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## When Informationists Get Involved: the CHICA-GIS Project

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### Abstract

Child Health Improvement through Computer Automation (CHICA) is a computer decision support system (CDSS) that interfaces with existing electronic medical record systems (EMRS) and delivers "just-in-time" patient-relevant guidelines to physicians during the clinical encounter and accurately captures structured data from all who interact with the system. "Delivering Geospatial Intelligence to Health Care Professionals (CHICA-GIS)" (1R01LM010923-01) expands the medical application of Geographic Information Systems (GIS) by integrating a geographic information system with CHICA. To

provide knowledge management support for CHICA-GIS, three informationists at the Indiana University School of Medicine were awarded a supplement from the National Library Medicine. The informationists will enhance CHICA-GIS by: improving the accuracy and accessibility of information, managing and mapping the knowledge which undergirds the CHICA-GIS decision support tool, supporting community engagement and consumer health information outreach, and facilitating the dissemination of new CHICA-GIS research results and services.

Child Health Improvement through Computer Automation (CHICA) is a computer decision support system (CDSS) that interfaces with existing electronic medical record systems (EMRS) and delivers "just-in-time," patient-relevant guidelines to physicians during the clinical encounter, and accurately captures structured data from all who interact with the system. "Delivering Geospatial Intelligence to Health Care Professionals (CHICA-GIS)" integrates a geographic information system (GIS) with CHICA enabling spatial analysis of patient data, and new EMRS capabilities such as generating maps that are tailored to a patient's residential address to identify community resources for improving health.

CHICA-GIS aims to improve the provision and uptake of pediatric referrals to dentists, exercise facilities, and academic tutoring. In short, CHICA-GIS helps pediatricians refer patients to preventive health services near the patient's neighborhood. CHICA-GIS depends upon the exchange of health information at several key points -- from patient to systems; from systems to physician; from physician to patient; and, ultimately, from patient to organizations in their communities. To provide knowledge management support for CHICA-GIS, three informationists at the Indiana University School of Medicine were awarded a supplement from the National Library Medicine. The informationists will en-

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hance CHICA-GIS by: improving the accuracy and accessibility of information, managing and mapping the knowledge which undergirds the CHICA-GIS decision support tool, supporting community engagement and consumer health information outreach, and facilitating the dissemination of new CHICA-GIS research results and services.

### **Background on the CHICA-GIS system**

As a clinical decision support system, CHICA collects or provides information at key moments during patient visits to six clinics in central Indiana. First, upon checking in to the clinic, the patient (or the patient's guardian) completes a pre-screener form (PSF). The form includes 20 yes/no questions relevant to the patient's health status and medical history. CHICA uses optical character recognition (OCR) to process the PSF and enter patient information into a database. Based on the information provided by the patient, as well as existing information in the EMRS, CHICA generates a Physician Worksheet (PWS). The PWS prompts physicians to address specific needs of the patient and incorporate evidence-based clinical guidelines. Since every preventive health issue cannot be addressed in a single visit, prompts are weighted by clinical importance. Selected prompts are accompanied by the delivery of just-in-time handouts (JITs) which provide supplemental information such as health education or suggestions for resources for the patients. Thus, the CHICA system helps physicians prioritize and address preventive health topics as well as refer patients to additional services during typical time-pressured clinic visits.

Our project, CHICA-GIS, is studying the addition of a geographic information system (GIS) to electronic medical record systems. GIS enables visualization and spatial analysis of information, improving the understanding of physical, social, or other environmental contexts. The visual representation of information can uncover connections not previously obvious, and can be especially

useful for informing health care and health decisions. CHICA-GIS aims to demonstrate both the feasibility and effectiveness of geographic information to improve physician referrals and patient compliance by providing information about community resources for dental care, physical activity, and school performance. For example, a physician might ask about the last time the patient saw the dentist, and the patient's answer to the question could then trigger a JIT document with information about the importance of brushing and fluoride. In addition, the JIT would include a map of dental clinics near the patient's home address. Three areas were chosen as the initial foci for developing CHICA-GIS: dental care, physical activity, and school performance. These topics are highly relevant and prevalent to the pediatric population. Dental caries (or tooth decay) are the most common chronic disease in children; 31.8% of children in the U.S. are overweight; and 5% of U.S. school children have a learning disability. All three of these health issues have potentially strong environmental determinants. And, furthermore, all three need infrastructure to support and achieve behavior change. CHICA-GIS helps the physician and patient to identify and discuss ways to get started down the path toward healthy habits in their community.

### **Our role(s) as informationists**

The success of CHICA-GIS depends, in part, upon the reliable exchange of accurate clinical information and valid data regarding community resources. The value of the tool is lost if patients and clinicians do not trust the questions, prompts, and guidance the system provides. Furthermore, the addition of a map to the JIT document introduces a degree of consumer health information service and community outreach typically not delivered in pediatric primary-care clinics. CHICA-GIS, therefore, provides many opportunities for informationists to bring added value to the grant and to improve its chances of success. To do so, our project pursues four main aims:

- 1) Information quality: To enhance the accuracy and literacy level of referral data, as well as the accuracy and literacy level of the automatically generated documents.
- 2) Knowledge management: To develop a knowledge management plan for CHICA-GIS.
- 3) Community outreach: To participate in community health information outreach services and seek more ways to engage community resources.
- 4) Dissemination: To support the research, writing, and sharing of generalizable knowledge about the outcomes of the CHICA-GIS study.

