

Improving Adolescent Primary Care through an Interactive Behavioral Health Module

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ABSTRACT

Purpose: The primary aims of our research were to: 1) develop an interactive behavioral/emotional health screening module for adolescents that can be integrated into health care; and 2) pilot-test the implementation of the module in primary care.

Scope: Despite preventable adolescent morbidity and mortality, clinicians inconsistently screen adolescents for risky behavior. Health information technology has potential to improve health care quality and behavioral outcomes for adolescents.

Methods: In Phase 1, we developed a computerized behavioral/emotional health module that is acceptable to teenagers and the health professionals who care for them in primary care settings. In Phase 2, we implemented the module in two primary care clinics serving large numbers of diverse adolescent patients. Several qualitative and quantitative approaches were taken to evaluate the acceptability of the behavioral screening intervention, test the effects of the intervention on screening and counseling by providers, assess effects on adolescent knowledge and discussion of health behaviors, and assess the impact of the system on practice operations.

Results: We developed Health e-Check, an iPad screening module covering multiple behavioral risk areas and emotional health. Health e-Check takes 5 minutes for adolescents to complete, and includes a customized printout with prompts and cues for providers that has been integrated into the EHR within the health system. Post-implementation data collection indicates an increase in provider preventive screening of adolescent patients. Health information technology to assist with preventive screening and counseling appears acceptable to adolescents and providers and has potential for increasing the consistency of behavioral health screening in primary care.

Key Words: Adolescent clinical preventive services, Health information technology, Primary care, Adolescent risk behavior, Depression screening

PURPOSE

The majority of morbidity and mortality during adolescence is preventable. Most adolescents visit a health care provider once a year, providing an ideal opportunity to integrate behavioral/emotional health screening into clinical care. Yet despite clinical guidelines, providers screen adolescents for risky health behaviors and depression at rates consistently lower than recommended. New strategies are needed to increase behavioral health screening in primary care. Health information technology, with clinician decision support (CDS), has tremendous potential to improve health care quality and subsequent behavioral health outcomes for adolescents. Although the majority of adolescent health problems are amenable to behavioral intervention, and most adolescents are comfortable using interactive computerized technology, few health information technology interventions have been integrated into adolescent care.

The primary aims of our research were to:

- 1) Develop an interactive behavioral/emotional health module for adolescents that can be integrated into health care delivery, serving both as a risk assessment and an intervention tool to enhance adolescent behavior change.
- 2) Pilot-test the implementation of the computerized module/screening system in adolescent primary care, assessing clinician, adolescent, and system outcomes.

SCOPE

The majority of morbidity and mortality during adolescence is preventable and related to behaviors such as risky sexual activity, substance use, and vehicle-related injuries. Most mental health problems begin in adolescence, with about 20% of youth experiencing depression prior to turning 18, and 30% of teens reporting depressive symptoms at any given time. Depression is a major risk factor for suicide, the third leading cause of death among adolescents. Depression and depressive symptoms are also associated with unsafe health behaviors such as substance use and risky sexual behavior.¹

The majority of adolescents visit a health care provider once a year, providing an ideal opportunity to integrate behavioral/emotional health screening into clinical care. For close to 15 years, adolescent clinical preventive guidelines have recommended screening and counseling adolescents for risky health behaviors and emotional health.¹⁻³ Recently, clinical practice guidelines have been developed specifically to assist primary care providers in the identification and management of adolescent depression.⁴

Yet despite research indicating that it is possible to increase preventive services to teenagers across a variety of healthcare settings⁴⁻⁶ providers screen adolescents for health behaviors at rates consistently lower than recommended;⁸ and only about one third of teenagers are asked about emotional distress when visiting their primary care provider.^{7,8}

The opportunities for delivering behavioral services to adolescents in primary care are not well-utilized at the present time. It has been well-documented that there are significant provider and system barriers to integrating recommended guidelines into the primary care of adolescents.^{9,10} These include providers' lack of confidence that they can treat depression,¹¹ or talk to teenagers about changing risky health behavior,¹² and lack of integrated systems to screen and conduct brief interventions in this area.^{10,13} New strategies are needed to increase behavioral health screening in primary care, offer brief effective interventions, and promote follow-through care. Health information technology, with clinician decision support (CDS), has

tremendous potential to improve health care quality and subsequent behavioral health outcomes for adolescents.

