)	IS 530B Health Sciences Information Services and Resources		A2			A5	
6	15-LIS	15. IN Indiana University - Bloomington (Continued accreditation)						1:4
	15-LIS-26 (10 of 38)	Z653 Health Sciences Librarianship	A1					
7	16-LIS	16. IN Indiana University - Purdue University, Indianapolis (Continued accreditation)						2:3
	16-LIS-27 (11 of 38)	LIS-S 653 Health Sciences Librarianship	A1				A5	

(*Continued*)

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
8	18-DP	18. KY Kentucky, University of (Continued accreditation)						4:1
	18-DP-30 (12 of 38)	LIS-S 653 Health Sciences Librarianship		A2	A3	A4		
	18-DP-32 (13 of 38)	LIS 640 Health Information Resource Services					A5	
9	19-LIS	19. LA Louisiana State University (Continued accreditation)						1:4
	19-LIS-33 (14 of 38)	LIS 7404 Health Sciences Information Centers				A4		
10	21-LIS	21. MD Maryland, University of (Continued accreditation)						1:4
	21-LIS-36 (15 of 38)	SI 554: Consumer Health Informatics					A5	
	21-LIS-37 (16 of 38)	653 Evidence-Informed Decision-Making for the 21st Century Health Care					A5	
11	22-DP	22. MI Michigan, University of (Continued accreditation)						2:3
	22-DP-38 (17 of 38)	SI 554: Consumer Health Informatics					A5	
	22-DP-43 (18 of 38)	653 Evidence-Informed Decision-Making for the 21st Century Health Care			A3		A5	
12	28-LIS	28. NC North Carolina at Chapel Hill, University of (Continued accreditation)						2:3
	28-LIS-50 (19 of 38)	INLS 515: Consumer Health Information		A2		A4		
13	30-DP	30. NC North Carolina Central University (Continued accreditation)						1:4
	30-DP-58 (20 of 38)	LSIS 5245. Health Sciences Resources and Services				A4		

(*Continued*)

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
14	31-LIS	30. NC North Carolina Central University (Continued accreditation)						1:4
	31-LIS-60 (21 of 38)	Health Sciences Information				A4		
15	39-DP	39. OH Kent State University (Continued accreditation)						3:2
	39-DP-64 (22 of 38)	LIS 60620 Health Information Resources				A4		
	39-DP-66 (23 of 38)	HI 60402 Legal Issues In Health Informatics		A2				
	39-DP-74 (24 of 38)	HI 60415 Health Informatics Inquiry And Assessment					A5	
	39-DP-75 (25 of 38)	HI 60416 Ethics, Politics, & Policy In Health Informatics		A2				
16	40-LIS	40. OK Oklahoma, University of (Continued accreditation)						2:3
	40-LIS-83 (26 of 38)	LIS 5163 Biomedical Databases	A1	A2				
17	41-LIS	41. PA Clarion University of Pennsylvania (Continued accreditation)						2:3
	41-LIS-87 (27 of 38)	LS 592 - Consumer Health Informatics			A3		A5	
	41-LIS-88 (28 of 38)	LS 593 - Health Science Librarianship					A5	
18	43-LIS	43. PA Pittsburgh, University of (Continued accreditation)						4:1
	43-LIS-94 (29 of 38)	LIS 2581 - Collections And Resources In Healthcare Environments				A4		
	43-LIS-95 (30 of 38)	LIS 2585 - Health Consumer Resources And Services		A2	A3	A4	A5	

(*Continued*)

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
19	46-DP	46. SC South Carolina, University of (Continued accreditation)						2:3
	46-DP-102 (31 of 38)	SLIS 749 - Health Sciences Information Resources				A4		
	46-DP-103 (32 of 38)	SLIS 758 - Consumer Health Resources and Information Services			A3			
20	47-LIS	47. TN Tennessee, University of (Continued accreditation)						2:3
	47-LIS-104 (33 of 38)	INSC 547 Health Sciences Information Centers				A4	A5	
21	48-DP	48. TX North Texas, University of (Continued accreditation)						1:4
	48-DP-106 (34 of 38)	INFO 5636 - Community-Based Health Information					A5	
22	49-LIS	49. TX Texas at Austin, University of (Continued accreditation)						1:4
	49-LIS-110 (35 of 38)	INF 382K: Information Resources in the Health Sciences				A4		
23	50-DP	50. TX Texas Woman's University (Continued accreditation)						1:4
	50-DP-114 (36 of 38)	LS 5483. Consumer Health Information Resources			A3			
24	51-LIS	51. WA Washington, University of (Continued accreditation)						2:3
	51-LIS-115 (37 of 38)	LIS 528 Health Sciences Information Needs, Resources, and Environment		A2	A3			

(*Continued*)

Program count	Program code & course code(s)	Institution Course(s) and health attribute(s)	A1	A2	A3	A4	A5	Program ratio
25	52-LIS	52. WI Wisconsin-Madison, University of (Continued accreditation)						2:3
	52-LIS-116 (38 of 38)	517 Digital Health: Information and Technologies Supporting Consumers and Patients		A2			A5	

Note. The HL program attribute ratio (Ratio) appears on the institution title row in the last column.