

## Viewpoint Paper ■

## Evolution of a Mature Clinical Informationist Model

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**Abstract** Achieving evidence-based practice will require new approaches to providing information during health care delivery and to integrating evidence and informatics at the point of care. To support evidence-based practice, Vanderbilt University Medical Center's Eskind Biomedical Library (EBL) introduced the role of clinical informationist, an information specialist with sufficient knowledge and insight to function as a true partner in the health care team. To further disseminate evidence-based knowledge, the Vanderbilt University Medical Center's (VUMC) electronic medical record system and pathway development processes integrate advanced information synthesis capabilities provided by clinical informationists. Combining clinical informationist expertise with informatics tools is an effective strategy for delivering the evidence needed to support patient care decisions.

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### Limited Clinical Time and the Demands of Evidence-Based Practice

The literature of information science and medicine is rife with concerns about the exponential growth of available medical information.<sup>1-5</sup> However, the demands of everyday practice often preclude physicians from spending the time required to address many questions that arise during patient care. Lack of time echoes throughout the literature as one of the main barriers to the practice of evidence-based medicine (EBM).<sup>6-20</sup> As Davidoff and Florance<sup>21</sup> assert, "Physicians don't, and never will, have [one hour or more] to look for the answers to most of their clinical questions themselves." In addition to time constraints, Ely et al.<sup>7</sup> and other investigators identified the limited coverage of information resources and lack of readily available syntheses of the voluminous primary literature as two major obstacles to successful evidence

seeking.<sup>22</sup> A recent Vanderbilt study supported these observations, finding limited ability of several synthesized EBM information resources to address adequately a random sampling of complex questions received from critical care specialists and from clinical pathway development teams.<sup>23</sup> Thus, research indicates that physicians often encounter multiple questions during daily practice,<sup>6,24-27</sup> yet many questions generated during patient care may never be pursued or answered.<sup>6,9,28-31</sup>

Pressed for time and inundated by information, clinicians are often unable to consult the plethora of evidence sources necessary to answer a complex clinical question.<sup>32-34</sup> Paradoxically, clinicians with inadequate time to keep up with the literature face a growing demand for evidence-based practice and its core tenet of "integrating individual clinical expertise with the best available external evidence from systematic research."<sup>35</sup>

### Strategies to Integrate Information into Clinical Care

To address this problem, the Eskind Biomedical Library (EBL) at Vanderbilt University Medical Center (VUMC) has developed several solutions to leverage the power of informatics tools and the advanced evidence retrieval and appraisal skills of librarians. These strategies, evolved from EBL's development of a clinical informationist model, center around integrating expert information provision with informatics systems. A clinical informationist is a professional member of the healthcare team who focuses on the intersection between clinical care and the evidence base contained in the literature and in biomedical databases and resources. The informationist acts as an expert in identifying and addressing the complex evidentiary needs of the team.<sup>21,36-48</sup>

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Eskind Biomedical Library has implemented the informationist concept in its Clinical Informatics Consult Service (CICS) and extended its reach via integration of CICS expert evidence syntheses in VUMC's electronic health record system. In addition, EBL has leveraged both informatics tools and the knowledge gained through CICS practice to link practice guidelines to patient records and to incorporate evidence into the creation of nursing care pathways. These solutions, described in more detail below, represent novel means to facilitate evidence-based practice and the synergistic relationship between EBL and medical informatics systems in the provision of evidence supporting patient care. Such strategies illustrate the value that intensively trained librarians can bring to informatics and clinical care teams in supporting high quality healthcare delivery.

### **Toward a Clinical Informationist Model**

An early iteration of the informationist concept was the clinical medical librarianship (CML) model.<sup>49,50</sup> CML successfully expanded librarians' roles to include service as an information consultant for patient care<sup>49,51-60</sup> but met with limited uptake and significant challenges to widespread penetration.<sup>43,51,61-64</sup> Current emphasis on cost-effective, high-quality care, with its strong focus on applying evidence-based guidance to decrease medical errors, has fostered increased interest in and demand for expert support to clinicians in accessing and applying the information contained in the clinical literature.

The approach taken by EBL assumes that (1) informationists, equipped with extensive, relevant clinical knowledge and an understanding of research practices, can deliver highly targeted evidence in support of patient care and (2) the integration of evidence identified by human insight and intelligence with informatics tools provides an efficient and effective mechanism for making relevant information available when and where clinical decisions are made.