Improving Health Care Decision Making: Using Health Information Technology to Integrate Patient and Clinician Decision Support

Computer programs and the Internet are increasingly being used to exchange health information, and to access health advice. Health information technology has been shown to be a useful vehicle for exchanging health related knowledge, attitudes, beliefs and personal preferences; and computer-delivered health communications can change client behavior. Interactive computer technology provides a promising solution to increasing behavioral interventions for teenagers as it can be designed to assess an adolescent's risk, and provide a convenient, individualized means for informing, enabling, motivating, and guiding individuals to make changes in their lives.¹⁴ Computer-based interviewing modules encourage clients to think about their health and enhance their readiness to interact with providers, and patients are accepting of computers and interested in receiving health information during wait time for a visit. Interactive information can be provided before or after a provider visit, prompting the teenager and health care professional for specific action. Further, technology can be tailored to the specific mother language, level of education, age and gender, and cultural needs of a particular individual and/or populations targeted for care.

Computerized assessment tools may be important in reducing provider/system barriers to screening adolescents for behavioral/emotional health. Thus far, however, integration into primary care clinics has been limited. The project was focused on developing and implementing the health module in busy, real-world pediatric primary care clinics. It was an essential first step that will inform more comprehensive health IT implementation research. The exploratory R21 provided an ideal opportunity to understand how the screening module intervention addresses the diverse needs of teenagers, and whether it had any influence on their knowledge and attitudes about their behavioral health. It also contributed to better understanding of the factors that influence clinic uptake and effective implementation.

METHODS

Study Overview

The overall purpose of this study was to reduce adolescent risky behaviors and emotional health problems by integrating into primary care clinics an interactive computerized behavioral health module that is linked to the delivery of adolescent care. The goal of the module is to 1) facilitate initial screening/risk assessment in health care settings to improve the delivery of care; and 2) provide feedback based on the adolescent's background and health risk assessment to help build the knowledge, personal efficacy and self-regulatory skills necessary to enable teenagers to engage in healthy behavior.

The screening/risk assessment component of the computerized module focused on multiple behavioral areas that are associated with major morbidity and mortality in adolescents. Targeted risk areas included: sexual behavior, alcohol and other substances, tobacco, safety (helmet and seat belt use, violence, bullying); nutrition, physical activity, and emotional health.

The specific aims of this project were:

- 1) To develop a computerized behavioral/emotional health module that is acceptable to diverse teenagers, ages 12-18 years of age, and to health care professionals who care for them in primary care settings.
- 2) To implement the behavioral/emotional health module into two primary care clinics serving diverse adolescent patients.
- 3) To test the effects of the behavioral/emotional health module on the screening of adolescents by primary care providers for risky health behaviors and emotional distress.
- 4) To assess whether use of the module is related to changes in adolescents' knowledge and discussion of health behaviors.
- 5) To assess the impact of the new system on practice operations.

Study Sites

We utilized two outpatient primary care clinics within the University of California SF Medical Center. The UCSF Medical Center has 763,000 outpatient visits per year, cares for a large pediatric patient population, and has a clinical enterprise that is accustomed to accommodating clinical research. The Dept. of Pediatrics clinics are part of The SF Bay Collaborative Research Network (CRN), facilitating practice-based research in diverse primary care settings, under the auspices of the UCSF Clinical and Translational Sciences Institute. We utilized a **Pediatric Primary Care Practice** that serves a large proportion of San Francisco's youth with over 32,000 visits per year from a diverse patient population, a large proportion of whom (35%) are covered through public insurance, and a **Primary Care Clinic** that delivers care on a daily basis to over 4,500 ethnically and sociodemographically diverse adolescents each year. Approximately 40% of the treatment population is covered by Medi-Cal (CA form of Medicaid). We looked for variation across study sites on types of screening/intervention systems currently in place. For example, one clinic was already using a paper and pencil adolescent screening form and another relied solely on clinical interview.

