

Interactive Web-based Portals to Improve Patient Navigation and Connect Patients with Primary Care and Specialty Services in Underserved Communities

by Linda Highfield, PhD, MS; Cecelia Ottenweller; Andre Pfan; and Jeanne Hanks, DrPH

Abstract

This article presents a case study in the redesign, development, and implementation of a web-based healthcare clinic search tool for virtual patient navigation in underserved populations in Texas. It describes the workflow, assessment of system requirements, and design and implementation of two online portals: Project Safety Net and the Breast Health Portal. The primary focus of the study was to demonstrate the use of health information technology for the purpose of bridging the gap between underserved populations and access to healthcare. A combination of interviews and focus groups was used to guide the development process. Interviewees were asked a series of questions about usage, usability, and desired features of the new system. The redeveloped system offers a multitier architecture consisting of data, business, and presentation layers. The technology used in the new portals include Microsoft .NET Framework 3.5, Microsoft SQL Server 2008, Google Maps JavaScript API v3, jQuery, Telerik RadControls (ASP.NET AJAX), and HTML. The redesigned portals have 548 registered clinics, and they have averaged 355 visits per month since their launch in late 2011, with the average user visiting five pages per visit. Usage has remained relatively constant over time, with an average of 142 new users (40 percent) each month. This study demonstrates the successful application of health information technology to improve access to healthcare and the successful adoption of the technology by targeted end users. The portals described in this study could be replicated by health information specialists in other areas of the United States to address disparities in healthcare access.

Keywords: web-based portal, patient navigation, health information technology, health disparities

Introduction

Individuals in low-income, underserved communities often face personal and system-based barriers to accessing healthcare that may make addressing health problems difficult.¹⁻³ Access to healthcare is defined in two ways: potential access and realized access. Potential access is the ease with which individuals may access health services based on their present circumstances, though it does not include service utilization.^{4,5} Realized access is informed by potential access and covers the actual use of a service.^{6,7} Individualized patient-centric navigation is a healthcare delivery mechanism focused on reducing barriers to healthcare access with an emphasis on facilitating timely screening, diagnosis, treatment services, and the patient's adherence to follow-up with the recommended health plan.⁸ Patient navigators seek to assist patients with both types of access. Although patient navigation programs have existed for more than two decades, they have only recently gained recognition from policy makers. The

Patient Protection and Affordable Care Act describes patient navigation as an important service delivery component for reducing disparities in healthcare access.⁹ Healthy People 2020 objectives have also emphasized the need for the integration of health information and health communication to improve population health outcomes for underserved communities.¹⁰ An important challenge to seamless patient navigation is posed by the lack of integration and coordination of healthcare services and the continuum of care within the different layers of service providers.¹¹

To improve underserved communities' potential access to healthcare, St. Luke's Episcopal Health Charities (SLEHC) created two web-based health information portals, Project Safety Net and the Breast Health Portal, to connect individuals to subcounty level healthcare resources in the Greater Houston region in 2005 and 2007, respectively. SLEHC is a nonprofit 501(c)(3) grant-making and research-based public charity affiliated with the St. Luke's Episcopal Health System and the Episcopal Diocese of Texas. Its mission is to increase opportunities for health enhancement and disease prevention, especially among the medically underserved. Since its inception in 1997, SLEHC has awarded more than \$80 million in grants to 1,500 organizations. SLEHC also houses the Center for Community-Based Research, which conducts both internally and externally funded research projects using mixed methods and community-based participatory research approaches. The portals were designed to link the large number of uninsured and underinsured people with area safety net clinics including public hospitals and health systems, federally qualified health centers, and nonprofit and for-profit clinics that offer free or discounted care.

The original Project Safety Net and the Breast Health Portal provided an online clinic search that gave users information on clinics based on their address or zip code, along with information on clinic hours, languages spoken, hours of operation, eligibility requirements, payment plans accepted, and a detailed list of services provided. Recently, other groups have begun to adopt similar approaches.¹² However, these applications have been limited to assisting only patients who attend clinics within those networks. Connecting patients to services at a wider level has recently been attempted by the Health Resources and Services Administration (HRSA), which launched an online tool to locate HRSA health centers at the county and state level. However, the services are limited in scope, and the tool does not provide information on other vital diagnostic and support services necessary to create a continuum of care. To date, Project Safety Net and the Breast Health Portal are the only comprehensive web-based tools for virtual patient navigation in underserved populations in the local healthcare delivery system.