### **Development of the Eskind Biomedical Library's Clinical Informatics Consult Service**

Librarians are increasingly called upon as intermediaries between clinicians and the immense quantities of available information. To be effective in such roles, and to ease the integration of evidence into the health care delivery process and foster patient safety, librarians must become active members of health care teams. Such immersion requires a collaborative culture of learning and the willingness to expand the library's purview. At VUMC, a key development in the EBL's model of clinical librarianship was understanding the vital importance of participating in an environment to comprehend it. This awareness led to the development of the Clinical Informatics Consult Service (CICS)<sup>65,66</sup> and the training and infrastructure necessary to support the service.<sup>39,65-71</sup>

Cited by Davidoff and Florance<sup>21</sup> in 2000 as an innovative "informationist" model, the CICS is a novel approach to advancing clinical librarianship that mitigates many of the previous concerns raised about CML practice. The CICS integrates librarians into clinical rounding teams as expert information providers, equipped with adequately deep background knowledge in both principles of clinical medicine and information seeking. CICS participants can diagnose unexpressed information needs as they occur during practice and prepare relevant, balanced syntheses of the evidence

from the medical literature. Since the program's inception, the service has expanded to collaborate with 10 clinical teams.

Eskind Biomedical Library has focused on high-acuity hospital inpatient care units for CICS implementation. Such units provide care for the most critically ill patients and generate complex queries regarding information needs. These environments also encompass the potential for tremendous impact of information on patient outcomes and clinician education at highly meaningful points in time. Targeting these units allows CICS informationists to work in some of the most challenging environments and reach large numbers of clinicians. Residents and fellows undertaking specialty training in almost all areas of clinical practice must now rotate through the hospital critical care units associated with their specialties. The EBL CICS program matches the interests of the librarian-informationists (i.e., their enthusiasm for a particular area of clinical practice) to the specific unit assigned to them. Motivation and enthusiasm figure significantly in determining the success of a clinical informationist in a given field.

Just as the patient's care team must accept caseworkers, nutritionists, pharmacists, and other ancillary specialists as acknowledged experts for them to play vital roles in patient care, clinical informationists at Vanderbilt University Medical Center must establish themselves as legitimate partners in the provision of high-quality health care. The CICS supports best clinical practices through providing, as Pearson advocates,<sup>72</sup> carefully vetted evidence appraised for its relevance and significance, representing the essence of the literature in a balanced manner.

The CICS efforts required the library to develop a supporting culture of pervasive learning, training, and adapting of skills. For more than a decade, EBL has devoted significant resources to creating an environment that values and engages in lifelong learning. The EBL training infrastructure supports a diversity of roles for librarians, focuses on improved utilization of resources, and has reallocated librarians from reference desk services to collaborations in the medical center without adversely impacting the library's budget.<sup>69</sup> To prepare themselves for new roles, informationists build their personal knowledge bases in medicine and research design. They enroll as students in Vanderbilt nursing and medical school classes in areas such as biostatistics, anatomy, and physiology. They also participate in case presentations on rounds, attend clinical seminars, complete in-house learning modules, and review journal articles and key textbooks in general medicine and specialty areas.

As implemented in the clinical setting, CICS informationists, upon receiving a complex information request, negotiate a priority level for results delivery with the clinical team. The type and urgency of the need prompting the information request determines the priority. Informationists provide results to the initiating clinical team for acute information needs within a period of several hours; intermediate priority queries within two to three days; and queries with an educational or general information emphasis within seven days.

To respond to information requests, informationists execute and filter searches in a multistep cycle. First, they retrieve a targeted initial group of articles and hand select the most relevant items based on their ward experience-derived understanding of the question and the article's content, thus,

taking into consideration the individual patient and hospital unit situation. They then go beyond searching, by reading and filtering the full text of the most appropriate articles, highlighting passages that are relevant to the clinical case at hand. When necessary, prior steps are repeated, including searching for and reading additional articles. When search results yield multiple viewpoints, clinical informationists select the best article representing each viewpoint—analyzing study methodology and quality of execution as well as relevance to clinical context. An analysis of viewpoints represented in EBL-authored evidence summaries indicated that if librarians had stopped searching the literature after finding the first relevant answer, additional relevant viewpoints would have been missed for more than half the treatment-related questions.<sup>66</sup>

Eskind Biomedical Library clinical informationists, in preparing their written reports, synthesize all of the highlighted information from articles into a concise summary. Each summary points out such factors as conflicting recommendations in different articles, strength of the evidence, and facts about a study that differ from the specifics of the clinical case. This summary also includes a disclaimer, jointly authored with the VUMC Office of General Counsel, advising clinicians to consult the full text of the articles (appended to the summary report) before taking action and noting that the summary is not intended to serve as a substitute for clinical judgment. Ultimately, the clinician has the final responsibility for determining whether the evidence applies to a specific patient. Finally, the informationists present their results to the clinical team during rounds, addressing any questions about the evidence that arise during the discussion, and identifying additional information needs as they arise.