Adolescent Sample

We included adolescents between the ages of 12 and 18 years who were presenting for a well-visit as these are critical years for the onset of risky health behaviors and depressive symptoms; and adolescent preventive care guidelines and the U.S. Preventive Services Task Force recommends the screening of adolescents 12 to 18 years of age for risky health behaviors and emotional distress.^{2,3,13} Data on the risk behavior of teens who utilize outpatient clinics in California indicates that by age 16, about half of adolescents endorse using alcohol, close to a third report having tried drugs and engaged in sex, and about one quarter report depressive symptoms.^{7,15} An ethnically diverse sample of adolescents was recruited to participate in the research.

Research Protocol and Data Collection

The research project was divided into 2 primary phases. 1) The first involved the development of a computerized behavioral/emotional health module that is acceptable to teenagers and to health care professionals who care for them in primary care settings. 2) The second involves piloting the implementation of the computerized module/screening system into adolescent primary care.

In Phase 1, we:

- 1) Developed an individually tailored, computerized behavioral/emotional health module that reflects the diverse racial/ethnic, and developmental characteristics of teenage girls and boys, 12-18 years of age.
- 2) Developed a linked computerized printout/form for the health care provider that displayed salient information from the behavioral module, serving to prompt the health care provider about additional screening areas, target discussion of specific behavioral issues, and guide potential follow up/referrals.
- 3) Piloted the behavioral screening/intervention module among adolescent patients and received feedback from clinicians on the provider print-out.
- 4) Collected baseline data on rates of provider screening of adolescent patients for risky health behaviors and emotional distress.

In Phase 2, we:

- 1) Implemented the behavioral/emotional health module into two primary care clinics serving large numbers of diverse adolescent patients.
- 2) Evaluated the acceptability of the behavioral screening/intervention module.
- 3) Tested the effects of the behavioral/emotional health module on the screening and counseling of adolescents by primary care providers for risky health behaviors and emotional distress.
- 4) Assessed whether use of the module is related to changes in adolescents' knowledge and discussion of health behaviors.
- 5) Assessed the impact of the new system on practice operations.

First Overall Primary Aim: *Develop an interactive behavioral/emotional health module for adolescents that can be integrated into health care delivery*

**PHASE 1 – A. BASELINE DATA COLLECTION
B. DEVELOPING & PILOTING MODULE**

PHASE 1 – BASELINE DATA COLLECTION

Baseline Data Collection in Study Sites

Base-line Data on Rates of Provider Delivery of Services to Teenagers: Following a routine primary care visit, 168 adolescents, ages 13- to 18-years, completed surveys reporting on whether their provider screened and counseled them for risky behavior. This adolescent-report comprised data to assess changes in provider behavior post- module implementation. The exit survey was a modified version of our previously developed Adolescent Report of the Visit (AROV) form.

Clinic System Assessments – The presence of the Research Assistant in clinics for baseline data collection allowed us the opportunity to observe clinic procedures and plan for the implementation of the tool into regular clinic operations. The RA recorded qualitative aspects of adolescent clinic visits in order to determine which areas of operation might change post-module implementation.

Provider Pre-Intervention Survey: We collected data from providers in study sites, asking about knowledge and self-efficacy to screen adolescents across multiple behavioral/health areas.

PHASE 1 - A. DEVELOPING AND PILOTING MODULE

1) INITIAL DEVELOPMENT

Utilizing Prior Intervention Materials: The initial version of the provider computerized form was adapted from our team's previous intervention research in the area of adolescent preventive interventions in primary care and experience in developing linked computerized printouts to prompt the health care provider and client about recommended action. We also reviewed existing tools and had conversations with colleagues who had developed interactive screening tools with different emphases (e.g. mental health, substance use, violence, obesity, etc.) to build off lessons learned from development of these colleagues' instruments.

