

Grant Final Report

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Impact of a Wellness Portal on the Delivery of Patient-Centered Preventive Care

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Abstract

Purpose: To determine the impact of a novel web-based patient Wellness Portal on the process of patient-centered preventive care by examining the behavior and experiences of both patients and primary care clinicians and the degree to which recommended services were individualized and delivered.

Scope: Eight primary care practices in Oklahoma.

Methods: We conducted a three-year, systematic Portal development and testing study that included a 6-month feasibility and acceptability pilot in two primary care practices, followed by a 12-month cluster randomized controlled trial (c-RCT) in eight practices. The study design and data analyses accounted for patient clustering.

Results: The majority of pilot study participants were satisfied with the Portal. Ninety percent found it easy to use, 83% found it to be a valuable resource, and 80% said that it facilitated their participation in their own care. The c-RCT included 422 adults 40 to 75 years of age and the parents of 116 children 2 to 5 years of age. Seventy three percent of patients used the Portal during the study. Both patient activation and participants' perception of patient-centeredness of care increased significantly in the Portal group compared to control ($p=0.0014$ and $p=0.037$ respectively). A greater proportion of Portal users adhered to recommendations about aspirin use (78.6% intervention v. 52.3% control; $p<0.0001$), received pneumovax because of chronic health conditions (82.5% v. 53.9%; $p<0.0001$) and age (86.3% v. 44.6%; $p<0.0001$). A set of multivariate hierarchical linear analyses suggested that Portal use had a significant impact on patients' perception of receiving more patient-centered care and that system-level enhancements are likely to improve the clinician's knowledge about the medical history of their patients.

Key Words: wellness portal, personal health record, prevention, self-management, primary care

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Final Report

Executive Summary

Aims of the Wellness Portal Study

The Specific Aims of this project were: 1) To develop, field test, and refine an Internet-based patient Wellness Portal linked to the previously developed Preventive Services Reminder System (PSRS) to facilitate patient-centered, preventive care in primary care practices; 2) To determine the impact of the Wellness Portal on the process of patient-centered preventive care by examining the behavior and experiences of both patients and providers and the degree to which recommended services are individualized; and 3) To develop model Wellness Portal practices and disseminate the Wellness Portal technology and knowledge derived from Aims 1 and 2.

Pilot Study

At the beginning of the study, an advisory panel was assembled and the Portal was developed based upon their input. A pilot implementation project was carried out in two clinician practices over a 6-month period. The proposed recruitment approach was modified, resulting in similar changes to the recruitment approach that we used later in the cluster randomized controlled trial (c-RCT). Patients were generally satisfied with the Portal and had several suggestions for incorporating more value-added features. These included vital signs and lab results tracking and charting, medical encounters logging, a symptom diary, medication list management, vaccination history documentation for children, secure messaging with PCPs, and the capability to generate an interoperable PHR.

Preliminary survey feedback indicated that participants were generally satisfied with the Portal (e.g. 90% found it easy to use; 83% found it to be a “valuable resource;” and 80% said that it facilitated their participation in their own care). Suggestions for further improvement included shortening some of the drop-down menus, enhancing site navigation, improving the language of on-screen instructions and descriptions, and expanding the options of medication entries.

Cluster Randomized Trial

Eight clinicians in 6 different practices were then enrolled in a c-RCT, randomly assigning half to an intervention and the other half to a control group. Intervention group clinicians and their staff received education about the Portal and assistance in developing office processes that would facilitate its use. Intervention group patients also received education about the Portal and were assisted with initial account creation. Control clinicians and patients were not given access to the Portal or to education about it. Medical records abstractions were performed at baseline and after the 12-month intervention period. Patients and clinicians in both groups completed baseline and post-intervention surveys. Several adjustments were made to the original study

protocol including extension of the intervention period from 9 months to 12 months, changing the inclusion criteria for women from [50 – 75] to [40 – 75] years old, providing small financial incentives for patients and practices, and weekly patient prompts highlighting new or special features of the Portal.

Results of the c-RCT

A total of 422 adults 40 to 75 years of age and parents of 116 children 2 to 5 years of age completed the baseline survey (N=538), and 279 adults and parents of 105 children (N=384) completed both initial and follow-up surveys. Medical record information was collected for all participants.

During the 12-month c-RCT intervention period 280 distinct users from intervention practices logged on to the Portal in 576 separate sessions (2.05 sessions per user). Beyond creating an account, logging in, and reviewing the website, 73% of patients used the Portal in a “meaningful” fashion at least for one task (e.g. entering preventive services, recording vital signs, or generating a wellness plan). About 12% of patients used the Portal twice, 10% used the site 3-5 times and 5% were frequent users (6-25 times).

At baseline, there was no significant difference between control and intervention groups regarding the participants’ perception of patient-centeredness of care. A difference-in-differences analysis indicated that in the intervention group there was a 0.32 point *increase* in the composite patient-centeredness score (calculated as a sum of CAHPS survey items 1 to 8, plus 10 and 11) after the Portal intervention, while in the control group the composite score *decreased* by 0.43 points in the course of the study (p=0.037). The difference in the magnitude and the direction of changes were detectable and significant, even with a limited level of Portal adoption and modest frequency of use.

We conducted bivariate analyses of chart abstraction data containing patient information from intervention and control groups using t-statistics and chi-square tests to examine the impact of the Portal on individual preventive services. Compared to the control group, a greater proportion of Portal users adhered to recommendations about aspirin use (78.6% intervention v. 52.3% control; p<0.0001), received pneumovax because of chronic health conditions (82.5% v. 53.9%; p<0.0001) and age (86.3% v. 44.6%; p<0.0001), even though patients in the intervention group had fewer visits over the 12-month study period compared to those in the control group (average of 2.9 vs. 4.3 visits; p<0.0001). Adult intervention group participants received 84% of all recommended preventive services, while in the control group, participants received only 67% of recommended services during the study period (p<0.0001). Children in the intervention group received 95% of all recommended immunizations compared to 87% in the control group.

We compared patient activation between the two arms of the study before and after the Portal intervention using the short version of the Patient Activation Measure (PAM-13) questionnaire and adjusting for patient clustering. There was no difference in PAM scores at baseline between the two groups (p=0.44). However, PAM scores (that range typically from 38.6 to 53.0) indicated a modest, but significant increase in patient activation in the Portal intervention group compared to the control group at the end of the study (47 points vs. 45 points; p=0.0014). This suggests that more Portal users transitioned from the 2nd stage of activation (“Confidence and Knowledge to Take Action”) to the 3rd stage (“Taking Action”) compared to those who did not use the Portal.

When we examined the change in CAHPS patient-centeredness scores in a multivariate hierarchical linear model, we found that Portal users were more likely to report either an increase or no change in the score when, in addition to demographics, risk factors, and PAM scores, we also controlled for the Assessment of Chronic Illness Care (ACIC) “community linkages” variable (OR=8.22; CI[95%]: 3.22 - 22.16). Portal users were more likely to report an improvement in their clinician’s knowledge of their medical history without practice-level indicators in the model (OR=1.80; CI[95%]=1.05 - 3.11). When we included practice-level indicators, clinician knowledge of their patients’ medical history was also perceived to be higher in the Portal group compared to control, including the following ACIC variables: “community linkage” (OR=3.82; CI[95%]=2.75 - 5.31), “self management support” (OR=2.00; CI[95%]=1.17 - 3.40), “decision support” (OR=1.85; CI[95%]=1.09 - 3.12), “delivery system” (OR=1.72; CI[95%]=1.12 - 2.64), “clinical information system” (OR=1.60; CI[95%]=1.13, 2.26), and “integration of prevention model” (OR=1.8; CI[95%]=1.00 - 3.25). These results suggest that Portal use had a significant impact on patients’ perception of receiving more patient-centered care and that system-level enhancements are likely to improve the clinician’s knowledge about the medical history of their patients.