Initial subjective evaluation of informationists' performance by clinical team members showed that clinicians consistently rated clinical informationists' ability to function in the clinical environment, as well as the utility of the information they provided, at the highest levels.<sup>65</sup> In addition, recent research, conducted collaboratively by EBL team members and Vanderbilt's Department of Biomedical Informatics faculty, indicates that informationists identify literature relevant to complex clinical questions as reliably as physicians trained in clinical research. This work suggests that experienced clinical informationists with training in information seeking, literature synthesis techniques, and research design and biostatistics are adequately equipped to function as surrogates for clinicians in selecting relevant evidence for specific information needs.<sup>73</sup>

This advanced level of information filtering represents a crucial component of the clinical informationist program at VUMC and provides a concrete demonstration of the value librarians bring to the clinical environment. EBL has also successfully used this model for collaboration with biomedical professionals in other settings, including fostering information expertise among Tennessee public health officials and aiding basic science researchers with focused application of specialized molecular biology resources.<sup>74,75</sup>

### Using Informatics Systems to Scale Library Consultation Efforts

In 2001, VUMC implemented the use of a more advanced version of its electronic medical record system for outpatient clinical practices. This web-based informatics system, StarPanel,

seamlessly integrated all aspects of a patient's medical care at the institution. The StarPanel approach took into consideration, as a design principle, that unique patterns of communication represent core activities of each clinical team.<sup>76,77</sup> As a "central information hub," StarPanel brings into a single interface data needed for outpatient (and most inpatient) clinical decision-making.<sup>78</sup> The EBL recognized that its evidence-related services might scale to reach a broader range of clinic and hospital specialties (and care providers) through integration of such services into informatics tools such as StarPanel. This insight, as well as lessons learned from CICS, informed the development of a more mature clinical informationist model that involves capture and delivery of evidence requests via StarPanel.

Physicians in VUMC's Adult Primary Care Center currently use the existing secure, internal messaging feature of StarPanel<sup>78</sup> to send patient care questions directly to EBL librarians via "information baskets." As part of the question submission process, clinicians select from a list of priority levels reflecting the urgency of the information request.

Because CICS librarians are integral components of care delivery teams, they must sign and agree to abide by the same stringent confidentiality measures as clinicians for accessing patient information. Thus, the outpatient StarPanel information queries arrive connected to the patient medical records from which they arise, providing the specific CICS librarian assigned to the case with direct access to the details of the case at hand. Integration of the "outpatient evidence consultation request" function within the electronic health record system overcomes the need for CICS librarians to be omnipresent in less acute outpatient care delivery settings, and diminishes the need for busy health care providers to collect and send the patient-specific details necessary for librarians to provide highly targeted evidence syntheses in response to questions.<sup>79</sup>

The Vanderbilt experience in this project has already demonstrated that CICS librarian access to patient records affords a clear advantage during the patient-specific information evidence synthesis process. For example, in response to the clinical query, "When should one operate on a patient with hyperparathyroidism?" an EBL librarian examined the patient's laboratory values (calcium, phosphate, and other blood counts) and previous radiology reports as well as coexisting diagnoses and related notes from the patient's endocrinologist regarding bone density results. Most importantly, the librarian was able to extract from the literature the specific recommendations for the patient's relatively young age. These details of the nature of the patient's condition equipped the librarian with a powerful means to customize the response to the specific situation without requiring additional time from the clinician making the request. This type of evidence synthesis also becomes a permanent part of the patient's medical record. Upon completion of the question, the information specialist attaches the synthesized packet of information directly to the patient's electronic chart for review by members of the health care team.

Provision of relevant evidence-based information, even with direct access to patient data, cannot be performed completely "behind the scenes." This model thus incorporates lessons learned about the importance of deep subject knowledge and the benefits of domain immersion with inpatient teams. Realizing that the existence of the EBM Literature Request

button alone is not enough to generate continued use of the service, EBL librarians make regular "drop-in" visits to the clinic to maintain visibility and continue to develop trust as well as collegiality with the clinicians. These periodic visits also enable the librarian to stay current with clinical topics under discussion in the outpatient setting.

### Linking Evidence-Based Guidelines Within the Patient Record

The inclusion of the EBM Literature Request service in the StarPanel system provides a mechanism for addressing especially complex or uncommon patient problems. To support management of common conditions, EBL has further integrated evidence into StarPanel through the provision of links to nationally recognized guidelines, dynamically generated by mapping International Classification of Diseases, 9th Revision, Clinical Modification Codes (ICD-9-CM) <<http://www.cdc.gov/nchs/about/otheract/icd9/abticd9.htm>> to relevant guidelines. Integration of evidence-based guidelines with the medical record has been used extensively<sup>80-85</sup> and affords the institution's health care providers ready access to information noted by the Institute of Medicine as an important tool in its recommended armamentarium for improving patient safety.<sup>86</sup>