While the portals were comprehensive and provided much-needed information to assist in patient navigation, by 2010 the original platform was outdated and the system was in need of an upgrade. The objective of this article is to describe the redevelopment and enhanced functionality of the portals.

Methods

Study Setting

The application was implemented by SLEHC in Houston, Texas, and focused on patient navigators working in the Greater Houston region (a nine-county area centered on Harris County). The study region is home to just over 6 million individuals and has an uninsured rate of 30 percent.^{13, 14}

Previous System Workflow

A series of interviews were conducted with SLEHC staff that managed the portals to identify maintenance issues and elicit their understanding of front-end issues experienced by outside users. Interviews were conducted with six staff members, including the community liaison who was responsible for overseeing data maintenance. Interviewees were asked a series of questions about who they thought used the portals, their personal assessment of the current usability of the portals, and any related issues and desired usability for the new interface. A focus group was also held with patient navigators to elicit their use of the portals, issues with usability, and desired usability for the new platform. The usability assessment identified a number of user and system issues as described in Table 1.

Challenges

Management of the portals required validation and authorization from programming staff in the hospital system's information technology (IT) department, which resulted in delays in information updates. In addition, maintenance of clinic information in the database was time intensive. The process required that SLEHC staff maintain regular contact with the local clinics to facilitate maintenance of their information within the system. Service providers were directly responsible for updating their data within the tool. In addition, a large number of fields required updating in the database, and approval from the IT department was required before changes were processed on the portals. Adding to the difficulties, clinics could not update their listings in both Project Safety Net and the Breast Health Portal at the same time, so clinics that provided both primary care and breast health services had to repeat the data entry process. Finally, clinic identifiers were not apparent on the update form, making updates a challenge. Following data entry by the clinics, SLEHC staff members double-checked that their information was entered correctly. Due to the large number of processing steps, the portals contained outdated clinic information. Furthermore, the system suffered from technical issues that led to system hangs, often with the loss of data.

End-User Feedback, Acceptance, and Suggestions for the Redeveloped System

End-user feedback was obtained through a focus group, which was done with patient navigators working at clinics enrolled on the portals. Clinics were contacted for participation via e-mail from their information registered on the site. The focus group was facilitated by one of the co-authors. The focus group used a semi-structured interview guide that asked users who used the portals and how they used it (which parts of the portals they used), their personal assessment of the current usability of the portals, and any related issues and desired usability for the new interface. Notes from the focus group were transcribed at the time of the meeting. Data from the focus group were analyzed for common themes using a grounded theory approach. Additionally, the new system was beta tested with both staff and navigators prior to launch.

Results

Recommended Solutions

After a system requirements analysis, a web-based application was designed and developed on the basis of navigator and staff workflows. Based on the results of the interviews, the interface remained divided into two distinct parts: a mapping search that would meet the needs of researchers and a simple provider search to meet the needs of patient navigators or individuals who simply wanted access to information regarding where to get low-cost or free healthcare. For a complete description of the mapping interface, see Highfield et al. (2011).¹⁵

System Components of the Portals

The redeveloped system offers a multitier architecture that includes a data layer (Microsoft SQL Server 2008), a business layer (stored procedures and ASP.NET 3.5 Framework [C# programming]), and a presentation layer (HTML, Cascading Style Sheets, and JavaScript [jQuery framework]). The technology used included Microsoft .NET Framework 3.5, Microsoft SQL Server 2008, Google Maps JavaScript API v3, jQuery, Telerik RadControls (ASP.NET AJAX), and HTML. Telerik RadControls and jQuery are used as part of the presentation layer of the application to enhance the user experience.

The system specifications for the clinic search in the new application were as follows:

- Search for clinics based on various criteria.
- Display the results with the ability to e-mail and print selected clinic results.
- Calculate the distance from each clinic to the address or zip code supplied by the user.
- Sort clinics by clinic name, type, or distance.
- Add, edit, and delete clinics by authorized administrative users.

- Provide a Google map version of the clinic results.
- Navigate to a particular section of the clinic maintenance using top navigation.
- Make the site bilingual.
- Consolidate the search criteria, search results, and clinic maintenance forms in user controls.
- Be browser agnostic.
- Be universally accessible.
- Not require any additional software downloads.

Assumptions:

- End users are knowledgeable about web-based searches.
- An Internet connection is available.
- Clinic staff will log in and maintain their data on a regular basis.