Conclusions and Lessons Learned

Results of the Wellness Portal study suggest that a comprehensive patient portal integrated into the regular process of care delivery can increase the patient-centeredness of care, enhance the delivery of both age and personal risk factor -dependent preventive services, improve patient activation, promote the utilization of web-based personal health records, and increase the knowledge of clinicians about their patients’ medical history in primary care settings.

The Portal implementation demonstrated the pivotal importance of developing a more sophisticated understanding of patient-computer interactions and technology-related human behavior in primary care, the central role of “intelligent design” in implementing secure, web-based resources with personal health content, patient attitudes toward preventive / prospective care, and the varying ability of clinician practices to redesign their workflow around a patient-centered preventive care approach, even when significant external support is available.

Dissemination

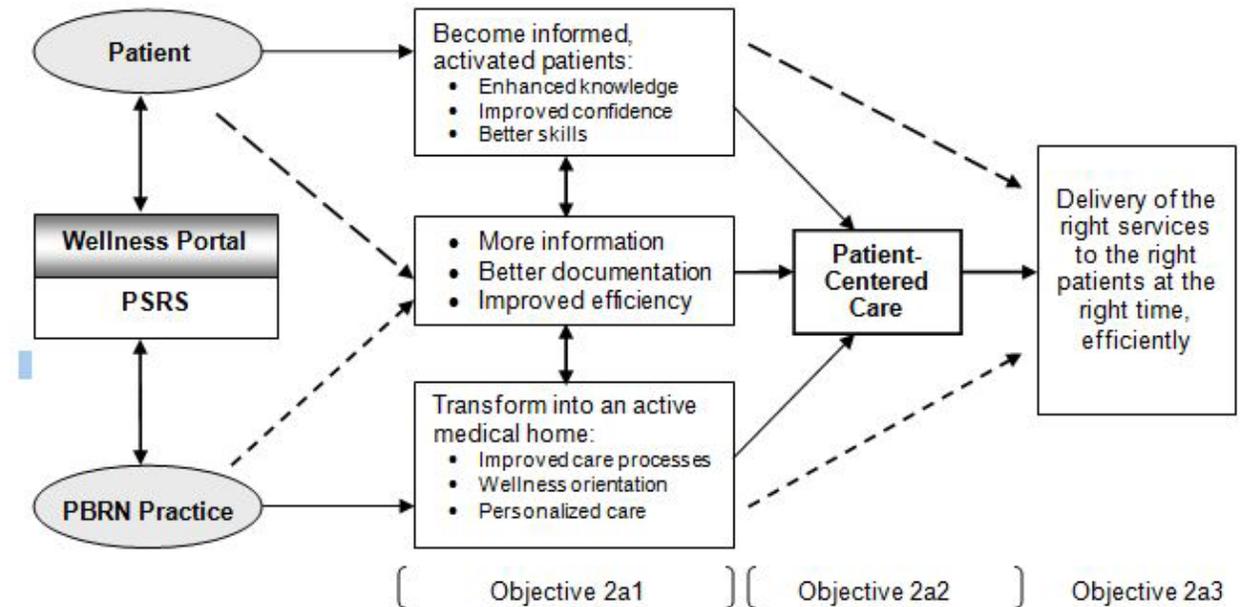
The initial Portal model and preliminary outcomes were presented at a number of conferences in 2009 and 2010. These include the AcademyHealth Research Conference, the American Public Health Association Annual Research Conference, the Annual AHRQ Health IT Meeting, the Annual AHRQ PBRN Meeting, the STFM Practice Improvement Conference, the Annual Oklahoma Academy of Family Physicians Meeting, and the 3rd Oklahoma State Medical Association Health IT Conference. Manuscripts have been published in the *Journal of Primary Care and Community Health* (JPCCH, 2010 Jul;vol.1 no.2:88-92) and the *Journal of the Oklahoma State Medical Association* (JOSMA, 2010 Oct;103(10):498-501.) on preliminary findings. A manuscript containing the final results of the study, currently in preparation, after AHRQ approval, will be submitted initially to the *Journal of the American Board of Family Medicine*. A dissemination plan has been developed, which includes four phases, reflecting widening circles of users: 1) University of Oklahoma Physicians (OUP) clinicians and staff and Oklahoma Physicians Resource/Research Network (OKPRN) clinicians and staff; 2) OUP

patients and OKPRN patients involved in further clinical trials of newer version of the Portal (e.g. including health risk appraisal functionality); 3) all interested Oklahoma clinicians and their patients; and 4) clinicians and patients throughout the country. We are currently implementing Phase 1 of this plan.

Scope

As the number of recommended preventive services continues to increase, clinicians struggle to maintain a balance between immediate patient concerns and the time required to address prevention. It is clear that without effective and timely clinical decision support, integrated into a comprehensive care delivery approach (e.g. the Chronic Care Model), and without patient-centered tailoring of recommendations, primary care clinicians' performance in this area is likely to go from suboptimal (40-60% rates of delivery of well-accepted preventive services) to unsatisfactory. Optimal delivery of primary, secondary, and tertiary preventive services will increasingly require sophisticated information processing and significantly greater patient involvement. Despite the importance of patient-centered delivery approaches, however, there is limited information available on the impact of integrated health information technologies (HIT) on the delivery of patient centered, preventive care in primary care settings.

Figure 1. Conceptual model of the impact of the wellness portal on patient centered, individualized care



Building upon our experience with a sophisticated preventive services prompt and reminder system, the Preventive Services Reminder System (PSRS), we conducted a systematic three-year study with the following aims:

1. Develop, field test, and further refine an Internet-based Wellness Portal for patients in primary care settings to facilitate patient-centered, preventive care.
 - a) Assemble an Advisory Committee of clinicians, office staff, patients, and national HIT experts and develop a patient Wellness Portal that can be accessed by patients through the Internet and also in the provider's office via computer kiosks;
 - b) Field test the Wellness Portal in two OKPRN practices and collect patient and provider satisfaction data via surveys and personal feedback to improve and refine the Wellness Portal and its integration into the comprehensive care delivery process.
2. Determine the impact of the Wellness Portal on the process of patient-centered preventive care by examining the experience of patients and providers with care and individualization of recommended services.
 - a) Assess the impact of the Wellness Portal on patient-centered care:
 1. Assess the impact of the Wellness Portal on patient activation and the medical home;
 2. Understand the impact of Wellness Portal use, the role of activated patients, and the concept of medical home on the provision of patient-centered care;
 3. Measure the impact of the Wellness Portal on the individualization of preventive services that are recommended and delivered based upon individual risk factors and patient preferences;
 - b) Describe utilization and implementation of the Wellness Portal, capture and analyze documented decisions on opting out from evidence-based recommendations, and assess the impact of the portal on missed opportunities for delivering preventive care.
3. Develop and describe model Wellness Portal practices, produce and disseminate a video of these model practices to clinicians, and disseminate the knowledge derived from the project through publications and presentations.
 - a) Develop and describe model Wellness Portal practices;
 - b) Produce and disseminate these model practices to clinicians;
 - c) Disseminate the knowledge and technology derived from the project.

As a result of the Wellness Portal approach, we expected that activated patients and transformed medical practices would be more likely to engage in proactive, patient-centered care, and that this would result in more consistent delivery of appropriate preventive services to the right patients at the right times.

