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# Responding to Clinicians' Information Needs: Designing a Context-Specific Calculator

**Mureen Allen[a], Leanne M. Currie[a,b], Mark Graham[a], Viktoria Janetzki[c], Nam-Ju Lee[b], Suzanne Bakken[a,b], Vimla L. Patel[a], James J. Cimino[a]**

[a]*Department of Biomedical Informatics, Columbia University, New York, New York, USA*
[b]*School of Nursing, Columbia University, New York, NY, USA*
[c]*Department of Medical Informatics, Ruprecht-Karls-Universität, Heidelberg, Germany*

## Abstract

Providing clinicians with context-specific information remains a challenge. One of the information needs we identified while using a CIS was the desire to perform calculations using laboratory results. This is not new but, using current technologies; we are devising a methodology for performing calculations in a context-specific, institution-neutral manner. We have built a context-specific institution-neutral anion gap calculator, which utilizes MED codes, as these can be mapped to standardized terminologies.

## Introduction

Providing clinicians with context-specific information remains a challenge. We have recently described the issue of information needs while using a clinical information system (CIS) [1]. The importance of this finding lies in the ability to address these needs using current technologies (i.e. the World Wide Web). One of the information needs we identified while using a CIS was the desire to perform calculations using laboratory results. This is not new [2] but, using current technologies, we are devising a methodology for performing calculations in a context-specific institution-neutral manner.

## Materials and Methods

We found that clinicians had information needs of the generic form: *How do you calculate <finding> for this patient with these results?* [3] Four percent of the questions were of the format: "*What is the anion gap for this patient?*". We used this question as the basis for the development of a Common Gateway Interface (CGI), which performs the calculations and is accessible within any Web-based CIS.

## Results

We found that the need to perform calculations occurred in the context of the laboratory results page specifically while looking at chemistries. Based upon this finding we placed a link or infobutton (IB) in the laboratory results window. This provides a link to the infobutton manager (IM), which directs the user to a number of context-specific questions including "*What is the anion gap?*". Choosing this question sends all the values of the chemistry panel to the CGI as the value of the parameter "info_other" as shown in figure 1a. This obviates the need to "hard-wire" the parameter with the values required for the calculation (i.e. param{sodium} = 145). The CGI parses out the values it needs and returns an HTML form that performs the calculations on the client-side (using JavaScript embedded in the HTML), displays the results, and provides a link to an online resource for more information about the topic of interest.

To realize our aim of an institution-neutral anion gap calculator program we used the codes in the Medical Entities Dictionary (MED): a knowledge-based representation terminology [4]. These codes can be mapped to standardized terminologies including the UMLS and LOINC. The only requirement is that values be sent to the program in a predefined format as shown (figure 1b). Furthermore, since the program accepts all the values of the chemistry panel, the same methodology of parsing and extracting the required values could be used with other calculators.

**a. Entire chemistry values sent to CGI**

<textarea name = info_other>
56253|138|136-146|mM/l|56254|4.9|3.6-5.0|mM/l|56255|105|102-109|mM/l|56256|26|25-33|mM/l|56257|10|7-20|mg/dl|56258|134|70-105|mg/dl|56259|0.7|0.5-0.9|mg/dl|56260|8.5|8.49.8|mg/dl|</textarea>

**b. Predefined generic format for sending values to CGI**

<textarea name = info_other>
code*|value|NR**|units|code|value|NR|units|code|value|NR|units|
code|value|NR|units|…… |code|value|NR|units| </textarea>
* MED codes ** Normal Range

*Figure 1 – Coding of Laboratory Values Sent to CGI*

## Conclusions

Our example serves to illustrate a method for formatting data using standard terminologies, and calling a CGI calculator which satisfies the need for information that is context-specific and could be accessed from a number of institutions. The proof of our method will occur with its intra- and inter-institution utilization and with the development of other calculators using the same methodology.

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## References

[1] Currie LM, Graham M, Allen M, Bakken S, Patel VL, Cimino JJ. Clinical information needs in context: an observational study of clinicians while using a clinical information system. Proc AMIA Symp. 2003:190-194.

[2] Bleich HL. Computer-based consultation: Electrolyte and acid-based disorders. Am J of Med 1972;53:285-291.

[3] Allen M, Currie LM, Graham M, Bakken S, Patel VL, Cimino JJ. The classification of clinicians' information needs while using a clinical information system. Proc AMIA Symp. 2003:26-30.

[4] Cimino JJ. From data to knowledge through concept-oriented terminologies: experience with the medical entities dictionary. JAMIA 2000;7(3):288-297.