### **Information Quality**

Informationists monitor and assess both the accuracy of information in the CHICA-GIS databases and the usability of the forms and handouts produced by the system. After a quick review and suggested revisions to the readability of the JIT documents, the informationists found ways to improve the quality of the information in the geographic database regarding tutoring resources. No single, authoritative list for tutoring options exists in central Indiana. The Indianapolis Public School system provided a list of tutoring resources; however, many of the services identified on the list were either online options, outside the central Indiana region or no longer in business. Another database, maintained by non-profit organizations and agencies, included records for some tutoring services in Indiana, but very few records were relevant to the CHICA-GIS population. Therefore, we conducted web searches for services that expanded potential tutoring sites to include churches and community centers in the relevant zip codes. In addition, we contacted local public libraries. We called to verify the availability of tutoring at each location. Clearly, this is an aspect of CHICA-GIS that will require ongoing community outreach and quality control. Neverthe-

less, the informationists doubled the number of tutoring resources in the geographic database.

One approach to improving the quality control of the community services in the geographic database is to give the patients the ability to provide the CHICA team with feedback regarding the dental care sites, tutoring services or physical activity facilities they may have visited following a referral. The informationists contributed items assessing quality and accessibility of community service to a phone survey being used to evaluate CHICA-GIS. If a patient reports that a YMCA is no longer located at that address or playground or other exercise facilities at a park are broken, the CHICA-GIS team can decide to amend the geographic database accordingly. If this patient feedback proves to be useful, a more robust system for patient feedback may be proposed.

### **Knowledge Management**

The nature of the informationist contribution to the knowledge management plan is rapidly evolving. Initially, when we conceived of a knowledge management as part of our project, we were thinking of capturing tacit knowledge, the work flow and best practices associated with the day-to-day operations of the CHICA-GIS project. The informationists are now working to describe and manage the knowledge that provides the foundation for the clinical decision support system. The logic that drives the CDSS has grown organically during the eight years that CHICA has served local clinics. Although the system has proven its utility, it could benefit from a review of its structure and content. To accomplish this, the informationists are creating a map of the CHICA decision rules. This knowledge map will show how system decisions are related to each other, both at the level of system logic (decisions that share a common item of data) and at the level of conceptual domain (decisions that share topical or clinical relevance). The information to be mapped is contained within the set of

rules that govern CHICA. These Medical Logic Modules (MLMs), written in the Arden Syntax, refer to each other and often store shared observations. Additional rules can be added to the system as needed. However, there currently are no comprehensive maps of connections between these rules, nor is there a formal catalog of clinical conditions addressed by the rule set. The knowledge map will help the CHICA team to identify both the unexpected connections between decision rules and the need to develop new rules when gaps are found. For example, there is no current connection in the system between parents who smoke and a child with asthma. From a clinical perspective, the relevance of physicians being aware of and acting on both of these factors is obvious, but the disconnect is not readily apparent to the various persons working daily to refine CHICA. Thus the knowledge map will assist in the writing of new MLMs to bridge clinically related concepts and to ensure a robust rule library. Ultimately, this map will make the CHICA system a better tool for the physicians and patients it serves.

### **Community Outreach**

For community health outreach, there are several services the informationists can provide. To begin with, the informationists are developing a communication plan to share the basics of the CHICA-GIS project with the referral locations. The majority of community resources included in the database have been a part of other research projects on campus, but making sure we are collaborating with the referral locations and that they are aware of our project will advance current and future partnerships. Next, the informationists plan on providing health information resources at these referral locations and working with community resources to make sure reliable and appropriate materials are available. Finally, the informationists hope to identify barriers to the adoption of CHICA-GIS in the community.

### **Dissemination**

While there are already papers written on the CHICA system, the informationists are actively writing, presenting, and seeking local, regional, and national arenas in which to promote the CHICA-GIS project in collaboration with the CHICA-GIS Principal Investigator. Opportunities are being sought across disciplines that highlight the interdisciplinary nature of this grant collaboration. In addition to its relevance to the medical library profession, the project promises to be useful to those in health informatics, pediatrics, health promotions, and other professions. We also will facilitate public access compliance for the scholarly products as well as inform the CHICA team about the value of open-access publishing to impact the dissemination of our work.

### **Conclusion**

Providing informationist services to CHICA-GIS is not without its challenges. Developing a practical evaluation plan has been difficult. While we can measure the work we do on the project, an important question overall for future informationist services like ours will be: how does this project ultimately benefit our libraries? Other challenges include: dividing and conquering responsibilities among the three informationists on our team, communicating the role informationists can play in our current project, and balancing our time spent on the project with our prior and ongoing job expectations. Additionally, the changing and evolving nature of the knowledge management plan, while ultimately very useful, was an unexpected change in the initial project. While overall the knowledge management plan we are pursuing has broad implications for the clinical decision support system, this is a change from what we initially envisioned. The learning curve to understand the inner workings of a decision support system and syntax has been steep.

As we discovered soon after our work be-

gan, the informationists enrich the quality of the information (such as, in this case, increasing tutoring locations) in a research study. As non-physicians and new eyes on the project, the informationists also bring their own set of skills and provide a different perspective to how the information is viewed. Additionally, the development and creation of the knowledge map promises to add to the long-term success of the CHICA-GIS system. While improving a clinical decision support system, we are motivated by the opportunity to promote child health. Even though we have encountered some challenges, we expect that this work will lead to continued collaboration and mutual benefit for CHICA-GIS and the informationists.

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