Methods

Objective 1a: Portal Design through an Advisory Committee

A Portal advisory panel was assembled, including three clinicians, two office staff, and six patients, who met three times over lunch. A prototype Wellness Portal website was developed during a six-month period, based upon their input and in an incremental process. The most unexpected outcome of Advisory Committee discussions included recommendations for a set of Portal features that went beyond the initially planned functions that included management of preventive services history, tracking personal risk factors and preferences, and a tailored Wellness Plan. Additional elements included vital signs and lab results tracking and charting, medical encounters logging, a symptom diary, medication list management, a vaccination history document for children, secure messaging with PCPs, and generation of an interoperable PHR. The wisdom of advisor patients and health care professionals was validated later, when our team realized the pivotal importance of connecting the management of preventive services and wellness to other, more frequently occurring events (e.g. regular visits and communication) to encourage frequent Portal use, one of the most significant challenges we had to face. This approach was aligned with the patient value model and the intention to deliver a value-added service to patients and practices.

Portal beta-testers, members of the advisory committee, and patients in the consequent six-month pilot study were generally satisfied with the tool, found it useful and helpful in tracking their preventive services and receiving care recommendations. They also provided useful suggestions for improving it. These included: shortening and consolidating some of the drop-down menus, enhancing site navigation, improving the language of on-screen instructions and descriptions, expanding the options of medication entries, more information and educational materials on most prevalent chronic conditions (e.g. diabetes), adjusting the design and language of the website to make it more appropriate to lay audiences, and designing a signup process that was less complicated.

Objective 1b: Portal Field Testing

We selected a convenience sample of two willing OKPRN practices where PSRS and the main elements of the comprehensive care delivery model had been implemented. We tested and refined the integrated Wellness Portal over a six-month period.

Patient Recruitment. We requested a list generated from billing records in each practice on all patients seen in the past three months by enrolled clinicians. Lists included the patients' name, gender, and date of birth to determine age. Clinicians reviewed the lists and eliminated patients who had moved or switched practices, were deceased, or were too confused to participate. Clinicians or their staff provided the race and ethnicity of patients (often not captured by billing/medical records) to help us include vulnerable populations. We then grouped patients into six strata by age and ethnicity/race and ensured that each patient group (including those who are disadvantaged) was represented in the total sample (N=30; see enrollment table below).

Patient Enrollment and Informed Consent. Eligible patients (or their caretakers) received a letter from their clinician informing them about the study. Patients were then contacted over the phone by a research assistant to explain the study and determine if they were willing to participate. Willing patients received a mailed study participation packet including the consent form to sign and return. The participation packet also included the information needed to log in to the Wellness Portal and create a secure patient account. The research assistant then called those patients who had not submitted their signed consent forms and/or surveys to ensure that each participant was prepared to enter the study. After consent was received, patients were provided full access to the Wellness Portal, and were asked to review and update their records before their next visit to their clinician’s office. Participants received a \$20 gift certificate after they enrolled in the study and completed their baseline surveys.

Patient Recruitment Issues. Patient recruitment in the pilot study was less successful than we anticipated. Our initial process relied heavily on the initiative of patients to respond to mailed invitations and return completed surveys via regular mail. This process resulted in a relatively low recruitment rate and a low survey return rate. We responded with a heightened recruitment effort and increased the recruitment time. However, it became clear that the recruitment strategy had to be modified. We used lessons learned from the pilot study and other, previous projects to redesign patient enrollment for the second phase of the Wellness Portal study (see description below).

Participating patients (N=30) ranged in age from 23 to 83 years (mean age was 41 years). Seventy-eight percent were female, 22% were from racial or ethnic minorities, and 80% had some college-level education. This sample was less representative of the general patient population, but relatively representative of those who are willing and capable of using a web-based portal for their care at the current time. This discrepancy is well known and has been widely published in the literature.

Table 1. Gender, racial, and ethnic distribution of patients enrolled in the six-month portal pilot

Gender	White, Non-Hispanic	Black Non-Hispanic	Hispanic	American Indian/Alaskan Native	Asian/Pacific Islander	Other	Total
Female	17	3	2	1	0	0	23
Male	4	1	1	1	0	0	7
Total	21	4	3	2	0	0	30

Patient and Clinician Surveys. Both patients and clinicians were surveyed to measure satisfaction with the Wellness Portal prototype. The survey instrument included both structured and open-ended questions to more fully capture patient and clinician experience. Survey items were worded at a six-grade reading level determined by using the Flesch-Kincaid Reading Levels function. Satisfaction with the Wellness Portal was measured using scales from the quality domains articulated in the AHRQ HIT Evaluation Toolkit (Version 3): 1) Ease of use; 2) Ease of understanding; 3) Optimal structure and content; 4) Perception of relevance to patients; 5) Appropriateness and usefulness of information; 6) Value of the service; and 7) Perception of potential impact.

Clinician Feedback. In addition to clinician surveys, we obtained frequent feedback from enrolled clinicians and their staff in the form of unstructured personal inquiries. Dr. Nagykaldi

contacted or visited the practices several times a month during the implementation period to obtain information about the progress of implementation, obstacles encountered, and to identify best practice solutions tailored to the practices. In addition, the Portal was also improved based on feedback received from patients in the form of verbal and e-mail communication.

Data Analysis. Survey data on satisfaction was coded and analyzed by individual subscales. Open ended questions were analyzed to describe general impressions of the Wellness Portal use. Information regarding features that served as barriers or facilitators to improving care and recommendations for further improvement were compiled. Survey results are shown below in Table 2. The 4-point Likert scale responses (1 = disagree strongly; 2 = disagree; 3 = agree; 4 = agree strongly) were dichotomized into disagree (1 or 2) and agree (1 or 2).

Table 2. Frequency statistics of responses on Portal utility

	Number Agree (N=30)	% Agree
Ease of Use: It is easy to navigate the Portal	28	93
Ease of Use: It is easy to find information on the Portal	27	90
Ease of Use: It is easy to understand information on the Portal	28	93
Ease of Use: It is easy to understand instructions to manage one's health information	28	93
Ease of Use: Information on the Portal is arranged well	23	77
Importance and Usefulness: Information on the Portal is important	26	87
Importance and Usefulness: The Portal is a valuable resource	25	83
Importance and Usefulness: The Portal improves interactions with providers	18	60
Importance and Usefulness: Information on the Portal is helpful for one to participate in one's own care	24	80
Importance and Usefulness: Information on the Portal is what is needed to make more informed decisions	22	73
Potential Impact: Information on the Portal is what a person needs to manage his/her wellness	24	80
Potential Impact: Information on the Portal is helpful to improve one's health	22	73
Potential Impact: The Portal helped me to improve my health	18	60
Potential Impact: The Portal will likely help to continue to improve my health and well-being	21	70

Objective 2a: Assessment of the Impact of the Wellness Portal on the Provision of Patient-Centered Care

In order to complete the RCT with a sufficient number of subjects, several adjustments were made to the original protocol. These included a revised recruitment approach (see below), extension of the intervention period from 9 months to 12 months, changing the inclusion criteria for women from [50 – 75] to [40 – 75] in order to accommodate mammography schedules, sending weekly e-mail highlights/updates to Portal patients to increase their level of involvement, providing small financial incentives to intervention practices to encourage them to remind patients to use the Portal, and providing small financial incentives to patients to complete their post-intervention surveys.