The architectural context design of the new system is shown in Figure 1. The architectural flow is shown in Figure 2. As shown in Figure 3, the front-end user experience with the portals follows the recommendations made by the patient navigators. Figure 4 shows the search option features as shown in the current version of the portals, which include searches by service through a drop-down list, by address or zip code, and within a selected search radius. Figure 5 shows an example of the search results generated by the system. The latest versions of the Project Safety Net provider search interface can be found at <http://www.slehc.org/Research/PSN-Providers>. The latest version of the Breast Health Portal provider search is available at <http://www.slehc.org/Research/BHP-Providers>. Currently, the portals have 548 unique registered clinics. Some clinics are registered in both portals; therefore, the total clinic count for the two portals combined is not equivalent to the unique clinic count. The Project Safety Net database has 469 registered clinics that serve 90 Texas counties, and the Breast Health Portal provider database has 334 registered clinics that serve all 254 Texas counties. The goal is for the Project Safety Net database to eventually cover the entire state. The redesigned navigator portals have averaged 355 visits per month since their launch in late 2011, with the average user visiting five pages per visit. Usage has remained relatively constant over time, with an average of 142 new users (40 percent) each month. While the total number of patients navigated as result of the portals is unknown due to limited data tracking, the portals are being used to connect underserved patients to care. For example, the portals are used by the Memorial Hermann health system's emergency department navigators to link patients to appropriate medical homes. In 2012 alone, Memorial Hermann navigated more than 4,000 patients using the portals (personal communication April 2013, Memorial Hermann).

Discussion

The redesigned portals minimized the workload for staff required to maintain clinic records. The new facility table contains 41 fields, making it 10 times smaller than the original. This change improved database maintenance, overall performance, and accuracy. Language issues have also been resolved. Instead of a separate file with duplicated functionality, the new portals use one form with the required language information called up from another file. The new structure also allows the site administrator maintaining the information to add additional language information to the tables rather than requiring the intervention of a programmer to make structural changes. Clinic information, such as days and hours of operation, are stored in a cross-referenced, database-normalized form. For clinic users, the clinic maintenance form auto-saves every few minutes to avoid lost work. The new portals use client-side scripting to validate numeric fields. Users cannot accidentally enter non-numeric characters and can provide only numeric entries in the data fields. The new programming is also sensitive to the needs of individuals with vision issues. Labels tied to the corresponding form fields improved access via a screen reader and added accessibility to the controls.

In addition, the user experience was also improved by allowing access from any browser with no additional software or downloads required. A simple-to-use system allows navigators to select and e-mail or print information on clinics that provide service to underserved populations. While the redesigned portals address many of the issues identified in the interviews and focus groups, site administrators still contact individual clinics to request that they update their own data. There is no mechanism for automated data transfer from the clinics into the portals (e.g., through their electronic health records system). This option was considered but was not implemented because of concerns regarding patient and clinic data privacy and cost. While 548 unique clinics are registered on the portals, the portals do not include all safety net clinic locations in the state of Texas. Clinic enrollment has been limited in some areas outside the Greater Houston region. Clinic enrollment is done through word of mouth and community contacts, and there is limited outreach and advertising to attract clinics at this time. This shortcoming limits the ability of the portals to reach underserved populations in some locations. However, the portals continue to be the only online source of detailed safety net clinic data in Texas.

Conclusion

The redesigned portals have improved the usability for patient navigators and the efficiency of maintenance for staff. The portals serve as a centralized location for navigators to link uninsured and underinsured populations to healthcare. They allow for the identification of local resources that would otherwise have to be identified from multiple, nonintegrated data sources. Typically, this type of centralized health access information has only been available to insured populations (e.g., through health maintenance organizations). To our knowledge, Project Safety Net and the Breast Health Portal remain the only comprehensive web-based tools for virtual patient navigation in underserved populations in the Greater Houston healthcare delivery system. Future studies will evaluate the impact of the improvements to the portals through follow-up interviews with both users and site administrators.