Initial Meetings with Clinicians and Clinic Staff: This included obtaining data reflecting all visits from adolescents to UCSF Pediatric clinics; meetings with clinic directors and other staff to discuss tool development and integration of tool/study into the clinic; obtaining copies of any paper/pencil screening instruments used in the clinics; obtaining information on clinic flow and key roles of clinic staff, and the use of any pre-existing health IT applications in the clinic, such as an electronic medical record. .

Identifying Clinic Champions: Clinic champions (e.g., clinician, support staff) were identified in each site. The commitment of local opinion leaders to champion the project and ensure the effective implementation of practice change strategies is an important component of successful quality improvement efforts.¹⁶ We began ongoing meetings with the champions over the course of the module development to integrate information on the content and format of the adolescent information that would be most useful to the clinicians/clinic; and had ongoing discussion throughout the project about implementation plans, issues related to triaging patients to module, documentation in charts, plans to link to electronic system; and other practice operations topics.

2) ITERATIVE PROCESS OF MODULE PILOT TESTING AND REVISION

Screening Tool & Provider Printout Development

Informed by theory, and initial data from adolescents, providers, and clinical staff, we began preliminary development of the computerized screening module as well as the provider printout.

Screening Tool

With continued conversations with colleagues/consultants on the content of the screening tool, ongoing input from clinic directors, clinicians and clinic staff, and multiple paper prototype iterations, we developed a first version of the computerized screening tool that links to the PHQ-9¹⁷ (depression) and CRAFFT¹⁸ (adolescent substance use) screening tools. Teenagers reviewed the preliminary version of the screening tool and provided feedback on the look and feel of the module. As described below, using feedback from adolescents and providers, we worked closely with our technology team to revise the initial web-based version of our screening tool, including modifying the wording of questions, incorporating additional screening items, and editing the wording of questions to eliminate teen confusion on several items.

Piloting Screening Module with Teens and Revising: To pilot test and receive individual feedback from teenagers on the module, we asked 30 teenagers (spanning age, gender, ethnic/diversity, and risk level) who were utilizing the outpatient clinics to test the module and then debrief in individual interviews with a research associate. The pilot testing and debriefing interview was done at the health site after a scheduled visit. Patients completed the module

confidentially on an iPad tablet. The module was revised throughout this process as indicated. Additionally, we used this opportunity to pilot questions for teenagers to be completed pre- and post- use of the module.

Formal Pilot Testing with Teenagers in Clinic Study Sites

We formally pilot tested a full version of the computerized screening tool in both clinic sites with 20 adolescents. Using protocol based on our and others' prior work, we assessed teen acceptability to screening questions, length of time for completion of the module, and the look and feel of the module. The basic version of the screening tool took about 5 minutes to complete.

This process led to additional iterative refinement as well as re-naming our screening tool “**Health e-Check**” after pilot testing several names with teenagers. This final version of the screening tool prepared us to move into the implementation phase of our project.

Provider Printout

We worked with clinicians in both pilot sites on drafts of the provider printout, developed to provide customized information on the behaviors of teens (reflecting their responses on the screening tool) and include prompts and cues for providers during conversations with teenagers.

Feedback from Clinicians: We asked clinicians (about 25 across the 2 clinics) to review versions of the provider print-out to give feedback on the content, format, and usefulness of the information. We utilized regularly scheduled administrative lunches or clinician meetings so that the information was collected most efficiently and there was some time for discussion. This feedback informed revisions of the print-out as well as future plans for implementation of the module into the clinic site for evaluation of the acceptability and utility.

Linking the Provider Printout to the Screening Tool - After developing the initial versions of the provider printout using input/feedback from clinicians, we developed a printout that outlines adolescent responses to screening questions and creates a customized report for each teenager.