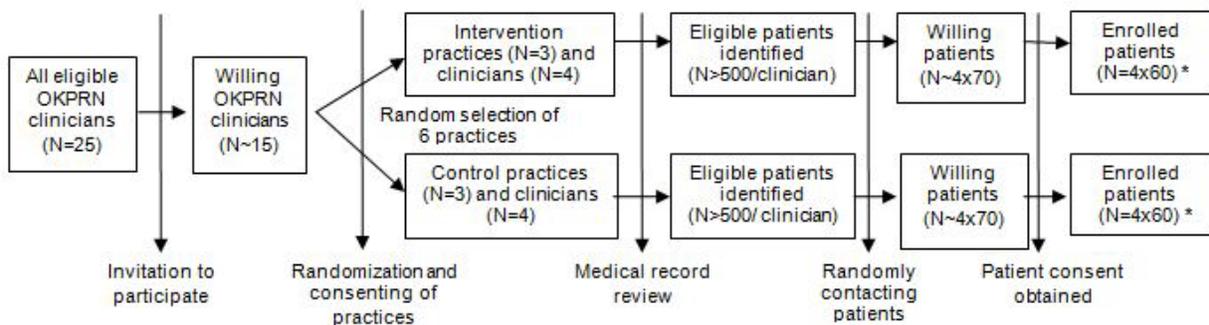
Recruitment of Clinicians. Eight OKPRN clinicians from six practices were selected, recruited, and enrolled. Enrolled practices were matched on location (urban, suburban, or rural)

and then randomized to intervention and control arms. Selection criteria included: clinician experience with the Preventive Services Reminder System; inclusion of both young children (age <6) and adults (age>50) in the patient panel; and no previous participation in Aim 1 activities.

Recruitment of Participants. After practices were randomized to the two study arms, patients in each participating clinician’s practice were notified about the availability of the study (according to their study group assignment) through handouts, flyers, and verbal communication. Interested patients were enrolled by a Research Assistant (RA) in the waiting room of the PCP’s office until 70 patients from each practice were recruited (N=560). At the baseline visit, the RA asked patients to read and sign an OUHSC IRB consent form and complete baseline surveys. Our goal was to enroll enough patients to assure a post-intervention sample of at least 50 established patients (25 children 6 years old or younger and 25 adults 50 or older) from eight participating practices (N_{goal}=400). Selection criteria are listed in the following:

- Patient had to be seen at least twice by the enrolled clinician in the last twelve months;
- Patients had to be six years old or younger or between 40 and 75 years old if female or 50 years old if male;
- Patients (or their caretakers) had to be able to speak either English or Spanish and must have a basic level of computer skills that include being able to navigate a simple, consumer-oriented web site, use the keyboard and the mouse to interact with the browser, and understand / respond to web content phrased at a six-grade level;
- Patients could not have participated in Aim 1 activities.

Figure 2. The randomization process of practices and enrollment of patients clustered in practices



* We expected that approximately 10 patients from each clinician’s practice will drop out from the study leaving 50 enrolled patients per clinician

Patient Surveys. Patients were surveyed via paper questionnaires at two time points: at baseline (pre-test) and 12 months after the baseline survey (post-test). Survey questionnaires included items describing patient experience receiving preventive services, satisfaction with the system of care, perception of patient-centeredness of care, patient activation, and patient empowerment. Patients from both intervention and control arms of the study completed the

surveys. The pre- and post-test survey instruments were identical with the exception that patients from the intervention arm were asked to assess their satisfaction with the Wellness Portal after the intervention. Patients in intervention practices were asked, upon enrollment, to review and update their wellness records, risk factor information, allergy and contraindication profile, and personal preferences through the Wellness Portal before each visit to their primary care provider. Clinicians and their staff were asked to either use the practice portal (PSRS) to generate recommendation lists or to ask patients to print the list of recommendations from their Wellness Portal and bring it to the annual visit. Control practices were allowed to continue to use their practice portal, but their patients were not given access to the Wellness Portal and did not receive personalized recommendations or review their wellness plans.

Patient Experience of Patient-Centeredness of Care. To measure the patient-centeredness of care, we used the Consumer Assessment of Healthcare Providers and System (CAHPS) survey which was developed and validated by the AHRQ Ambulatory CAHPS Initiative. The instrument became available in Spring 2007, with a kit that provided users with all materials necessary to field the questionnaire and analyze results (https://www.cahps.ahrq.gov/cahpskit/cahpskit_main.asp). We created a composite score from CAHPS survey questions 1 to 8, plus 10 and 11 to measure the patient-centeredness of care as it relates to prevention. These questions had binary (yes/no) outcomes for the following scales pertaining to patient-clinician dialog about preventive care: assisting patients to make changes in their health habits, helping patients to make changes, encourage patients to address health concerns, healthy diet, physical activity, worry and stress, depression, pros and cons of care options, and clinician guidance for appropriate care choices (10 questions yielding a maximum of 10 points for each patient). In addition to the patient-centeredness composite score, an item measuring patient perception of provider knowledge of patient medical history was also included. Pre-post differences in composite patient-centeredness scores were calculated for each patient and the differences were compared between control and intervention groups.

Patient Activation. Patient activation was assessed using an adapted Patient Activation Measures (PAM) questionnaire. The shorter form of the PAM instrument has 13 items that form three scales measuring patient knowledge, confidence, and skills that demonstrate patient efficacy.

Patient Demographics and Health Status. Patient age, gender, race/ethnicity, level of education, marital status, insurance coverage information, and employment status were collected via medical record reviews and baseline surveys. Baseline health status of patients were determined by reviewing and documenting chronic health conditions, and the number and type of office visits during a 12-month period before and during the study. We documented the patients' comorbid conditions by calculating the Charlson comorbidity index as they can act as confounding factors.

Medical Record Reviews. Medical records of patients (paper and electronic) and PSRS records were reviewed to determine the number and type of preventive services that were recommended for patients by PSRS during the 12-month study period. We also determined the number and type of risk factors, contraindications, and personal care preferences entered into the Portal database by patients.

Clinician and Office System Surveys. We administered an adapted version of the Assessment of Chronic Illness Care (ACIC) survey in each participating clinician office before and after the study to evaluate the level and nature of improvements made by clinicians and their staff in the delivery of preventive services. The ACIC addresses several Chronic Care Model domains that include community linkages, organization of care delivery, self-management support, decision support, clinical information systems, activated patients and prepared, proactive practice teams.

Delivery of Appropriate Services at the Right Time. We examined PSRS recommendations and the delivery of preventive services under a list of conditions in which recommendations differ based upon individual patient risk factors. For example, in administering pneumococcal vaccination, patients younger than 65 years old (2-64) should receive pneumococcal immunization if they have chronic cardiovascular disease (including congestive heart failure and cardiomyopathy), chronic pulmonary disease (including COPD and emphysema), or diabetes mellitus. In the absence of these chronic conditions, patients are usually eligible for pneumococcal vaccination at 65 years of age or older. Review of medical records and PSRS records allowed us to assess the individualization of recommendations as a result of patient input via the Wellness Portal and documentation of the patient's risk profile. We created a binary variable to describe appropriate delivery of services. If the appropriate service was delivered at the right time, the variable was assigned the value one, whereas if a service should have been delivered and was not delivered, the variable was assigned the value zero.