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Notes

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Table 1

Usability Assessment Results with End Users and Evaluation of System Components

	Initial Design	Barriers Identified and Addressed
User Issues Identified		
<ul style="list-style-type: none"> • Search navigation 	Required several fields to be entered by front-end users to return clinic search results	Searches were too slow and returned inconsistent results
<ul style="list-style-type: none"> • Zip code search inconsistencies 	Searches returned no clinics when navigators knew they existed	Incorrect programming for the zip code search
<ul style="list-style-type: none"> • Outdated clinic services 	Clinic services must be updated by clinics, then validated by programming staff	Duplicated data entry and inefficient database procedures were leading to outdated data
<ul style="list-style-type: none"> • Additional software tools 	Required an ActiveX tool download that could only be used in Internet Explorer	Restricted use by requiring additional software; many firewalls and administrative protocols prevented download of the tool
System Issues Identified		
<ul style="list-style-type: none"> • Cumbersome fields 	429 unique fields	Caused maintenance issues and reporting errors
<ul style="list-style-type: none"> • Duplicated database structure 	Double data entry was required to update if clinics were listed on both the Breast Health Portal and Project Safety Net	Increased data entry time and possibility of data entry errors
<ul style="list-style-type: none"> • New databases created each year 	A new database was created annually to capture data updates	Resulted in a large number of databases that needed to be linked and queried in the system
<ul style="list-style-type: none"> • Discrete form for language 	A discrete form was used for each language, requiring double data entry	Duplicated programming efforts
<ul style="list-style-type: none"> • Validation and authorization from programming staff 	All data updates required validation and authorization prior to pushing live on the system	Led to delays in data updates
<ul style="list-style-type: none"> • Data storage 	Data was stored in a comma-delimited string format	Data was not database normalized