Currently, the library has integrated links to more than 750 guidelines within the electronic medical record. Librarians at EBL developed a priority list of key conditions with potential for significant impact by compiling feedback and requests from outpatient physicians and clinic leaders; this list expands with additional topics that come to the forefront. Librarians select and match guidelines from three evidence-based medicine resources (National Guideline Clearinghouse, HealthGate, and UpToDate®) to appropriate ICD-9-CM codes. The resulting EBL-maintained data file of paired ICD-9-CM codes/guidelines interfaces with the StarPanel system. The ICD-9-CM codes from Vanderbilt's patient medical billing records drive the linkage for displaying, within the problem list portion of StarPanel records, the guidelines relevant to the care of individual patients based on their primary condition. For example, a clinician caring for a patient who has received treatment at VUMC for diabetes and hypertension will be connected with key guidelines, such as the 2004 American Diabetes Association standards of care<sup>87</sup> and the 2003 American College of Physicians recommendations for blood pressure control in diabetics.<sup>88</sup>

Plans to further extend this functionality include establishing linkages based on additional standard medical coding systems (for example, using Common Procedural Terminology [CPT] codes for procedure-related guidelines) and linking internally created sources of evidence to the patient record. Additionally, a web portal currently in development for use by patients remotely as well as within the clinic will provide patients with direct access to guidelines relevant to their care. The anticipated growth of available guidelines will make information regarding best practices seamlessly accessible for both providers and patients, further facilitating informed compliance and the delivery of high-quality health care.

### Integrating Evidence into Pathway Development

Eskind Biomedical Library has also expanded librarians' contribution of expertise to the clinical enterprise by providing

evidence-based literature to support medical center "pathways" efforts to manage inpatient care practices. Each disease- or procedure-specific pathway defines the institution's daily goals for therapeutic interventions, laboratory tests, nutrition, nursing assessments, and consultations for treating specific conditions.<sup>89</sup> The library has assumed a proactive role in organizing and filtering published literature that best addresses these pathway topics to facilitate their creation and revision.<sup>23</sup>

Applying expertise gained through participation in clinical rounds, EBL librarians utilize their subject knowledge bases to separate pathway topics into component facets. They then create corresponding expert search strategies for five key online sources of primary and synthesized evidence. Librarians also create overall analyses of the state of the literature as they review the information gained during pathway development. These analyses detail current areas of controversy, the types of studies typically encountered (e.g., few RCT, many retrospective studies) and relevant search terms for further exploration. The expert, topic-specific search strategies as well as librarians' overall analyses for pathways topics reside in the EBL-created Pathway Literature Locator (PLL) database, thereby providing automatically updated access to evidence at the time of need. For example, the team responsible for the maintenance of the "adult splenectomy" pathway utilizes librarian-created search strategies to access evidence on key facets of the topic, ranging from timing of perioperative vaccination to specific considerations in the myriad of indications for splenectomy. The PLL database also accommodates specific questions from pathway team members when more in-depth synthesis of the literature is required, providing a mechanism for contacting the librarian regarding particularly focused aspects of the literature, such as new interventions currently in the exploratory phase of clinical research.

Anticipating future applications of the PLL content, librarians match ICD-9-CM codes to entries in the database. To complement outpatient evidence provided through guideline linkages within StarPanel, similar mapping techniques enable StarPanel's inpatient records to access Pathways Literature Locator entries. Moreover, the relevance of pathway evidence to inform creation of order sets calls for incorporation of the PLL linkages within the hospital's computerized physician order entry system, WizOrder.<sup>90</sup> Through this continuing integration as members of multidisciplinary clinical teams involved in pathway refinement, EBL librarians' contributions to defining best practices for patient care can be viewed as proof of concept that librarian-provided evidence can affect hospital policy.

### Conclusions

Successive iterations of the clinical informationist model involve increasing integration of evidence-based services and resources into clinical workflows throughout a health center's inpatient and outpatient practice environment. Clinical information systems provide a rich variety of opportunities to deliver evidence-based information at the point of care. The effectiveness of this type of approach, however, must still be demonstrated formally. The EBL has completed the formative stage and currently is in the summative phase of a three-year evaluation (funded by the National Library of Medicine) of

the Clinical Informatics Consult Service's impact on clinical practice and decision-making at VUMC. This evaluation of a mature clinical information approach investigates the efficacy of the clinical informationist's role as an expert information partner in the practice of clinical medicine.

The combination of literature synthesis by trained experts and integration with well-established clinical systems leverages the strengths of both tools for facilitating clinical practice and communication, likely leading to greater gains than either technique in isolation. The advanced skills and forward-thinking mentality of informationists make logical the next step of integrating them into clinical software development (informatics) teams. As team members, they can lend their valuable expertise and perspective to further informatics goals such as the effective use of technology to facilitate health care processes.

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