Electronic Integration

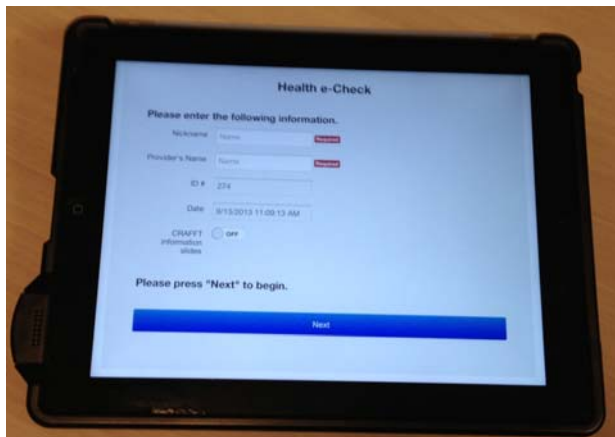
Given the developmental nature of the module, when we began the study, we assumed that any electronic interface with existing health IT applications would be subsequent to this research period. However, as we began to meet with providers and plan the implementation of the Health e-Check module in the practices, we gained insight into an important area of provider focus for our work – EHR integration. UCSF uses the Epic systems EHR. Given the amount of time spent in and focus on the Electronic Health Record (EHR) for clinical care, the providers were hesitant to adopt a new system that did not integrate well into their existing workflows. To aid our module adoption, we decided to add an EHR integration component to our work. We developed an administrative screen to allow providers to view and print the provider printout, as well as copy and paste a modified version of the printout into their medical record notes. Additionally, this option is available from *within* the EHR so that providers are able to work efficiently.

Second Overall Primary Aim: Pilot-test the implementation of the computerized module/screening system in adolescent primary care, assessing clinician, adolescent, and system outcomes.

PHASE 2 – IMPLEMENTATION OF SCREENING MODULE INTO CLINICS

In-Service Seminars: Interventions that combine two or more modalities (e.g., combination of training and resources at the systems level such as tools) lead to greater success in changing professional practice. In-service seminars were held with all clinicians, as well as meetings with support staff, prior to the start of the intervention period. The meetings were held during a lunch hour or a regularly scheduled meeting time. The in-service focused on guidelines for preventive screening in primary care and a brief overview of the goals of the project, a demonstration of how the modules work, and information about their role in the screening process. The sessions were led by the PI Ozer and Dr. Jasik, a UCSF faculty member/Pediatrician collaborating on the research.

Health e-Check Module Implementation into Clinic Sites:



Module Integration and Feedback – We implemented Health e-Check into both pilot clinics including a system for linking Health e-Check to the UCSF electronic medical record system (EPIC) and utilized the module with approximately 70 adolescents across the 2 clinics before beginning post-implementation data collection. During this time, our primary activities were the following:

Integrating Provider Printout into Clinics – After finalizing the Health e-Check screening module based on clinician and teen

feedback, we formally pilot tested the integration of the provider printout in clinics, gathering input from clinicians on the utility of the printout during adolescent visits, the layout of the printout, and the integration of the Health e-Check into the UCSF electronic medical record system (EPIC). We worked closely with our technology team to ensure that the provider printout is automatically printed as soon as a teen completes the Health e-Check screening module. Automatic printing allows us to further streamline the screening process and reduces the time needed to distribute the screening results to the provider.

As noted, we developed both a *paper printout* and an *electronic administrative screen* for providers that allows for viewing, printing, and copying of teen screening results during the visit, and developed a system for providers to easily view screening results through the on-line electronic medical record (EPIC) system. We worked with clinics to figure out the best ways for them to access/use this data. For example, some clinicians prefer to use paper printouts of the provider printouts while others are comfortable viewing screening results through the on-line electronic medical record (EPIC) system.

Integration of Screening Results into EPIC – Based on provider feedback, we improved the integration of the provider printout into EPIC, using a “dot phrase,” which automatically generates a link to access screening results within each teen’s medical record. The link routes

the provider to the administrative screen to view and copy the screening results. This modification will better position us for wider dissemination of the screening tool with accompanying provider printout.

Ongoing process evaluation, with clinicians and staff, based upon Rapid-Cycle Change Model to guide local teams to rapidly innovate in an iterative fashion, and tailor intervention strategies to meet site specific needs was employed. For example, as one clinic had not used a paper-screening questionnaire that provided them with teen risky behavior information, we conducted additional training to further talk through high risk and low risk teen scenarios and how they might discuss the various behaviors with teens. We also provided ongoing feedback to both clinics on screening rates across adolescent risk behaviors, as well as modified strategies for Health e-Check clinic integration as needed.