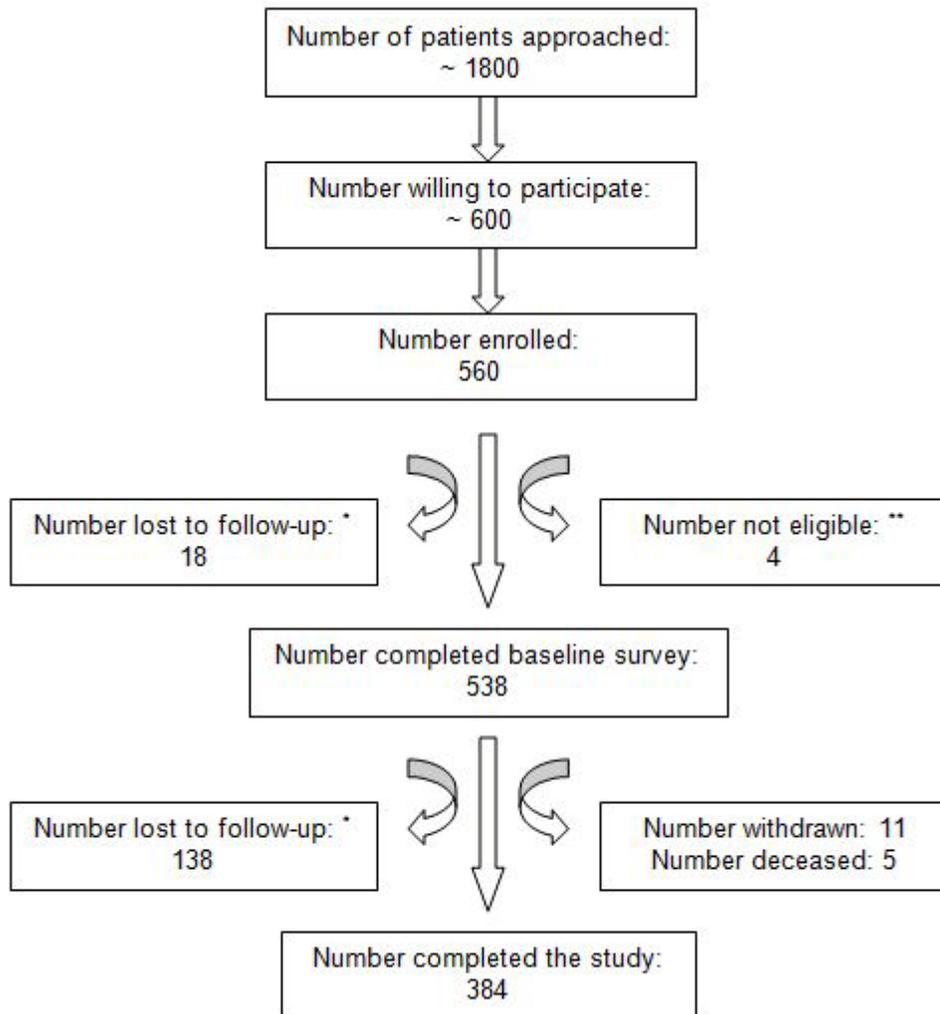
Patient Utilization of the Wellness Portal. We created two variables associated with patients' portal use during the 12-month period: 1) A dichotomous variable where the value of "use" is assigned one, if the patient accessed the Portal and reviewed his/her recommendations at least once; 2) A continuous variable documenting the number of times patients have accessed the portal. Categorical variables were created to describe the type of information patients provided to clinicians through the portal that contributed to the individualization of the wellness plan. Utilization of the Portal was tracked via server security logs that were automatically created in each user session and contained detailed information about user behavior and information exchange between users and the Portal database.

Patient-Centeredness of Care (Multivariate Analysis). In a set of multivariate analyses, we examined the effect of the Portal on changes in patient-centeredness, controlling for patient demographics, disease status, PAM scores, and practice-level ACIC scores. Two dependent variables were created to measure change in patient centeredness: (1) change in overall patient-centeredness score by computing the difference between the sum of the 10 binary CAHPS items collected before and that collected after the implementation of the Portal intervention; and (2) change in patient perception of clinician knowledge of their medical history by taking the difference between the response before and after the Portal intervention. Both variables were then dichotomized into positive or no change, with the value of one, and negative change, with the value of zero. For each variable, a series of eight hierarchical generalized linear modeling was conducted, each model with a different ACIC measure.

Results

A total of 422 adults 40 to 75 years of age and parents of 116 children 2 to 5 years of age completed the baseline survey (N=538), and 279 adults and parents of 105 children (N=384) completed both initial and follow-up surveys. Medical record information was collected for all participants.

Figure 3. CONSORT diagram of the Wellness Portal RCT



* Participant did not complete or send the survey back to investigators and/or was unreachable.

** Participant signed up as a spouse of another participant and this became evident to investigators only later.

Table 3. Gender, racial, and ethnic distribution of patients enrolled in the RCT

Gender	White, Non-Hispanic	Black Non-Hispanic	Hispanic	American Indian/ Alaskan Native	Asian/Pacific Islander	Other	Total
Female	282	20	17	9	0	0	328 (61%)
Male	159	22	16	13	0	0	210 (39%)
Total	441 (82%)	42 (8%)	33 (6%)	22 (4%)	0	0	538 (100%)

Table 4. Distribution of patient characteristics enrolled in the RCT by study arm (N=560)

Patient Characteristics	Control	Intervention
Mean age (years)	50.5	54.6
Gender proportion (female)	59%	63%
Minority group proportion	18.5%	18.1%
High school education proportion	54%	45%
Avg. number of risk factors per patient	0.66	0.54
Ratio of active smokers	15%	17%
Prev. service coverage at baseline	41%	37%
Household income less than \$30K per year	26%	40%

Table 5. Distribution of patient characteristics in the subgroup that did not complete the study (N=154)

Patient Characteristics	Control	Intervention
Mean age (years)	69.0	60.3
Gender proportion (female)	48%	51%
Minority group proportion	10%	6.1%
High school education proportion	82%	90%
Household income less than \$30K per year	35%	22%

At the end of the study, 384 participants, completed the post-intervention instrument, including adults and parents of children from the initial group of enrolled patients (N=538). This represents a 71% overall participant retention rate, however, due to strategic oversampling, our effective retention rate was 96% compared to the RCT target sample size (N_target=400). Thus the power of the study was maintained.

Bivariate analyses of chart abstraction data that accounted for the clusterization of patients indicated that adult intervention group participants received 84% of recommended preventive services, while in the control group, participants received only 67% of recommended services during the study period ($p < 0.0001$). Similarly, adult intervention patients received 86.3%, while control patients received only 44.6% of all recommended pneumococcal vaccinations ($p < 0.0001$). When 40-64 year old patients with qualifying risk factors (e.g. chronic conditions) were examined separately, 82.5% of intervention and 53.9% of control patients received pneumococcal immunization ($p < 0.0001$), corresponding to a more appropriate intervention in response to an elevated risk of infection. Overall, children in the intervention group received 95% of recommended immunizations compared to 87% in the control group. Immunization coverage was calculated as the number of doses received over all doses recommended at that particular age. Compared to the control group, a greater proportion of Portal users adhered to recommendations about aspirin use (78.6% intervention v. 52.3% control; $p < 0.0001$). These differences were significant, even though patients in the intervention group had fewer visits over the 12-month study period compared to those in the control group (average of 2.9 vs. 4.3 visits; $p < 0.0001$). Since we relied primarily on a medical record abstraction approach to measure the delivery of preventive services, it was not feasible to completely separate the effect of potentially improved documentation from an actual increase in care delivery. It is therefore possible that the impact of the Wellness Portal on preventive services may be explained, at least in part, by improved practice-level documentation.

At baseline, there was no significant difference between control and intervention groups regarding the participants' perception of patient-centeredness of care. A difference-in-differences analysis indicated that in the intervention group there was a 0.32 point *increase* in the composite patient-centeredness score (calculated as a sum of CAHPS survey items 1 to 8, plus 10 and 11;

score range: 1-10) after the Portal intervention, while in the control group the composite score *decreased* by 0.43 points ($p=0.037$). The difference in the magnitude and the direction of changes were detectable and significant, even with a limited level of Portal adoption and modest frequency of use.

We compared patient activation between the two arms of the study before and after the Portal intervention using the short version of the Patient Activation Measure (PAM-13) questionnaire and adjusting for patient clustering. There was no difference in PAM scores at baseline between the two groups ($p=0.44$). However, PAM scores (that range typically from 38.6 to 53.0) indicated a modest, but significant increase in patient activation in the Portal intervention group compared to the control group at the end of the study (47 points vs. 45 points; $p=0.0014$). This suggests that more Portal users transitioned from the 2nd stage of activation (“Confidence and Knowledge to Take Action”) to the 3rd stage (“Taking Action”) compared to those who did not use the Portal.

