ABSTRACT

This paper describes the integration of web-enabling features of the SAS System into an existing clinical information system developed for the National Comprehensive Cancer Network (NCCN). The prevalence of thin-client web browsers has fully enabled remote on-site data entry of clinical research data, even for organizations that need to operate on a not-for-profit budget. This project, which required minor effort but produced significant impact, should encourage anyone who is considering moving a traditional data entry system into the world of browsers and the internet. The application will be demonstrated on-line during the presentation.

INTRODUCTION

As the Data Coordinating Center for the NCCN Breast Cancer Outcomes project, the City of Hope National (COH) Medical Center developed an application to enable distributed data entry at each of seventeen members of an alliance for the treatment of cancer. The five centers that participated in the pilot phase are located throughout the U.S. A major purpose of the database is to measure compliance with published guidelines and to measure the quality of cancer care in a rapidly changing medical environment:

Patients, physicians and payers alike need a constant flow of data and information to facilitate optimal decision-making. ... The NCCN supports the need for greater accountability in medicine, and fuller participation in decision making by all interested parties. In recognition of these needs, the NCCN has drawn on its expertise in research and data management and has established a national outcomes database. ¹

Accurate, up-to-date information needed to be collected quickly and disseminated quickly. Because of the importance of these goals to the lives of individuals, it was critical that the data be carefully monitored and validated to assure its integrity in the face of peer review.

THE WEB-BASED DATA ENTRY SYSTEM

The application was developed by James Chen, Senior Programmer/Analyst at COH, using HTML-based data entry screens and a Microsoft SQL*Server database. We found that the HTML forms, while straightforward for the user and relatively easy to develop and maintain, do not provide a mechanism for integrating robust and careful edit checks such as are standard operating procedure in clinical trials.

Therefore, members of COH’s departments of Biostatistics and Biomedical Informatics developed a separate SAS- and paper-based process for querying the database and reporting errors, omissions and anomalies in the database back to people authorized to make changes to the database. Paper reports displayed the queried values for on-site research personnel to investigate.

This first iteration of SAS data management had two weaknesses. First, it relied on attended execution of SAS programs outside of the application, which needed to be timed to occur after a significant batch of data entry. Second, it produced large amounts of paper output that was faxed or shipped to the five pilot sites. In other words, data that had been transmitted electronically from one site in the U.S. to the Data Coordinating Center now made the return trip on paper. The on-line data entry system met NCCN’s criteria for speed, but we needed to make sure that the application could also guarantee efficiency as well as accuracy.

USING WEB-BASED EDIT CHECK REPORTS

NCCN now publishes the results of edit checks, produced by SAS programs, on the same extranet used by the data entry system.

In the first phase of this migration to the web, the NCCN technical team simply modified the existing SAS programs, which were standard DATA steps, PROC PRINT’s and PROC TABULATE’s, adding calls to the SAS HTML formatting tools to divert output to HTML files.

At this point, we took care to use the macro parameters so that the look of the SAS output conformed to the style already established in the existing data entry screens, with which the users had been working for several months. We used the same font, the same colors, and the same background. Thus, even though the SAS edit check subsystem had been in essence grafted onto an existing system without any shared technical components, the output still integrated seamlessly without appearing extraneous to the user.

It should be noted that whereas the original system took several months to implement, we were able to integrate the SAS edit checks in a single afternoon. Now users were able to view the results of their accuracy review without waiting for a shipment of paper.

CONCLUSION
Our experience demonstrates the exceptional ease with which the web allows us to integrate and distribute systems. The web-enabling features of the SAS system are free and exceptionally easy to use. They bring power and immediacy to applications, even those without big budgets. All healthcare companies and research organizations are similarly pressured simultaneously to reduce timelines and to maintain the highest levels of data integrity. Companies considering remote data entry should be encouraged by technical developments.

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