Post-Implementation Data Collection:

Post-implementation data has been collected from approximately 125 teenagers in both of our pilot clinics. Adolescents that were consented/assented to participate in the research completed assessments: 1) immediately after completing/interacting with the screening module and 2) after their entire well visit with their provider (post both using screening tool and having discussion with provider during well-visit). In addition to collecting data about adolescents' experience with and learning from the module and provider visit, the post-implementation data collection includes the Adolescent Report of the Visit (AROV) questionnaire, which assesses provider rates of screening adolescents for risky behaviors. This allowed for the examination of changes in provider screening rates pre- and post- implementation of the screening module.

Measures for the Evaluation

Provider/Staff Measures

- The *Provider Attitudes Questionnaire* is a self-report paper and pencil survey that asks about demographics (e.g., type of training, when graduated) and assesses provider's *knowledge* and *self-efficacy* in the delivery of clinical services to adolescents in the areas of substance use, sexual behavior, and safety.¹² We modified the measure to expand to other areas assessed in the screening module, including depression.

Adolescent Measures

The Adolescent Report of the Visit assesses provider behavior during adolescent visits. It is completed by the adolescent immediately following a visit. Items in the overall measure address confidentiality, the provider delivery of preventive services across risk areas, and adolescent demographic and risk behaviors. The provider behaviors assessed include screening, anticipatory guidance, and counseling.

If an adolescent reported to the provider that s/he is not engaging in a risky behavior, the adolescent responds to questions about whether the provider offered support for the positive behavior and encouragement to continue the positive behavior. If an adolescent reported to the provider that s/he is engaging in a risky behavior, s/he responds to questions about whether the provider further assessed level of use, expressed concern, and provided brief counseling on that behavior. The evaluation of a provider's behavior closely reflects guidelines for screening and brief intervention with adolescent patients that are presented to providers in the in-service

training. The AROV measure possesses construct validity in relation to provider self-reports of practices.¹²

Acceptability

Adolescents were asked to what extent they agreed with items such as: a) the module was easy to use; b) they trusted the information it provided; c) they understood the questions; d) they were satisfied with the look/feel. Responses ranged from 1=Strongly Agree to 5=Strongly Disagree (Post-module survey.)

Knowledge Gained from Module

Adolescents were asked to what extent they agreed with items such as: a) using Health e-Check screening tool has made me think about my health behaviors; b) using this Health e-Check screening tool has encouraged or influenced me to talk to my doctor about health behaviors; c) Health e-Check screening tool gave me new information about my health behaviors. Responses ranged from 1=Strongly Agree to 5=Strongly Disagree (Post-module survey.)

Adolescent Preferences for Clinic-Based Behavior Screens

Participants indicated their level of agreement with the following statements – “I am comfortable answering questions about my health behaviors _____” and “I feel that I can be honest answering questions about my health behaviors _____” for a paper-pencil screening questionnaire, in person with a health provider, and on a computer. Responses ranged from 1=Strongly Agree to 5=Strongly Disagree. Patients were also asked about preferences for timing, method, and location of screening, as well as access to electronic devices in their home.

Clinic System Assessments:

Qualitative and quantitative assessments of clinic practice included:

- percent of patients ages 12 to 18 who utilized the module
- comparison of module users with non-users
- staff satisfaction with module based screening process
- average provider length of visit with adolescent patient when utilizing module form
- relationship between use of print-out and delivery of services to teenagers
- time spent in trainings/in-service for module training
- barriers to screening/using module
- qualitative on-going feedback from staff and clinicians
- extent to which computer module impacts client flow
- satisfaction with module integration into the UCSF EPIC system

Study Limitations

While the goal of the study was for all teenage patients to utilize the module as a clinic practice, data could only be utilized for research purposes from those teenagers from whom the research associate had received formal consent and assent. The presence and role of the research associate thus limited the “real-life” integration of Health e-Check into the clinic system as this will need to be done on a regular basis without a research associate if Health e-Check is to become standard of care in the clinics (see discussion below in Results section re: plans to integrate the module into standard of care).