When we examined the change in CAHPS patient-centeredness scores in a multivariate hierarchical linear model, we found that Portal users were more likely to report either an increase or no change in the score when, in addition to demographics, risk factors, and PAM scores, we also controlled for the Assessment of Chronic Illness Care (ACIC) “community linkages” variable (OR=8.22; CI[95%]: 3.22 - 22.16). Portal users were more likely to report an improvement in their clinician’s knowledge of their medical history without practice-level indicators in the model (OR=1.80; CI[95%]=1.05 - 3.11). When we included practice-level indicators, clinician knowledge of their patients’ medical history was also perceived to be higher in the Portal group compared to control, including the following ACIC variables: “community linkage” (OR=3.82; CI[95%]=2.75 - 5.31), “self management support” (OR=2.00; CI[95%]=1.17 - 3.40), “decision support” (OR=1.85; CI[95%]=1.09 - 3.12), “delivery system” (OR=1.72; CI[95%]=1.12 - 2.64), “clinical information system” (OR=1.60; CI[95%]=1.13, 2.26), and “integration of prevention model” (OR=1.8; CI[95%]=1.00 - 3.25). These results suggest that Portal use had a significant impact on patients’ perception of receiving more patient-centered care and that system-level enhancements are likely to improve the clinician’s knowledge about the medical history of their patients.

Objective 2b: Utilization and Implementation of the Wellness Portal

During the 12-month intervention period, 280 distinct users from intervention practices logged on to the Portal in 576 sessions (2.05 sessions per user). This is 11 users more than the number of enrolled patients who interacted with the Portal in the intervention arm. The difference arises from the activity of family members, who were encouraged to sign up and use the Portal along with enrolled participants. Although their outcomes were not included in the study, their use of the Portal is nevertheless important, since it is precisely the clinical advantage of a family-centered approach to health improvement through technology. Beyond creating an account, logging in, and reviewing the website, 73% of patients used the Portal in a “meaningful” fashion at least for one task (e.g. entering preventive services, recording vital signs, or generating a wellness plan). About 12% of patients used the Portal twice, 10% used the site 3-5 times and 5% were frequent users (6-25 times). One patient with CHF monitored his weight on a daily basis for a period of time (50+ user sessions). Factors associated with more frequent use included the presence of significant health conditions where regular tracking of parameters was desirable, a higher level of interest in health and wellness and the use of technology to improve

health, and more computer and web experience. These results also indicated that healthier individuals might have used the Wellness Portal less frequently, simply because they had no current health needs or concerns.

In the course of the study, 128 patients entered 498 immunization records via the Portal website, including 24 distinct vaccine doses for children (e.g. Hib3, MMR2) and adults (Influenza, Pneumococcal, and Adult dT). Similarly, 117 patients documented 487 preventive services, including 23 distinct service types (e.g. mammography, diabetes education, smoking counseling). In addition, 77 Portal users recorded 173 personal risk factor entries, representing 15 risk categories (e.g. tobacco use, having diabetes, riding a bike) that helped personalize care recommendations through the Portal risk engine.

Missed Opportunities for Preventive Services. At the beginning of the study, preventive service recommendations were run for all participants via the PSRS risk engine, based on medical history gleaned from medical record abstractions. A total of 1692 care recommendations were generated for patients in the control group and 1947 in the intervention group that required clinicians' attention in the course of the study. At the end of the trial, the same analysis indicated that 2311 preventive services were due in the control group (37% increase), while 2265 were due in the Portal intervention group (16% increase). These numbers suggest that while more services were recommended based on the same clinical practice guidelines as time passed in both patient groups (not surprisingly), a significantly higher number of services remained unaddressed in the control group compared to the intervention group. Since the size, demographics, and clinical characteristics of the two patient groups were comparable due to randomization, it is not unreasonable to hypothesize that this difference might be explained, at least in part, by the use of the Wellness Portal that personalized care recommendations and prompted users to act upon them.

Findings from Semi-Structured Practice Interviews. We evaluated the experience of clinicians and their staff with the Wellness Portal-driven care delivery system and collected success stories and exemplary approaches to implementation via semi-structured interviews after the study in intervention practices. The semi-structured interviews were constructed and analyzed based on the Grounded Theory method. The interviews were digitally recorded at participating clinic sites and audio records were transcribed. The study team met to discuss the findings and generate propositions regarding relationships among the categories.

When asked how many Wellness Portal recommendation printouts clinicians remembered seeing, the numbers ranged from none to about 10. All intervention practices had assigned Portal functions to either the front desk staff or to their nurses, as they had been counseled to do, to insure that it became an institutionalized part of practice routine. All clinicians said that the impact on their practice had been minimal. One emphasized that his practice had done a good job of providing preventive care before the study (a possible ceiling effect); two others thought that perhaps patient requests for prevention services had increased slightly; and the fourth thought that it had increased patient satisfaction.

When asked to recall specific comments from patients regarding the Portal, clinicians reported positive statements such as: "Patients were excited about it."; "they thought it was a good idea." and "patients asked for specific procedures, immunizations, or lab tests." However, specific cases could only be cited by one clinician who said that a patient used the Portal to get information about their medicine.

One of the difficulties in integrating the tool into practice processes was that the Portal website had been available for only a small proportion of patients in each practices. This created specific logistical barriers, such as difficulty in remembering which patient received the intervention and/or putting a system in place to track patient assignments for the study. When asked what the impact of having the Portal available for all patients, these clinicians suggested that: having patients remember to follow-up on procedures or lab/work would be very helpful; making it a requirement for being seen regularly (e.g. via a yearly wellness visit or physical exam) would greatly improve compliance; and another clinician thought it would change very little in his practice.

When asked about the main obstacle, all clinicians reported that they thought the first version of the Portal kiosk (a full-size kiosk in the waiting room) was too intimidating and conspicuous for private medical information and all supported replacing the kiosk with a small tablet computer with a touch screen (e.g. a Tablet PC or an iPad). Another clinician cited habits as being the major barrier given that most patients arrived with a specific problem to be addressed and did not want to address prevention (which reinforced the necessity of an annual, dedicated wellness visit). This clinician suggested that annual wellness visits might be instituted to incorporate the Portal. None of the clinicians reported using the Portal for their own or their families' prevention recommendations, although all intervention clinicians and their practice staff have been offered to use the Portal. However, they did unanimously report that the Portal would be very helpful if their patients would use it. This finding strengthened our intention to promote the Portal for medical professionals and office staff first, before it is offered to their patients.

Themes Form the Qualitative Analysis of Patient Focus Groups. Focus groups were conducted with a subset of patients who tested the prototype Wellness Portal. In addition to quantitative survey evaluating user satisfaction and experience with the tool, we wanted to complement quantitative findings with the information from two groups of patients: 1) Those who were satisfied and frequent users of the portal; and 2) those who were less satisfied and possibly sporadic users. The intent of using focus groups was exploratory and fact finding, and therefore, the sample was purposive rather than random.

A focus group discussion guide was developed by the investigators based on literature review and preliminary findings of the study. The focus group discussion topics were centered on three key domains: 1) patient experience with the use of the Wellness Portal; 2) factors that facilitated or hindered the use of the Wellness Portal; 3) patients' feedback on further improvement to facilitate the use of the Wellness Portal. Group sessions that lasted about 60 minutes were led by two interviewers (Dr. Aspy and Dr. Chou) and audio-recorded. The two interviewers coded the sessions independently and then discussed their findings for the report.

Wellness Portal Use and Experience.