Figure 1

Architectural Context Design

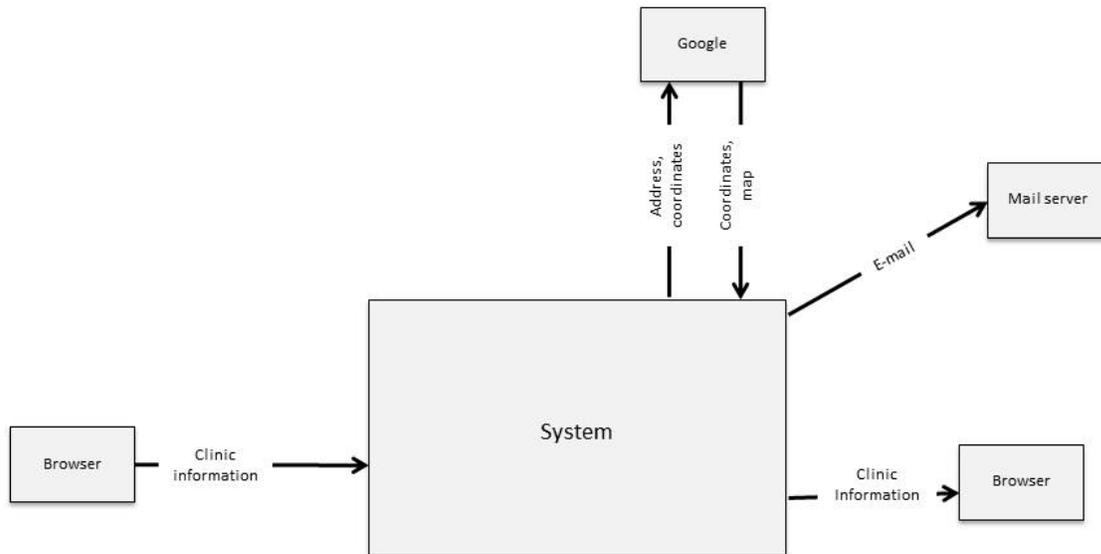


Figure 2

Architectural Flow Diagram

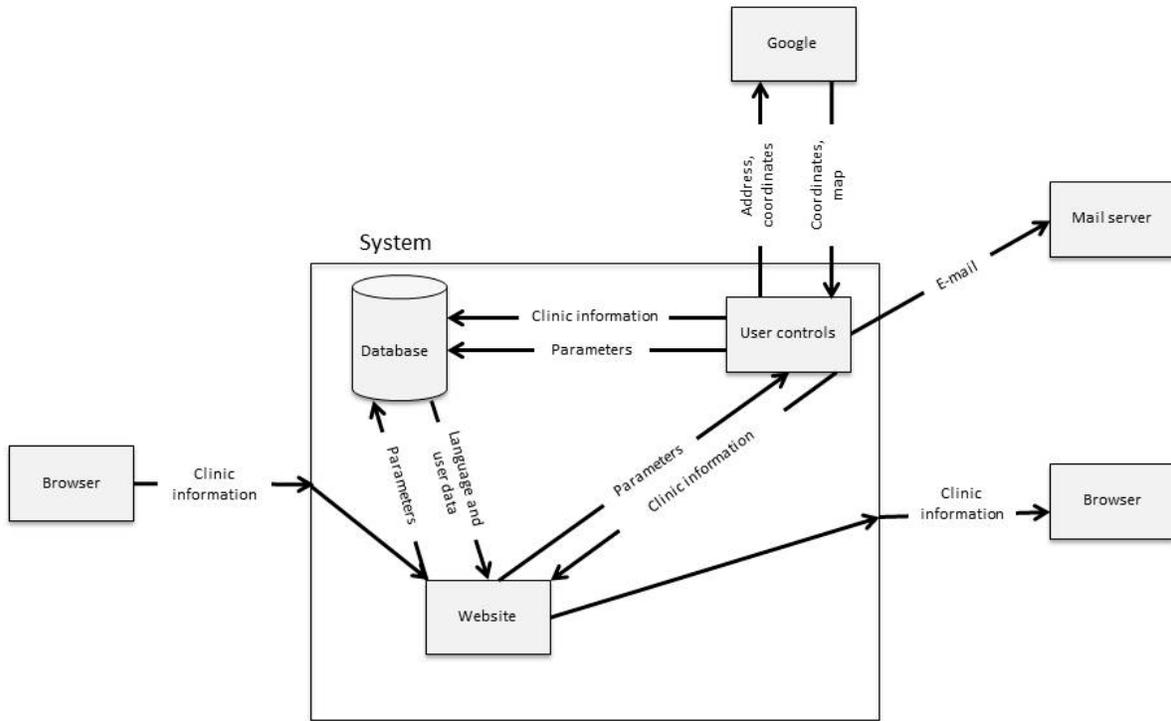


Figure 3

Front-End User Flow Diagram

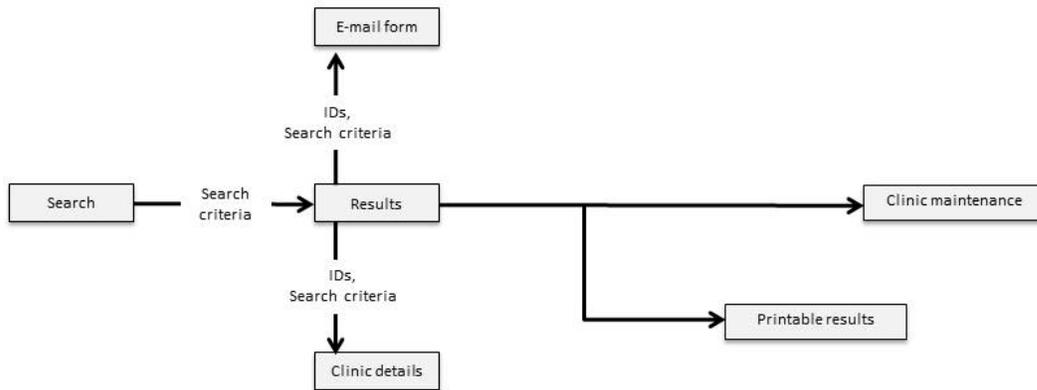


Figure 4

Basic Search Criteria on the Portals

Project Safety Net Provider Search

Free, bilingual search of Safety Net clinics and providers

Interactive Project Safety Net Mapping: by [Zip Code](#) or by [Census Tract](#)

[Provider Login](#)
[Register New Site](#)

English ▾

Services

-- All Services -- ▾*

***Required**

MY ADDRESS

Address

City

State

Texas ▾

Zip*

SEARCH RADIUS

Within

5 ▾ Miles

Advanced Search



SEARCH

Figure 5

Clinic Search Results

English

SEARCH RESULTS

SEARCH CRITERIA

Type of Service: GYN/Women - Gynecology (including pap smears)
 My Address: 3411 Mt. Vernon Houston, TX 77006
 Search Radius: 10 Miles

Sort by: Name Clinic
 Distance

EMAIL SELECTED

PRINT SELECTED

Legacy Montrose Clinic - Details

1415 California Street

Houston, TX 77006

713-830-3000

Clinic Type: Federally Qualified Health Center

Clinic last updated 4/24/2013

 Add to Queue

Distance: 0 Miles

San Jose Clinic - Details

2615 Fannin

Houston, TX 77002

713-228-9411

Clinic Type: Non-Profit Provider

Clinic last updated 6/27/2013

 Add to Queue

Distance: 1 Miles

Lesbian Health Initiative of Houston, Inc. - Details

401 Branard

Houston, TX 77006

713-426-3356

Clinic Type: Non-Profit Provider

Clinic last updated 4/22/2013

 Add to Queue

Distance: 1 Miles

Healthcare for the Homeless - Houston - Details

2505 Fannin St.

Houston, TX 77002

713-878-0000

 Add to Queue

Distance: 2 Miles