RESULTS

Adolescents' Experience with the Health e-Check Screening Tool

Using Screening Tool: Health e-Check is completed by adolescents on an iPad prior to their routine primary care appointment confidentially in a private area of the clinic waiting room. The module takes approximately 5 minutes to complete.

Acceptability: Adolescents rated the screening module as highly acceptable, finding the module easy to use (mean = 1.5); understanding the screening questions (mean = 1.3); and satisfied with the look/feel of the module (mean = 1.5). (1=Strongly Agree to 5=Strongly Disagree)

Knowledge Gained from Module: Adolescents *agreed* that "Health e-Check screening tool has encouraged or influenced me to talk to my doctor about health behaviors" (mean = 2.3), and *strongly agreed* (1.0) that it is important for doctors to talk to all teens about health behaviors as part of a check-up. (1=Strongly Agree to 5=Strongly Disagree).

They also reported that "using Health e-Check screening tool made me think about my health behaviors *a little*" (2.0); "Health e-Check screening tool gave me new information about my health behaviors *somewhat*" (3.0); and "Health e-Check screening tool changed my understanding about how health can be affected by alcohol, tobacco and drugs *somewhat*" (3.0) (1=not at all to 5=a great deal).

Adolescent Preferences for Clinic-Based Behavior Screens: Adolescents reported the highest level of comfort for preventive screening conducted via computer (1.76), then health provider (1.99), and last, paper screening questionnaires (2.31). Comfort with computer screening was significantly different than a health provider ($p=0.02$) and paper questionnaire ($p<0.001$). Adolescents also reported being most honest for preventive screening conducted via computer (1.76), then health provider (1.99), and last, paper screening questionnaires (2.2). Honesty with computer screening was significantly different than a health provider ($p=0.01$) and paper questionnaire ($p<0.001$).

Conclusions: Adolescents found Health e-Check to be acceptable and they agreed that use of the module encouraged them to talk to their provider about their health behavior. Adolescents report a preference for computer-based screening over paper screening questionnaires and responding to questions directly from a health provider. Given research establishing that pre-visit behavioral screening tools increase provider screening and counseling of adolescents during visits, a greater number of clinics should consider computerized pre-visit screening in the waiting room in combination with in-person counseling with their provider.

Clinicians' Delivery of Preventive Services to Adolescents during Routine Visits

Targeted risk areas for the Health e-Check screening module included: sexual behavior, alcohol and other substances, tobacco, safety (helmet and seat belt use, violence, bullying); nutrition, physical activity, and emotional health.

Baseline:

At baseline, 168 adolescents provided pre-implementation data across the 2 pilot clinics on provider screening and counseling rates during routine visits. The average age of participants in

this phase of the study was 15 years and slightly more than half (54%) of the teens were male. The plurality of the study participants (37%), identified as non-Hispanic white, while 32% identified as black or African American, 25% identified as Latino, 21% identified as Asian, 5% identified as Native American or Alaska Native, and 10% identified as “other” racial/ethnic. At baseline, 9% of teens reported alcohol use, 6% reported tobacco use, 8% reported drug use in the past 30 days, and 19% reported ever having sex.

Adolescents reported being screened by their provider an average of 61% across all health risk areas. At baseline, screening rates were highest in the areas of talking about immunizations, physical activity, and nutrition; moderately high in the areas of alcohol, smoking, drugs, and emotions/moods; and lowest in the areas of helmet and seatbelt use, STD prevention, prevention of sun exposure, and riding in the car with a driver who has been drinking. Screening rates were consistently higher at baseline in “Clinic 1” (74%), the clinic that had already fully integrated a paper screening form, compared to “Clinic 2” (44%), the clinic that was not using any type of screening questionnaire/tool prior to module implementation

Post-Module Implementation:

Post-implementation, 125 adolescents have provided data on provider screening and counseling rates during routine visits. The demographic profile of teens screened post-implementation was similar to the profile of the teens screened pre-implementation. The average age of participants post-implementation was 15 years and 42% of the screened teens were male. As at baseline, the largest group of study participants (46%) identified as non-Hispanic white, while 18% identified as black or African American, 26% identified as Latino, 20% identified as Asian, 5% identified as Native American or Alaska Native, and 15% identified as “other” racial/ethnic.