1. We'd like to ask you some questions about the amount you used the Portal. How often would you say that you log onto the Portal over the last year?
 - 1 - 24 entries
 - 4 times a month over the last 12 months

- 2 times over the last few months
- Cannot recall
- Used it one or two times after signing on

2. What was your experience using the Portal?

- All indicated that they liked entering the information for the purpose of record keeping. They would like to be able to make entries on medication that was not on the preselected list and the type of doctor (name of doctors). There are too many options in the drop-down menu.
- In the last 2 years, one noted that she saw only one doctor, who prescribes frequently. Portal is nice for tracking medication.
- There is no category for OTC medications. Many would like to use this function; one stated that she takes >45 OTC and would probably not enter them all.
- One wondered if he could communicate with the clinician, and others indicated that they would like to know how to use the messaging function.

Barriers/Facilitators to Use.

3. Is there anything about the Portal that you really liked?

- Participants liked the encounter history (documentation of visits, communications, and events) and the medication list. Some wanted more information on the reminder function (patients could schedule an e-mail self-reminder for any event via the Portal).
- They liked having all medical history in one place and the ability to have copies available for children.
- One said that her sister is her health care proxy and her sister can have a copy of her medical history.

4. What are some of the things that we did right with the Portal to make it easy to use?

- Liked the tracking function on the Portal
- Will use it more if needed, but currently there is less medical need
- Clinician can print out a copy to keep track

Documentation of Encounters.

5. Is there anything about the Portal that frustrated you as a user?
 - Issues with signing on (completing the signup process or recovering forgotten credentials)
 - Finding the correct website (issue of communicating the URL without an e-mail and typing the wrong address)
 - Drop-down menus with too many options
6. What are some barriers with the Portal that made it hard for you to use?
 - Did not use enough to know
 - Being savvy with computers (not many barriers, if one has more experience)
 - The website address was not intuitive and hard to remember - must keep URL as a bookmark
 - Difficulty finding some modules / features, e.g., immunizations (flu, pneumovax), self-reminder function

Discussion on Improvement.

7. What are your suggestions for improving the Portal?
 - Report could be printed out from clinician office or Portal could be tied to their EMR
 - Easier navigation for entering preventive services (e.g., mammography; pap smear; colonoscopy)
 - Increase the number of characters for data entry, especially under “encounter history”
 - Navigation is somewhat difficult like putting medications in, more clarity needed for dosage/units

Closing.

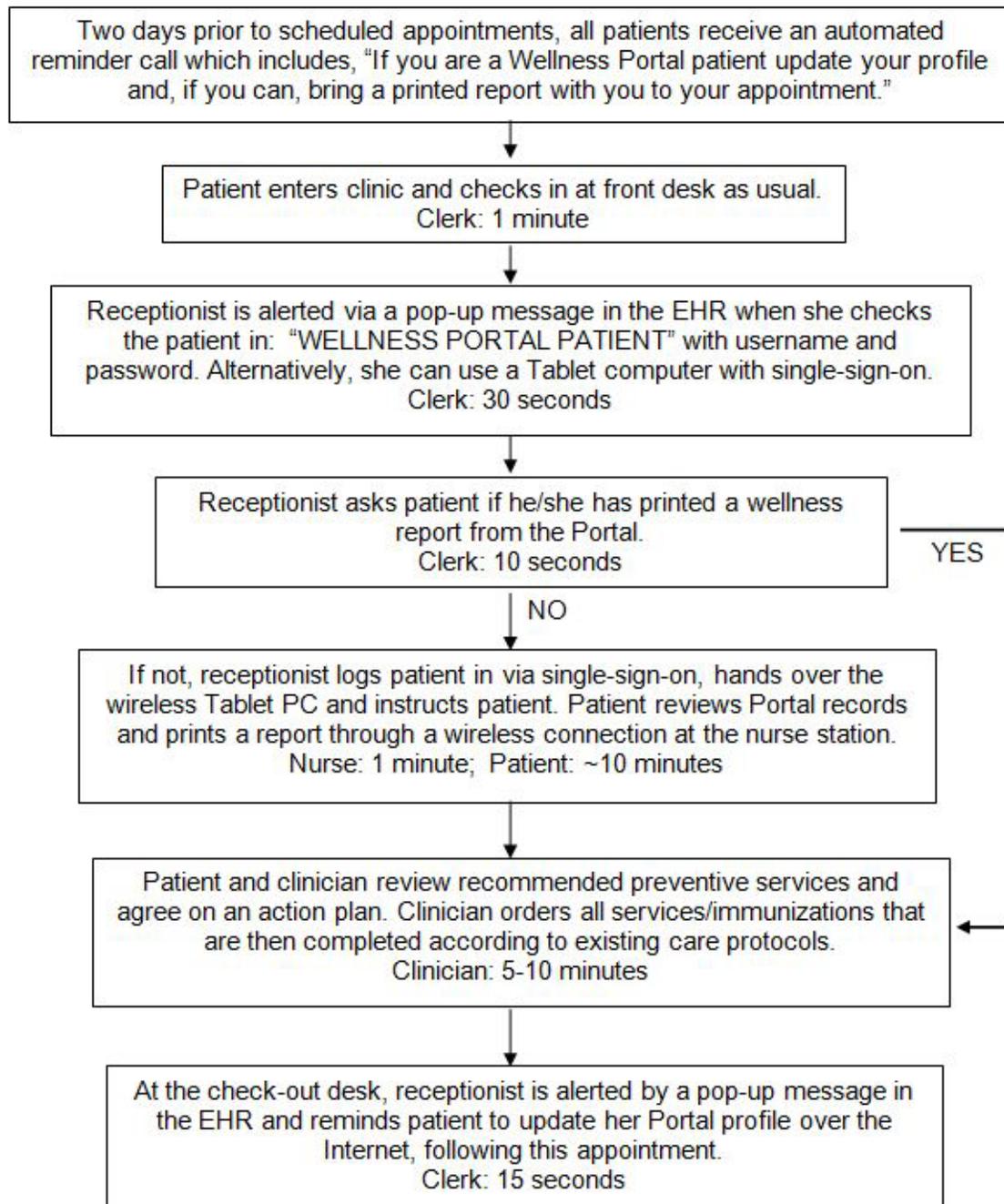
8. Are there any questions you have?
 - We would like to know how to communicate with the clinician using the messaging function
 - Clinicians need to share their email addresses and help us set up communication

Objective 3a: Development and Description of Model Wellness Portal Practices

The geographical diversity and substantial regular patient care workload of intervention practices made it very difficult to organize monthly quality circles, as we originally planned. Travel was prohibitive and recurring communication bandwidth issues also plagued especially small rural practices. The research team therefore opted for an effective and previously tested practice facilitation method that included weekly cross-pollination of good ideas and lessons learned via regular PEA visits. One of the PEAs, for example, helped a small rural practice overcome their limitations in terms of office space in the waiting room that made the use of the full-size patient kiosk prohibitive. With the help of the investigators, a wireless Tablet PC version of the kiosk was developed and the PEA helped the practice design an alternative patient intake workflow that took advantage of the mobility and small size of the Tablet. PEAs then extended this approach to two other intervention practices across the state that experienced similar challenges. Other “innovations” or lessons have also been shared between practices. These included the creation of a practice work-flow chart (facilitated by the PEA) that helped clinicians and staff identify the appropriate points where the Portal technology could be integrated into their care processes, redesign of the management of patient credentials by the practice (e.g. practice-level single-sign-on to patient Portal accounts), giving a small incentive and sending out regular patient e-mail notifications that improved patient involvement, and approaches to interacting with patients at check-in in order to remind them to review their profiles and run their care recommendations via the Portal before their wellness visit.

To map practice processes related to Portal implementation in an iterative process, PEAs helped intervention practices design an individualized work-flow diagram that captured care delivery processes pertaining to the Portal implementation and the approximate time to accomplish each step. A small rural practice, for example, constructed the following work-flow plan:

Figure 4. Dr. A's work-flow diagram of portal implementation



Two of the four intervention practices had difficulty implementing their own work-flow plans. PEAs have made a significant effort and worked with practices on a regular basis to facilitate the process of work-flow redesign in each practice. As expected, practices that had an innovative and energetic leadership team were able to implement more of their work-flow changes with the help of the PEA compared to practices with a more tempered attitude toward change and innovation.

Model Practices. From lessons learned in Portal intervention practices, a set of “best practice” implementation principles have been distilled by the research team. None of the practices enrolled in the RCT managed to master all steps of the Portal implementation process, but between all practices, an optimal Portal implementation approach could be synthesized that included the following:

- Patient demographics are securely captured from the practice’s electronic records and preloaded into the Portal database before the Portal is introduced.
- Patients are invited to sign up for the Portal in repeated campaigns via office flyers, posters, mass e-mails, practice website announcements, social media communications, and verbal advertising.
- Patients sign up via the Portal website and receive an e-mail with instructions and account information.
- Patients are reminded to review and update their records, complete a health risk appraisal questionnaire before their annual wellness visit and (if they can) print a copy of the wellness report before the visit.
- Patients are scheduled for an annual wellness visit (e.g. around their date of birth) and asked to bring in their wellness report. Alternatively, the receptionist can hand the patient a wireless Tablet computer in order to review the Portal record and print a report (wirelessly) while in the waiting room. In this setting, Portal accounts are accessed via a secure, practice-level single sign-on, initiated by the receptionist. This eliminates the need for the patient to remember Portal credentials (a significant barrier).
- Patient and clinician discuss the wellness report and agree upon a personalized wellness plan.
- Ideally, a dedicated practice staff (e.g. wellness nurse) provides periodic follow-up and links the patient to community resources as part of regular care (requires more significant practice redesign).
- As patients use the Portal website, an administrator proactively scans server logs not just for security purposes, but to identify potential utilization barriers and problems that users might have encountered in order to offer active help, sometimes even before the user would realize that a specific error occurred. These include: repeatedly entering various credentials (e.g. those for one’s private e-mail account) expecting that access will be granted to the Portal; looking down while typing and not noticing that the CAPS ON warning has been displayed when the user is logging in; trying to register family members separately on different accounts when family accounts are available and their use is clearly encouraged; registration attempts outside of practices where the Portal has been offered and thus no PCP assignment is available yet; and obvious signs of navigation difficulties or utilization barriers in certain areas of the website.

- An active analysis and learning process is applied by Portal developers to proactively redesign elements of the Portal based on ongoing user feedback and most frequent issues and barriers users encounter. For example, a more sophisticated contextual help system has been developed that detects some of the most common user mistakes or issues and offers assistance in the form of written or audiovisual help content and tutorials, before contact information for personal assistance is offered. Another example is an industry-standard, secure credential recovery approach that significantly decreases the need for human contact for the most frequent user problem: forgotten or misplaced user names and passwords. These “smart” resources are designed purposefully, based on a deeper understanding of the science of human-machine interactions and the fundamentals of human behavior.
- The realization that Internet use, even frequent use, does not necessarily result in the ability to navigate a secure website with protected health information. In this regard, Portal investigators distinguished four tiers of users based on their computer and internet literacy. Tier I: uses only a pre-set e-mail account (usually installed by a family member), but nothing else; Tier II: also browses for information (e.g. health information) on a regular basis with good general web navigation skills, but no experience in secure account management; Tier III: manages secure web accounts (e.g. bank accounts), can complete financial transactions online; Tier IV: the “geek”, who, has a better understanding of computers and web communication, who is not stopped even by error messages and usual glitches. A more in-depth knowledge about user behavior is then used to provide tailored (tier-specific) help to Portal users.

Objective 3b-c: Dissemination of the Knowledge Gained and Adoption of the Portal Technology

At the conclusion of the Wellness Portal trial and after receiving considerable positive feedback about the Portal from practices and patients, we contracted with an Oklahoma City metro area PR firm to develop and disseminate targeted promotional materials about the Portal. These included a carefully designed tri-fold patient handout in color with a professional, glossy finish, a four-page clinician / practice educational brochure, and a practice flyer that can be reproduced in various sizes. The patient handout introduces the Portal in lay terms, describes its features and potential value to patients, and provides simple instructions about signing up. The handout has been designed to be appropriate for a wide range of patient groups and it includes photos and graphics that are representative of ethnic minorities in Oklahoma (e.g. African Americans, Latinos, and Native Americans). The practice brochure is more technical and clinical in nature. It describes the features of the Portal, the potential value of the Portal to primary care practices and provides guidance about steps to incorporate the Portal into a practice with the help of our research team.

In addition to printed materials, we also developed a full-length (10 minute) and a contextually segmented version of a Wellness Portal introduction and tutorial video that can be viewed and or downloaded from the Portal website. In one of the implementation practices, the video was adapted to a DVD-based, looped presentation via a patient education station located in

the waiting room. Short video clips have also been produced that helped office staff review best practices for interacting with patients and the Portal during patient intake and discharge.

Audiovisual materials have been matched with a strategic dissemination campaign of the Portal tool. First, we approached those practices that participated in the three-year investigation and offered the Portal to all of their patients. Then, we invited primary care providers on our Campus (OU Physicians) and also sent over 200 letters to OKPRN member clinicians and made the Portal available to them for their personal use and for their family members to pave the way of a more significant, state-wide dissemination effort to patients. In the course of the last year of the study, several entities approached us with interest in implementing the Portal in their organizations. These include the Oklahoma State and Education Employees Group Insurance (OSEEGIB, a government organization), a local fitness company, and a regional private third party payer. We are also working with the Oklahoma Medicaid program to extend the availability of the Wellness Portal to Medicaid beneficiaries throughout the state. These organizations found the emerging Health Risk Appraisal (HRA) tool one of the most exciting components of the Portal. The HRA is being developed and tested currently by Dr. Nagykaldi funded through his AHRQ K08 Grant. The two studies thus complement each other in a way that facilitates the continuity of development and dissemination of the complete Wellness Portal package.

The initial Portal model and preliminary outcomes were presented at a number of conferences in 2009 and 2010. These include the AcademyHealth Research Conference, the American Public Health Association Annual Research Conference, the Annual AHRQ Health IT Meeting, the Annual AHRQ PBRN Meeting, the STFM Practice Improvement Conference, the Annual Oklahoma Academy of Family Physicians Meeting, and the 3rd Oklahoma State Medical Association Health IT Conference. A manuscript has been published in the *Journal of Primary Care and Community Health* and the *Journal of the Oklahoma State Medical Association* on preliminary findings. A manuscript containing the final results of the study, currently in preparation, after AHRQ approval, will be submitted initially to the *Journal of the American Board of Family Medicine*.

Further dissemination plans include the expansion of Portal implementation to the state-wide Secure Medical Records Transfer Network (SMRTNET), an AHRQ-funded, nationally renowned health information exchange network, the Oklahoma Health Care Authority (the state's Medicaid program), and other studies that will examine the impact of our integrated health risk appraisal tool.

List of Publications and Products

1. Chou AF, Nagykaldi Z, Aspy CB, Mold JW. Promoting Patient-Centered Preventive Care Using a Wellness Portal: Preliminary Findings. *Journal of Primary Care and Community Health*, 2010;1(2) 88-92
2. Nagykaldi ZJ, Chou AF, Aspy CB, Mold JW. Engaging Patients and Clinicians Through a Wellness Portal to Improve the Health of Oklahomans. *JOSMA*, 2010 Oct;103(10):498-501.