Adolescent reports of rates of engaging in risky behaviors was higher post-module implementation. Post-implementation, 23% of teens reported alcohol use, 2% of teens reported tobacco use, 20% of teens reported drug use in the past 30 days; and 27% reported ever having sex.

Analyses indicate an increase in provider screening rates of adolescent patients post-module implementation across most areas, particularly those with lower rates pre-implementation. This is most striking in the clinic (2) with lower pre-implementation rates and hence a greater capacity for increase in screening. Rates of provider discussion of the targeted behaviors increased significantly from an average of 44% to 64% of the time, with particularly dramatic increases in the areas of asking adolescents about tobacco (81%), alcohol (81%) and drug use (84%); seatbelt and helmet use; and emotions/moods (88%). Rates of provider discussion of the targeted behaviors stayed stable in Clinic 1 (with a paper screening tool at baseline); given the relatively high rates of screening at baseline, the focus for this clinic was on transferring from a paper screening questionnaire to integrating Health e-Check into clinic practice.

Optimization of Health e-Check Module and Migrating Hosting of Module to UCSF:

A next step to system implementation is the migration of the Health e-Check from an external web service to the UCSF virtual server network. Ongoing pre migration system administration, maintenance, and small optimizations have been managed by a study research assistant with a computer science background. Several system changes are being made by IT as Health e-Check transitions from research and implementation to full clinical adoption. During the research

study, the study RA needed to be present in clinic with a laptop during screening. This assured secure printing, distribution of reports, and patient identification. Post-research study, printing is being modified, allowing screening reports to be printed independent of the RA. Providers will continue to access reports and add notes electronically through the UCSF electronic medical record. Additional changes and optimizations are likely as needed.

EHR Integration into UCSF School of Medicine/Medical Center: We successfully worked with the health system to add the functionality to include the screening results in the provider note in the EHR. Providers reported being very satisfied with this feature. Based on this feature and the positive change in screening rates, the clinical leadership has endorsed Health e-Check as standard of care. The EHR integration functionality was presented at the Epic Spring user meeting in 2014, which is attended by 10,000 Epic customers.

Discussion/Implications

This project focused on initial development of the behavioral/emotional health module and an accompanying computerized print-out to link with provider services; and piloting the implementation of the module in clinics. Our study indicates that integrated health information technology screening modules, such as Health e-Check, have potential for increasing the consistency of behavioral health screening in primary care. This exploratory effort informed us about contextual factors that contribute to quality of implementation in varied clinic contexts, and informed strategies for adaptation and integration in larger scale health IT implementation. Specifically we gained knowledge about the acceptability of the behavioral module among adolescent patients and primary care clinicians; the effect of the module on increasing provider rates of screening/brief counseling with adolescent patients; found that the module is related to changes in adolescents' knowledge and discussion of health behaviors; and preliminary knowledge about the impact of the module implementation on clinic practice operation. We also extended beyond our original goals of this exploratory research period by developing an electronic interface with existing health IT applications.

Additional steps are necessary before this clinical decision support tool can be integrated into larger scale health IT implementation. The next phases of the work involve broader systematic integration of the clinical support tool in the outpatient Pediatric clinics and adaptation of the module for integration across diverse delivery systems. The research collaborations already established by the study investigators will allow for future phases of the research to be conducted in established research sites and networks. The collaborative clinical/research relationships with multiple healthcare systems will expedite rapid diffusion and dissemination of the model. Strategic dissemination of this exploratory and developmental health IT project will enable us to share lessons learned from the development and pilot implementation of the module to inform more comprehensive health IT implementation research and larger scale real world health IT implementation.

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